DEPARTMENT OF COMMERCE AND LABOR

REPORT OF THE SUPERINTENDENT

OF THE

COAST AND GEODETIC SURVEY

SHOWING

THE PROGRESS OF THE WORK

FROM

JULY 1, 1909, TO JUNE 30, 1910

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

National Oceanic and Atmospheric Administration

Annual Report of the Superintendent of the Coast Survey

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LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, September 30, 1910.

SIR: In compliance with the requirements of section 4690, Revised Statutes, I have the honor to transmit herewith, for the information of Congress, a report submitted to this Department by Mr. O. H. Tittmann, Superintendent of the Coast and Geodetic Survey, showing the progress made in that work during the fiscal year ended June 30, 1910. It is accompanied by maps illustrating the general advance in the operations of the Survey up to that date.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
COAST AND GEODETIC SURVEY,
Washington, September 29, 1910.

SIR: In conformity with law and with the regulations of the Department of Commerce and Labor, I have the honor to submit herewith, for transmission to Congress, the annual report of progress in the Coast and Geodetic Survey for the fiscal year ended June 30, 1910. It is accompanied by maps illustrating the general advance in the field work of the Survey up to that date.

Respectfully,

O. H. TITTMANN,
Superintendent.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

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CONTENTS.

REPORT OF THE SUPERINTENDENT.

ILLUSTRATIONS.

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REPORT OF THE SUPERINTENDENT.

WORK OF THE YEAR.

FIELD WORK.

The usual progress was made in the collection and preparation for publication in the form of Charts, Coast Pilots, Tide Tables, and Notices to Mariners of all information useful to navigators and relating to the coasts of the United States and under the jurisdiction of the United States.

Very satisfactory progress was made in the Philippine Islands, where surveys were made for charting purposes along the unsurveyed portions of the coast, covering 10 per cent of the whole extent of the estimated general coast line of the archipelago.

Good progress was made also in charting the unsurveyed coasts of Alaska, the work being confined to the regions where the demand for charts is most urgent.

Important improvements were made in the construction and use of the long wire drag, and its length was increased to 8 400 feet when used in open water. The long drags greatly increase the area possible to be covered in any given time, and consequently decrease the cost of examining harbors and channels of large extent. The improvements were described in a publication issued for the information of hydrographers.

Details in regard to the work assigned to the Survey and to the Superintendent as Commissioner representing the United States in recovering and marking the international boundary between the United States and Canada and in the demarcation of the Alaska boundary are given in Appendixes 1 and 2, and form the basis of the following general statements. The establishment of reference monuments in the United States along the water boundary between the United States and Canada between Point Roberts and the Pacific Ocean was completed. All these monuments were connected with the coast triangulation. The same boundary was surveyed and monumented from the summit of the Rocky Mountains eastward to the North Fork of Milk River, a distance of 50 miles, and considerable work was done to the east of this point. West of Lake Superior, the boundary was surveyed along Pigeon River to South Fowl Lake, a distance of 30 miles. On the eastern borders of Maine the survey of the boundary was completed from a point 2 miles below Van Buren, Me., to a point in the vicinity of Fort Kent, Me. On the St. Croix River the triangulation along the boundary from the mouth of the river to Butler Islands was completed. The work of all the parties east of the Rocky Mountains was in progress on June 30.

In the demarcation of the Alaska boundary a survey was made and marks were established in the vicinity of the Unuk and Blue rivers in southeastern Alaska, and on

June 30 a party was at work in the valley of Salmon River and another party was at work in the region north of the head of Portland Canal.

On the one hundred and forty-first meridian the survey of the boundary was completed between the Yukon River and the Natazhat Mountains 200 miles to the southward, and good progress was made in surveying the line to the northward of the river. This work was in progress on June 30.

In this connection I wish to emphasize the importance of providing means for a triangulation down the great valley of the Yukon River from the international boundary to the mouth of the river to form the basis for the economic surveys in progress or in contemplation as a much more desirable plan than the coordination and adjustment of such surveys after they are made. Attention has been called to this work in my annual reports for 1908 and 1909, and an appropriation to begin this triangulation should not be delayed any longer.

Work at the latitude observatories at Gaithersburg, Md., and Ukiah, Cal., maintained by the International Geodetic Association under my direction, was continued during the year.

One officer continued on duty as a member of the Mississippi River Commission, and another was continuously employed in cooperation with the Maryland State Board of Shell Fish Commissioners in making a survey of the natural oyster bars and rocks in the State of Maryland. The work in Calvert County was completed and a report covering the work was prepared and published. This officer was also authorized to supervise the survey of certain portions of the oyster beds in the State of Delaware, as requested by the governor, without expense to the National Government.

Buoys were placed on the boundary between the States of Louisiana and Mississippi in Lake Borgne and Mississippi Sound and referred to the marks previously established on shore, as requested by the state authorities, to aid in the enforcement of the state laws relating to oyster culture.

The officer in charge of the Survey exhibit at the Alaska-Yukon-Pacific Exposition remained on that duty until the close of the exposition, on October 16.

In accordance with a request made by the War Department, an officer was detailed to serve as the representative of the United States on a commission of engineers created to make a survey of a portion of the Military road leading from the Aqueduct Bridge (across the Potomac River) to Fort Myer, Va. The location of a portion of the boundary of this road being in controversy between the United States and the owners of the adjoining property and the case being before the United States court for the eastern district of Virginia for settlement, a special master commissioner in chancery was named to take testimony, and he appointed the commission of engineers mentioned above. The survey was made and a final report was placed on file.

In accordance with instructions issued to Civil Engineer R. E. Peary, U. S. Navy, as stated in the previous Annual Report, tide observations were made in the Arctic regions at Cape Sheridan, Cape Columbia, Cape Bryant, Fort Conger, and Cape Morris Jessup, and the records of the work have been placed on file. Valuable information in regard to the tides was obtained, and a discussion of "Arctic Tides" is being made for publication which will embody all the available information on this subject.

Astronomic observations to determine latitude, longitude, or azimuth were made in Texas and in Alaska.

Observations to determine the relative force of gravity were made with a half-second pendulum at 27 stations distributed as follows: Four in Arizona, one in California, one in the District of Columbia, one in Maine, two in Michigan, two in Minnesota, two in New Mexico , three in New York, one in Nevada, one in North Dakota, one in South Dakota, two in Tennessee, five in Texas, and one in Vermont. The use of an interferometer, suitably modified, to determine the flexure of the pendulum support was continued. A description of the instrument and the method of using it is given in Appendix 6.

The Standard levels were extended in Arizona, New Mexico, Oklahoma, and Texas.

Topographic surveys were made in Alaska, California, Hawaii, Maryland, New Hampshire, North Carolina, Philippine Islands, Virginia, and Washington.

Triangulation was done in Alaska, California, Delaware, Florida, Hawaii, Maine, Maryland, Massachusetts, Montana, New Mexico, North Carolina, Philippine Islands, Texas, Virginia, and Washington. The recovery of old triangulation stations was continued on the coasts of Connecticut, Florida, Maryland, Massachusetts, and North Carolina. This work was completed on the west coast of Florida.

Hydrographic work was done in Alaska, California, Delaware, Florida, Hawaii, Maine, Maryland, Massachusetts, New Hampshire, North Carolina, Philippine Islands, South Carolina, Virginia, and Washington.

The examination of the navigable waters on the coast of Maine with the long wire drag was continued and a similar examination of Mayaguez Harbor and approaches in Porto Rico was made.

A new edition of the Coast Pilot volume covering the coast from New York to Chesapeake Bay Entrance was prepared and published.

The magnetic survey of the country was continued by making observations at 238 stations distributed over 39 States and Territories, including Porto Rico and the Philippine Islands, and numerous observations were made at sea on board the surveying vessels on their cruises to and from their fields of work in various portions of the country. A continuous record of the relative value of the magnetic elements was obtained at the magnetic observatories maintained by the Survey at Cheltenham, Md., Sitka, Alaska, Honolulu, Hawaii, and Vieques, P. R. Observations were made at Baldwin, Kans., for a portion of the year, and the instruments were then transferred to Tucson, Ariz., where observations are now in progress.

Self-registering tide gauges were maintained at the following stations: Fort Hamilton, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Colonial Beach, Va.; Wilmington, N. C.; Fernandina, Fla.; Weeks, La.; Galveston, Tex.; San Diego, Cal.; Presidio of San Francisco, Cal., and Seattle, Wash. A similar gauge was installed at Portland, Me.

The tide indicators at Fort Hamilton, N. Y.; Reedy Island, Delaware Bay, Delaware; and at Alcatraz Island, San Francisco, Cal., have been continued, and the electric tide indicator in the rooms of the Maritime Association, at New York, continued to give satisfaction. A similar indicator was installed in the building of the American Seamen's Friend Society's Institute, in New York City.

ALASKA.

Surveys were made in Portland Canal, Tongass Narrows, Cordova Bay, Controller Bay, Prince William Sound, Cook Inlet, Nushagak Bay (in Bristol Bay), and in the vicinity of Kodiak.

The survey of Controller Bay was completed and an examination of the waters offshore between Kayak and Montague Island inside of Middleton Island was made, the dangers to navigation within this area being located and their positions determined. A number of supposed dangers do not exist and have been removed from the charts.

On the coast of Prince of Wales Island the areas west of Mexico Point to Dewey Rocks, south to the Barrier Islands, and through Eureka Pass were carefully developed by sounding, and the hydrographic survey was extended over the area north of the Barrier Islands, including Tah and Hunter bays to the eastward and to Long Island on the west. In Cordova Bay, westward of the Barrier Islands, lines of soundings were made from a point opposite Shipwreck Point to the international boundary line to the eastward of Cape Muzon.

Hydrographic and topographic surveys were made in Tongass Narrows between Ketchikan and Rosa Reef Spindle.

In Prince William Sound surveys were made along the shores of Knight and Hinchinbrook islands. The survey of Nushagak Bay, in Bristol Bay, was completed.

A revised edition of the Coast Pilot Notes from Yakutat Bay to Cook Inlet was prepared and published.

PHILIPPINE ISLANDS.

Excellent progress was made in charting the unsurveyed coasts of the islands, 10 per cent of the estimated mileage of the general coast line of the islands being covered during the year. The results of the fieldwork were promptly made available at the suboffice at Manila, in the form of drawings for charts, which were forwarded to Washington for review and publication. The statistics for the year show that the triangulation covered 23 988 square miles and the hydrographic work 9 385 square miles. The topographic survey covered 1 708 square miles and extended along 1 637 miles of coast line. The Coast and Geodetic Survey steamer *Pathfinder* and the insular government steamers *Fathomer*, *Marinduque*, *Research*, and *Romblon* were engaged in the work, and also parties living on shore. The expenses of the work were divided between the General Government and the insular government in accordance with the agreement under which the previous work has been done. Surveys were made on the west coast of Samar, north and south coasts of Leyte, north and south coasts of Mindanao, south coast of Masbate, west and east coast of Mindoro, in Surigao and Tañon straits, and around the Tablas Islands.

Tide observations were made in connection with the hydrographic work, and a continuous record of tidal changes was obtained with self-registering gauges at Manila and Iloilo.

The organization of the work in the Philippine Islands remains unchanged. All the work necessary for chart construction is performed at the suboffice. New editions of the sailing directions for the islands are prepared and published as often as necessary and notices to mariners are also published.

Details in regard to the work are given in Appendix 1.

OFFICE WORK.

Progress was made in the various branches of the office work, including computation, plotting, and discussion of the results of the work in the field and the preparation of data for publication by chart or otherwise.

A Supplementary Discussion of the Figure of the Earth and Isostasy was prepared, utilizing additional data to 1909.

Tables of predicted tides for numerous ports on the coasts of the United States and in foreign countries for the year 1911 were prepared and published.

Three volumes containing the results of observations at the magnetic observatories in past years were also published, and the Annual Report for 1909 was prepared for transmission to Congress.

On account of the territorial expansion of the United States and the consequent extension of the sphere of the Survey's operations, there have been urgent and continually increasing demands on this Bureau for surveys and new charts. Each year adds to the number of charts published, and all of these exact time and energy to keep them up to date. The Navy Department has urgently requested that the charts of this Bureau be constructed on the mercator projection. In view of these conditions, I appointed a board to fully consider the whole subject of chart construction and publication, consisting of a chairman, Mr. G. R. Putnam, Chief of the Drawing and Engraving Division, who had given years of study to the problem, and two members, Assistants D. B. Wainwright (who succeeds Mr. Putnam as chief of division) and P. A. Welker, both experienced hydrographers, navigators, and commanders of ships. The first charting of the Atlantic, Gulf, and Pacific coasts of the United States having been practically completed and splendid progress having been made in the work in our distant territories, it was possible to consider the subject in its broadest aspect.

The later charts of the Survey are examples of the best modern usage in chart construction, and they will only need in some cases a rearrangement of limits and the further simplification of some details to perfect them from an economical standpoint. With respect to the charts of earlier date, the changes will have to be more radical. On these charts a great amount of detail was represented which under modern conditions is not considered necessary, and its rendering was also much more minute and elaborate than accords with present practice. Their correction involves an adherence to the same time-consuming method of representation. For twenty years all new charts have been oriented with the meridian, but there still remain a number of the earlier charts which were oriented diagonally with a view to include greater sea area. But for this feature they are as useful and accurate as any others.

Formerly on many charts a double unit for depths was employed, fathoms for deep water and feet on dotted surfaces for the shoal areas. During the last decade the practice has been to employ a single depth unit for a chart, either feet or fathoms, depending on which unit will best suit the area represented.

The difference between the mercator and polyconic projections is imperceptible on the large-scale charts, but on the small-scale charts it is very apparent, especially in northern latitudes.

The board submitted a report fully covering all these points, with recommendations which I have approved, wherein a definite program is outlined for eliminating the

old-style charts and for replacing them with a smaller number on the mercator projection, simpler in character, and on which the latest information can be more readily shown.

The demand for charts was greater than any previous year except the preceding fiscal year, when the issue was abnormally large.

A notable event of the year was the completion of a tide-predicting machine in the instrument shop of the Survey. It embraces many new features and provision has been made for 37 constituents of tidal fluctuations instead of the 19 provided for in the machine previously used. The construction of this machine has been incidental to the regular repair work of the Survey, and consequently it has been many years in progress. It was completed in February and has been tested in predicting the most complicated known tides, and the quantities obtained have been compared with the results of computation and found to be satisfactory from every point of view.

The amount appropriated for the Coast and Geodetic Survey for the fiscal year ended June 30, 1910, and accounted for by the bureau disbursing agent was $997 349.14 (exclusive of the appropriation for printing), of which $245 000 was for manning and equipping the vessels of the Survey, $40 000 for repairs and maintenance of vessels, and $50 000 for Office expenses. The remainder of the appropriation was divided between the expenses of parties in the field ($326 400) and salaries of field and office forces ($335 890). In addition to the above sums, the appropriations to the State Department for marking the United States and Canada boundary (except a portion of the water boundary) and for locating and marking the Alaska boundary are disbursed under my direction as Commissioner through the bureau disbursing agent, as special disbursing agent of the Department of State.

OFFICE OF ASSISTANT IN CHARGE.

ANDREW BRAID, *Assistant in Charge.*

The Assistant in Charge has direct supervision of the work of the divisions of the Office, as follows: Computing Division; Division of Terrestrial Magnetism; Tidal Division; Drawing and Engraving Division; Chart Division; Instrument Division; Library and Archives Division. He also has charge of the purchase of supplies and of all other expenditures for Office expenses, the care of the public property at the Office, the distribution of the publications of the Survey issued free, and of the sale of the charts, Coast Pilots, and Tide Tables published by the Survey.

Details of the Office operations are given in Appendix 2.

OFFICE OF INSPECTOR OF HYDROGRAPHY AND TOPOGRAPHY.

J. J. GILBERT, *Inspector.*

The Inspector supervised the field work done by the parties on the surveying vessels and all the other hydrographic and topographic work and the coast-pilot work in the field and Office. He prepared plans for the field work and the necessary instructions for the chiefs of parties, and recommended the approval of estimates for expenses and all changes in the personnel on the vessels when such changes became necessary. He made monthly reports of the progress of the work and monthly statements covering all temporary employees not under civil-service rules. Numerous short trips were made by him in supervising the maintenance of the surveying vessels.

The routine work in connection with the enlistment of crews for the vessels and the administrative examination of accounts of the vessels was kept up to date.

COAST PILOT.

The following publications were prepared and the proof was read: United States Coast Pilot, Atlantic Coast, Part V, fourth edition; Supplements to United States Coast Pilot, Atlantic Coast, Parts I–II, III, VI, VII, and VIII; Alaska, Coast Pilot Notes from Yakutat Bay to Cook Inlet and Shelikoff Strait, second edition.

The preparation of material for new editions of Parts I–II and III of the United States Coast Pilot on the Atlantic Coast was begun.

VESSELS AND THEIR WORK.

STEAMER BACHE.

Two pairs of Welin quadrant davits were installed on the *Bache* at Baltimore, July 1–8, and the vessel sailed for the New England coast July 10. En route magnetic observations were made in Chesapeake Bay and at Vineyard Haven, Mass., and soundings were made in Nantucket Sound and in Pollock Rip Slue to examine certain selected areas. The vessel reached Boston on July 22 and preparations were made for repairs. Hydrographic work was done off Plymouth, Mass., July 28–31 and on August 11, and off Boothbay and Portland, Me., August 19–29. During the interval between these dates details in regard to repairs were attended to, the delay in approving the contract for repairs necessitating several trips to Boston.

A hydrographic resurvey of Shank Painter Bar off Provincetown, Mass., was made September 2–4, and then the vessel went to Boston for repairs, as the condenser was in such a condition that the vessel could not be used with safety. The repairs were completed on October 7, and the vessel returned to Portland, Me. The work in this vicinity and off Portsmouh, N. H., was completed on November 6, and hydrographic work was then done in the vicinity of The Graves Light-house and at Salem, Marblehead, and Plymouth. Some minor repairs were made at Boston November 23 to December 3, and a hydrographic resurvey was then made of Pollock Rip Slue and of the shoals east of Monomoy Island. The vessel sailed for Norfolk, Va., on December 14 and was engaged on the resurvey of the approach to Hampton Roads December 17 to February 26. On March 11 the *Bache* sailed for Fernandina, Fla., and made off shore soundings on the coast of Florida until May 12. Hydrographic work was done off Charleston, S. C., May 15 to June 13, when the vessel returned to Boston for repairs. This work was in progress on June 30.

STEAMER ENDEAVOR.

On July 1 the *Endeavor* was at work in Albemarle Sound, N. C. This work was completed on September 27, when the vessel proceeded to Norfolk, Va., for repairs. The repairs were completed on October 20, and then chart revision work, including supplementary surveys, was done in Elizabeth and James rivers until March 12, when the work was suspended and a special survey of the Delaware Breakwater speed trial course was made as requested by the Navy Department. This survey was completed on April 14 and the vessel went to Wilmington, Del., for repairs, but the charges were considered

excessive, and the repairs were made at Jersey City, May 1–25, the work being delayed by a fire which started in the engine room. On May 27 the vessel went to Buzzards Bay, Mass., and continued supplemental surveys in that bay during the remainder of the fiscal year.

SCHOONER MATCHLESS.

Repairs were made to this vessel July 1–16, and then supplemental work for chart revision was begun in Rappahannock River and completed to the head of navigation above Fredericksburg on March 25. The vessel then proceeded to Annapolis, Md., and a supplementary survey was made in Severn River, March 27 to June 15. A search was made for a reported shoal in the vicinity of York Spit, Chesapeake Bay, June 20–23, and the vessel then went to Newport News (June 25) for repairs to the launch. This work was in progress on June 30.

STEAMER HYDROGRAPHER.

This vessel was out of commission and laid up July 1 to April 4, when she was taken to Baltimore for repairs. The repairs were completed, and on June 20 the vessel sailed for coast-pilot work on the coast of New England via Jersey City for supplies. Some hydrographic work was done at Fishing Point, Va., en route, and the vessel was at Jersey City on June 30.

STEAMER EXPLORER.

On July 1 this vessel was at work on the survey of Nushagak Bay, in Bristol Bay, Alaska, and work was continued until September 21, when the vessel sailed for San Francisco, Cal., via Unalaska, Alaska, and Seattle, Wash. The *Explorer* reached Seattle on October 8 and San Francisco on October 17. From November to March 15 the vessel was engaged in making supplemental surveys along the California coast. Repairs were made to the ship at San Francisco, and on April 23 she sailed for Bristol Bay via Seattle. The vessel reached Port Moller, Alaska, on May 19 and was delayed there by ice until June 3. During this interval a general survey was made of the port. On June 4 the vessel reached Nushagak Bay and resumed the survey of the bay. The work was in progress on June 30.

STEAMER GEDNEY.

The steamer *Gedney* was at work on the survey of Cordova Bay, Alaska, on July 1 and the work was continued until September 17, when the vessel proceeded to Ketchikan for work in Tongass Narrows to locate a reported reef. The steamer *Cosmos*, the tender of the *Gedney*, continued work in Cordova Bay until September 25 and then joined the vessel. The work in Tongass Narrows was suspended on October 20 and the vessel proceeded to Seattle, Wash., reaching there on the 28th. Chart revision work was begun in Puget Sound with a reduced crew on December 1 and continued until March 5, when the vesssel returned to Seattle for repairs. The repairs were completed on April 10, and on April 20 the vessel sailed for Ketchikan, Alaska.

Repairs were made to the *Cosmos* April 28 to May 20, and the *Gedney* then resumed work in Tongass Narrows and the *Cosmos* proceeded to Portland Canal to make a topographic and hydrographic survey of the head of the canal in the vicinity of Bear River. The work of both vessels was in progress on June 30.

THE M'ARTHUR.

The survey of Cook Inlet was in progress on July 1 and was continued until September 26. The *McArthur* sailed for Seattle on October 3, and reached there on the 13th. Repairs were made and the vessel sailed for Grays Harbor, Wash., on October 31. The survey of Grays Harbor began on November 5 and was continued until March 6, when the vessel returned to Seattle for repairs and to prepare for work in Alaska. The repairs were completed on April 11, and the vessel sailed for Cook Inlet on the 19th. Work began north of the Forelands on May 12 and was in progress on June 30.

STEAMER PATTERSON.

The survey of Controller Bay, Alaska, was in progress on July 1 and was continued until October 1, when the *Patterson* went to Cordova and sailed for Seattle on the 15th. The vessel reached Seattle on October 27 and most of the officers were detached and the crew reduced. Repairs were made to the vessel in January and February, and on April 18 she sailed for Cook Inlet via Cordova to get her tender, the launch *Alpha*. The ship reached Port Graham, Cook Inlet, on May 5, and the survey of the inlet south of the Forelands was begun on May 9. The work was in progress on June 30.

STEAMER TAKU.

The survey of Prince William Sound, Alaska, in the vicinity of Knight Island, was in progress on July 1 and was continued until September 23, when the vessel was taken to Cordova and laid up for the winter. Repairs were made to the *Taku* April 28 to May 22, and work on the survey of the sound was resumed on May 31 and continued during the remainder of the fiscal year.

STEAMER YUKON.

The survey of the east coast of Afognak Island, Alaska, was in progress on July 1, and was continued until September 25, when the vessel was hauled out of the water and laid up for the winter. Repairs were made to the *Yukon* April 19 to May 10 at Kodiak, Alaska, and the vessel sailed on May 12 for Cook Inlet. Hydrographic and topographic work along the east side of Cook Inlet south from the Forelands began on May 17 and was in progress on June 30.

OFFICE OF INSPECTOR OF GEODETIC WORK.

J. F. HAYFORD, *Inspector*, July 1 to November 23; WILLIAM BOWIE,* *Inspector*, December 10 to June 30.

The duties of the Inspector were performed at the Office in Washington, where the records of the field parties were examined as they were received and an effective supervision of the work was maintained in this way.

The Survey made an important contribution to the science of geodesy by the issue of two publications entitled "The Figure of the Earth and Isostasy from Measurements made in the United States" and "Supplementary Investigation in 1909 of the Figure of the Earth and Isostasy." These two publications are important, because they furnish a determination of the figure and size of the earth of a high grade of accuracy, because

* Acting Inspector, September 5 to December 9.

the methods of computing and investigating are somewhat novel, and because this investigation has established the fact that in and around the United States the condition called "isostasy" exists. The publication giving the results of the first investigation was available for distribution in August, 1909, and copies were immediately mailed to the members of the International Geodetic Association in anticipation of the meeting of the General Conference of the association in September last.

The supplemental investigation, for which a large amount of additional data had become available, confirmed and strengthened the conclusions deduced in the original discussion. It should be borne in mind that practically all of the field work upon which these investigations are based was done to furnish correct geographic positions along the coast and throughout the interior of the country for controlling surveys and engineering works undertaken by the General Government, States, cities, private corporations, and individuals.

Another noteworthy event of the year in connection with the geodetic work was the issue of a preliminary publication giving the results of an investigation of the effect of topography and isostatic compensation upon the intensity of gravity. Additional observations have been made and the investigation is in progress.

The Texas-California triangulation was continued and 480 kilometers (300 miles) of progress was made.

The precise level net of the United States was extended by the addition of 1 260 kilometers (788 miles) and the relative intensity of gravity was determined in 26 selected localities.

OFFICE OF INSPECTOR OF MAGNETIC WORK.

R. L. FARIS, *Inspector.*

The instructions for magnetic work and the information required by parties in the field were prepared by the Inspector. Supervision of the work was maintained by an examination of the records of the parties in the field as they were transmitted to the Office from time to time as the work progressed.

The activity of the Survey in magnetic work may be summarized as follows:

OBSERVATORY WORK.

The magnetic observatories at Cheltenham, Md.; Honolulu, Hawaii; Sitka, Alaska; and Vieques, P. R., were kept in continuous operation. The observations at the observatory formerly at Baldwin, Kans., were discontinued on October 22, 1909, and the instruments were transferred to the building recently completed at Tucson, Ariz. Observations at the Tucson Observatory began on November 16 and were continued during the remainder of the fiscal year. At Cheltenham the usual number of magnetic storms were recorded. The one on September 25 was exceptionally severe and caused the greatest variations in the magnetic elements ever recorded at this observatory. Special observations were made in connection with similar work abroad from May 15 to 20, the period during which the earth passed through the tail of Halley's comet, but no definite result was obtained which can be ascribed to the comet's proximity to the earth.

MAGNETIC WORK ON LAND.

The values of the magnetic elements declination, dip, and intensity were determined at 238 stations, distributed over 39 States and Territories, including Porto Rico and the Philippine Islands, as shown in the following table:

State.	Localities.	Stations.	Old localities reoccupied.	Declination results.	Dip results.	Intensity results.
Alabama	4	5	4	5	5	5
Alaska	16	16	3	21	10	11
Arizona	3	3	3	4	4	4
California	5	6	5	6	6	6
Connecticut	2	2	2	2	2	2
Florida	1	1	1	1	1	1
Georgia	1	1	1	1	1	1
Hawaii	1	1	1	1	1	1
Illinois	10	10	1	10	10	10
Indiana	21	22	2	24	24	24
Iowa	29	30	3	30	30	30
Kansas	7	7	5	7	8	7
Kentucky	5	5	1	5	5	5
Louisiana	3	3	3	3	3	3
Maine	8	8	2	8	8	8
Maryland	2	2	2	4	8	3
Massachusetts	6	6	4	7	6	5
Michigan	2	2	1	2	2	2
Minnesota	25	25	1	25	25	25
Mississippi	2	2	2	2	2	2
Missouri	2	2	0	2	2	2
Nebraska	20	20	0	20	20	20
New Hampshire	4	4	2	4	4	4
New Jersey	2	2	1	2	2	2
New Mexico	2	2	2	2	2	2
New York	4	4	3	4	4	4
North Dakota	1	1	1	1	1	1
Ohio	1	1	1	1	1	1
Pennsylvania	3	3	2	3	3	3
Philippine Islands	7	7	0	7	0	0
Porto Rico	1	1	1	1	1	1
Rhode Island	2	2	2	2	2	2
South Carolina	1	1	1	1	1	1
South Dakota	10	10	2	10	10	10
Tennessee	6	6	2	6	6	6
Texas	5	6	4	6	6	6
Vermont	1	1	0	1	1	1
Virginia	3	4	3	4	4	4
Washington	3	3	0	3	0	0
Foreign countries	1	1	1	3	3	3
Total	232	238	74	251	234	228

MAGNETIC WORK AT SEA.

The magnetic work done on board the vessels of the Survey is shown in the following table:

Vessel.	General region.	Results from surveys.			Course observations.		
		Declination.	Dip.	Intensity.	Declination.	Dip.	Intensity.
Bache	Atlantic Ocean	7	7	7	0	0	0
Explorer	North Pacific Ocean	19	23	23	11	0	0
Gedney	do	13	0	0	0	0	0
Patterson	do	2	3	3	0	0	0
Romblon	Philippine Islands	1	0	0	0	0	0
Marinduque	do	3	0	0	0	0	0
Fathomer	do	8	0	0	0	0	0
Total		53	33	33	11	0	0

As usual, the magnetic work at sea was incidental to the regular surveying work of the vessels, and the observations were made when the vessels were en route to and from the different fields of work or when there was a suitable opportunity during the working season.

OFFICE OF THE DISBURSING AGENT.

SCOTT NESBIT, *Disbursing Agent.*

The Disbursing Office of the Coast and Geodetic Survey has charge of all of the appropriations made for that service and, in addition, the appropriations made to the State Department for the survey and marking of the United States and Canada boundary and of the boundary between Alaska and Canada. The extremely wide field of work covered by these appropriations compels payments to be made in all parts of the United States, including Alaska, Porto Rico, Hawaii, and the Philippine Islands. The services of more than 70 bonded chiefs of parties are required to make these payments at the remote points occupied by the working parties of this Survey, both on land and sea. All of the public funds used by these officers are advanced from the central Disbursing Office of the Coast and Geodetic Survey, and the resulting bookkeeping and auditing are done in that office. Necessarily a very extensive line of correspondence results, as, in addition to all pay and salaries, the manning, equipping, outfitting, and repairing of the vessels of the Survey, the purchase and sale of clothing and small stores, the system of allotments made by seamen and other employees, and the entire expense of the field work of the Service, which is both extensive and varied, and the survey and marking of the two boundary lines mentioned, are financed entirely from the central Disbursing Office. The above-mentioned chiefs of parties are bonded in the sums of from $2,000 to $10,000 each, and, while acting as chiefs of parties, these officers receive from time to time such advances of public funds from the Disbursing Agent as are approved by the Superintendent and are required to meet the necessary current expenses of the work in hand. A ledger account is kept in the office of the Disbursing Agent with each chief of party receiving an advance of public funds, each one being charged with all advances made

to him and, on the other hand, receiving credit for all proper expenditures made by him, when presented on regularly supported vouchers, after such accounts have been audited in the office of the Disbursing Agent, found to be correct, and approved by the Superintendent of the Survey. All of these accounts, after they have received the administrative examination required by law in the office of the Superintendent of the Coast and Geodetic Survey, are, with their supporting vouchers, sent through the Department of Commerce and Labor to the Auditor for the State and other Departments for examination and audit by him. This system has met the needs of this Survey and results, in the main, in economy and good order in its expenditures. A very large proportion of the appropriations named is now being expended in the survey of the most remote waters of Alaska and the Philippine Islands, and in the survey and marking of the boundary between Alaska and Canada, far in the interior of that territory.

OFFICE OF EDITOR OF PUBLICATIONS.

The Annual Report of the Superintendent (pp. 1–184), covering the progress of the work of the Survey during the fiscal year 1909, was completed and sent to the Public Printer, through the Secretary of Commerce and Labor, on September 21, 1909, and the last proof was read and returned to the printer on January 4, 1910.

The publications of the Coast and Geodetic Survey during the fiscal year are given in the following list:

Report of the Superintendent of the Coast and Geodetic Survey, showing the progress of the work from July 1, 1908, to June 30, 1909. 184 pages, with the following appendices, also published separately:

No. 3. Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1908, and June 30, 1909. Reprint. 76 pp.

No. 4. Distribution of the Magnetic Variation in Alaska and adjacent regions for 1910. Reprint. 30 pp.

The Figure of the Earth and Isostasy from Measurements in the United States. 178 pp.

Supplementary Investigation in 1909 of the Figure of the Earth and Isostasy. 80 pp.

Catalogue of Charts, Coast Pilots, and Tide Tables, 1909. 228 pp.

Survey of Oyster Bars, Calvert County, Md. 94 pp.

Geodetic Operations in the United States, 1906–1909. 12 pp.

Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Cheltenham, Md., 1905 and 1906. 110 pp.

Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory near Honolulu, Hawaii, 1905 and 1906. 116 pp.

Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Sitka, Alaska, 1905–1906. 116 pp.

Description of Long Wire Drag. 22 pp.

Tide Tables for the year 1911. 530 pp.

Tide Tables for the Atlantic Coast of the United States, including Canada and the West Indies. Reprint from the Tide Tables for 1911. 180 pp.

Tide Tables for the Pacific Coast of the United States, together with a number of foreign ports in the Pacific Ocean. Reprint from the Tide Tables for 1911. 167 pp.

United States Coast Pilot, Atlantic Coast. Part IV: From Point Judith to New York. Fifth edition. 212 pp.

United States Coast Pilot, Atlantic Coast. Part V: From New York to Chesapeake Bay Entrance. Fourth edition. 166 pp.

Alaska Coast Pilot notes from Yakutat Bay to Cook Inlet and Shelikof Strait. Second edition. 82 pp.

United States Coast Pilot, Atlantic Coast. Parts I-II: From St. Croix River to Cape Ann. Supplement to second edition. 19 pp.

United States Coast Pilot, Atlantic Coast. Part III: From Cape Ann to Point Judith. Supplement to second edition. 16 pp.

United States Coast Pilot, Atlantic Coast. Part VI: Chesapeake Bay and Tributaries. Supplement to third edition. 10 pp.

United States Coast Pilot, Atlantic Coast. Part VII: From Chesapeake Bay Entrance to Key West. Supplement to third edition. 23 pp.

United States Coast Pilot, Atlantic Coast. Part VIII: Gulf of Mexico from Key West to the Rio Grande. Supplement to third edition. 12 pp.

Philippine Island Sailing Directions. Section II: Southwest and South Coasts of Luzon and Adjacent Islands from Manila to San Bernardino Strait. Fourth edition. 102 pp.

Philippine Island Sailing Directions. Section V: Coast of Mindanao and Adjacent Islands. Third edition. 136 pp.

Catalogue of Charts, Sailing Directions, and Tide Tables of the Philippine Islands, 1910. 54 pp.

Philippine Islands. Notices to Mariners. Nos. 5, 6, 7, and 8 of 1909 and Nos. 1, 2, 3, and 4 of 1910.

APPENDIX 1

REPORT 1910

DETAILS OF FIELD OPERATIONS

CONTENTS.

DETAILS OF FIELD OPERATIONS.

UNITED STATES.

IOWA, NEW JERSEY, NEW YORK, AND PENNSYLVANIA.

[J. R. BENTON.]

STATIONS OCCUPIED.—*Iowa:* Audubon, Bedford,* Chariton, Clarinda,* Corning, Denison, Glenwood, Greenfield, Guthrie Center, Harlan, Indianola, Jefferson, Leon, Mount Ayr, Nevada, Red Oak, Sidney, Webster City, and Winterset. *New Jersey:* Boonton and Trenton. *New York:* Carmel. *Pennsylvania:* Easton and Norristown.

The extension of the magnetic survey of the country was resumed in Iowa on July 15 and the work was continued until September 13. During this period the stations in Iowa named above were occupied and observations were made to determine the value of the three elements of terrestrial magnetism. Work was resumed June 13 in Pennsylvania and observations were made at the stations in New Jersey, New York, and Pennsylvania named above. The work was in progress on June 30.

NORTH CAROLINA AND VIRGINIA.

[J. B. BOUTELLE, Commanding Steamer *Endeavor*.]

SUMMARY OF RESULTS.—Hydrography: 235 miles of lines sounded, 15 003 soundings made, 4 tide stations occupied. Topography: 2 square miles of area covered, 140 miles of shore line surveyed, 5 miles of road surveyed, 1 topographic sheet completed. Triangulation: 544 square miles of area covered, 58 stations occupied, 70 geographic positions determined.

On July 1 the party on the steamer *Endeavor* was engaged in revising and supplementing the survey of Albemarle Sound, North Carolina. This work was continued until September 27, and during this period a new triangulation was extended over the sound from Durant Island to the head of the sound and continued up Chowan River to a point a short distance above Montrose. The shore line on both sides of the sound is receding, and none of the triangulation stations used in the previous work were recovered between Durant Island and Edenton. Five old triangulation stations along Chowan River were recovered and used in the new work. A long railroad bridge is being constructed across the sound at Skinners Point, and the geographic positions of the range towers at the ends of the bridge were determined.

On September 29 the vessel left Edenton, N. C., for Norfolk, Va., for repairs.

The revision of the survey of Nansemond River from its mouth to Suffolk was begun on October 20 and completed on December 10.

* Meridian stones set as requested by the county surveyors.

Three old triangulation stations at the mouth of the river were recovered and a few additional stations were established. From these stations a plane-table triangulation was extended up the river to Suffolk, the survey of the shore line was revised, and soundings were made in the channel of the river.

After December 10 the party was engaged in revising the survey of James River until March 17, when the work was suspended, as the vessel was needed for other duty.

During this period a number of the old triangulation stations were recovered and supplementary work was done to complete the triangulation of the river up to the mouth of the Chickahominy River. A resurvey was made of the shore line and supplementary hydrographic work was done in order to determine the existing conditions in the channel.

The information necessary for a revised edition of the charts covering the locality was secured.

Supplemental surveys were begun by the party on the *Endeavor* on May 31 in Buzzards Bay, Mass., and the work was in progress on June 30. Seven old triangulation stations were recovered and 8 new stations were established for use in the hydrographic work.

Serious delay was caused by the rainy and foggy weather which prevailed in June.

MARYLAND.

[J. E. BURBANK.]

The work at the magnetic observatory at Cheltenham, Md., was continued without interruption during the year. A practically continuous record of the relative force of the three elements of terrestrial magnetism was obtained and observations to determine absolute values for the three elements were made at regular intervals.

There was an exceedingly severe magnetic storm on September 25, with a greater disturbance of the magnets than has occurred since the observatory was established, in 1901. The variations in the earth's magnetic intensity were so violent and so sudden that it was impossible to keep the vertical intensity magnets in position for any considerable length of time, and the Eschenhagen intensity magnet was repeatedly unbalanced.

The Eschenhagen declination magnet and the Adie horizontal intensity (Bifilar) and declination magnets all remained in operation during the storm, but the ranges were beyond the limits of the paper on the recording apparatus and a considerable loss of record occurred.

The seismograph afforded good results, and 40 earthquakes were recorded, nearly all of which were at distant points and the resulting motion was very slight at this station.

ARIZONA, CALIFORNIA, DISTRICT OF COLUMBIA, MAINE, MICHIGAN, NEW MEXICO, NEW YORK, NEVADA, NORTH DAKOTA, SOUTH DAKOTA, TENNESSEE, TEXAS, AND VERMONT.

[W. H. BURGER.]

SUMMARY OF RESULTS.—Gravity: 26 stations occupied. Magnetic observations: 12 stations occupied.

On July 1 gravity and magnetic observations were in progress and the work continued without interruption until November 12, when field work was suspended. Work was resumed on January 10 and continued until May 5, when the observations at Denison, Tex., were completed and the instruments were sent to Washington for observations

at the base station. These observations were completed in the latter part of May. Gravity observations were made at the following stations: *Arizona:* Two stations were occupied at the Grand Canyon of the Colorado, one on top of the plateau at an elevation of 2 179 meters above sea level and the other 1 330 meters almost vertically below it; Nogales and Yuma. *California:* Compton. *District of Columbia:* Observations were made at the base station in November and again in May. *Maine:* Fort Kent. *Michigan:* Alpena* and Iron River.* *Minnesota:* Ely.* *New Mexico:* Gallup and Las Vegas. *New York:* Lake Placid,* Potsdam,* and Wilson.* *Nevada:* Goldfield. *North Dakota:* Pembina.* *South Dakota:* Mitchell.* *Tennessee:* Cloudland* and Hughes. *Texas:* Denison, El Paso, Kerrville,* Shamrock, and Sweetwater.* *Vermont:* North Hero.*

At each station the flexure of the pendulum support was measured in terms of the wave length of light by the use of an interferometer.

WASHINGTON.

[R. B. DERICKSON, Commanding Steamer *Gedney.*]

Supplementary surveys and the collection of information for the revision of the charts covering Puget Sound and adjacent waters were begun on December 1 and continued until March 9. The localities named below were visited and sheets were prepared to show all changes necessary to bring the charts up to date: Olympia (survey of water front, including improvements in Budd Inlet), Boston Harbor, Shelton, Pickering Pass and Hammersley Inlet, head of Cases Inlet, Vaughn Bay, lower portion of Cases Inlet, Hope Island and mainland adjoining Puget Sound, Puget, Tituse Bay, Von Gelderns and Mayo coves in Carrs Inlet, head of Carrs Inlet, along the shores of Colvos Passage, McNeil and Fox islands, and the mainland adjoining Puget Sound, Dupont powder works, and Anderson Island. The work was suspended on March 9 in order to make repairs to the vessel and to prepare for work in Alaska.

CALIFORNIA.

[W. C. DIBRELL, Commanding Steamer *Explorer.*]

SUMMARY OF RESULTS.—Hydrography: 358 square miles of area covered, 790 miles of lines sounded, 2 695 soundings made, 2 tide stations occupied, 7 hydrographic sheets completed, 185 miles of lines run with submarine sentry set covering 5 square miles of area, 18 miles of lines run with wire drag set covering 1 square mile of area. Triangulation: 8 square miles of area covered, 9 stations occupied, 4 geographic positions determined.

The party on the steamer *Explorer* was engaged November 3 to March 13 in searching for reported dangers to navigation along the coast of California and in doing supplemental work for chart correction.

A search was made for a reported sunken rock off Fort Ross. The locality was covered by a survey and no evidence of this danger was found.

A hydrographic survey was made of an area of small extent off Montara Point to develop Colorado Reef. An examination was made off Point Surin in the vicinity of the charted position of the so-called "Alert Bank," and it was shown that this "bank" does not exist. The soundings were extended out to the 100-fathom curve. A pinnacle

* Magnetic observations were also made.

rock in the approach to Port San Luis was located and its geographic position determined. Soundings were made over the area in its immediate vicinity. A search was made off Point Arguello for a bank, reported by the U. S. S. *St. Louis*, but no indications of it were found and the soundings show that no bank exists in the position reported. Soundings were made out to a depth of 100 fathoms.

A line of soundings was run parallel to the coast, between Point Piedras Blancas and Point Buchon, outside of the soundings shown on the chart, the soundings being made at intervals of 4 or 5 miles, while en route from San Francisco to Port San Luis.

Supplemental triangulation was done to determine the position of hydrographic signals in the vicinity of Fort Ross and Montara Point, and the geographic position of the light-house at Port San Luis was determined.

From November 26 to January 2 Assistant Paul C. Whitney was in command of the vessel, and during this period chart-revision work in San Francisco Bay was done.

Field work closed on March 14 in order to prepare the ship for work in Alaska.

VIRGINIA.

[W. B. FAIRFIELD.]

March 6–18 the geographic position of the light-house on Ragged Point (Potomac River), Virginia, was determined by triangulation. Three old triangulation stations in the vicinity were recovered and observations were made from these stations to determine the position of the light-house.

MARYLAND AND VIRGINIA.

[O. W. FERGUSON, Commanding Schooner *Matchless*.]

SUMMARY OF RESULTS.—Hydrography: 179 square miles of area covered, 733 miles of lines sounded, 30 657 soundings made, 10 tide stations occupied, 3 hydrographic sheets completed. Topography: 42 square miles of area covered, 100 miles of shore line surveyed, 171 miles of shore line of creeks surveyed, 7 miles shore line of ponds surveyed, 65 miles of roads surveyed, 13 topographic sheets completed. Triangulation: 9 square miles of area covered, 11 stations occupied, 8 geographic positions determined.

July 23 and 24 the *Matchless* made a supplemental topographic survey at Point Lookout, Chesapeake Bay, Maryland, covering 3 miles of the shore line of the point, and then proceeded to the Rappahannock River, Virginia, to revise the survey of the river from the mouth to the head of tide water, a point 2½ miles above Fredericksburg, to secure the data necessary to bring the charts of the river up to date. The work included plane-table triangulation, topography, and hydrography, and it was completed during the period July 26 to December 22.

The chart-revision work was then extended to the creeks tributary to the Rappahannock River, and this portion of the work was completed on March 25. An examination was made in 19 creeks and the work extended from one-half to 9 miles above the mouths. Serious delay resulted from ice in the river.

On March 26 the vessel sailed for Annapolis, Md., to do supplementary work for chart revision in Annapolis Harbor and the entrance to the Severn River. This work began on April 1 and was completed June 17. Several of the old triangulation stations were recovered and supplemental triangulation was extended from these stations to cover

the harbor and to determine the geographic positions of all prominent objects in Annapolis.

The tidal bench mark at Greenbury Point Light-house was recovered and a tide staff was erected at that place. Another staff was placed near the southeast corner of the Naval Academy grounds and the reference plane for sounding previously established at Greenbury Point Light-house was transferred to the new position by simultaneous observations at intervals of fifteen minutes for a period of twenty-four hours. All the tidal bench marks in Annapolis were searched for, but only three could be recovered. These were connected by leveling with the Naval Academy Standard bench mark, with a bench mark on the court-house established by the United States Geological Survey and with two new bench marks which were established.

A resurvey was made of the shore line with a plane table and a hydrographic resurvey of the harbor with current observations in the entrance to Severn River. On June 17 the vessel sailed for Newport News, Va., and stopped en route at Mobjack Bay to make an examination of the shoal 4½ miles southeast of York Spit Light-house. The work was completed on June 23, the vessel reached her destination on the 25th, and on the 30th was making preparations to begin chart-revision work in James River.

NEW YORK.

[E. G. FISCHER.]

In September a tide indicator was installed in the building of the American Seamen's Friend Society's Institute at 507 West street, New York City. An electrical transmitter was placed in position on Pier 51 and connected by wire with the indicator. A steel float tube was used, with the float resting on 6 feet of kerosene to prevent the water from freezing in the tube in cold weather.

An inspection of the tide gauge at Fort Hamilton was made and the tide staff was referred to adjacent bench marks by leveling.

In the following April a mechanician was sent to New York to make some necessary repairs to the indicator and transmitter and the apparatus was again left in good order.

The tide indicator in the rooms of the Maritime Association was inspected and some repairs were made to the transmitter on Pier "A."

An inspection of the tide gauge at Fort Hamilton was again made, and some instruction was given to the observer who was temporarily in charge of the gauge.

MARYLAND AND VIRGINIA.

[S. FORNEY.]

SUMMARY OF RESULTS.—Hydrography: 13 square miles of area covered, 136 miles of lines sounded, 3 744 soundings made, 3 tide stations occupied, 2 hydrographic sheets completed. Topography: 44 square miles of area covered, 42 miles of shore line surveyed, 60 miles of shore line of creeks surveyed, 134 miles of roads surveyed, 4 topographic sheets completed. Triangulation: 42 stations occupied and 48 geographic positions determined.

On July 1 the topographic resurvey of the western shore of Chesapeake Bay and its tributaries was in progress between Dividing Creek and Smith Point. The work was continued during the summer and completed on August 31.

A hydrographic resurvey of Great Wicomico River and Cockrills Creek was then made, the work extending to the head of steamboat navigation on Great Wicomico River and to Reedville, Va., on Cockrills Creek.

On October 5 the party proceeded to Chestertown, Md., to make a topographic resurvey of the river. A number of old triangulation stations were recovered and, based on these, a supplemental triangulation was extended along the river to Crumpton. The topographic resurvey was completed on February 23.

On December 25 and 26 a severe blizzard prevailed, with 16 inches of snow, and in January and February there was serious delay on account of ice in the river, which was closed to navigation on many days.

On February 27 the party went to Wachapreague, Va., to recover old triangulation stations and do supplementary work from Cedar Island toward Cape Charles, along the eastern coast of Virginia, and to revise the survey of the shore line from Assawaman Inlet toward Cape Charles. A search was made for old stations between Wachapreague Inlet and the southern end of Cobbs Island, but they have all been destroyed. New stations were selected and marked and an attempt was made to secure observations, but unfavorable weather prevailed, with rain, fog, and haze, and a complete set of observations were made at only one station.

At the end of May work on the triangulation was suspended and the party began the revision of the shore line along the coast south of Assawaman Inlet. This work was in progress at the end of June in the vicinity of Paramore Life Saving Station. Notable changes have occurred at several points.

HAWAII AND MASSACHUSETTS.

[O. B. FRENCH.]

SUMMARY OF RESULTS.—Hydrography: 28 miles of lines sounded, 1 824 soundings made, 1 tide station occupied. Reconnaissance: 105 square miles of area covered, 41 stations selected. Topography: 1 square mile of area covered, 2 miles of coast line surveyed, 2 miles of roads and railroads surveyed. Triangulation: 58 square miles of area covered, 29 stations occupied, 114 geographic positions determined.

Chart revision work on Cape Cod Bay, Massachusetts, was in progress on July 1 in the vicinity of Wellfleet. The work was continued until September 16, when work assigned was completed. The revision covered the area shown on one of the coast charts. The observer reports as follows:

> It was quite surprising to me to find such accuracy in these old [topographic] sheets. Although some of them were made more than sixty years ago, the details were still true except where there was no doubt about there having been an actual change in the topography since the original sheet was constructed.

Six triangulation stations were occupied and the geographic positions of a number of prominent objects were determined. A search was made for 107 old triangulation stations; 35 of these were recovered and 69 have been destroyed. A search was also made for 20 tidal bench marks, 13 of which were recovered and 5 have been destroyed.

On December 11 preparations began for a revision of the charts of the Hawaiian Islands. The records of the Hawaiian government survey, made before the annexation of the islands, were examined and some supplementary triangulation was done in the

vicinity of Honolulu. The original records of the trigonometric work on Oahu were sent to Washington and abstracts of similar records on the other islands were made where the books contained records of local work and were frequently needed in Honolulu. In February a survey was made of Nahukona Harbor, island of Hawaii, in accordance with an urgent request for the work.

Mr. R. R. Elgin, manager of the Hawaiian Railway Company, transported the party between the triangulation stations in his automobile and showed the party many other courtesies. The railway company also furnished other transportation and such assistance as was required.

In March preparations were made for a trigonometric connection between the islands of Oahu and Kauai, but there was no suitable weather before the end of the fiscal year in which observations could be made over the long lines involved in this connection.

Observers were ready on both of these islands after March 14, and while waiting for suitable weather the observer on Kauai made a reconnaissance around the island and later extended a triangulation along the shore about halfway around the island, covering the east end. During the progress of this work the positions of numerous points were determined for use in the hydrographic survey which will be made later.

The computations connected with the survey of Mahukona Harbor were completed and a drawing in the form of a chart was made. Copies of this drawing were furnished to the Hawaiian Railway Company as authorized.

The abstracts of the observations in the old triangulation on the islands of Molokai, Maui, and Lanai, and more than half of the work on Hawaii, were completed. A reconnaissance was also made to extend a triangulation around the island of Oahu.

VIRGINIA.

[H. C. GRAVES, Commanding Steamer *Hydrographer*.]

On June 20 the *Hydrographer* sailed from Baltimore for the coast of New England to secure information in the field for the revision of the United States Coast Pilot volumes covering the coast from the St. Croix River, Maine, to Point Judith, Rhode Island.

En route the vessel stopped at Assateague Anchorage, Virginia, to observe the changes in the conditions at Fishing Point, and a hydrographic reconnaissance was made off the point. On June 30 the vessel was at Jersey City completing preparations for coast-pilot work on the New England coast.

MAINE, MASSACHUSETTS, AND NEW YORK.

[N. H. HECK.]

SUMMARY OF RESULTS.—Hydrography: 77 square miles of area covered with wire drag, 490 miles of lines covered with wire drag, 141 soundings made, 5 tide stations occupied, 7 current stations occupied, 7 hydrographic sheets completed.

On July 1 a party was organized to examine certain waters on the coast of Maine with a wire drag. The area examined included the southern end of West Penobscot Bay, Hurricane Sound, portions of Muscle Ridge and Two Bush channels, part of East

Penobscot Bay, the channel south of Vinalhaven Island, and a special examination in Eggemoggin Reach.

Several changes in the drag and the method of using it greatly facilitated the work and increased the area possible to be covered in any given time. A drag 8 400 feet long was used, but it was found that motor power was necessary to turn the reels in taking up a drag longer than 6 000 feet, and consequently the shorter length was regularly used in open water. By using buoys with a hoisting apparatus attached, changes of depth to allow for the state of the tide were made without stopping the drag. In order to prevent their destruction, it was necessary to have many thousands of lobster pots removed from the areas to be examined. These areas were marked by spar buoys in advance and notice was given to the lobster fishermen to remove their pots. The buoys were removed as soon as the examination was completed. The increased length of the drag and other improvements in its construction and the method of using it greatly reduced the cost of the work.

On October 30 the work on the coast of Maine was discontinued and the party was divided into two sections, one of which was sent to Buzzards Bay, Massachusetts, and the other to Gardiners Bay, Long Island, New York. Examinations with the drag in Buzzards Bay were made November 5–16, and the work was then discontinued for the winter on account of unfavorable weather conditions. At Gardiners Bay an examination was made of the northeastern approach and numerous bowlders were found in the channel with less water on them than the charted depths indicated. This work was also discontinued on November 16, on account of unfavorable weather, and resumed on May 16, when the examination was extended over Plum Gut and a portion of Gardiners Bay, as well as in the channel mentioned above.

On June 9 the party proceeded to Rockland, Me., and the work was in progress in that locality on June 30.

CALIFORNIA, NEW MEXICO, AND TEXAS.

[J. S. HILL.]

SUMMARY OF RESULTS.—Astronomical observations: 5 azimuths determined. Base measurement: 1 base line measured. Triangulation: 20 000 square miles of area covered, 29 stations occupied, 40 geographic positions determined.

The extension of the triangulation in Texas westward toward California was resumed on September 1 in the vicinity of Pecos River, and the work continued until January 27, when it was suspended for the winter at a point in central New Mexico. Three hundred miles of progress was made, measured along the axis of the triangulation. The average length of lines observed was 56 kilometers and the longest line had a length of 163 kilometers.

Two bench marks, one at El Paso, Tex., and the other at Deming, N. Mex., and 8 triangulation stations, established by the United States Geological Survey, were connected with the work, as was also several of the international boundary stations, as follows: El Paso court-house, Federal Building, Juarez Cathedral, and boundary monuments Nos. 2, 3, 31, 32, 39, and 40. The observations were all made by the chief of the party. Field work was resumed on June 22 and was in progress on June 30 at a station in California.

WASHINGTON.

[J. S. HILL and G. H. REKATE.]

SUMMARY OF RESULTS.—Reconnaissance: 2 600 square miles of area covered, 13 triangulation stations selected. Triangulation: 130 square miles of area covered, 6 stations occupied, 22 geographic positions determined.

On July 1 the extension of the triangulation along the coast of Washington was in progress and the work was continued until August 31. During this period a reconnaissance was also made from Grays Harbor toward Puget Sound to connect with previous work, and up the coast from Grays Harbor to Destruction Island for the extension of the triangulation to the points mentioned.

The triangulation was done by Mr. Rekate under Mr. Hill's direction, and he also prepared 6 stations for the observing party by opening lines through the timber and by building observing tripods and scaffolds where necessary.

On September 1 the charge of the work was transferred to Mr. Rekate and he continued to prepare stations for the observing party until November 12, when the work was suspended for the winter. Lines were opened and other preparations were made, such as opening trails, etc., at 6 stations. At some of them there was a dense growth of timber and the work of opening the lines of sight was very laborious.

ALABAMA, ARIZONA, CALIFORNIA, INDIANA, KENTUCKY, LOUISIANA, MISSISSIPPI, NEW MEXICO, NORTH CAROLINA, TENNESSEE, TEXAS, AND VIRGINIA.

[W. M. HILL.]

STATIONS OCCUPIED.—*Alabama:* Florence,* Huntsville, Scottsboro, and Tuscaloosa. *Arizona:* Benson, Tucson, and Yuma. *California:* Barstow, Indio, Red Bluff, and San Bernardino.* *Indiana:* Boonville,* Brazil,* Corydon, Covington, Decatur, Delphi,* English, Evansville, Fowler, Huntington, Petersburg, Portland, Rockport,* and Rockville. *Kentucky:* Bowling Green,* Brownsville, Franklin,* and Munfordville.* *Louisiana:* Ruston, Shreveport, and Tallulah. *Mississippi:* Jackson and Meridian. *New Mexico:* Deming and Lordsburg. *North Carolina:* Fayetteville. *Tennessee:* Athens, Franklin, Gallatin, Knoxville, Lawrenceburg, and Springfield. *Texas:* El Paso, Mineola, and Odessa.* *Virginia:* Bristol, Charlottesville, and Lynchburg.

Magnetic work was done in the field July 1 to September 30, and April 18 to June 30. Observations were made to determine the value of the three elements of terrestrial magnetism at the stations named above and meridian lines were established at 10 of the stations. Several of the stations had been previously occupied and the observations were repeated to determine the annual change in declination.

FLORIDA, MAINE, MASSACHUSETTS, NEW HAMPSHIRE, SOUTH CAROLINA, AND VIRGINIA.

[W. C. HODGKINS, Commanding Steamer *Bache*.]

SUMMARY OF RESULTS.—Hydrography: 70 square miles of area covered, 2 906 miles of lines sounded, 51 553 soundings made, 16 tide stations occupied, 34 current stations occupied, 16 hydrographic sheets completed. Magnetic observations: 5 stations on land and 3 stations at sea occupied. Triangulation: 34 stations occupied, 25 geographic positions determined.

The steamer *Bache* was engaged in supplementary hydrographic work at various places along the Atlantic coast of the United States during the year except at such

* Meridian lines also established.

times as were required to make repairs to the ship and to sail between the different localities where work was required. The following is a brief summary of the work completed, stated in chronological order:

On July 10 the *Bache* sailed from Baltimore for the coast of New England. Magnetic observations were made at sea off the mouth of the Patuxent River in Chesapeake Bay, and at a point about 9 miles WSW. from Vineyard Sound Light-vessel and also on shore at Vineyard Haven.

July 17 to 19 was spent in searching for a shoal spot reported to the southeastward of Bishop and Clerk Light-house, and soundings were also made on the east and west sides of Monomoy Island, Massachusetts. On July 22 magnetic observations were made on shore on Castle Island, Boston Harbor, and hydrographic work was done in the approaches to the harbors of Plymouth and Duxbury until August 14, and on that date magnetic observations were made at a station on shore at Long Beach. On August 19 the *Bache* proceeded to Boothbay Harbor, Maine, and five days were spent searching for a reported ledge in Fisherman Island Passage. The vessel reached Portland, Me., on August 24 and prepared for hydrographic work in the harbor. A tide gauge was established on Little Diamond Island and supplementary triangulation was done to determine the positions of hydrographic signals.

On the 29th the *Bache* returned to Boston for repairs, but the contract for the work had not been approved and soundings were made on Shank Pointer Bar near Provincetown until September 4, when the work was completed and the *Bache* went to Boston for repairs. On October 8 the vessel returned to Portland, Me., and completed the work in the harbor the following day. Soundings were made in the approaches, from the northward and eastward, to the harbor of Portsmouth, N. H., between October 10 and November 6, and after that date the examination of a shoal spot reported in the approach to Salem Harbor was continued at intervals when the weather permitted until November 23, when the work was suspended and minor repairs were made to the ship. On December 5 the vessel sailed from Boston for Pollock Rip Slue. En route a few additional soundings were made off Plymouth. The examination of Pollock Rip Slue was completed on December 11 and the vessel started to Norfolk, Va. On December 7 the three-masted schooner *Nat Meader* was found at anchor near Pollock Rip Shoals Light-vessel, in distress as the result of a collision, and the schooner was towed to Hyannisport.

On December 21 supplemental hydrographic work began in the approaches to Hampton Roads and was continued until March 11, when it was completed and the vessel sailed for Fernandina, Fla., for offshore hydrographic work in the latitude of St. Marys Entrance. This work was continued until May 13, when the ship proceeded to Charleston, S. C., and was at work in the approaches to the harbor until June 13, when the vessel proceeded to Boston, Mass., for repairs.

IDAHO AND MONTANA.

[H. D. KING, May 14 to June 11; C. Y. HARGER, June 12–30.]

The closing of the circuit Ogden, Utah–Butte, Mont.–Crawford, Nebr.–Cheyenne, Wyo.–Ogden, Utah, in the standard levels showed an error in the leveling, and a revision of the work was begun at Pocatello, Idaho, on May 14 and was in progress on June 30.

During this period the revision was completed over 371 kilometers of the circuit starting at Pocatello, Idaho, and proceeding northward and eastward via Butte, Mont., toward Crawford, Nebr.

MICHIGAN AND MINNESOTA.

[H. D. KING.]

Observations with a pendulum to determine the relative force of gravity were made in June at Iron River, Mich., and at Minneapolis, Minn. The work began on the 18th and was in progress at Minneapolis on the 30th.

TEXAS.

[H. D. KING, April 1–20; C. M. CADE, April 21 to June 30.]

SUMMARY OF RESULTS.—Leveling: 260 kilometers of line completed, 94 bench marks established.

The standard levels were extended in Texas, April 1 to June 30, along the Texas and Pacific Railway from Fort Worth toward El Paso, and the line was completed to Abilene. The elevation of the track in front of 28 railroad stations along the line was determined and also the elevation of one of the triangulation stations in this region. The work was in progress on June 30.

OKLAHOMA AND TEXAS.

[FORD KURTZ.]

SUMMARY OF RESULTS.—Leveling: 328 kilometers of line completed, 81 bench marks established.

The standard levels were extended in Oklahoma and Texas in July, August, and September, forming a portion of the line between El Reno, Okla., and Goffs, Cal. The work began at El Reno on July 1 and was suspended at Jericho, Tex., on September 14 in consequence of the serious illness of the observer. The route follows the Chicago, Rock Island and Pacific Railway from El Reno to the state line and thence along the Chicago, Rock Island and Gulf Railway to Jericho. The thanks of the Survey are due the officials of these railway companies for granting the privilege of using velocipede cars on the tracks of their roads as the means of transporting the party to and from work, and also for the privilege of camping on the company's ground at railway stations and of using water from the company's tanks.

The country passed over is comparatively level and no unusual difficulties were encountered. The party used tents for quarters and secured meals at hotels and boarding houses. This plan was satisfactory over the route followed and was adopted on account of the large charge for moving the outfit cars which had been in use on other lines.

MASSACHUSETTS AND NEW YORK.

[E. B. LATHAM.]

SUMMARY OF RESULTS.—Topography: 29 square miles of area covered, 1 topographic sheet completed. Triangulation: 45 square miles of area covered, 8 stations occupied, 20 geographic positions determined.

The collection of data for chart revision was in progress on the south shore of Long Island, New York, on July 1, and the work was continued until September 7. The supplementary triangulation was extended to a point near Long Beach and the geographic

positions of all prominent objects visible from the stations were determined. In connection with this work a search was made for 23 old triangulation stations, and 8 of them were recovered.

A resurvey was made of the shore line from a point near Fire Island Light-house to a point near Long Beach to a junction with work of the same character recently completed. The resurvey of the shore line was extended into the inlets where changes had occurred, and the location of the shore line of the bays and creeks was verified and found practically unchanged.

A connection was made with a survey of the marsh lands belonging to the town of Hempstead which was in progress and also with a survey of Great South Bay made by the Corps of Engineers in 1905.

On April 16 chart-revision work in the vicinity of Gloucester, Mass., was begun and continued to the end of the fiscal year. During this period a revision was made of the work on two topographic sheets, 90 per cent of one and 50 per cent of the other being completed. This work was in progress on June 30.

ARIZONA AND NEW MEXICO.

[H. W. MAYNARD.]

SUMMARY OF RESULTS.—Leveling: 670 kilometers of line completed, 179 bench marks established.

The extension of the standard levels between Goffs, Cal., and El Reno, Okla., was in progress on July 1 in the vicinity of Gleed, Ariz. The leveling was continued along the Atchison, Topeka and Santa Fe Railway until December 3, when the line was completed to Albuquerque, N. Mex., and the work was then suspended for the winter.

Outfit cars were used for quarters, and the use of velocipede cars as the means of transporting the party to and from the working ground was permitted by the railway officials. The Survey is under obligations to the company for granting this valuable privilege.

Water was furnished to the party by the company and the outfit cars were moved promptly as requested.

The country traversed varies between the extremes of an arid desert and land covered with forests, and the elevation varies between 500 and 7 000 feet above sea level. The observer reports unusual conditions of refraction, which retarded the work and added to the usual difficulties of the leveling work.

CONNECTICUT, ILLINOIS, MAINE, MASSACHUSETTS, MINNESOTA, NEBRASKA, NEW HAMPSHIRE, RHODE ISLAND, AND SOUTH DAKOTA.

[H. E. MCCOMB.]

STATIONS OCCUPIED.—*Connecticut:* New Haven and New London. *Illinois:* Eureka, Rock Island, and Watseka. *Maine:* Auburn, Bethel, Capens, Greenville, Kineo, and Oakland. *Massachusetts:* Dedham and Lawrence. *Minnesota:* Owatonna, Pipestone, Rochester, Slayton, and Waseca. *Nebraska:* Central City, Columbus, Dakota, Fremont, Greeley, Ord, Pierce, Stanton, and Wayne. *New Hampshire:* Concord, Gorham, Plymouth, and Woodsville. *Rhode Island:* Kingston and Providence. *South Dakota:* Armour, Flandreau, Madison, Plankinton, Tyndall, Vermilion, Wessington Springs, and Woonsocket.

Observations were made by this observer July 10 to September 30 and May 18 to June 30. During the periods covered by these dates the value of the three elements of

terrestrial magnetism were determined at the stations named above. All the stations were marked by stone posts or by drill holes at the intersection of cross lines cut in solid rock or in large bowlders. Meridian lines were established at a number of the stations. The work was in progress on June 30.

INDIANA, ILLINOIS, IOWA, AND MINNESOTA.

[F. A. MOLBY.]

STATIONS OCCUPIED.—*Indiana:* Laporte and Valparaiso. *Illinois:* Dixon, Galena, Joilet, Morrison, and Yorkville. *Iowa:* Algona, Cresco, Elkader, Mason City, Sibley, Spencer, and Spirit Lake. *Minnesota:* Ada, Aitkin, Bagley, Breckenridge, Carlton, Center City, Montevideo, Morris, New Ulm, Park Rapids, Pine City, Redwood Falls, St. James, Stillwater, Wabasha, Windom, Winona, and Worthington.

Magnetic work was in progress in the field on July 1 and was continued until September 20. During this period observations were made to determine the value of the three elements of terrestrial magnetism at the stations named above.

CALIFORNIA.

[FREMONT MORSE.]

SUMMARY OF RESULTS.—Triangulation: 107 square miles of area covered, 5 stations occupied, 24 geographic positions determined.

Observations were made December 20 to January 6 to determine the geographic position of the new light-house on Alcatraz Island, in San Francisco Bay, and incidentally the position of a number of prominent objects in the vicinity of San Francisco were also determined. Two old stations were recovered and used as base stations, and from this base the positions of two other old stations, supposed to be affected by the earthquake of 1906, and one new station were determined.

ARIZONA, MAINE, AND TEXAS.

[E. MUELLER.]

The construction of a magnetic observatory near Tucson, Ariz., was in progress on July 1, as stated in the previous annual report. The officer in charge was fatally injured in line of duty on July 3 by falling into the well (for water) which was being dug under his direction, and Assistant Mueller was instructed to complete the work. He took charge on July 12 and completed the work on October 29.

The buildings are located on a tract of 160 acres of the public land reserved for an observatory site by Executive Order No. 1082, dated June 3, 1909, on the Aguas Calientes, or Rincon road, about 8 miles east of Tucson. Two observatory buildings were constructed, one for the relative measure of the magnetic variations with a self-registering magnetograph, and the other for making observations to determine the absolute value of the three magnetic elements. An office building, including living accommodations for the observers, was erected, a well was dug, and a stable was built.

En route to Washington an inspection of the tide station at Galveston, Tex., was made November 3–6, and necessary repairs were made, including a new float well; a new self-registering gauge was placed in position.

January 7 and 8 a location for a self-registering tide gauge was selected at Portland, Me., and preliminary arrangements were made for the construction of the gauge house.

MAINE AND PENNSYLVANIA.

[C. G. QUILLIAN.]

During the period February 24 to March 7 a self-registering tide gauge was established at Portland, Me., on a wharf belonging to the Grand Trunk Railway in accordance with the permission granted by the officials of the company. A long steel pipe was used as a float well, and it was partially filled with kerosene oil in order to prevent freezing in winter. A tide staff was erected and connected by leveling with several permanent bench marks.

En route to Washington an inspection of the tidal station at Philadelphia, Pa., was made, and the tide staff was referred to permanent bench marks by leveling.

FLORIDA.

[G. H. REKATE.]

SUMMARY OF RESULTS.—Triangulation: 284 square miles of area covered, 89 stations occupied, and 95 geographic positions determined.

The work of recovering old triangulation stations on the west coast of Florida was begun on January 6 in Pensacola Bay. A search was made for 18 old stations, 7 of which were recovered. Three new stations were established and their positions and the positions of 7 aids to navigation in Pensacola Bay and 1 in East Bay were determined. A search was then made for the old stations (49) on Santa Rosa Sound and Choctawhatchee Bay, and 2 stations were recovered in each case.

New stations were established and the triangulation was extended along Santa Rosa Sound from Pensacola Bay to Choctawhatchee Bay and to cover the latter bay. The party then proceeded to Cedar Keys and searched for the old stations (61) in the vicinity and south to Clearwater Harbor, and 32 of these were recovered. The positions of 4 aids to navigation in the vicinity of Cedar Keys and of Withlacoochee Light-house were determined. The triangulation was then extended from Clearwater Harbor to the upper end of Anclote islands by establishing new stations to supplement the triangulation in places where no old stations were recovered. This work covers Clearwater Harbor, St. Joseph Sound, and Anclote Anchorage.

The field work closed on May 1 at Cedar Keys.

WASHINGTON.

[H. W. RHODES, Commanding Steamer *McArthur*.]

The survey of Grays Harbor was begun on November 6 and continued until March 6. A base line was measured in the vicinity of the south jetty on Point Chehalis, and from this triangulation was extended up the harbor to Hoquiam. Fourteen stations were selected and marked and observations of angles were made at 8. Stormy weather prevented the extension of the work to the outer shore.

The topographic survey of the shore line was begun in the vicinity of the entrance and was completed on the north shore to a point near Hoquiam except for the portion around the head of North Bay and for a shorter portion in the vicinity of Brackenridge

Bluff. Fifty-one miles of shore line, 23 miles of roads, 9 miles of railroads, and 7 miles of the shore line of creeks were surveyed. Tide observations were made at the North Jetty wharf, and 2 lines of soundings were made in the dredged channel between the lower bay and Aberdeen, with observation on a tide staff at the city wharf at Hoquiam.

Stormy and unfavorable weather prevailed, with excessive rain, and the heavy smoke from the numerous mills near the head of the bay generally obscured the shore line during favorable weather.

CONNECTICUT AND NEW YORK.

[H. P. RITTER.]

The collection of data for the revision of the charts along the coasts of Connecticut and New York was in progress on July 1, and this work was continued at intervals, when other duties of the observer permitted, during the whole year.

All the principal topographic changes since the previous survey of this region was made were noted on the north shore of Long Island Sound between Georges Island and Sheffield, including Saugatuck and Norwalk rivers, and drawings were prepared showing the corrections necessary to bring chart No. 267 to date. Similar work on the adjoining chart No. 268 (extending from Sheffield Island to Westcott Cove), begun during the previous fiscal year, was completed.

A topographic resurvey was made of the shore line in front of New Haven, Conn., from Oyster River Point to Five Mile Point, and the revision of topographic details for chart correction was extended from Five Mile Point to East Haven River. A topographic resurvey was also made along the south shore of Long Island between Edgemere and Rockaway Beach, and similar work between Long Beach and Edgemere was completed.

In connection with the work mentioned above 115 old triangulation stations, in the localities covered by the topographic revision, were recovered and remarked in cases where it was considered necessary to do so.

NORTH CAROLINA.

[G. T. RUDE.]

Under the authority of a special act of Congress and in response to a request from the governor of North Carolina an officer of the Survey placed marks to indicate the boundaries of certain areas in the waters of the State "in which the use of any or all fishing appliances are prohibited by law." Certain areas in Pamlico, Croatan, and Albemarle sounds and in Chowan River were selected, and the limits proscribed by law were laid down on charts prepared for the purpose. This includes the proscribed areas at Hatteras, New, and Oregon inlets. The marks were then established at the proper places in the waters mentioned above to indicate the boundaries defined by law. Sixty-six marks were established at the points selected, and the positions are defined by magnetic bearings to known positions of aids to navigation and of objects on shore, and to adjacent boundary marks.

The work began on December 14 and was completed on February 19. The launch used in the work was furnished by the North Carolina Fish Commission.

DELAWARE, FLORIDA, MARYLAND, AND VIRGINIA.

[EDWIN SMITH.]

SUMMARY OF RESULTS.—Triangulation: 412 square miles of area covered, 132 stations occupied, 218 geographic positions determined.

Supplementary triangulation was in progress along the coast south of Delaware Bay on July 1, and this work was continued until November 12. The triangulation was extended from Delaware Bay, Del., to Ocean City, Md., and from Chincoteague Bay to Wachapreague, Va. Very few of the old triangulation stations were recovered on the first section of the work, and consequently new stations were established all along the coast in the localities mentioned. The geographic positions of several life-saving stations and numerous prominent objects along the coast were determined. On the second section more old stations were recovered, but a new station was established wherever an old station could not be found to make the triangulation continuous.

Supplementary triangulation, including the determination of the geographic positions of aids to navigation and the recovery of all old triangulation stations was begun on the west coast of Florida in Apalachicola Bay on January 14. In the West Pass to the bay the positions of 5 aids to navigation were determined, and connection was made with the work of the Engineer Corps, U. S. Army, in this vicinity. The positions of 2 aids to navigation in the vicinity of Apalachicola and of 4 in the vicinity of Carrabelle were also determined. Work was then begun in Apalachee Bay, and a search was made for 32 of the triangulation points previously established. Nineteen of these were recovered, and additional marks were placed in position wherever they were needed to secure future recovery of the stations.

This work was completed on March 14, and the party then proceeded to St. Andrews Bay. A search was made for the old triangulation stations in this vicinity and 4 of them were recovered. From these a new triangulation was extended to cover St. Andrews Bay, including West and North bays and St. Andrews Sound to St. Andrew Point, and this work was completed on May 1.

The work in St. Joseph Bay was then taken up and was completed on June 15, when the party was disbanded. A few old triangulation stations were recovered and used as a base from which a triangulation was extended to cover the bay. The observer then returned to Apalachicola to secure some additional observations in that vicinity, and the work for the season closed on June 22.

CALIFORNIA, FLORIDA, LOUISIANA, MAINE, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, TEXAS, VIRGINIA, AND WASHINGTON.

Self-registering tide gauges were kept in operation during the year at the following places: Presidio and San Diego, Cal.; Fernandina, Fla.; Weeks, La.; Fort Hamilton, N. Y.; Wilmington, N. C.; Philadelphia, Pa.; Galveston, Tex.; Colonial Beach, Va.; and Seattle, Wash. On March 8 the installation of a self-registering tide gauge at Portland, Me., was completed, and after that date a record of the tidal changes was obtained for the remainder of the fiscal year.

KANSAS.

[S. G. TOWNSHEND, Jr.]

The work at the magnetic observatory at Baldwin, Kans., was continued from July 1 to October 22. A record of the relative force of the three elements of terrestrial magnetism was obtained with self-registering instruments, and observations were made at least once every week to determine the absolute value of these elements. Several magnetic storms occurred, the greatest being recorded on September 25, and this storm was so severe that telephone and telegraph service was affected.

On October 22 observations ceased and the work of the observatory was concluded, as the instruments were needed at the observatory recently completed in Arizona, near Tucson.

NEW HAMPSHIRE.

[D. B. WAINWRIGHT.]

SUMMARY OF RESULTS.—Topography: 21 square miles of area covered, 37 miles of shore line of rivers surveyed, 16 miles of shore line of creeks surveyed, 69 miles of roads surveyed, 3 topographic sheets completed.

On July 1 the topographic survey of Great Bay and its tributaries, New Hampshire, was in progress, and the work was continued until November 1, when the survey was completed. The work for this season began at a point on the west side of the bay a short distance above Adams, and was extended to cover the valley of Oyster River to Durham, the Bellamy and Cocheo rivers to Dover (including Dover Neck), and the Salmon Falls River to South Berwick. From the mouth of Salmon Falls River the survey was continued down the Piscataqua River to Greenacre, to a junction with the work already completed.

HAWAII.

[W. F. WALLIS, July 1 to August 19; O. H. GAARDEN, June 30 to August 20.]

A continuous record of the variations in the earth's magnetic condition was obtained at the magnetic observatory near Honolulu, Hawaii, during the year with self-registering instruments. Observations were made once each week to determine the absolute value of the three elements of terrestrial magnetism, and once each month to determine the scale values. The seismograph was kept in operation and a practically continuous record was obtained. Ninety-four earthquakes were registered during the year at this station.

Daily meteorological observations were made and monthly reports were sent to the United States Weather Bureau observer at Honolulu.

ARIZONA.

[W. F. WALLIS.]

The buildings for the magnetic observatory located near Tucson, Ariz., were completed in October and the instruments in use at the Baldwin Observatory, in Kansas, were transferred to the Tucson Observatory. They were placed in position and the final adjustments were completed on November 16. On the same date the observations began and a continuous record of the relative force of the three elements of terrestrial magnetism was obtained during the remainder of the fiscal year.

Observations to determine the absolute value of the magnetic elements were made once each week, and after January 1 an additional determination of the vertical intensity was made every week. Meteorological observations were made every day. A room for the installation of a seismograph was completed. The magnetograms show the effects of earthquake shocks as follows: Twice in January, once in February, once in April, three times in May, and once in June.

DELAWARE.

[P. A. WELKER, Commanding Steamer *Endeavor*.]

SUMMARY OF RESULTS.—Hydrography: 6 square miles of area covered, 141 miles of lines sounded, 1 960 soundings made, 1 hydrographic sheet completed.

In accordance with a request made by the Navy Department, a special hydrographic survey was made over the speed trial course off Delaware Breakwater in order to afford data desired in determining the effect of the depth of water upon the speed and power developed in certain cases.

The depth of water on this course is 25 fathoms and more, and the strength of the current varies from 1 to 3 knots per hour. Under these conditions a lead weighing 40 pounds was used with a trolley system which made it possible to drop the lead near the bow and to read the lead line near the stern of the ship. Soundings were made at intervals of two minutes and the position of each sounding was determined by observations made with sextants. The work began on March 22 and was completed on April 2.

After completing the survey of the speed trial course a survey was made at Cape Henlopen to show the present condition of the shoal off the cape and the position of the shore line. The limit of the hydrography was within the lines of breakers under ordinary conditions, and where there are strong tide rips, so that the soundings were necessarily made when the sea was smooth and near the time of slack water. The work was completed on April 14.

CALIFORNIA.

[FERDINAND WESTDAHL.]

The suboffice at San Francisco was continued and the officer in charge acted as the representative of the Superintendent in attending to numerous duties, many of them being matters of routine, in connection with the survey of the Philippine Islands and the transfer of officers assigned to that work. In addition to these duties the field work described below was done under the direction of this officer by others who reported to him for this purpose.

In July the position of the tide staff at the Presidio tidal station was verified by leveling to the bench marks in the vicinity.

The revision of the topographic survey along the coast of Mendocino County between Laguna and Greenwood landings began on August 11 and was completed on November 16. In connection with this work a search was made for a sunken rock which was supposed to exist in Albion Cove, and it was shown that no such rock exists.

In October repairs were made at the Presidio tidal stations and to the tide indicator on Alcatraz Island in San Francisco Bay.

An inspection of the tidal station at San Diego, Cal., was made November 19 to 24, and the tide staff was connected by leveling with the bench marks at the quarantine station.

A revision of the topographic survey along the shore of certain portions of Monterey Bay was made January 11 to May 23. Several old triangulation stations were recovered and some supplementary triangulation was done to determine the geographic positions of prominent landmarks and to furnish additional bases for use in the topographic work. All changes due to natural causes and the artificial features which had been added were located.

LOUISIANA.

[ISAAC WINSTON.]

Advantage was taken of the presence of an officer of the Survey in Louisiana on special duty and an inspection of the tidal station at Weeks, La., was made on May 4. Some necessary repairs were completed, the relation of the tide staff to the bench marks near the gauge house was determined, and the tide observer was given additional instructions in regard to the performance of his duties.

ILLINOIS, INDIANA, IOWA, KANSAS, MISSOURI, NEBRASKA, OHIO, AND PENNSYLVANIA.

[C. F. WOODYARD.]

STATIONS OCCUPIED.—*Illinois:* Carlyle and Quincy. *Indiana:* Franklin, Lebanon, Meadville, and Spencer. *Iowa:* Des Moines and Rockwell City. *Kansas:* Council Grove, Iola, Leavenworth, Lincoln, Oskaloosa, and Salina. *Missouri:* Lebanon and Rolla. *Nebraska:* Alma, Auburn, Bloomington, Falls City, Hebron, Nebraska City, Nelson, Pawnee City, Plattsmouth, Red Cloud, and Wilber. *Ohio:* Dayton. *Pennsylvania:* Meadville.

The extension of the magnetic survey of the country was in progress in Indiana on July 1, and this work was continued until September 10, when the observations were discontinued. The work was resumed on June 11 and was in progress on the 30th. Observations to determine the value of the three elements of terrestrial magnetism were made at the stations named above.

MARYLAND.

[C. C. YATES.]

SUMMARY OF RESULTS.—Triangulation: 250 square miles of area covered, 340 stations occupied, 352 geographic positions determined.

Under authority conferred by law, the Survey continued to cooperate with the Maryland Shell-Fish Commission in surveying and marking the natural oyster beds, bars, and rocks in the State of Maryland. The field work undertaken by the Survey was finished during the year in Kent and Talbot counties, which completes the work in all the producing counties in the State except Dorchester, and on June 30 the party was ready to begin work in that county. Field work was done during the periods July 6 to December 24 and March 14 to June 30.

The descriptions of the boundaries and landmarks in Calvert County were prepared for publication.

ALASKA.

[F. L. ADAMS.]

The work at the Sitka Magnetic Observatory was continued during the year and a record of the variation in the relative value of the three elements of terrestrial magnetism was obtained with self-registering instruments. Observations to determine the absolute value of the magnetic elements were made at regular intervals and meteorological observations were also made. Severe magnetic storms occurred in September, October, November, and March. The magnetic storm of September 25 was very severe and was accompanied by a very fine auroral display.

A seismograph was kept in operation and 47 earthquake shocks were recorded.

[H. L. BECK, Commanding Steamer *McArthur*.]

The steamer *McArthur* sailed from Seattle for Cook Inlet, Alaska, on April 19, via the inside passage. No pilot was taken and the vessel anchored at night. Good weather prevailed, and nothing unusual occurred except that the vessel grounded for a few minutes on an uncharted shoal in Wrangell Narrows. The vessel reached Seldovia on May 4 and the launch *Delta*, which had been hauled out for the winter at this place was prepared for the season's work. A self-registering tide gauge was installed on the wharf at Seldovia and kept in operation. North Spit Buoy No. 1, off Port Graham, was replaced in position in accordance with the request of the inspector of the Thirteenth light-house district.

The preceding winter was unusually cold and the snow still extended from the hill and mountain tops down to the water's edge, but the field work began on May 12, when a party was placed in camp on shore, with the *Delta* and a dory as their means of transportation, to do inshore hydrographic work and to make a survey of the shore line. Hydrographic signals were erected by the ship and offshore sounding began on the 23d.

On account of the strong tidal currents it was found to be impossible to run sounding lines normal to the shore in satisfactory manner, and lines parallel to the shore were substituted.

Details in regard to the work and statistics of the work accomplished will be given in the next report. The work was in progress on June 30, 1910.

[H. C. DENSON, Commanding Steamer *Patterson*.]

SUMMARY OF RESULTS.—Hydrography: 4 883 square miles of area covered, 3 643 miles of lines sounded, 44 871 soundings made, 1 tide station occupied, 6 hydrographic sheets completed. Magnetic observations: 3 stations occupied. Topography: 48 square miles of area covered, 96 miles of shore line surveyed, 53 miles of shore line sketched, 2 topographic sheets completed. Triangulation: 72 square miles of area covered, 8 stations occupied, 25 geographic positions determined.

The survey of Controller Bay was in progress on July 1 and was continued until October 3, when the vessel sailed for Cordova, and thence via Orca to Seattle, Wash., where she arrived on October 27. The statistics given above cover the work of the whole season (May 20 to October 3), and the extent of the work may be stated as follows:

The hydrography covers the area bounded by Montague and Hinchinbrook islands on the west, Copper River Sand Reefs on the north, Kanak, Wingham, and Kyak islands on the east, and Middleton Island on the south. A detailed survey was made of Controller Bay and approaches, and also of the area eastward of Kyak Island to Cape Suckling, and out to the 100-fathom depth to the southward of Cape St. Elias. The position of a number of dangers to navigation in this region were accurately located and many others, marked on the charts as possible dangers, have been removed, as the investigation proved that these reported dangers do not exist. The charts of this region have been corrected, and information in regard to the more important changes has been furnished to the public in notices to mariners.

In connection with the hydrographic work tide observations were made on a staff located off the north end of Kyak Island during four months.

A survey was made of the shore of Controller Bay and of Wingham and Kyak islands, and along Okalee Spit as far as Cape Suckling. A running survey of the east shore of Montague Island was made from the ship by observations with sextants to determine the position of the heads of bays and of prominent headlands. The existing triangulation was supplemented and additional points were located for use in making the survey.

Assistant Quillian's party and outfit was transported from Seattle to Kodiak, and the steamer *Yukon* was prepared for work by the crew of the *Patterson*. A party of 3 officers and 17 men was placed in camp on shore and much of the inshore work was done by this party.

On October 10, while the *Patterson* was tied to the dock at Orca with the boilers blown down, a violent wind storm arose and cast the ship adrift. Salt water was pumped into the boilers in order to get up steam and control the ship. Fortunately the vessel was only slightly damaged.

On October 26, while en route to Seattle, the vessel touched on a reef 11¾ miles east of Alert Bay, Johnstone Straits, but no apparent damage resulted.

Assistant Denson reports that the spring months offer the best conditions for the work of the Survey in this locality and states that after the middle of June and until the beginning of August the ship was run night and day while sounding, as the mountain peaks were distinct enough at midnight to be reflected by the sextant mirrors.

[R. B. DERICKSON, Commanding Steamer *Gedney*.]

SUMMARY OF RESULTS.—Hydrography: 136 square miles of area covered, 1 482 miles of lines sounded, 11 029 soundings made, 5 tide stations occupied, 7 hydrographic sheets completed. Magnetic observations: 3 stations on land occupied, 13 stations at sea occupied. Topography: 82 square miles of area covered, 248 miles of general coast line surveyed, 19 miles of the shore line of creeks surveyed, 5 miles of roads surveyed, 5 topographic sheets completed. Triangulation: 188 square miles of area covered, 42 stations occupied, 72 geographic positions determined.

The survey of the coast of Prince of Wales Island, Alaska, was in progress on July 1. The topographic and hydrographic work was extended from Point Nunez, at the southern extremity of the island, west and north. A topographic survey was made along the south coast of Prince of Wales Island, including Bronsons Bay, Point Marsh, the coast line and many of the islands to the north, Hessa Inlet, and the Barrier Islands. A topographic survey was also made along the coast from the north entrance to Eureka

Pass to Shipwreck Point, including Tah Bay, and Hunter bays, the islands and entrance to Klakass Inlet, and Ship Islands, and from Kassa Inlet along the west coast of Prince of Wales Island to Nutqua Inlet, including the entrance to Kassa Inlet, Point Webster, and Hassiah Inlet. The survey of the shore line was completed from Point Nunez to Lime Point in Cordova Bay except in Nutqua and Hassa inlets, and extends into Nutqua Inlet to a point 1 mile above the entrance.

The hydrographic work was done while the topographic work was in progress. A survey was made of the waters from Point Marsh south to the international boundary line and westward to Cape Muzon, and lines were sounded in the passage back of Point Marsh and in Minnic Bay.

The areas west of Mexico Point to Dewey Rocks, south to the Barrier islands, and through Eureka Pass were carefully developed by sounding, and the hydrographic survey was extended over the area north of the Barrier Islands, including Tah and Hunter bays to the eastward and to Long Island on the west. In Cordova Bay, westward of the Barrier Islands lines of soundings were made from a point opposite Shipwreck Point to the international boundary line to the eastward of Cape Muzon. The *Gedney* suspended work on September 17 and proceeded to Tongass Narrows. The tender *Cosmos* continued at work until September 27, when she went to Ketchikan to join the *Gedney*. Work was done in Tongass Narrows September 17 to October 20.

The rock on which the steamship *Ohio* struck, in June, was found and its geographic position was determined and a hydrographic survey was made in its vicinity.

Hydrographic and topographic surveys were also made in Tongass Narrows from Ketchikan to Rosa Reef Spindle. The vessel sailed for Seattle on October 21 and reached that port on the 28th.

On April 19 the *Gedney* sailed from Seattle for Ketchikan, Alaska, to resume work in Tongass Narrows. Repairs were made to the tender *Cosmos* May 2 to 19 and on May 24 the *Cosmos* sailed for the head of Portland Canal to make a survey of the head of the canal in the vicinity of the point where the international boundary leaves Portland Canal. This work was in progress on June 30.

The party on the *Gedney* continued the survey of Tongass Narrows.

The topographic work was completed at the north end of the Narrows to Point Higgins and the hydrographic work was almost completed from Bar Point to Guard Island, including Wards Cove. The survey was in progress on June 30.

[W. C. DIBRELL, Commanding Steamer *Explorer*.]

SUMMARY OF RESULTS.—Hydrography: 389 square miles of lines sounded, 1 901 miles of lines sounded, 2 452 soundings made, 5 tide stations occupied, 8 current stations occupied, 6 hydrographic sheets completed. Magnetic observations: 8 stations on land occupied, 29 stations at sea occupied. Topography: 26 square miles of area covered, 70 miles of general shore line surveyed, 4 miles of creeks surveyed, 6 topographic sheets completed. Triangulation: 131 square miles of area covered, 6 stations occupied, 14 geographic positions determined.

On July 1 the survey of Nushagak Bay, in Bristol Bay, was in progress and the work was continued until September 21. During this period the work completed may be stated as follows:

Preliminary astronomical observations to determine a latitude and an azimuth were made at Clark Point. A base line was measured in the upper part of the bay and triangulation was extended from it to cover the bay from Williams Island to Points Etolin

and Protection. A preliminary topographic survey of the shore line was made from the entrance of the bay to the mouth of Wood River.

A hydrographic survey was made of the whole of the bay except in Igushik River and the approach. Mud flats bare or partly bare at low water were not included. The main channel was surveyed up to a point just below the mouth of Wood River. Tide observations were made at Clark Point and current observations were made at a number of places in the bay where the vessel anchored.

Everything possible was done by the officers and employees of the Alaska Packers' Association to advance the progress of the work and many courtesies were shown the members of the party. Mess supplies and ship stores were brought from San Francisco free of charge.

The vessel sailed for Seattle, Wash., on September 21 and reached that port on October 8. On April 23 the *Explorer* sailed from San Francisco for Bristol Bay via Seattle and reached Port Moller, Bering Sea, on May 18. Ice was encountered near this place and it was impracticable to enter Bristol Bay at this time. The vessel was detained at Port Moller until June 3 and work was done in the vicinity while waiting for the opening of navigation in Bristol Bay.

The survey of Nushagak Bay was resumed on June 4 and was in progress on the 30th.

[W. E. PARKER, Commanding Steamer *Patterson*.]

SUMMARY OF RESULTS.—Hydrography: 125 square miles of area covered, 542 miles of lines sounded, 3 549 soundings made, 2 tide stations occupied, 1 current station occupied. Magnetic observations: 3 stations occupied. Topography: 36 miles of general shore line surveyed. Triangulation: 500 square miles of area covered, 12 stations occupied, and 11 geographic positions determined.

The steamer *Patterson* sailed from Seattle, Wash., on April 18 for Cook Inlet, Alaska, via Orca, Alaska. Magnetic observations were made at sea off Union Bay, British Columbia, after coaling the ship, and at two points between Capes St. James and St. Elias. The *Patterson* reached Orca on April 29 and a portion of the party for the steamer *Yukon* was landed at Cordova. The vessel sailed on May 2 with the launch *Alpha* in tow and reached Port Graham, Cook Inlet, on May 5. A self-registering tide gauge was established on the Alaska Commercial Company's wharf at Port Graham and magnetic observations were made on shore at a station across the bay.

The survey of the eastern shore of Cook Inlet and the main channel was begun to extend the work previously completed from its southern limit along this shore to Port Graham and into Kachemac Bay as far as Homer. At the close of the fiscal year the work was in progress, and the statistics given above show what had been accomplished.

[C. G. QUILLIAN, Commanding Steamer *Yukon*.]

SUMMARY OF RESULTS.—Hydrography: 299 square miles of area covered, 690 miles of line sounded, 8 892 soundings made, 2 tidal stations occupied, 3 hydrographic sheets completed. Topography: 66 square miles of area covered, 85 miles of general coast line surveyed; 10 miles of shore line of rivers surveyed, 42 miles of shore line sketched, 5 topographic sheets completed. Triangulation: 822 square miles of area covered, 21 stations occupied, 45 geographic positions determined.

The survey of the coasts of Alaska was in progress in the vicinity of Kodiak on July 1 and the work was continued until October 17, when the field season closed and the party reached Seattle, Wash., on October 26. During this period the triangulation was

extended northward along the east coast of Afognak Island from Spruce and Whale islands until it joined the work previously completed at Cape Tonki and the north end of Marmot Island.

A topographic survey was made northward along the east coast of Afognak Island from the work previously completed to Cape Izhut and along the north and east shores of Cape Tonki. The shore line of the west side of Marmot Island was also surveyed and a topographic reconnaissance was made along the shores of Izhut Bay. Hydrographic work was done in the south approach to Kodiak Harbor and the survey previously completed off Afognak Bay was extended north and east to Cape Izhut and to include Marmot Bay and the northern approaches to Kodiak Island. Tide observations were made at Kodiak and at Danger Bay.

Work was resumed in Cook Inlet in the vicinity of Kenai on May 17 and continued during the remainder of the fiscal year. The triangulation and topographic survey was extended to a point 5 miles above the mouth of Kenai River. Topographic and hydrographic work was also done along the south shore of the inlet at the mouth of Kenai River and in the vicinity of Cape Kasilof and of Kasilof River.

The thanks of the Survey are due the officers of the Alaska Packers' Association and the Northwestern Fisheries Company for courtesies shown the party.

The work was in progress on June 30.

[H. W. RHODES, Commanding Steamer *McArthur*.]

SUMMARY OF RESULTS.—Hydrography: 184 miles of lines sounded, 842 soundings made, 4 tide stations occupied, 10 current stations occupied. Topography: 6 square miles of area covered, 155 miles of general coast line surveyed, 14 miles of shore line of creeks surveyed. Triangulation: 18 stations occupied, 18 geographic positions determined.

On July 1 the party on the steamer *McArthur* was at work in the upper portion of Cook Inlet north of the Forelands. Parties were established in camp on shore, one on each side of the inlet extending the triangulation and the topographic survey of the shore line. The work during the whole season may be summarized as follows:

The principal work was the triangulation, and it was extended from East and West Foreland to the head of the inlet, with stations at the entrances to Turnagain and Knik Arms. Twenty-eight new stations were established and carefully marked, 20 of which were occupied for the measurement of horizontal and vertical angles, and observations were made at 5 old stations. The shore of the upper portion of Cook Inlet is, in general, a bluff line heavily wooded, and heavy cutting was necessary on many of the lines, and high signals were erected at a number of stations. Directions to Mount McKinley were obtained at 3 triangulation stations and observations to determine the magnetic declination were made at 6 stations.

A topographic survey was made of the east shore of the inlet from a point about 5 miles above Kenai to a point about 12 miles inside Knik Arm, including Fire Island and the south shore of Turnagain Arm, to a point about 4 miles above the entrance. On the west shore of the inlet the survey extends from a point about 5 miles west of West Forelands to a point about 8 miles inside of Knik Arm, except that three gaps covering a total distance of 21 miles were left in this work.

Tide observations were made at Seldovia, at a point about 2 miles above East Foreland, on the west side of Fire Island, and on the east shore of Knik Arm about 5

miles above Point Woronzof. Reconnaissance sounding lines were run by the vessel whenever practicable between the Forelands and the head of the inlet and current observations were made at 17 different places where the vessel anchored.

[G. T. RUDE, Commanding Steamer *Taku*.]

SUMMARY OF RESULTS.—Hydrography: 156 square miles of area covered, 533 miles of lines sounded, 3 296 soundings made, 2 tide stations occupied, 4 hydrographic sheets completed. Topography: 85 square miles of area covered, 144 miles of general coast line surveyed, 4 topographic sheets completed.

Hydrographic and topographic surveys along the shores of Knight Island, Prince William Sound, were resumed on July 6 and continued until September 23, when the field work closed for the winter. The work was completed along the portions of the coast described below: From the north point at the entrance to Hogan Bay to a point 1 mile north of the entrance to Discovery Bay and including Snug Harbor; the north end of Knight Island and the islands offshore between Knight and Naked islands; the south coast of Knight Island from Mummy Bay to Lower Herring Bay.

Hydrographic work was done inshore along the east and north coasts of Knight Island to complete the work previously done along these shores, and it was extended to cover Discovery Bay, Snug Harbor, Lower Passage, Upper Passage, Foul Passage, Louis Bay, and Northwest Bay. On the south coast of Knight Island, hydrographic work was done in Mummy Bay, Long Passage, and Knight Island Passage from Mummy Bay to Lower Herring Bay, and extended to the entrances of Prince of Wales and Bainbridge passes. In the same region a survey was made of the shore line in Mummy and Copper bays around Squire Island and through Long Passage to Drier Bay, completing the unfinished work in this locality.

The survey of Prince William Sound was resumed on May 23 on the shores of Hinchinbrook Island, vicinity of Point Johnstone. The work at this point was completed on June 14 and the vessel proceeded to Knight Island, and on June 30 the survey was in progress between Johnson Bay and Lower Passage.

OUTLYING TERRITORY.

PHILIPPINE ISLANDS.

[E. F. DICKINS, *Director.*]

The survey of the coast of the Philippine Islands was continued under the immediate supervision of a Director, who represented the Superintendent in all matters requiring immediate action.

He made plans for field operations and issued instructions for field work at the suboffice in Manila. The observations made in the field were computed, and drawings for charts of the regions surveyed were prepared for transmission to Washington for review and publication. Sailing Directions and Notices to Mariners were prepared and published. He was aided in this work by such advice and instructions issued from Washington as became necessary.

The work was done under the same general plan of the division of expenses in force during the previous year. The National Government paid the salaries and subsistence of its technical corps detailed for duty in the Philippines, including several experts in the suboffice, furnished the instrumental equipment, paid the expenses of 1 large surveying steamer and for the supplies for 2 other surveying steamers, paid the expense of chart publication, the traveling expenses of officers to and from the Philippine Islands, and the hire of launches. The Philippine government paid the operating expenses of 2 surveying steamers, paid for the crew and repairs of 2 other surveying steamers (not including pay of officers), the party expenses of several surveying parties on shore, the salaries of the office force, and for office supplies obtained in Manila, and furnished office accommodations and printing.

There was a free exchange of information and good offices between the Survey and the various military and civil bureaus having common aims, and a gratifying interest was shown in responding to requests for information.

FIELD WORK.

Steamer Pathfinder.—This vessel was at Manila July 1–13 having repairs made. She sailed for Surigao Strait on July 14 to continue the survey of the strait and adjacent waters to the southward. The work began on the 19th and was in progress until January 15, when it was suspended and the vessel sailed for Manila. She arrived on January 23 and remained in port until March 26. During this period the field records were completed and repairs were made to the ship. She sailed for Surigao, via Cebu, to deliver the mail for the postal authorities, on March 26 and arrived March 29. The survey in this vicinity was resumed immediatley and was in progress on June 30.

Steamer Romblon.—This vessel closed work on the south coast of Leyte Island on July 2 and sailed for Manila. She remained in port from July 9 to November 11 and

during this time extensive repairs were made. She sailed for Lion Bay on the south coast of Leyte Island on the 12th and resumed work in that vicinity on the 16th. The survey of Sogod Bay was continued until January 4, when it was completed. The vessel then proceeded to the north coast of Mindanao Island and the survey of that coast and adjacent waters was begun on January 8 and was in progress on June 30.

Steamer Marinduque.—The survey of Illana Bay on the southern coast of Mindanao Island was in progress on July 1. This work was completed and special surveys were made at Malabang and Parang as requested by the military authorities.

On August 12 the vessel sailed for Manila for repairs. The repairs were made August 19 to September 12, and the vessel sailed the following day for Iligan Bay, north coast of Mindanao. The survey of the north coast of Mindanao Island was continued until June 30, when the work was still in progress.

Steamer Research.—The survey of Tanon Strait was continued from July 1 to November 26 when the survey of the unfinished portion of this strait was completed. Minor repairs were made to the vessel at Iloilo November 27 to December 9, and on the following day she sailed for the southern coast of Masbate Island. The work on this coast began on December 11 and on June 30 the survey of the entire southern coast had been completed.

Steamer Fathomer.—Surveys were made along the coasts of Mindoro and Tablas islands July 1 to December 22, when the vessel went to Manila for repairs and remained there until February 23, when she sailed for the west coast of Mindoro Island. A special survey was made of the entrance to Bugsanga River as requested by the secretary of interior of the Philippine Islands and then the survey along the shores of Mindoro was continued during the remainder of the fiscal year.

In addition to the work of the parties on the ships mentioned above, surveys were made by parties living on land in San Juanico Strait and Janabatas Channel and on the west coast of Samar Island.

PROGRESS OF THE FIELD WORK.

At the close of the fiscal year ended June 30, 1910, 46.6 per cent (exclusive of Spanish and British surveys) of the general coast line of the archipelago had been surveyed for charting purposes, the progress for the fiscal year being 10.3 per cent of the whole.

Expressed in distance, the total amount of general coast line now surveyed is 5 368 statute miles (8 639 kilometers) out of a total of 11 511 statute miles (18 525 kilometers). During the year 119 statute miles of general coast line was surveyed, an increase of 56.6 per cent as compared with the mileage surveyed in the preceding year.

OFFICE WORK.

The suboffice at Manila is organized to do all the work included in chart construction. The records of observations were received as the work progressed. The necessary computations were made and the results were compiled in the form of drawings for charts. Eight drawings for new charts and 13 drawings for new editions of charts were prepared during the year and sent to Washington for publication.

The Director is the disbursing agent for the Philippine work, and all expenditures, except those on account of the steamer *Pathfinder*, are made by him, and under his direction. He renders his accounts to the General Disbursing Agent, at Washington,

for all expenses paid on the part of the General Government. This work involves a great deal of clerical labor and is increased by the accounts kept to show the disbursements of the funds furnished by the insular government, for which vouchers are rendered to the proper accounting officers of that government.

The following publications were prepared and printed: Philippine Islands Sailing Directions, Section II, fourth edition, and Section V, third edition; Notices to Mariners Nos. 5 to 8 of 1909 and Nos. 1 to 4 of 1910; and a Catalogue of Charts, Sailing Directions, and Tide Tables.

[ARTHUR CROWELL.]

SUMMARY OF RESULTS.—Hydrography: 97 square miles of area covered, 308 miles of lines sounded. 14 984 soundings made. Topography: 10 square miles of area covered, 58 miles of general shore line surveyed, 14 miles of roads surveyed, 2 topographic sheets completed. Triangulation: 263 square miles of area covered, 5 stations occupied, 19 geographic positions determined.

The survey of the west coast of Samar and the north coast of Leyte was continued from February 1 to March 10. The triangulation was extended to cover Carigara Bay and completed to a junction with the work previously completed in Biliran Strait. The triangulation was also extended a short distance northward on the coast of Samar, in the vicinity of Catbalogan, and a reconnaissance for triangulation was then made along the coast to a point north of Jibatan River. Hydrographic work in Zumarraga Channel and on the west side of Daram Island (inshore work) was completed.

The work in Búrri Island Harbor was completed and some soundings were made in Carigara Bay. Tide staffs were established in the north end of Daram Island and in Carigara Bay and referred by simultaneous observations to the tide gauge at Catbalogan. A topographic survey was made of a small area on the coast of Samar Island north of Catbalogan and of the north half of Daram Island.

[H. C. DENSON, Commanding Steamer *Romblon*.]

SUMMARY OF RESULTS.—Hydrography: 356 square miles of area covered, 404 miles of lines sounded, 10 680 soundings made, 2 hydrographic sheets completed. Topography: 67 square miles of area covered, 70 miles of general coast line surveyed, 3 topographic sheets completed. Triangulation: 822 square miles of area covered, 8 stations occupied, 17 geographic positions determined.

The survey of the north coast of Mindanao Island was continued from May 4 to June 30, and the work previously completed was extended between Agusan River and Bagacay Point. The survey of Gingoog Bay was completed, and a trigonometric connection was made between Mindanao and Camiguin Island. A survey of Nasipit Harbor was also completed and soundings were made along the coast to the Agusan River.

[C. V. HODGSON, Commanding Steamer *Research*.]

SUMMARY OF RESULTS.—Hydrography: 656 square miles of area covered, 3 379 miles of lines sounded, 89 576 soundings made, 3 tide stations occupied, 4 hydrographic sheets completed. Topography: 159 square miles of area covered, 84 miles of general shore line surveyed, 27 miles of shore line of rivers surveyed, 2 miles of roads surveyed, 5 topographic sheets completed. Triangulation: 240 square miles of area covered, 10 stations occupied, 22 geographic positions determined.

The survey of the south coast of Masbate Island was continued from February 8 to June 30. The main triangulation was completed by occupying the one remaining station, and then supplementary work was done to furnish points for use in the topographic and hydrographic work. The topographic survey was extended from the

completed work in the vicinity of Guion River westward around the shores of Asid Gulf to the southwestern point of the island, and the hydrographic survey was completed over the gulf and the approaches and was extended some distance beyond Jintololo Light-house.

[C. V. HODGSON.]

SUMMARY OF RESULTS.—Hydrography: 176 square miles of area covered, 1 314 miles of lines sounded, 86 921 soundings made, 8 tide stations occupied, 3 current stations occupied, 4 hydrographic sheets completed. Topography: 155 square miles of area covered, 283 miles of general coast line surveyed, 36 miles of shore line of rivers surveyed, 7 miles of roads surveyed, 5 topographic sheets completed. Triangulation: 296 square miles of area covered, 14 stations occupied, 42 geographic positions determined.

The survey of the north coast of Leyte and the west coast of Samar was in progress on July 1 and the work was continued until January 31. Triangulation was extended from the north coast of Samar to a point at the north entrance to Maqueda Bay, and it includes points on Daram Island and the other islands within the area stated.

A topographic survey was made along the north coast of Leyte at the entrance to Janabatas Channel and along the south shore of the channel and thence northward along the coast of Samar to and around Maqueda Bay to the point at the north entrance to the bay. The topographic survey includes nearly all of the southern half of Daram Island and the islands between Daram and Samar islands.

The hydrographic work covers Maqueda Bay, the waters south of Buad Island and inside of Daram Island, and the entrance and wide portion of Janabatos Channel.

After January 1 the survey was extended along the west coast of Samar Island from the vicinity of Catbalogan as far north as Majacob, including the offlying islands, and also around the shore of Carigara Bay to a junction with work already completed in Biliran Strait.

[D. R. JEWELL, Commanding Steamer *Marinduque*.]

SUMMARY OF RESULTS.—Hydrography: 2 541 square miles of area covered, 1 884 miles of lines sounded, 35 651 soundings made, 5 tide stations occupied, 15 hydrographic sheets completed. Magnetic observations: 3 stations at sea occupied. Topography: 361 square miles of area covered, 289 miles of general coast line surveyed, 36 miles of shore line of rivers surveyed, 53 miles of roads surveyed, 15 topographic sheets completed. Triangulation: 6 150 square miles of area covered, 66 stations occupied, 70 geographic positions determined.

On July 1 the party on the steamer *Marinduque* was engaged in making a survey of Illana Bay, including hydrography in the approaches, and on August 13 the work was finished. This completed the survey of the unfinished portion of the coast of Mindanao in this locality. Special surveys were made at Malabang and Parang, as requested by the military authorities, to furnish information to aid in the establishment of docks and a sewerage system at these places. On September 17 work began in Iligan Bay, and the survey of this bay and of Dapitan Bay were completed by the end of January, and the work was then extended westward to Point Blanco, in the vicinity of Disacan.

The triangulation was extended to include points on Negros, Siquijor, Cebu, Panglao, Bohol, and Camiguin islands, to a junction with work previously completed. Many of the lines of sight were unusually long, and it was necessary to use heliotropes at the stations.

[J. B. MILLER, Commanding Steamer *Fathomer*.]

SUMMARY OF RESULTS.—Hydrography: 1 967 square miles of area covered, 4 914 miles of lines sounded, 69 675 soundings made, 14 tide stations occupied, 11 hydrographic sheets completed. Magnetic observations: 8 stations on land occupied, 12 stations at sea occupied. Topography: 299 square miles of area covered, 291 miles of general coast line surveyed, 122 miles of shore line of rivers surveyed, 11 topographic sheets completed. Triangulation: 6 863 square miles of area covered, 72 stations occupied, 178 geographic positions (including 9 aids to navigation) determined.

On July 1 the survey of the east coast of Mindoro Island was in progress and the work was continued until December 31, when the *Fathomer* went to Manila for repairs. During this period the triangulation was extended to cover the east coast of Mindoro from Buyallao Point (latitude 12° 17′) to Dumali Point (latitude 13° 13′) and to include points on Maestro de Campo, Dos Hermanas, Banton, Simara, Cobrador, Romblon, and Tablas islands.

The topographic survey covers the coast of Mindoro within the limits of the triangulation and the shore line and interior of the small islands mentioned and about half of the area of Tablas Island. The hydrographic work covers waters along the coast of Mindoro, within the limits mentioned above, and was extended offshore to Tablas Island, covering the northwestern and northern shores of that island and the waters around Samara and Banton islands. A hydrographic survey was made around Dos Hermanas Islands.

Triangulation stations were selected to extend the work southward to a connection with Panay and the islands offshore. All the work mentioned is an extension southwarp of a survey previously completed.

On February 23 the *Fathomer* went to the west coast of Mindoro and made a special survey of the entrance to Bugsanga River as requested by the secretary of interior of the Philippine Islands. The survey of the east coast of Mindoro was then taken up and extended southward from the point reached in December. The triangulation was extended around the south end of the island to Bugsanga River and lines were observed to connect with stations on Panay, Caluya, and Panagatan islands. Positions were determined on a number of islands along the coast.

The topographic work was extended from Buyallo Point on the east coast to Lumintao River on the west coast, and covers the shore line of 5 large bays and 9 small islands, and also Ilin and Ambolon islands.

The hydrographic survey covers the inshore work within the limits of the topography except for a distance of 3 miles where the work was not completed. The offshore work was completed to a line 10 miles distant from the mouth of Lumintao River. It also extends to a line 3 miles off Ambolon Island and thence to Panagatan Island, covering the passage between Ilin, Panagatan, Cemerara islands and Dominga Shoal.

A self-registering tide gauge was maintained in Looc Bay, Tablas Island, and observations were also made at 8 other stations, and all the stations were connected by simultaneous observations.

[E. H. PAGENHART, Commanding Steamer *Romblon*.]

SUMMARY OF RESULTS.—Hydrography: 1 042 square miles of area covered, 1 115 miles of lines sounded, 14 168 soundings made, 5 tide stations occupied, 6 hydrographic sheets completed. Topography: 151 square miles of area covered, 141 miles of general coast line surveyed, 34 miles of shore line of rivers surveyed, 5 miles of roads surveyed, 7 topographic sheets completed. Triangulation: 1 520 square miles of area covered, 18 stations occupied, 25 geographic positions determined.

The steamer *Romblon* sailed from Manila on November 12 to complete the survey of Sogod Bay in the south end of Leyte Island. The triangulation of the bay was almost

finished before the close of the previous season, and only four stations remained to be occupied. The survey of the bay was resumed on November 16 and completed on January 4.

A topographic survey was made along the shores of the bay joining similar work previously completed on both the west and east sides of the bay near the entrance. The topographic survey was extended to cover entire west shore of Panaon Island. The hydrographic survey of the bay was also completed.

The work covers the whole bay and extends along the west coast of Panaon Island for a short distance offshore to a junction with work previously completed. Tide observations were made at Tabogon during the progress of the hydrographic work.

The survey of the north coast of Mindanao Island was begun on January 8 and continued until May 4. During this period the survey of Butuan Bay was completed and the survey was extended along the eastern shore of Surigao Sea to the north point of Mindanao Island. The triangulation and topographic work along the coast was completed and the hydrographic work was extended about 2 miles offshore. The shore line is practically straight and there are no shoals. Heliotropes were used at the stations of the main scheme of triangulation in order to make the observations over the longest lines with as little delay as possible.

In connection with the hydrographic work, tide observations were made on a tide staff established at Bilan Bilan, near Surigao, and later a self-registering tide gauge was installed in Nasipit Harbor. These three stations were connected by simultaneous observations made on ten days.

[J. F. PRATT, Commanding Steamer *Pathfinder*.]

SUMMARY OF RESULTS.—Hydrography: 1 959 square miles of area covered, 4 038 miles of lines sounded, 60 217 soundings made, 4 tide stations occupied, 12 hydrographic sheets completed. Topography: 290 square miles of area covered, 460 miles of general coast line surveyed, 9 miles of shore line of rivers surveyed, 40 miles of shore line of creeks surveyed, 31 miles of road surveyed, 11 topographic sheets completed. Triangulation: 3 840 square miles of area covered, 35 stations occupied, 230 geographic positions determined, 93 elevations (in the interior) determined trigonometrically.

The work of the party on the steamer *Pathfinder* was done during two periods, the first lasting from July 19 to January 15 and the second from March 29 to June 30. During the year a trigonometric connection was made between Samar, Homonhon, Leyte, Dinagat, Panaon, Limasaua, and Mindanao islands and the triangulation was extended to cover Surigao Passage and Strait. A topographic survey was completed along the eastern coast of Leyte from latitude 10° 40′ to Panaon Strait and thence along the entire eastern coast of Panaon Island, and along the western coast of Dinagat Island and the northern coast of Mindanao Island. The topographic survey covered many of the small islands in Surigao Passage and adjacent waters and also a considerable portion of the south end of Dinagat Island.

The hydrographic survey covers Surigao Strait and Passage, including a considerable area north of the strait and offshore to the eastward of the north end of Dinagat Island and also along the north coast of Mindanao Island.

In connection with the triangulation the geographic positions and elevations of numerous peaks in the mountains were determined. An excellent anchorage for safety in typhoons was found in Tagbabui Bay, which lies about 5 miles to the eastward of

Sibanag Island. This anchorage can be entered in any weather, has good holding ground, and is well sheltered.

On November 6 the ship's steam launch (No. 35) became a total wreck in a typhoon and during the same storm the whaleboat was lost.

On March 27 while en route to Cebu a signal of distress was seen flying at Tanguingui Light-house and the keepers were found to be out of provisions. They were supplied with sufficient food to last until the weather changed and they could go for supplies.

Acknowledgment is made of assistance rendered and of courtesies shown the party by the navy officers in charge of the United States Naval Station at Cavite.

[S. SCHATTSCHNEIDER, Commanding Steamer *Research*.]

SUMMARY OF RESULTS.—Hydrography: 651 square miles of area covered, 2 003 miles of lines sounded, 26 891 soundings made, 5 tide stations occupied, 8 hydrographic sheets completed. Topography: 872 square miles of area covered, 192 miles of general coast line surveyed, 177 miles of shore line of rivers surveyed, 140 miles of road surveyed, 13 topographic sheets completed. Triangulation: 4 693 square miles of area covered, 40 stations occupied, 139 geographic positions determined.

The survey of Tañon Strait was in progress on July 1 and the work was completed on November 27. The triangulation and topographic work were extended along the coasts of Negros and Cebu islands to complete unfinished portions of the survey in this locality, and the hydrographic survey covered the strait within the same limits. The vessel then proceeded to the southern coast of Masbate Island via Iloilo for minor repairs, and work began in that locality on December 11 and was continued until January 27, when the vessel returned to Iloilo. During this time a triangulation was extended to cover the entire southern coast of Masbate and to connect with Jintotolo, Gigantes, and Tanguingui islands and many of the small islands near the coast, and the topographic survey was completed along the coast from the southeast point of the island to a point a short distance north of Guion River.

PORTO RICO.

[GEORGE HARTNELL.]

The work at the magnetic observatory at Vieques, P. R., was continued during the year and a practically continuous record of the relative value of the three elements of terrestrial magnetism was obtained with self-registering instruments. Observations were made twice each week to determine the absolute value of the magnetic elements. A remarkable magnetic storm was recorded on September 25 and 26, when the variations reached a wide range.

The seismograph was kept in continuous operation and a record of earthquakes was obtained on July 7 and 30, August 16, October 3, November 18, January 1, May 11 and 31, and June 14 and 15.

[N. H. HECK.]

SUMMARY OF RESULTS.—Hydrography: 14 square miles of area covered with wire drag, 222 miles run while dragging, 105 soundings made, 1 tide station occupied, 1 hydrographic sheet completed.

During the period January 6 to April 28 an examination of the harbor of Mayaguez, P. R., and approaches was made with the wire drag. The outfit for the party did not arrive until February 7, and the work during the first month was done with an

improvised drag and accessories and the work accomplished was relatively small. As this was the first work of the kind done in this locality, the delay in organizing the party was unusually great.

An examination was made of Mayaguez Bay, of the northern approach inside of Outer Manchos, of the main entrance, of the southwest channel between Rodriguez Bank and Machos Grandes, and of Guanijibo Channel. Within the area covered as stated above all dangers to navigation have been found and their positions have been determined with the least depth of water on each.

The weather was usually favorable for the work before noon each day, but in the afternoon the wind was generally strong enough to make the sea too rough for work with the drag.

The geographic positions of a hill and a mountain peak, marking the range for entering Mayaguez Harbor, were determined by triangulation during intervals when the weather conditions did not permit the use of the drag.

SPECIAL DUTY.

LOUISIANA AND MISSISSIPPI.

[E. MUELLER.]

November 7–23 an inspection was made to determine the condition of the beacons erected in the spring along the boundary between Louisiana and Mississippi, the shores of Lake Borgne, and Mississippi Sound as range marks, to detremine the damage done by the September storm.

It was expected by the state authorities that buoys could be placed in position to mark the line, but the buoys were not available and no further work could be done.

ALASKA-YUKON-PACIFIC EXPOSITION.

[W. E. PARKER.]

As required by law the exhibit representing the work of the Coast and Geodetic Survey was continued, with an officer in charge, from July 1 to October 16, the date on which the exposition closed.

TIDE OBSERVATIONS IN ARCTIC REGIONS.

[R. E. PEARY, Civil Engineer, U. S. Navy.]

In accordance with the instructions issued to Civil Engineer Peary, U. S. Navy, as stated in the previous annual report, tide observations were made in the Arctic regions at Cape Sheridan, Cape Columbia, Cape Bryant, Fort Conger, and at Cape Morris Jesup. The observations were made day and night at hourly intervals covering periods varying from 231 days at Cape Sheridan to 10 days at Cape Morris Jesup, and valuable information in regard to the tides was obtained. Meteorological observations were also made in connection with the tide observations, and soundings were made on the meridian of Cape Columbia, 9 in all, extending from Cape Columbia to latitude 89° 55′.

MISSISSIPPI RIVER COMMISSION.

[H. P. RITTER.]

As authorized by law, an officer of the Survey remained on duty as a member of the Mississippi River Commission and performed all the duties required by his office. He attended meetings of the Commission in October, February, April, and June, and in April also attended a meeting of the Board on Examination and Survey of the Mississippi River, of which he is a member.

INTERNATIONAL BOUNDARIES.

[O. H. TITTMANN.]

UNITED STATES AND CANADA BOUNDARY.

The work of re-marking this boundary, as prescribed in the treaty signed at Washington April 11, 1908, was in progress at several points along the line during the year, under the direction of an international commission, in which Mr. O. H. Tittmann represents the United States and Mr. W. F. King represents Great Britain.

On July 1 Mr. Fremont Morse was at work establishing reference monuments along the United States shore of the water boundary between Point Roberts and the Pacific Ocean, and the work was continued until October 14, when the work was completed.

Monuments built of concrete were placed at Pillar Point, Tongue Point, Angeles Point, Iceberg Point, Pile Point, and at Turn Point and on San Juan Island opposite Kelp Reef Beacon. Dungeness Light-house and Patos Island Light-house were used as reference monuments.

All these reference monuments and the boundary monument at Point Roberts were connected with the Coast and Geodetic Survey triangulation, and a large scale topographic map was made of the region in the immediate vicinity of each monument.

The recovery and survey of the United States and Canada boundary was in progress on the eastern slope of the Rocky Mountains under the direction of Mr. C. H. Sinclair, representing the United States Commissioner in the field, on July 1, and the work was continued until October 21, when it was suspended. The season's work began on May 7, and the statistics given below refer to the whole season.

The boundary was surveyed and monumented from the summit of the Rocky Mountains eastward to the North Fork of Milk River, a distance of 50 miles. Thirty boundary monuments (bronze) were placed in position along this section.

The triangulation was extended over the whole section and a topographic survey was made under the direction of E. C. Barnard, chief topographer, along the boundary on both sides. This survey was extended to cover a strip 2 miles wide on each side for a distance of 27 miles, and the width was then reduced to 1 mile on each side over the remaining portion of the work. A vista 20 feet wide was opened along the boundary wherever any cutting was necessary. All of the old monuments on this section were recovered.

Mr. M. F. Cochrane, of Canada, was with the party during the whole season as the representative of the British Commissioner.

The survey of the boundary was resumed by Mr. Sinclair on May 19, and the work was in progress on June 30. During this period the reconnaissance for the triangulation, the erection of signals, and the placing of boundary monuments were completed from the North Fork of Milk River to a point 20 miles west of Sweet Grass.

On July 1 a Canadian party, accompanied by Mr. F. D. Granger, as the representative of the United States Commissioner, was at work between Coutts, Alberta, and the West Fork of Milk River placing monuments on this section which had been previously surveyed. This work was completed, and the survey along the boundary was then extended eastward to Frenchmans Creek, a distance of 205 miles from Coutts. One hundred and forty-four monuments were placed in position, and all of these were con-

nected with the triangulation before the season closed on November 6. The work was resumed on May 1 and was in progress on June 30.

In July the survey of the boundary westward from the mouth of Pigeon River, at the west end of Lake Superior, was resumed by Mr. W. B. Fairfield. The survey was extended along the river from the base, 2 miles west of its mouth, furnished by the triangulation of the previous year. The river above the Great Falls is a very crooked, narrow stream with numerous rapids, cascades, and falls, and the banks are densely wooded over almost the whole length, which made it impracticable to extend a triangulation along this portion of the boundary and a survey by the stadia method was made. It extends from the base line mentioned above to the eastern end of South Fowl Lake, a distance of 30 miles. Eighty-seven stadia stations were marked by brass plates set in the natural rock along the river and numbered, even numbers being used in the United States territory and odd numbers on the Canadian side of the boundary. Sixty-seven additional stations were marked, drill holes and cross lines cut in the rock, and 148 temporary stations were marked by wooden stubs.

A topographic survey was made along the river, using a mountain plane table, and the position of the shore line of the river and of the island and some other topographic details were secured. The river is used to float logs to Lake Superior, and many of the signals were carried away by rafts of logs day after day. Fortunately, the Pigeon River Lumber Company was at work in the region and its officers permitted the use of its transportation facilities, thus greatly furthering the work and lessening the time and expense.

Late in November the work was suspended for the season and the party was disbanded on the 28th. In June a party was organized to resume the work and on June 30 was at the mouth of Pigeon River waiting for transportation to South Fowl Lake.

The survey of the United States and Canada boundary was in progress along the St. Croix River on July 1 by two cooperating parties, under charge of Messrs. J. E. McGrath and A. J. Brabazon, representing the United States and British Commissioners, respectively. Stations were selected and observations were made to extend the triangulation up the river from its mouth to the railroad bridge above Baring, Me. The stations in this work were generally established near the banks of the river by a subsidiary triangulation which was controlled by connecting it, in several places, with the large and well-conditioned triangulation which covers the whole river valley in this locality. The United States and Canadian parties made observations at the stations in the territory of their respective countries in accordance with a plan adopted in advance to secure the greatest amount of progress consistent with the object of the work. Work was suspended on November 28 on account of unfavorable weather conditions.

Most agreeable relations existed between the parties and the cooperation was entirely successful. The survey of the boundary was resumed on June 20 under the conditions named above, and was in progress on the 30th, on which date the triangulation had been completed from the mouth of the St. Croix River to Butler Islands.

The work of recovering and re-marking the boundary between the United States and Canada along the St. John River was in progress under the charge of Messrs. J. B. Baylor and G. C. Rainboth, representatives in the field of the United States and British

Commissioners, respectively, on July 1, and this work was continued until November 1, when it was suspended for the winter on account of unfavorable weather.

The triangulation was extended as the joint work of the two parties, each occupying the stations in their respective countries, from a point 2 miles below Van Buren, Me., to a point about 3 miles above Edmundston, New Brunswick, a distance of 35 miles. Boundary reference monuments built of reenforced concrete were placed in position on the river bank and referred to the boundary by being connected with the triangulation. In connection with this work two base lines were measured with steel tapes to verify the triangulation, and a connection was made with an astronomic station established by Canada at Edmunston, New Brunswick.

A topographic survey was made along the boundary covering the territory adjacent to the river and extending to a distance of 1¼ to 1½ miles from the river bank. Five topographic sheets were completed on which the relative elevations are shown by contours at vertical intervals of 20 feet, and the artificial features are all indicated.

The survey of the boundary was resumed on May 5 by a joint party under the direction of the representatives of the Commissioners named above, and the work was in progress on June 30. Good progress was made and it was practically completed to Fort Kent, Me.

ALASKA BOUNDARY.

The demarcation of the boundary between Alaska and Canada along the one hundred and forty-first meridian was continued, as provided in the convention between the United States and Great Britain (signed April 21, 1906), by Mr. O. H. Tittmann, the Commissioner representing the United States, and Mr. W. F. King, the Commissioner representing Great Britain.

The demarcation of the Alaska boundary was in progress May 28 to June 30 in the vicinity of the head of Portland Canal by a Canadian party with Mr. Fremont Morse as the representative of the United States Commissioner.

On July 1 the demarcation of the boundary in southeastern Alaska was in progress under the direction of Mr. O. M. Leland, the representative of the United States Commissioner in the field. The season began on May 8, 1909, and the work was continued until November 7. During this period the survey and marking of the boundary was extended as stated below.

On the east side of the Unuk River the boundary was located and marked to Boundary Peak 7780. Peak 5800 was located and some timber was cut along the line on each side of it, and it was marked by a monument. Two points on the line between peaks 5800 and 6450 were marked, one by a monument and the other by a copper bolt.

Peaks 6450 and 6750 were marked by copper bolts and a "drilled" rock, and the line between 6750 and 7780 was marked in four places by two monuments and two bolts, as well as by cutting timber. Photographs with a photo-topographic camera were made to furnish information for the correction of the topographic maps.

On the west side of the Unuk River the boundary was located and marked to a point beyond the east fork of Blue River. Two monuments and a copper bolt were placed in position on this section of the line.

On the west fork of Blue River the boundary crossing was marked by opening a vista along the line to points one-quarter of a mile from the river on both sides and by

placing a monument on the west side. All of the peaks between 6500 and 7780 were located by triangulation and all of them except these two were occupied with a theodolite and with a photo-topographic camera.

A self-registering tide gauge was maintained at Skagway.

The survey of the boundary in southeastern Alaska was resumed on June 17 and the work was in progress on the 30th in the vicinity of the point where the boundary crosses the Salmon River.

The demarcation of the boundary between Alaska and Canada was in progress along the one hundred and forty-first meridian north of the Yukon River on July 1 under the direction of Mr. G. C. Baldwin, representing the United States Commissioner in the field. Mr. J. D. Craig accompanied the party as the representative of the British Commissioner.

The work began on June 20 and was continued until September 17. During this period the boundary line was located by extending the line northward from the monument on the south bank of the Yukon River for a distance of 40 miles. The triangulation along the boundary was extended from the work previously completed south of the Yukon for a distance of 43 miles, and 12 monuments were placed in position to mark this portion of the boundary.

A vista 20 feet wide on the sky line was cut through the timber along the line.

The triangulation and topographic survey of the boundary between Alaska and Canada along the one hundred and forty-first meridian was in progress on July 1 at a point about 100 miles south of the Yukon River by a party under the direction of Mr. Thomas Riggs, jr., the representative of the United States Commissioner in the field. The party was divided into six sections, each in a separate camp and completely equipped for the work assigned to it.

In addition to its own work each section of the party supplemented the work of the other sections in its vicinity from time to time and all aided each other to the extent of their ability in attaining the completion of the work before winter weather ended the season. The triangulation was extended 85 miles and the topographic survey 111 miles, both reaching the end of the line projection work at the Natazhat Range of Mountains, 225 miles south of the Yukon River. The triangulation was also extended along White River for a distance of 33 miles, and the topographic survey covered a strip 2½ miles wide on both sides of the boundary.

A strenuous effort was made to climb the Natazhat Range and establish the boundary crossing on the summit, but a heavy fall of snow made it necessary to give up the attempt.

The many obstacles of transportation were overcome and the work was completed in spite of the adverse weather conditions. The movement out of the country for the winter began on August 25, and each section started as soon as its work was finished.

The positions of 12 monuments placed on the line by the Canadian party were verified.

Work was resumed on the location and survey of the line north of the Yukon River on May 24, and it was in progress at the close of the fiscal year.

INTERNATIONAL GEODETIC ASSOCIATION.

[O. H. TITTMANN and J. F. HAYFORD.]

The duty of representing the United States as delegates to the Sixteenth General Conference of the International Geodetic Association at London and Cambridge, England, was performed by Messrs. O. H. Tittmann, Superintendent, and J. F. Hayford, Inspector of Geodetic Work, Coast and Geodetic Survey. The conference was in session from September 21 to 30, 1909.

The delegates of the United States presented a report covering the progress of geodetic operations and investigations in the United States from 1906 to 1909. The recent work in this country received the formal recognition of the conference when a famous geodesist arose and stated that he felt sure that he voiced the sentiment of the conference by saying that the Americans were to be congratulated on having introduced a new epoch in geodesy.

When it is remembered that the geodetic work in the United States is the incidental result of observations made primarily for other purposes, this recognition of the work by the world's leading geodesists forms a tribute to the Bureau in charge of these operations which should gratify every citizen of the Republic. The occasion of this tribute was the recent publication of a discussion by Mr. J. F. Hayford, an officer of the Survey, of the figure of the earth, under the title "The Figure of the Earth and Isostasy from Measurements in the United States."

Many courtesies were extended to the delegates, both in London and Cambridge, officially and privately, and notable among the former was an entertainment at Windsor Castle by the gracious invitation of His Majesty the King.

FORT MYER MILITARY ROAD.

[P. A. WELKER.]

In accordance with a request made by the War Department, an officer was detailed to serve as the representative of the United States on a commission of engineers created to make a survey of a portion of the military road leading from the Aqueduct Bridge (across the Potomac River) to Fort Myer, Va.

The location of a portion of the boundary of this road being in controversy between the United States and the owners of the adjoining property and being before the United States court for the eastern district of Virginia for settlement, a special master commissioner in chancery was named to take testimony, and he appointed the commission of engineers mentioned above.

This officer reported to the Quartermaster-General, U. S. Army, on September 22, and was engaged on this duty until December 10 at such times as were necessary, and after that date was directed to respond to all calls for information on this subject and to give testimony when required before the master in chancery referred to above.

The survey was made and a final report was filed under date of December 2, 1909.

LOUISIANA AND MISSISSIPPI WATER BOUNDARY.

[ISAAC WINSTON.]

In accordance with the request made by the chief state engineer, an officer was detailed to complete the marking of this boundary, as described in the previous annual report, by placing buoys along the line in Lake Borgne and Mississippi Sound at the intersection of the range lines previously established and at intermediate points approximately 1 mile apart. The work began on April 5 and was completed on May 2.

The men, material, and outfit, consisting of a tugboat and large barge, were furnished by the chief state engineer, and he had also obtained authority from the Light-House Board for the placing of the buoys. Six nun buoys and 22 spar buoys were placed in position.

During April strong winds prevailed and caused serious delay in the work, as the tug was not able to handle the barge with safety in rough water.

The work was inspected on May 6 by the chief state engineer, accompanied by a representative of the Louisiana Oyster Commission and the Light-House Inspector for the Eighth district.

Copies of a chart showing the positions of the buoys and data fixing their positions were furnished to the chief state engineer.

DELAWARE OYSTER BEDS.

[C. C. YATES.]

In response to a request made by the governor of Delaware and under the authority of the Secretary of Commerce and Labor, an officer of the Survey was directed to communicate with the governor and arrange to supervise the survey of certain oyster beds in the State, the work to be done for the Delaware Oyster Survey Commission at such times as his other duties permit and entirely at the expense of the State of Delaware.

APPENDIX 2

REPORT 1910

DETAILS OF OFFICE OPERATIONS

CONTENTS.

DETAILS OF OFFICE OPERATIONS.

OFFICE OF THE ASSISTANT IN CHARGE.

ANDREW BRAID, *Assistant in Charge.*

The Assistant in Charge of the Office has direct supervision of the work of the different divisions of the Office. The Miscellaneous Section is a part of the immediate office of the Assistant in Charge.

COMPUTING DIVISION.

The usual progress was made in the reduction of field observations and in the preparation of results for publication. It is the policy of the Survey to furnish the available information contained in its records and archives in response to all requests, and the most economical plan of doing this is to publish all data useful to geographers and engineers as rapidly as possible so that it may be distributed in printed form.

A Supplemental Investigation in 1909 of the Figure of the Earth and Isostasy was finished and prepared for publication. This completes the discussion of all data obtained in the United States prior to 1909 available for the determination of the problem, and it is gratifying to state that the results of this second investigation have confirmed and greatly strengthened those deduced in the original discussion.

The results of triangulation in northern California, including 1 600 geographic positions and descriptions of stations, were also prepared for publication, and progress was made in preparation of similar information in several other States and Territories.

The geographic positions of the subsidiary stations along the ninety-eighth meridian were computed. The transfer of all geographic positions in Florida determined previous to 1910 to the United States Standard Datum was completed.

A reduction of the base lines measured at Stanton, Tex., and Deming, N. Mex., was made and the results are published in Appendix 4.

DIVISION OF TERRESTRIAL MAGNETISM.

A steady demand for magnetic information continued during the year and the replies to such requests were prepared in this Division.

The preparation of the results of the observations on land and sea during the fiscal year 1909 for publication in the Annual Report for that year was completed.

A chart showing the lines of equal magnetic declination and of equal annual change for Alaska in 1910 and the data on which it is based was also prepared for publication in the same report.

Five volumes containing the results of the observations at the five magnetic observatories for the years 1905 and 1906 were prepared for publication and progress was made in the preparation for publication of the results at these observatories for the years 1907 and 1908.

Tabulations of the data pertaining to the earthquakes recorded at the Cheltenham, Sitka, Porto Rico, and Honolulu observatories during the calendar year 1909 were prepared and the office revision of the field computations was kept up to date.

TIDAL DIVISION.

Harmonic analyses were completed for 21 stations with a combined length of 5 years and 9 months. Nonharmonic reductions were made for 195 stations with a combined length of 31 years and 6 months. Mean sea level was computed for 33 stations with a combined length of 99 years and 6 months. High and low waters and hourly heights of the sea were tabulated for 322 stations with a combined length of 74 years and 7 months.

There were received, examined, and registered in this Division records from 28 self-registering tide-gauge stations with a combined length of 15½ years and records from 93 staff-gauge stations with a combined length of 4½ years.

The total of all tide observations made by the Survey and received during the year is 20 years at 121 stations and from other sources 7½ years at 8 stations, making a grand total of 27½ years at 129 stations.

The following is a list of the sources from which tide observations were received from outside parties during the year:

1. United States Army Engineers, tides in United States, 1 station, 1 year; Canal Zone, 2 stations, 2 years.
2. Hydrographic Office, U. S. Navy, Panama, 2 stations, 1 year and 5 months.
3. Insular Government, Philippine Islands, 2 stations, 2 years and 3 months.
4. Alaska Boundary Survey, Alaska, 1 station, 1 year.

Tables containing the predicted tides for 1911 at Sandy Hook, N. Y., Baltimore, Md., Charleston, S. C., and San Francisco, Cal., were furnished to the Imperial Hydrographic Office at Wilhelmshaven, Germany, in advance of publication.

Similar information for Wellington and Aukland, New Zealand, for 1911 was sent to the marine department of New Zealand.

The tide tables for 1911 were completed and the proof was read. The preparation of the tide tables for 1912 was nearly completed.

A discussion of the tidal observations recently made in the Arctic Ocean by Civil Engineer R. E. Peary, U. S. Navy, was completed by Mr. Rollin A. Harris, and progress was made by him in the preparation of a monograph on the subject of "Arctic Tides."

DRAWING AND ENGRAVING DIVISION.

The Division is divided into five sections—the Drawing, the Engraving, the Printing, the Photographing, and the Electrotyping sections. Each section does the work indicated by its title, and the combined results are shown on the charts published and issued by the Survey. Cooperation with the Light-House Board in compiling information for the

Notices to Mariners was continued during the year, and a weekly Notice to Mariners was issued as a joint publication of the Light-House Board and the Coast and Geodetic Survey.

Drawing Section.

During the year the following drawings for new charts were completed:

Chart No.	
262.	Bradford Coaling Station.
283.	Hudson River.
284.	Hudson River.
508.	St. Johns River.
509.	St. Johns River.
539.	Patuxent River.
6151.	Columbia River.
6152.	Columbia River.
6153.	Columbia River.
6154.	Columbia River.
6440.	Sinclair Inlet.
8247.	Hood Bay and Kootznahoo Inlet.
8250.	Chatham Strait.
8306.	Glacier Bay.
8570.	Kupreanof Strait to Kodiak.
8589.	Port Graham and Seldovia Bay.

A new drawing was also completed for a new edition of chart No. 218 (Port Yabucoa).

Extensive corrections were made to the drawings for 139 charts in preparing them for the issue of new editions. Nine drawings for new charts in the Philippine Islands were received from Manila and prepared for publication. Eight maps for the Maryland Shell-Fish Commission and a number of miscellaneous drawings were completed.

Engraving Section.

The following original engraved plates were completed:

Chart No.	
559.	Potomac River.
560.	Potomac River.
4243.	Manila and Cavite Anchorage.
5530.	San Francisco Bay.

The following original etched plates were completed:

Chart No.	
495.	York River.
4109.	Honolulu Harbor.
4246.	San Fernando Harbor.
4349.	Malampaya Sound.
4447.	Cebu Harbor.
4543.	Isabela Channel.
4647.	Agusan River Entrance.
4649.	Malalog Bay.
5145.	San Pedro Harbor.
8996.	St. Paul and St. George islands.

All of these plates represent charts already published by photolithography.

The following new bassos for new editions were completed:

Chart No.	
128.	Isle of Wight to Chincoteague Inlet.
137.	Cape Henry to Currituck Beach.
184.	St. Josephs and St. Andrews bays.
194.	Mississippi River.
369.	New York Bay and Harbor.
369[4].	Hudson and East rivers.
369[5].	Hell Gate and East River.
380.	Philadelphia Water Front.
420.	Beaufort Harbor.
453.	Fernandina Entrance.
526.	Galveston Entrance.
950.	Colon Harbor.
5143.	Wilmington and San Pedro harbors.
6185.	Willapa Bay.
6300.	Gulf of Georgio and Strait of Juan de Fuca.
6444.	Port Orchard.
6446.	Lake Washington.
6451.	Commencement Bay and City of Tacoma.

The following new bassos for reissues were completed:

Chart No.	
19.	Mobile Bay to Atchafalaya Bay.
51.	Nantucket Shoals to Montauk Point.
114.	Newport to Plum Island.
116.	Stratford Shoal to New York.
348.	Woods Hole.
424.	Cape Fear River.
5106.	San Diego Bay.
6140.	Columbia River.
6303.	Port Angeles.

SUMMARY.

Plates for former lithograph charts finished	14
Bassos completed	27

Extensive corrections were made on 162 plates and minor corrections on 862.

Printing Section.

New charts printed by photolithography:

Chart No.	
262.	Bradford Coaling Station.
283.	Hudson River.
284.	Hudson River.
508.	St. Johns River.
509.	St. Johns River.
539.	Patuxent River.
951.	Panama Harbor.
4224.	Sogod Bay to Calagua Harbor.
4225.	Lamon Bay and vicinity.
4413.	Sigat Point to Manigonigo Island.
4419.	Northern part of Cebu.
4427.	East Coast of Cebu.
4606.	Port Sibulan to Polloc Harbor.
4617.	Sibuguey Bay.
4623.	Southern part of Davao Gulf.
4624.	Northern part of Davao Gulf.
4655.	Delta to head of Mindanao River.
6440.	Sinclair Inlet.
6448.	Approaches to Everett.
8247.	Hood Bay and Kootznahoo Inlet.
8250.	Chatham Strait.
8306.	Glacier Bay.
8550.	Prince William Sound.
8570.	Kupreanof Strait to Kodiak.
8589.	Port Graham and Seldovia Bay.

New editions of different charts printed from copper plates	38
New editions of different charts printed from stones	12
New editions of different charts printed by photolithography	30
Number of different charts printed from stones	83
Number of different charts printed from plates	933
Charts printed from stones (impressions, 118 576)	47 237
Charts printed from plates (impressions, 90 883)	82 515

Photographing Section.

The following etched plates were made:

Chart No.	
262.	Bradford Coaling Station.
539.	Patuxent River.
4272.	Unisan to Malaney.
4463.	Escalante Harbor.
6440.	Sinclair Inlet.
8589.	Port Graham and Seldovia Bay.

Negatives of 98 charts were made for use in reproducing them by photolithography, and a large amount of miscellaneous work was done.

Electrotyping Section.

Altos completed	61
Bassos completed	52
Copper deposited (kilograms)	1 798

CHART DIVISION.

All the charts published by the Survey are issued through this Division, and hand corrections are made to show changes in aids to navigation of which notice is received prior to the date of issue and the buoys on the charts given their proper color. Charts are issued free to those entitled to receive them and sold to all other persons at the office in Washington and by 163 agents in different parts of the country.

All the work in connection with the sale of Charts, Coast Pilots, and Tide Tables is done in this Division. Charts were received as follows from the Drawing and Engraving sections:

	Number.
Prints from plates	82 515
Prints from stone	47 237

In addition to the above, 4 294 copies of special charts Nos. 16, 17, 18, 19, 20, and 26, prepared for the Maryland Shell-Fish Commission and printed by contract, were received for distribution, and 3 822 copies of this series (Nos. 1 to 26) were issued.

Charts were issued as follows:

Sales agents	45 296	Suboffice, Manila, P. I.	7 426
Sales at the office	2 417	Executive departments	6 038
Congressional account	4 823	Foreign governments	741
Hydrographic Office, U. S. Navy	32 111	Miscellaneous	1 242
Light-House Board	3 651		
Coast and Geodetic Survey Office	6 630	Total	110 375

Charts were issued at the suboffice in Manila, P. I., as follows:

Sales agents	951	Executive departments, Philippine Islands	1 235
Sales at the suboffice	1 183	Miscellaneous	119
United States Army	913		
Hydrographic Office, U. S. Navy	795	Total	5 658
Suboffice in Manila	462		

INSTRUMENT DIVISION.

In this Division an account was kept of all instruments and general property owned by the Survey or purchased during the year, except articles carried on the inventory of the Office at Washington. All necessary repairs were made to instruments used by the Survey. Minor repairs were made to the Office buildings and furniture.

The tide-predicting machine was completed. The construction of this machine has been incidental to the regular repair work of the Survey, and consequently it has been many years in progress. It embraces many new features, and provision has been made for 37 constituents of tidal fluctuations, instead of the 19 provided for in the machine previously used. This is at least 10 more than the number used in any other machine

in foreign countries. It was completed in February and has been tested in predicting the most complicated known tides, and the quantities obtained have been compared with the results of computation and found to be satisfactory from every point of view. Dr. Rollin A. Harris, of the Tidal Division of this Survey, furnished the theoretical data for solving mechanically, by using 5 long-period and 32 short-period constituents, an integrating formula which yields the heights and times of any tide without resetting, and the design and working drawings were prepared by the Chief of this Division. The machine not only gives the times and heights of the tides, but also simultaneously traces the corresponding tidal curve. Attached to the machine is an electric device which automatically stops it at the instant when the zero of the time chain is in contact with the pointer which indicates the quantities to be read by the operator. The details of construction will be given when a description of the machine is prepared for publication

An electric tide indicator similar to those already in use and previously described was prepared and installed at the American Seamen's Friend Society's Institute, New York City.

The patterns for certain monuments to be used on the United States and Canada boundary were inspected at St. Paul, Minn., and later an inspection was made of the monuments after completion.

A duplicate of the leveling instrument, devised and adopted by the Coast and Geodetic Survey, made for the Tunisian Government by private parties subject to inspection and approval by the Superintendent, was carefully examined and recommended for approval.

An improved form of tape stretcher for use in measuring base lines was constructed substantially as suggested by an observer in the field engaged on that work. This is shown in one of the illustrations to Appendix 4.

LIBRARY AND ARCHIVES.

The current routine work was kept up to date. The records of observations made in the field were indexed as they were received. The revision of the subject catalogue was continued, and three-fourths of the work was completed.

Accessions.

	Purchased.	Donated.	Exchanged.	Total.
Books and pamphlets	158	104	604	866
Maps and charts	7	0	1 183	1 190

Issued for temporary use.

Books and pamphlets	1 732
Serials	688
Records	6 150
Original sheets	5 079
Maps and charts	3 213

The following is a list of the original records received:

Subject.	Volumes.	Cahiers.	Sheets or rolls.
Astronomy	1	3	5
Geodesy	379	333	
Gravity	14	47	34
Hydrography	261	2	184
Hypsometry	150	13	
Log books	60		
Magnetism	1	486	
Miscellaneous surveys	1	1	
Tides	152	11	279
Topography			156
Total	1 019	896	658

Photographic prints	1 215
Photographic negatives	975

MISCELLANEOUS SECTION.

All purchases under the appropriation for Office expenses were made through this section, and this work involved a great deal of correspondence in addition to the work of preparing vouchers. Numerous purchases were also made to fill orders for supplies from field parties. An account was kept of all publications, except charts, received and issued by the Survey, and all requisitions for printing were prepared.

Stationery for the Office and for all field parties was kept in stock and issued as required. Supervision over the furniture in the Office was maintained by examination of the inventories of the various divisions.

The following publications were received from the Public Printer:

	Number.
Report of the Superintendent of the Coast and Geodetic Survey for 1909	2 000
Appendxies to Report for 1909, published as separates	1 600
Catalogue of Charts, 1909	2 500
United States Coast Pilot:	
Atlantic Coast: Part IV, fifth edition	3 000
Atlantic Coast: Part V, fourth edition	2 533
Pacific Coast: California, Oregon, and Washington, second edition	1 918
Coast Pilot Notes, Yakutat Bay to Cook Inlet, second edition	850
Supplements to Coast Pilots	3 200
Tide Tables, 1911:	
Complete	1 150
Atlantic Coast	1 550
Pacific Coast	10 000
Description of Long Wire Drag	200
The Figure of the Earth and Isostasy, etc	2 500
Supplemental Investigation, 1909, of the Figure of the Earth and Isostasy	2 000
Geodetic Operations in the United States, 1906–1909	350
Results of Magnetic Observations:	
Cheltenham, Md., 1905–1906	700
Honolulu, Hawaii, 1905–1906	700
Sitka, Alaska, 1905–1906	700
Survey of Oyster Bars:	
Calvert County, Md	500
Worcester County, Md	47
Notices to Mariners, Philippine Islands*	400

* Received from suboffice at Manila, P. I.

The following publications were issued by the Office:

	Number.
Annual Reports, 1851–1909	2 700
Appendixes to Annual Reports	3 525
Bulletins Nos. 1 to 41, inclusive	216
Title-pages for Bulletins, Vols. I and II	2
Catalogue of Charts	2 006
Catalogue of Charts, Philippine Islands	6
Atlantic Coast Pilots, parts 1 to 8 (latest editions)	2 599
Pacific Coast Pilots, Alaska, part 1, first edition	2
Pacific Coast Pilots, Alaska, part 1, fifth edition	215
Pacific Coast Pilots, California, Oregon, and Washington, second edition, 1909	553
Coast Pilot, Porto Rico	27
Supplements to Coast Pilots	3 200
Pan-American Exposition Leaflets, Spanish edition, Nos. 1–12	12
Sailing Directions for Philippine Islands, sections 1, 6, 7	148
Supplement to Sailing Directions for Philippine Islands	14
Special Publication No. 1	5
Special Publication No. 4	28
Special Publication No. 5	82
Special Publication No. 6	75
Special Publication No. 7	20
Tide Tables, complete	1 062
Tide Tables, Atlantic Coast	1 435
Tide Tables, Pacific Coast	10 120
Administration and Work of Coast and Geodetic Survey	5
Coast and Geodetic Survey in Alaska	16
Coast Pilot Notes on Bering Sea and Arctic Ocean	100
Coast Pilot Notes on Warren Channel	2
Coast Pilot Notes, Yakutat Bay to Cook Inlet	44
Coast Pilot Notes, Yakutat Bay to Cook Inlet, second edition	266
Construction and Distribution of Weights and Measures	308
Conversion Tables	17
Description of Long Wire Drag	32
Field Catalogue of 983 Transit Stars	2
Figure of the Earth and Isostasy	1 734
Supplemental Investigation, 1909, Figure of Earth and Isostasy	1 327
General Instructions for Coast Survey, Philippine Islands, 1906	5
General Instructions for Field Work, Coast and Geodetic Survey	142
General Proportion of Equations of Steady Motion	4
Geodetic Operations in United States:	
1900–1903	3
1903–1906	1
1906–1909	270
Historical Sketch, 1884	5
Irrigation, San Joaquin, Tulare, and Sacramento valleys	4
Laws and Regulations, 1887	15
List and Catalogue, 1908	262
Supplement to List and Catalogue, August, 1908	9
List of Publications Available for Distribution, 1908	9
Report on Nicaragua Route	3
Precise Leveling in United States, 1903–1907	92
Principal Facts of the Earth's Magnetism	158
Results of Magnetic Observations:	
Baldwin, 1901–1904	11
Cheltenham, 1901–1904	17
1905–1906	488
Honolulu, 1902–1904	12
1905–1906	413
Sitka, 1902–1904	10
1905–1906	476
Vieques, 1903–1904	10
Rules Governing Routine and Discipline Aboard Ship	1
Standard Mean Places of C. and T. Stars, 1866	1
Survey of Oyster Bars:	
Anne Arundel County, Md	207
Calvert County, Md	362
Somerset County, Md	308
Wicomico County, Md	93
Worcester County, Md	240
Table of Coefficients	10
Table of Factors:	
In feet	18
In meters	14
Table of Heights (in meters)	8
Tidal Researches	5
Tides and Tidal Action in Harbors	7
Treatise on Projections	32
United States Magnetic Tables and Charts, 1905	329
Work of the Coast and Geodetic Survey, second edition	106
Notice to Mariners, Philippine Islands	247

APPENDIX 3

REPORT 1910

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE COAST AND GEODETIC SURVEY BETWEEN JULY 1, 1909, AND JUNE 30, 1910

By

R. L. FARIS

Inspector of Magnetic Work; Assistant, Coast and Geodetic Survey

CONTENTS.

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE COAST AND GEODETIC SURVEY BETWEEN JULY 1, 1909, AND JUNE 30, 1910.

By R. L. FARIS,

Inspector of Magnetic Work; Assistant, Coast and Geodetic Survey.

INTRODUCTION.

The present publication contains the results of magnetic observations made on land and at sea by officers of the Coast and Geodetic Survey in the prosecution of the magnetic survey of the United States and outlying territories during the fiscal year ended June 30, 1910. There are also included some results obtained in preceding years not heretofore published.

Four magnetic observatories have been in continuous operation throughout the year—at Cheltenham, Md.; Sitka, Alaska; near Honolulu, Hawaii, and on Vieques Island, P. R. The observatory at Baldwin, Kans., was discontinued in October, 1909, and the instruments were transferred to Tucson, Ariz. The operation of the observatory at that place began in November, 1909. There will be found in the tables the values of the magnetic elements for each of the observatories based on the observations in December and January, except in the case of Baldwin, where the values are for October, 1909.

OBSERVATIONS ON LAND AND THEIR DISTRIBUTION.

The distribution of the stations on land is shown in the following table, from which it will be seen that observations were made during the year in 39 States and Territories. The greater part of the year's work was in the middle of the country—Illinois, Indiana, Iowa, Kansas, Minnesota, Nebraska, and South Dakota—where it would be important to have the records of the Baldwin observatory to correct the results for diurnal variation. Numerous old stations were reoccupied in order to determine the secular change of the magnetic elements. In April, 1910, an observer was sent out especially to occupy repeat stations, going through the southern tier of States from Alabama to California, up the Pacific coast, and back through the center of the country. He had reached central California at the close of the fiscal year.

Summary of results on land.

State	Localities	Stations	Old localities reoccupied	Declination results	Dip results	Intensity results
Alabama	4	5	4	5	5	5
Alaska	17	17	4	22	11	12
Arizona	3	3	3	4	4	4
California	5	6	5	6	6	6
Connecticut	2	2	2	2	2	2
Florida	1	1	1	1	1	1
Georgia	1	1	0	1	1	1
Hawaii	1	1	1	1	1	1
Illinois	10	10	1	10	10	10
Indiana	21	22	2	24	24	24
Iowa	29	30	3	30	30	30
Kansas	7	7	5	7	8	7
Kentucky	5	5	1	5	5	5
Louisiana	3	3	3	3	3	3
Maine	8	8	2	8	8	8
Maryland	2	2	2	4	8	3
Massachusetts	6	6	4	7	6	5
Michigan	2	2	1	2	2	2
Minnesota	25	25	1	25	25	25
Mississippi	2	2	2	2	2	2
Missouri	2	2	0	2	2	2
Nebraska	20	20	0	20	20	20
New Hampshire	4	4	2	4	4	4
New Jersey	2	2	1	2	2	2
New Mexico	2	2	2	2	2	2
New York	4	4	3	4	4	4
North Dakota	1	1	1	1	1	1
Ohio	1	1	1	1	1	1
Pennsylvania	3	3	2	3	3	3
Philippine Islands	9	9	0	9	2	2
Porto Rico	1	1	1	1	1	1
Rhode Island	2	2	2	2	2	2
South Carolina	1	1	1	1	1	1
South Dakota	10	10	2	10	10	10
Tennessee	6	6	2	6	6	6
Texas	5	6	4	6	6	6
Vermont	1	1	0	1	1	1
Virginia	3	4	3	4	4	4
Washington	3	3	0	3	0	0
Foreign countries	1	1	1	4	4	4
Total	235	241	75	255	238	232

SECULAR CHANGE OF THE MAGNETIC DECLINATION.

A comparison of the declination results at "repeat" stations occupied during the year with the results of earlier observations in the same localities is presented in the following table. The letters after the names of stations indicate (*a*) that the old station was reoccupied exactly, (*b*) that the new station was very near the old one, and (*c*) that the new station was some distance (quarter of a mile or more) from the old one. A tabular value of annual change refers approximately to the middle of the period from which it is deduced. A plus sign indicates increasing east declination or decreasing west declination, and a minus sign the reverse.

The resulting values of annual change show that, as compared with 1905, west declination is increasing more rapidly in New England and the Middle States and east

declination is increasing more rapidly in the western part of the country. The position of the line of no change is apparently about the same as in 1905.

Comparison of declination results at repeat stations.

State and station	Former observation		Last observation		Average annual change
	Date	Declination	Date	Declination	
		° ′		° ′	′
Maine:					
Kittery Point (*c*)	1898 No	13 12. 3 W	1909 Oc	14 24. 1 W	−6. 6
Greenville Junction (*c*)	1887 Se	16 48. 1 W	1910 Je	18 05. 3 W	−3. 4
New Hampshire:					
Plymouth (*a*)	1905 Se	13 32. 0 W	1910 Je	14 00. 9 W	−6. 1
Massachusetts:					
Vineyard Haven (*a*)	1906 No	12 22. 6 W	1909 Jy	12 38. 0 W	−5. 8
Boston (*a*)	1906 No	13 04. 0 W	1909 Jy	13 18. 5 W	−5. 4
Salem (*a*)	1906 No	14 28. 4 W	1909 No	14 42. 4 W	−4. 7
Lawrence (*a*)	1905 Oc	12 35. 3 W	1910 Je	13 03. 4 W	−6. 0
Rhode Island:					
Kingston (*a*)	1904 Au	11 40. 0 W	1910 My	12 16. 2 W	−6. 3
Providence (*a*)	1904 Au	12 06. 5 W	1910 My	12 41. 7 W	−6. 1
Connecticut:					
New Haven (*a*)	1904 Jy	10 05. 9 W	1910 My	10 40. 4 W	−6. 0
New London (*a*)	1904 Au	10 56. 0 W	1910 My	11 28. 8 W	−5. 7
New York:					
Lake Placid (*b*)	1907 Au	11 06. 2 W	1909 Au	11 17. 5 W	−5. 6
Carmel (*c*)	1904 Se	10 35. 9 W	1910 Je	11 08. 1 W	−5. 6
New Jersey:					
Trenton (*b*)	1903 Jy	8 00. 6 W	1910 Je	8 35. 7 W	−5. 1
Pennsylvania:					
Meadville (*a*)	1908 Jy	4 24. 6 W	1910 Je	4 35. 4 W	−5. 6
Easton (*b*)	1902 Se	7 11. 0 W	1910 Je	7 49. 2 W	−4. 9
Maryland:					
Cheltenham (*a*)	1906 Je	5 21. 3 W	1910 Je	5 41. 3 W	−5. 0
Virginia:					
Charlottesville (*b*)	1906 Au	3 50. 0 W	1910 Ap	4 03. 3 W	−3. 6
Lynchburg (*a*)	1901 Se	2 24. 8 W	1910 Ap	2 53. 1 W	−3. 3
Bristol (*a*)	1906 Au	0 33. 0 W	1910 Ap	0 42. 4 W	−2. 6
South Carolina:					
Charleston (*b*)	1902 My	0 32. 9 W	1910 My	1 00. 8 W	−3. 5
Florida:					
Fernandina (*a*)	1908 Ap	1 12. 2 E	1910 Ap	1 06. 2 E	−3. 0
Tennessee:					
Knoxville (*a*)	1907 Mh	0 12. 8 W	1910 Ap	0 21. 2 W	−2. 7
Athens (*a*)	1903 No	0 43. 3 E	1910 My	0 30. 0 E	−2. 0
Alabama:					
Scottsboro (*a*)	1903 De	3 21. 8 E	1910 My	3 18. 2 E	−0. 6
Huntsville (*a*)	1906 De	3 57. 3 E	1910 My	3 58. 6 E	+0. 4
Tuscaloosa (*a*)	1905 Mh	4 26. 4 E	1910 My	4 26. 9 E	+0. 1
Mississippi:					
Meridian (*a*)	1901 Ap	4 44. 6 E	1910 My	4 54. 8 E	+1. 1
Jackson (*a*)	1908 Ap	6 06. 2 E	1910 My	6 09. 2 E	+1. 4
Louisiana:					
Tallulah (*a*)	1904 Fe	6 00. 7 E	1910 My	6 15. 0 E	+2. 3
Ruston (*a*)	1904 Fe	6 45. 0 E	1910 My	6 56. 6 E	+1. 9
Shreveport (*a*)	1904 Ja	6 59. 1 E	1910 My	7 12. 0 E	+2. 0
Kentucky:					
Elizabethtown (*a*)	1904 No	1 46. 1 E	1909 Au	1 39. 2 E	−1. 5
Ohio:					
Dayton (*a*)	1905 Oc	0 02. 9 W	1910 Je	0 15. 3 W	−2. 7
Indiana:					
Evansville (*a*)	1900 De	3 49. 6 E	1909 Au	3 43. 4 E	−0. 7
Logansport (*a*)	1907 Jy	1 48. 5 E	1909 Se	1 42. 4 E	−2. 8

Comparison of declination results at repeat stations—Continued.

State and station	Former observation		Last observation		Average annual change
	Date	Declination	Date	Declination	
		° ′		° ′	′
Illinois:					
Joliet (*a*)	1905 Jy	2 52.3 E	1909 Jy	2 45.6 E	−1.7
Michigan:					
Alpena (*a*)	1907 Au	3 04.5 W	1909 Se	3 12.2 W	−3.7
Minnesota:					
Breckenridge (*b*)	1900 Se	12 01.7 E	1909 Au	12 16.4 E	+1.7
Iowa:					
Red Oak (*b*)	1900 Oc	8 43.4 E	1909 Au	8 55.2 E	+1.3
Des Moines (*c*)	1907 Jy	7 53.7 E	1910 Je	7 57.1 E	+1.2
North Dakota:					
Pembina (*a*)	1905 Au	11 28.8 E	1909 Oc	11 27.8 E	−0.2
South Dakota:					
Yankton (*a*)	1905 Jy	11 17.2 E	1909 Au	11 23.4 E	+1.5
Mitchell (*b*)	1896 My	11 40.3 E	1909 Oc	12 04.4 E	+1.8
Kansas:					
Oskaloosa (*c*)	1902 Au	8 30.8 E	1909 Au	8 38.3 E	+1.1
Council Grove (*c*)	1904 Je	9 18.0 E	1909 Jy	9 28.7 E	+2.1
Salina (*a*)	1906 Oc	11 10.6 E	1909 Jy	11 13.9 E	+1.2
Lincoln (*c*)	1904 Au	10 07.4 E	1909 Jy	10 14.4 E	+1.4
Baldwin (*a*)	1907 Oc	8 32.0 E	1909 Oc	8 34.8 E	+1.4
Texas:					
Mineola (*b*)	1902 Au	7 45.6 E	1910 My	8 01.9 E	+2.1
Kerrville (*b*)	1901 Je	8 28.8 E	1910 Ja	9 00.7 E	+3.7
Odessa (*a*)	1905 Ja	10 54.6 E	1910 My	11 15.0 E	+3.8
El Paso (*a*)	1905 Ja	12 03.2 E	1910 My	12 28.0 E	+4.7
New Mexico:					
Deming (*a*)	1905 Fe	12 09.0 E	1910 Je	12 33.3 E	+4.7
Lordsburg (*a*)	1903 My	12 40.7 E	1910 Je	13 09.8 E	+4.2
Arizona:					
Benson (*a*)	1903 Mh	12 48.9 E	1910 Je	13 20.8 E	+4.4
Tucson (*c*)	1903 Mh	13 08.1 E	1910 Je	13 26.5 E	+2.5
Yuma (*b*)	1905 Fe	14 07.2 E	1910 Je	14 41.0 E	+6.2
California:					
Indio (*a*)	1905 Mh	14 45.0 E	1910 Je	15 10.4 E	+4.8
San Bernardino (*a*)	1905 Mh	15 03.6 E	1910 Je	15 23.3 E	+3.7
Barstow (*a*)	1906 Jy	15 30.1 E	1910 Je	15 56.0 E	+6.5
Stockton (*a*)	1906 Jy	17 35.4 E	1910 Je	17 50.8 E	+3.8
Goat Island (*a*)	1904 My	17 36.5 E	1910 Ap	18 02.0 E	+4.3

OBSERVATIONS AT SEA AND THEIR DISTRIBUTION.

Magnetic observations at sea were secured on the *Bache* in connection with the hydrographic work along the Atlantic Coast, and on the *Explorer*, *Gedney*, and *Patterson* returning from Alaska in the fall of 1909 and going to Alaska in the spring of 1910. There are also included in this publication the results of observations in Philippine waters from 1906 to 1909 on the *Fathomer*, *Marinduque*, and *Romblon*.

Summary of results at sea.

Vessel	General region	Results from swings			Results from course observations		
		Declination	Dip	Intensity	Declination	Dip	Intensity
Bache	Atlantic coast	7	7	7	0	0	0
Explorer	North Pacific Ocean	19	23	23	11	0	0
Gedney	North Pacific Ocean	13	0	0	0	0	0
Patterson	North Pacific Ocean	2	4	4	1	0	0
Fathomer, 1908–9	Philippine Islands	14	0	0	0	0	0
Marinduque, 1906–8	Philippine Islands	11	0	0	0	0	0
Romblon, 1907–9	Philippine Islands	16	0	0	0	0	0
Total		82	34	34	12	0	0

METHODS OF OBSERVING.

LAND WORK.

The methods of observing have been the same as those followed in previous years. Observers engaged exclusively in magnetic work are supplied with a complete outfit consisting of theodolite magnetometer, dip circle, half-second pocket chronometer, observing tent, tape, etc. In addition to the regular magnetic observations they usually make an approximate determination of latitude and longitude at each station. Those who are expected to get magnetic results incidental to other branches of survey work are supplied with more or less complete outfits, according to circumstances. Where only declination results can be secured under the conditions involved, a compass declinometer is supplied, but to those who can attempt more, a dip circle with compass attachment is furnished, with which compact outfit, knowing the azimuth of some reference mark from triangulation or other source, the declination, dip, and total intensity (by Lloyd's method) can be obtained with a fair degree of accuracy.

SEA WORK.

The *Bache*, *Explorer*, and *Patterson* are each provided with a Lloyd-Creak dip circle and accompanying gimbal stand, by means of which the dip and total intensity can be determined on board ship. The *Explorer* and *Patterson* are also provided with a magnetometer, so that the "intensity constant" of the dip circle may be determined at each place where shore observations are made. Observations for declination are made with the usual standard liquid compass and an azimuth circle of Ritchie or Negus pattern. A value of declination, dip, or intensity usually depends upon the mean of observation made on 8 or 16 equidistant headings while steaming in a circle, once with port and once with starboard helm. In some cases, however, observations are made on three headings and the results are corrected for the effect of the ship's magnetism by comparison with the observations made while swinging ship.

ACCURACY OF RESULTS.

The endeavor in general is to secure, on land, declination and dip results of which the absolute error (including everything involved—errors of observation and reduction) does not exceed 2′, and to determine the horizontal intensity within 1 part in 1 000. As stated in previous reports, the experience of the Coast and Geodetic Survey has been that, under the conditions involved in a campaign of field work covering a large area, including the standardization of instruments and the determination of reduction corrections, this accuracy can not be much increased. In observatory work with special instruments, or when special investigations are made under the best conditions by special observers, there is no difficulty in reducing these limits of error, but in a large organization, where results must be secured under all conditions, and at times under physical difficulties, the degree of accuracy stated must be regarded as satisfactory and sufficient. It happens, of course, that these limits are occasionally exceeded, for one reason or another, and there may be a few rare cases in which the errors are two or three times the amounts given.

INSTRUMENTAL CORRECTIONS.

The instrumental comparisons made at Cheltenham during the year indicate that the instrumental corrections used the previous year require only small changes, except in the case of magnetometer No. 10, which had been overhauled and provided with a new magnet house. The following are the corrections which have been applied to reduce the field results to the Cheltenham observatory standard instruments:

Corrections to magnetometers.

Magnetometer	Correction to east declination	Correction to H, in parts of H
	′	
IIII	0. 0	0. 0000
8	0. 0	. 0000
10	0. 0	+ . 0009
11	0. 0	. 0000
17	0. 0	. 0000
18	0. 0	+ . 0016
19	0. 0	− . 0010
20	0. 0	+ . 0021
22	+0. 9	+ . 0016
29	0. 0	. 0000
30	0. 0	. 0000
31	0. 0	+ . 0010
36	−0. 7	+ . 0013
37	0. 0	+ . 0022

Corrections to dip circles.

Number	Pattern	Needles	Designation	Correction
				′
15	Kew-Casella	1 and 2	15. 12	−3. 2
15	Kew-Casella	5 and 6	15. 56	−1. 5
23	Kew-Casella	3 and 4	23. 34	−1. 4
30	Kew-Dover	1 and 2	30. 12	0. 0
31	Kew-Dover	3 and 4	31. 34	0. 0
32	L. C.-Dover	1 and 2	32. 12	−2. 3
34	L. C.-Dover	5 and 6	34. 56	+3. 5
35	L. C.-Dover	1 and 2	35. 12	+2. 3
36	Kew-Dover	1 and 2	36. 12	−1. 3
4655	Kew-Casella	3 and 4	55. 34	0. 0
5676	Kew-Casella	1 and 2	76. 12	−3. 4
5678	Kew-Casella	1 and 2	78. 12	−1. 9

REDUCTION OF OBSERVATIONS.

A first computation is made by the observer in the field, his instructions requiring him, before he leaves a station, to carry his computation far enough to assure himself that the desired degree of accuracy has been attained. This computation is revised in the Office, in the Division of Terrestrial Magnetism, and the necessary corrections are applied to reduce the results to the standard instruments, as indicated in the foregoing section.

Each value of the magnetic declination is then corrected to reduce it to the mean of the month in which the observation was made, with the aid of the continuous observations at the nearest observatory, allowance being made for the change in diurnal range with change in magnetic latitude. No attempt has been made to correct the dip and horizontal intensity results for diurnal variation.

ARRANGEMENT OF TABLES.

LAND OBSERVATIONS.

The values of declination, dip, and horizontal intensity presented in Table I are arranged by States alphabetically, the results for each State being given in the order of increasing latitudes. The latitudes and longitudes are in most cases the result of solar observations made with the small theodolite which forms a part of the magnetometer. In default of observations or a chart, the geographical coordinates were scaled from the best available map, either a topographic sheet of the United States Geological Survey, a post-route map, or some other state map. In such cases only the nearest whole minute of latitude and longitude is given. The horizontal intensity is expressed in terms of the one hundred thousandth part of a C.G.S. unit of intensity of magnetic force, termed a *gamma* and designated by the Greek letter γ.

In order to include the desired amount of information in the available space the following abbreviations have been adopted. Only the month and day of the date are given, since the observations were all made between July 1, 1909, and June 30, 1910, except when a statement is made to the contrary in a footnote. The names of the months have been abbreviated as follows:

January	Ja	May	My	September	Se
February	Fe	June	Je	October	Oc
March	Mh	July	Jy	November	No
April	Ap	August	Au	December	De

The observer is indicated by the initials of his name. The names of the observers are as follows:

F. L. Adams	D. R. Jewell	S. H. Schapiro
J. R. Benton	E. C. Kinnear	E. E. Smith
J. E. Burbank	R. F. Luce	A. M. Sobieralski
W. H. Burger	R. R. Lukens	S. W. Tay
R. B. Derickson	H. E. McComb	S. G. Townshend, jr.
O. W. Ferguson	F. A. Molby	W. F. Wallis
O. H. Gaarden	E. E. Mumaw	P. C. Whitney
G. Hartnell	E. H. Pagenhart	S. S. Winslow
W. M. Hill	S. D. Sarason	C. F. Woodyard

Sea Observations.

The results obtained on board ship are presented in Tables II and III. The general arrangement is indicated by the headings. Unless otherwise stated, the ship was swung both with port and starboard helms. In the column headed "Sea," sm means smooth; sw, swell; lt, light; mod, moderate. The commanding officers of the different ships were as follows:

Bache	W. C. Hodgkins
Explorer	W. C. Dibrell
Gedney	R. B. Derickson
Patterson	H. C. Denson, W. E. Parker
Fathomer	H. D. King, J. B. Miller
Marinduque	H. C. Denson, D. R. Jewell
Romblon	H. D. King, E. H. Pagenhart

Intensity results are expressed in C.G.S. units. The horizontal intensity has been computed from the observed dip and total intensity.

Table III contains the results of declination observations on board ship in Philippine waters from 1906 to 1909. None of the vessels there are equipped with Lloyd-Creak dip circles. Their cruises to and from the working ground are generally short and through the passages between the islands, and little would be added to our knowledge of the distribution of dip and intensity by observations on board ship under those conditions.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910.*

ALABAMA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		East ° ′	° ′	γ			
Tuscaloosa	33 12.7	87 32.6	My 10, 11	4 26.9	64 31.8	24697	19	23.34	W.M.H.
Scottsboro	34 41.9	86 01.6	My 5	3 18.2	66 30.6	23134	19	23.34	W.M.H.
Huntsville	34 44.2	86 34.8	My 7	3 58.6	66 20.3	23244	19	23.34	W.M.H.
Florence (old)	34 47.7	87 42.2	Jy 8	3 37.7	65 57.0	23641	19	23.34	W.M.H.
Florence (new)	34 49.6	87 44.8	Jy 9, 10	3 54.9	66 12.5	23409	19	23.34	W.M.H.

ALASKA.

	° ′	° ′		East ° ′	° ′	γ			
Dutch Harbor	53 53.5	166 32.1	Se 23	17 36.9	66 48.4	20982	IIII	34.56	S.W.T.
Do.	53 53.5	166 32.1	My 16, 17	17 29.2	66 45.7	20961	18	34.56	R.R.L.
Cordova Bay:									
Anchor	54 49.8	132 20.5	Jy 24	25 42.9	.. ....	.....	*15*	.....	E.C.K.
Rhea	54 51.0	132 20.9	Au 14	29 23.2	.. ....	.....	*15*	.....	R.B.D.
Turn	54 52.1	132 23.7	Au 14	27 24.1	.. ....	.....	*15*	.....	R.B.D.
Port Moller	55 56.2	160 32.8	My, Je	19 13.0	69 11.2	19251	18	34.56	R.R.L.
Sitka Observatory	57 03.0	135 20.1	De–Ja	30 15.0	74 35.0	15579	37	2 EI	F.L.A.
Kodiak	57 47.5	152 23.8	My 11, 12*	24 03.7	71 56.2	17392	8	32.12	P.C.W.
Protection Point	58 29.6	158 40.2	Je 23	21 33.3	71 24.5	17702	18	34.56	R.R.L.
Clark Point	58 50.4	158 31.8	Je 12*	21 37.9	71 40.7	17423	IIII	34.56	S.W.T.
Do.	58 50.4	158 31.8	Se 13	21 39.8	71 40.3	17427	IIII	34.56	S.W.T.
Do.	58 50.4	158 31.8	Je 7	21 39.5	71 41.2	17440	18	34.56	R.R.L.
Port Graham	59 21.5	151 49	My 6, 7	.. ....	72 54.0	*16402*	C	32.12	S.H.S.
Controller Bay	59 59.4	144 19.7	Jy 30	29 01.8	.. ....	15021	8	.....	P.C.W.
Do.	59 59.4	144 19.7	Oc 1	29 06.4	74 49.5	15092	8	32.12	P.C.W.
Cook Inlet:									
Boulder	60 46.1	151 15.9	Jy 8	27 03.2	.. ....	.....	*737*	.....	A.M.S.
Do.	60 46.1	151 15.9	My 14	27 08.5	.. ....	.....	*737*	.....	E.E.S.
Birch Hill	60 54.8	150 45.9	Au 7	26 35.1	.. ....	.....	*737*	.....	A.M.S.
Moose Point	60 57.3	150 41.1	Au 20–23	26 33.8	.. ....	.....	*737*	.....	A.M.S.
Race Point	61 09.9	150 13.8	Se 2, 4	27 08.2	.. ....	.....	*737*	.....	A.M.S.
Beluga	61 12.5	150 53.9	Se 15, 16	26 49.3	.. ....	.....	*737*	.....	A.M.S.
Little	61 15.9	150 18.0	Se 20, 21	26 58.8	.. ....	.....	*737*	.....	A.M.S.

ARIZONA.

	° ′	° ′		East ° ′	° ′	γ			
Benson	31 58.2	110 17.9	Je 11	13 20.8	58 58.8	27472	19	23.34	W.M.H.
Tucson	32 14.8	110 50.1	De–Ja	13 23.8	59 17.3	27419	30	15.56	W.F.W.
Do.	32 14.8	110 50.1	Je 13, 14	13 26.5	59 17.0	27382	19	23.34	W.M.H.
Yuma	32 43.5	114 37.4	Je 16, 17	14 41.0	58 50.9	27363	19	23.34	W.M.H.

*Results of observations in 1909 not heretofore published.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

CALIFORNIA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		*East* ° ′	° ′	γ			
Indio	33 43. 6	116 14. 0	Je 18, 19	15 10. 4	59 20. 8	27114	19	23. 34	W.M.H.
San Bernardino(new)	34 05. 2	117 17. 9	Je 23	15 30. 8	59 35. 2	26828	19	23. 34	W.M.H.
San Bernardino (old)	34 06. 4	117 17. 6	Je 21, 22	15 23. 3	59 38. 4	26765	19	23. 34	W.M.H.
Barstow	34 53. 9	117 01. 8	Je 26	15 56. 0	60 27. 4	26323	19	23. 34	W.M.H.
Goat Island	37 48. 8	122 21. 7	Ap 18	18 02. 0	62 12. 7	25220	IIII	34. 56	S.W.T.
Stockton	37 58. 6	121 17. 0	Je 29	17 50. 8	63 02. 9	25015	19	23. 34	W.M.H.

CONNECTICUT.

	° ′	° ′		*West* ° ′	° ′	γ			
New Haven	41 19. 4	72 55. 1	My 19, 20	10 40. 4	72 30. 2	17834	20	78. 12	H.E.M.
New London	41 21. 0	72 06. 7	My 21	11 28. 8	72 35. 9	17873	20	78. 12	H.E.M.

FLORIDA.

	° ′	° ′		*East* ° ′	° ′	γ			
Fernandina	30 40. 4	81 27. 0	Ap 14	1 06. 2	62 24. 5	25572	C	35. 12	S.S.W.

GEORGIA.

	° ′	° ′		*East* ° ′	° ′	γ			
Brunswick	31 08. 8	81 29. 0	Ap 8	0 48. 0	63 15. 0	24951	C	35. 12	S.S.W.

HAWAII.

	° ′	° ′		*East* ° ′	° ′	γ			
Honolulu Magnetic Observatory	21 19. 2	158 03. 8	De–Ja	9 28. 6	39 50. 7	29163	22	22 EI	O.H.G.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

ILLINOIS.

Station	Latitude	Longitude	Date		Declination	Dip	Horizontal intensity	Instruments		Observer
								M	DC	
	° ′	° ′			East ° ′	° ′	γ			
Carlyle	38 37	89 22.2	Jy	10	4 11.9	69 46.1	20828	36	76.12	C.F.W.
Quincy	39 54.2	91 25.3	Je	24	6 15.0	70 26.0	20352	36	76.12	C.F.W.
Eureka	40 43.7	89 16.3	Jy	16	4 01.4	71 31.1	19457	20	78.12	H.E.M.
Watseka	40 44.2	87 39.7	Jy	13, 14	2 58.2	71 34.3	19330	20	78.12	H.E.M.
Joliet	41 28.7	88 11.2	Jy	12	2 45.6	72 19.9	18718	11	31.34	F.A.M.
Moline	41 31.5	90 28.9	Jy	19	5 11.7	71 54.9	19087	20	78.12	H.E.M.
Yorkville	41 38.9	88 26.3	Jy	15	3 02.6	72 25.3	18605	11	31.34	F.A.M.
Morrison	41 47.9	89 57.4	Jy	19	5 09.0	72 19.0	18779	11	31.34	F.A.M.
Dixon	41 51.1	89 27.9	Jy	17	4 21.9	72 19.0	18828	11	31.34	F.A.M.
Galena	42 23.6	90 22.9	Jy	21	6 36.2	73 13.4	17918	11	31.34	F.A.M.

INDIANA.

	° ′	° ′			East ° ′	° ′	γ			
Rockport	37 53.9	87 02.6	Au	24, 25	3 10.8	69 06.5	21525	19	23.34	W.M.H.
Evansville	37 59	87 28	Au	21	3 43.4	69 12.6	21337	19	23.34	W.M.H.
Boonville	38 03.1	87 19.6	Au	26, 27	3 33.1	69 16.1	21210	19	23.34	W.M.H.
Corydon	38 12.2	86 09.1	Au	14, 15	4 07.8	69 55.0	20860	19	23.34	W.M.H.
English	38 19.7	86 28.7	Au	18, 19	2 43.8	69 48.5	20647	19	23.34	W.M.H.
Petersburg	38 30.4	87 17.6	Au	30, 31	2 56.7	69 53.5	20718	19	23.34	W.M.H.
Spencer	39 17.2	86 45.8	Jy	8	2 21.5	70 22.8	20379	36	76.12	C.F.W.
Franklin	39 28.8	86 03.8	Jy	2	1 21.3	70 39.9	20027	36	76.12	C.F.W.
Brazil	39 31.8	87 05.9	Se	4, 6	3 00.4	70 37.8	20069	19	23.34	W.M.H.
Rockville	39 45.8	87 14.7	Se	8	2 56.8	70 49.8	19876	19	23.34	W.M.H.
Noblesville	40 02.9	86 00.4	Je	18	1 41.2	70 59.5	19760	36	76.12	C.F.W.
Lebanon	40 02.9	86 27.5	Je	20	1 50.2	71 07.0	19675	36	76.12	C.F.W.
Covington	40 09.6	87 24.1	Se	10, 11	2 33.4	70 56.1	19922	19	23.34	W.M.H.
Portland	40 27	84 57.6	Se	27, 28	0 01.8	71 36.6	19120	19	23.34	W.M.H.
Delphi	40 36.4	86 42.0	Se	17, 18	1 42.4	71 35.2	19250	19	23.34	W.M.H.
Fowler	40 37.1	87 19.3	Se	14, 15	2 18.4	71 42.1	19117	19	23.34	W.M.H.
Logansport	40 45.8	86 19.0	Se	20	1 42.4	71 39.6	19107	19	23.34	W.M.H.
Decatur	40 50.2	84 54.0	Se	24, 25	0 01.7	72 14.6	19173	19	23.34	W.M.H.
Huntington	40 53.2	85 31.0	Se	22, 23	1 17.8	71 40.4	19164	19	23.34	W.M.H.
Valparaiso A	41 27.2	87 04.4	Jy	6–10	1 56.9	72 18.1	18683	11	31.34	F.A.M.
Do.	41 27.2	87 04.4	Jy	7–10	1 56.6	72 16.1	18703	20	78.12	H.E.M.
Valparaiso B	41 27.2	87 04.4	Jy	7–10	1 57.2	72 18.2	18704	11	31.34	F.A.M.
Do.	41 27.2	87 04.4	Jy	8–10	1 57.2	72 15.8	18685	20	78.12	H.E.M.
Laporte	41 35.2	86 45.0	Jy	1, 2	1 55.8	72 13.4	18830	11	31.34	F.A.M.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

IOWA.

Station	Latitude	Longitude	Date		Declination	Dip	Horizontal intensity	Instruments		Observer
								M	DC	
	° ′	° ′			*East* ° ′	° ′	γ			
Bedford	40 40. 1	94 43. 6	Jy	27, 28	9 39. 8	70 32. 1	20351	18	36. 12	J.R.B.
Mount Ayr	40 43. 1	94 08. 1	Jy	24	8 25. 4	70 47. 8	20050	18	36. 12	J.R.B.
Leon	40 44. 3	93 45. 6	Jy	22	8 10. 0	70 35. 0	20396	18	36. 12	J.R.B.
Clarinda	40 44. 7	95 02. 0	Jy	30, 31	9 23. 6	70 29. 4	20292	18	36. 12	J.R.B.
Sidney	40 44. 7	95. 39. 6	Au	2, 3	9 30. 0	70 18. 6	20384	18	36. 12	J.R.B.
Chariton	40 59. 2	93 18. 4	Jy	19, 20	7 43. 7	70 59. 2	20027	18	36. 12	J.R.B.
Corning	40 59. 9	94 46. 7	Au	9	9 33. 2	70 55. 9	19979	18	36. 12	J.R.B.
Red Oak	41 00. 9	95 13. 5	Au	7	8 55. 2	70 32. 2	20274	18	36. 12	J.R.B.
Glenwood	41 03. 6	95 45. 2	Au	5	9 38. 8	70 55. 8	19978	18	36. 12	J.R.B.
Greenfield	41 18. 3	94 29. 4	Au	11	9 01. 6	71 35. 5	19472	18	36. 12	J.R.B.
Winterset	41 19. 5	94 02. 4	Au	12, 13	7 16. 6	71 46. 8	18973	18	36. 12	J.R.B.
Indianola	41 21. 9	93 36. 1	Au	17, 18	7 54. 7	71 18. 4	19473	18	36. 12	J.R.B.
Des Moines	41 35. 3	93 33. 7	Je	28	7 57. 1	71 34. 9	19337	36	76. 12	C.F.W.
Guthrie Center	41 38. 3	94 32. 6	Au	20	9 09. 4	71 40. 0	19395	18	36. 12	J.R.B.
Harlan	41 39. 1	95 19. 1	Au	25	9 18. 6	71 12. 9	19585	18	36. 12	J.R.B.
Audubon	41 43. 6	94 56. 6	Au	21, 23	9 27. 6	71 15. 6	19569	18	36. 12	J.R.B.
Jefferson	42 01. 2	94 20. 0	Au	30, 31	9 08. 7	72 04. 7	18929	18	36. 12	J.R.B.
Denison	42 01. 3	95 17. 3	Au	28	8 48. 2	71 33. 0	19465	18	36. 12	J.R.B.
Nevada	42 01. 5	93 26. 6	Se	1	8 35. 1	72 05. 3	18848	18	36. 12	J.R.B.
Rockwell City	42 24. 0	94 36. 2	Je	30	9 40. 5	72 11. 7	18928	36	76. 12	C.F.W.
Webster City	42 26. 9	93 48. 1	Se	6, 7	7 41. 7	72 07. 9	18949	18	36. 12	J.R.B.
Elkader	42 50. 8	91 23. 2	Jy	23	6 05. 2	73 04. 9	17914	11	31. 34	F.A.M.
Algona	43 03. 4	94 13. 1	Jy	31	7 53. 0	73 10. 5	17878	11	31. 34	F.A.M.
Mason City	43 08. 1	93 12. 3	Jy	29	6 09. 0	73 13. 6	18032	11	31. 34	F.A.M.
Spencer	43 09. 0	95 08. 5	Au	2	8 02. 6	72 02. 2	18188	11	31. 34	F.A.M.
Osage	43 16. 5	92 47. 2	Jy	22	7 09. 8	73 05. 1	18011	20	78. 12	H.E.M.
Cresco	43 23. 4	92 06. 7	Jy	27	6 53. 2	73 14 9	18015	11	31. 34	F.A.M.
Sibley (old)	43 23. 5	95 44. 4	Au	6, 7	9 34. 2	72 55. 0	18182	11	31. 34	F.A.M.
Sibley (new)	43 23. 8	95 44. 0	Au	6	9 30. 7	72 55. 8	18214	11	31. 34	F.A.M.
Spirit Lake	43 27. 2	95 06. 7	Au	4	8 05. 8	72 34. 5	18621	11	31. 34	F.A.M.

KANSAS.

	° ′	° ′			*East* ° ′	° ′	γ			
Iola	37 55. 4	95 24. 6	Jy	20	9 24. 1	67 54. 6	22327	36	76. 12	C.F.W.
Council Grove	38 40. 1	96 29. 6	Jy	22	9 28. 7	68 20. 9	22143	36	76. 12	C.F.W.
Baldwin	38 47. 0	95 10. 0	Oc	1–21	8 34. 8	68 52. 8	21622	30	55. 12	S.G.T.
Salina	38 49. 0	97 37. 2	Jy	27	11 13. 9	68 17. 9	22140	36	76. 12	C,F.W.
Lincoln	39 02. 3	98 10. 0	Jy	29	10 14. 4	68 08. 1	22177	36	76. 12	C.F.W.
Oskaloosa	39 13. 5	95 18. 5	Au	9	8 38. 3	68 57. 1	21623	36	15. 12	C.F.W.
Leavenworth	39 20. 9	94 55. 5	Au	6	8 28. 1	69 25. 8	21362	36	76. 12	C.F.W.
Do.	39 20. 9	94 55. 5	Au	6	.. ....	69 24. 0	.....	..	15. 12	C.F.W.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

KENTUCKY.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		*East* ° ′	° ′	γ			
Franklin	36 43.5	86 35.3	Jy 27, 28	4 10.1	67 40.7	22362	19	23.34	W.M.H.
Bowling Green	36 59.7	86 26.2	Jy 31	5 00.9	68 11.8	22249	19	23.34	W.M.H.
Brownsville	37 11.0	86 17.2	Au 4, 5	3 58.6	68 38.6	21795	19	23.34	W.M.H.
Munfordville	37 17.1	85 55.3	Au 9, 10	3 03.8	69 22.0	20919	19	23.34	W.M.H.
Elizabethtown	37 41.6	85 52.0	Au 12, 13	1 39.2	68 38.5	21673	19	23.34	W.M.H.

LOUISIANA.

	° ′	° ′		*East* ° ′	° ′	γ			
Tallulah	32 25.1	91 12.0	My 17, 18	6 15.0	62 54.4	25768	19	23.34	W.M.H.
Shreveport	32 31.0	93 45.9	My 23	7 12.0	62 49.3	25980	19	23.34	W.M.H.
Ruston	32 32.6	92 37.4	My 20, 21	6 56.6	62 50.6	25734	19	23.34	W.M.H.

MAINE.

	° ′	° ′		*West* ° ′	° ′	γ			
Kittery Point	43 03.9	70 41.3	Oc 27	14 24.1	74 15.5	*16282*	C	35.12	S.S.W.
Auburn	44 05.4	70 14.8	Je 18, 19	16 23.4	74 34.4	15891	20	78.12	H.E.M.
Bethel	44 24.5	70 47.4	Je 14, 15	15 53.2	74 37.6	15858	20	78.12	H.E.M.
Oakland	44 32.8	69 44.2	Je 21, 22	16 41.2	74 38.0	15784	20	78.12	H.E.M.
Greenville Junction	45 27.8	69 37.2	Je 24	18 05.3	75 08.6	15412	20	78.12	H.E.M.
Capens	45 35.8	69 38.6	Je 27	18 14.6	75 17.5	15292	20	78.12	H.E.M.
Kineo	45 41.8	69 44.3	Je 29, 30	18 20.6	75 25.0	15158	20	78.12	H.E.M.
Fort Kent	47 15.0	68 34.9	Jy 22, 23	21 00.1	76 16.3	14298	29	30.12	W.H.B.

MARYLAND.

	° ′	° ′		*West* ° ′	° ′	γ			
Cheltenham	38 44.0	76 50.5	De–Ja	5 39.0	70 34.5	19848	26	26EI	J.E.B.
Do.	38 44.0	76 50.5	Oc 12	. ....	70 34.9	.....	..	23.34	J.E.B.
Do.	38 44.0	76 50.5	Oc 13, 14	. ....	70 35.8	.....	..	31.34	J.E.B.
Do.	38 44.0	76 50.5	No 2	. ....	70 36.1	.....	..	36.12	J.E.B.
Do.	38 44.0	76 50.5	No 3	. ....	70 36.1	.....	..	78.12	J.E.B.
Do.	38 44.0	76 50.5	No 3	. ....	70 35.3	.....	..	15.56	J.E.B.
Do.	38 44.0	76 50.5	No 4	. ....	70 36.5	.....	..	15.12	J.E.B.
Do.	38 44.0	76 50.5	Ja 15	. ....	70 34.1	.....	..	36.12	J.E.B.
Do.	38 44.0	76 50.5	My 25, 26	5 41.6	.. ....	19805	10	.....	J.E.B.
Do.	38 44.0	76 50.5	Je 4, 6	5 40.5	.. ....	19853	29	.....	J.E.B.
Greenbury Point	38 58.5	76 29.3	Je 11	6 21.3	.. ....	.....	*153*	.....	O.W.F.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

MASSACHUSETTS.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer.
							M	DC	
	° ′	° ′		*West* ° ′	° ′	γ			
Vineyard Haven	41 27. 0	70 36. 0	Jy 15	12 38. 0	72 19. 2	*18004*	C	35. 12	S.S.W.
Plymouth	41 58. 5	70 38. 9	Au 14	12 48. 0	73 21. 3	.....	C	35. 12	S.S.W.
Dedham	42 14. 2	71 09. 6	My 27, 28	13 49. 6	73 14. 2	17260	20	78. 12	H.E.M.
Boston	42 20. 2	71 00. 7	Jy 22	13 17. 6	.. ....	.....	C	28. 12	R.F.L.
Do.	42 20. 2	71 00. 7	Jy 22	13 19. 4	73 05. 1	*17339*	C	35. 12	R.F.L.
Salem	42 31. 6	70 52. 0	No 15	14 42. 4	73 47. 4	*17118*	C	35. 12	S.S.W.
Lawrence	42 42. 5	71 12. 1	Je 1	13 03. 4	73 28. 9	16968	20	78. 12	H.E.M.

MICHIGAN.

	° ′	° ′		*West* ° ′	° ′	γ			
Alpena	45 04. 5	83 29. 0	Se 11	3 12. 2	76 01. 9	15238	29	30. 12	W.H.B.
				East					
Iron River	46 05. 4	88 38. 4	Se 20	2 45. 3	76 06. 6	15010	29	30. 12	W.H.B.

MINNESOTA.

	° ′	° ′		*East* ° ′	° ′	γ			
Worthington	43 37. 1	95 35. 8	Au 9	9 11. 4	72 59. 2	18111	11	31. 34	F.A.M.
Austin	43 40	92 59. 7	Jy 28	6 07. 7	73 38. 3	17662	11	31. 34	F.A.M.
Windom	43 51. 9	95 07. 4	Au 10	9 11. 0	73 29. 0	17669	11	31. 34	F.A.M.
St. James	43 57. 6	94 36. 8	Au 12	9 04. 8	73 26. 8	17740	11	31. 34	F.A.M.
Rochester	44 00	92 28. 1	Jy 23, 24	6 31. 9	73 50. 6	17296	20	78. 12	H.E.M.
Slayton	44 00. 4	95 47. 1	Au 3	9 43. 0	73 22. 7	17701	20	78. 12	H.E.M.
Pipestone	44 01. 9	96 18. 6	Au 5	10 16. 4	73 18. 3	17881	20	78. 12	H.E.M.
Winona	44 02	91 39. 9	Se 8	6 09. 0	73 59. 8	17198	11	31. 34	F.A.M.
Waseca	44 05	93 29. 9	Jy 29, 30	9 15. 1	73 48. 2	17466	20	78. 12	H.E.M.
Owatonna	44 05. 2	93 13. 7	Jy 27	7 40. 3	73 54. 4	17559	20	78. 12	H.E.M.
New Ulm	44 19. 1	94 28. 1	Au 14	9 24. 2	73 47. 4	17411	11	31. 34	F.A.M.
Wabasha	44 23. 5	92 03. 6	Se 7	6 58. 0	74 17. 4	16954	11	31. 34	F.A.M.
Redwood Falls	44 32. 9	95 05. 4	Au 16, 17	9 06. 2	73 49. 4	17495	11	31. 34	F.A.M.
Montevideo	44 57. 0	95 43. 0	Au 18	10 01. 3	74 46. 2	16506	11	31. 34	F.A.M.
Stillwater	45 01. 0	92 47. 5	Se 4, 6	7 00. 0	74 37. 7	16764	11	31. 34	F.A.M.
Center City	45 24	92 49. 6	Se 2, 3	10 26. 3	75 06. 3	16320	11	31. 34	F.A.M.
Morris	45 35. 2	95 54. 0	Au 20	9 58. 8	75 00. 4	16264	11	31. 34	F.A.M.
Pine City	45 49. 4	92 58. 6	Se 1	10 27. 6	75 32. 6	15747	11	31. 34	F.A.M.
Breckenridge	46 15. 5	96 35. 5	Au 21	12 16. 4	75 38. 5	15622	11	31. 34	F.A.M.
Aitkin	46 31. 5	93 43. 2	Au 28	7 29. 3	75 34. 8	15735	11	31. 34	F.A.M.
Carlton	46 39. 3	92 25. 8	Au 30, 31	6 45. 4	76 14. 9	14885	11	31. 34	F.A.M.
Park Rapids	46 54. 9	95 01. 0	Au 26	9 23. 8	76 05. 8	15144	11	31. 34	F.A.M.
Ada	47 17. 6	96 30. 3	Au 23	11 28. 0	76 05. 1	15157	11	31. 34	F.A.M.
Bagley	47 31. 7	95 23. 2	Au 25	10 36. 4	76 41. 2	14596	11	31. 34	F.A.M.
Ely	47 48. 6	92 01	Se 29	11 18. 8	78 07. 2	12912	29	30. 12	W.H.B.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

MISSISSIPPI.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		East ° ′	° ′	γ			
Jackson	32 20. 0	90 11. 1	My 14	6 09. 2	63 33. 0	25201	19	23. 34	W.M.H.
Meridian	32 23. 2	88 44. 2	My 12	4 54. 8	63 12. 4	25544	19	23. 34	W.M.H.

MISSOURI.

	° ′	° ′		East ° ′	° ′	γ			
Lebanon	37 41. 2	92 39. 5	Jy 16	6 40. 9	68 10. 3	22429	36	76. 12	C.F.W.
Rolla	37 57. 1	91 46. 1	Jy 13, 15	5 48. 3	68 35. 5	21974	36	76. 12	C.F.W.

NEBRASKA.

	° ′	° ′		East ° ′	° ′	γ			
Falls City	40 03. 4	95 36. 2	Au 14	9 00. 7	69 50. 5	20768	36	15. 12	C.F.W.
Bloomington	40 05. 6	99 03. 3	Au 31	11 35. 4	69 01. 3	21409	36	15. 12	C.F.W.
Red Cloud	40 06. 1	98 32. 7	Au 28	12 14. 3	69 24. 2	21301	36	15. 12	C.F.W.
Alma	40 06. 4	99 22. 9	Se 2	11 58. 4	69 00. 4	21428	36	15. 12	C.F.W.
Pawnee City	40 06. 6	96 09. 2	Au 12	9 38. 2	70 07. 0	20460	36	15. 12	C.F.W.
Hebron	40 10. 5	97 34. 6	Au 23	11 02. 4	69 31. 1	21209	36	15. 12	C.F.W.
Nelson	40 11. 7	98 04. 5	Au 26	12 01. 3	69 35. 6	21153	36	15. 12	C.F.W.
Auburn	40 23. 6	95 51. 4	Au 17	9 55. 2	70 03. 2	20464	36	15. 12	C.F.W.
Wilber	40 28. 8	96 58. 7	Au 20	10 48. 1	70 11. 8	20437	36	15. 12	C.F.W.
Nebraska City	40 41. 3	95 52. 5	Au 18	9 22. 9	70 13. 7	20409	36	15. 12	C.F.W.
Plattsmouth	41 00. 9	95 54. 4	Au 19	9 46. 2	70 50. 6	19967	36	15. 12	C.F.W.
Central City	41 08. 7	97 59. 6	Se 23, 24	10 38. 4	70 49. 7	19918	20	78. 12	H.E.M.
Columbus	41 26. 2	97 20. 5	Se 21, 22	11 16. 8	71 31. 6	19121	20	78. 12	H.E.M.
Fremont	41 26. 5	96 30. 8	Se 18	10 20. 3	71 00. 6	19807	20	78. 12	H.E.M.
Greeley	41 33. 0	98 31. 1	Se 27	10 59. 0	71 07. 6	19713	20	78. 12	H.E.M.
Ord	41 37. 1	98 56. 1	Se 28	11 55. 8	70 51. 3	19998	20	78. 12	H.E.M.
Stanton	41 58. 0	97 11. 7	Se 16	10 59. 8	71 21. 1	19513	20	78. 12	H.E.M.
Pierce	42 12. 7	97 30. 8	Se 13	10 55. 7	71 23. 5	19573	20	78. 12	H.E.M.
Wayne	42 15. 0	96 59. 7	Se 9	10 57. 2	71 17. 6	19723	20	78. 12	H.E.M.
Dakota City	42 26	96 23. 9	Se 3, 4	9 42. 4	71 39. 0	19365	20	78. 12	H.E.M.

NEW HAMPSHIRE.

	° ′	° ′		West. ° ′	° ′	γ			
Concord	43 13. 4	71 31. 5	Je 3	13 37. 0	73 49. 5	16637	20	78. 12	H.E.M.
Plymouth	43 45. 7	71 42. 3	Je 4	14 00. 9	74 12. 9	16331	20	78. 12	H.E.M.
Woodsville	44 09. 4	72 02. 0	Je 7, 8	13 52. 2	74 23. 1	16276	20	78. 12	H.E.M.
Gorham	44 22. 0	71 09. 4	Je 13	15 49. 8	74 27. 0	16062	20	78. 12	H.E.M.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

NEW JERSEY.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		*West* ° ′	° ′	γ			
Trenton	40 14.5	74 48.3	Je 18, 20	8 35.7	71 29.7	18963	29	36.12	J.R.B.
Boonton	40 55.1	74 23.4	Je 24	9 30.8	71 49.8	18697	29	36.12	J.R.B.

NEW MEXICO.

	° ′	° ′		*East* ° ′	° ′	γ			
Deming	32 15.6	107 45.4	Je 7	12 33.3	59 38.8	27346	19	23.34	W.M.H.
Lordsburg	32 20.4	108 42.6	Je 9	13 09.8	59 47.8	27004	19	23.34	W.M.H.

NEW YORK.

	° ′	° ′		*West* ° ′	° ′	γ			
Carmel	41 25.5	73 41.2	Je 28	11 08.1	72 34.7	17960	29	36.12	J.R.B.
Wilson	43 18.4	78 49.6	Au 30, 31	6 10.9	74 15.0	16676	29	30.12	W.H.B.
Lake Placid	44 17.5	73 59.1	Au 13, 14	11 17.5	74 50.4	15806	29	30.12	W.H.B.
Potsdam	44 40.1	74 58.8	Au 21	11 37.6	75 18.2	15540	29	30.12	W.H.B.

NORTH DAKOTA.

	° ′	° ′		*East* ° ′	° ′	γ			
Pembina	48 58.0	97 14.9	Oc 8	11 27.8	77 22.6	13873	29	30.12	W.H.B.

OHIO.

	° ′	° ′		*West* ° ′	° ′	γ			
Dayton	39 44.8	84 16.0	Je 16	0 15.3	71 08.8	19567	36	76.12	C.F.W.

PENNSYLVANIA.

	° ′	° ′		*West* ° ′	° ′	γ			
Norristown	40 07.1	75 22.9	Je 15	7 23.0	71 23.6	19106	29	36.12	J.R.B.
Easton	40 42.0	75 12.4	Je 22	7 49.2	71 56.8	18616	29	36.12	J.R.B.
Meadville	41 36.8	80 09.3	Je 14	4 35.4	72 45.4	18059	36	76.12	C.F.W.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

PHILIPPINE ISLANDS.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	East ° ′		East ° ′	° ′	γ			
Bee, Tablas Id.	12 22	121 56	De 9	0 55	.....	.....	735	.....	S.D.S.
Sangelan, Tablas Id.	12 34	121 59	De 9	1 08	.....	.....	735	.....	S.D.S.
Duyagan, Mindoro Id.	12 38	121 32	Oc 5	0 59	.....	.....	735	.....	S.D.S.
Corcuera, Simara Id.	12 47	122 03	Oc 27	1 06	.....	.....	735	.....	S.D.S.
Mayllague, Mindoro Id.	12 49	121 30	Oc 5	1 09	.....	.....	735	.....	S.D.S.
Banton, Banton Id.	12 56	122 06	Oc 29	1 02	.....	.....	735	.....	S.D.S.
Pinamalayan, Mindoro Id.	13 02	121 30	Oc 4	0 51	.....	.....	735	.....	S.D.S.
Capalonga, Luzon Id.	14 20. 0	122 29	Au, Se *	0 35. 7	17 09. 3	38290	17	37. 34	E.H.P.
Hook, Polillo Id.	14 56. 2	121 49. 0	Se 21*	0 16. 6	16 39. 7	37976	17	37. 23	D.R.J.

PORTO RICO.

	° ′	° ′		West ° ′	° ′	γ			
Porto Rico Magnetic Observatory	18 08. 8	65 26. 9	De-Ja	2 16. 1	49 48. 7	28931	31	1 EI	G.H.

RHODE ISLAND.

	° ′	° ′		West ° ′	° ′	γ			
Kingston	41 29. 2	71 31. 7	My 23	12 16. 2	72 42. 5	17717	20	78. 12	H.E.M.
Providence	41 45. 5	71 27. 8	My 25	12 41. 7	72 47. 2	17524	20	78. 12	H.E.M.

SOUTH CAROLINA.

	° ′	° ′		West ° ′	° ′	γ			
Charleston	32 46. 2	79 49. 0	My 16	1 00. 8	64 31. 0	24405	C	35. 12	S.S.W.

*Observations of 1908 not previously published.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

SOUTH DAKOTA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		East ° ′	° ′	γ			
Vermilion	42 47. 5	96 55. 0	Au 30, 31	10 56. 5	71 57. 4	19210	20	78. 12	H.E.M.
Yankton	42 53. 4	97 22. 5	Au 25, 26	11 23. 4	72 58. 5	18054	20	78. 12	H.E.M.
Tyndall	42 59. 9	97 52. 7	Au 23, 24	10 57. 2	71 59. 3	19060	20	78. 12	H.E.M.
Armour	43 20. 2	98 20. 3	Au 20	12 21. 2	72 24. 9	18777	20	78. 12	H.E.M.
Mitchell	43 41. 8	98 01. 0	Oc 20	12 04. 4	73 04. 4	18047	29	30. 12	W.H.B.
Plankington	43 43. 5	98 26. 7	Au 18	12 35. 8	72 47. 9	18254	20	78. 12	H.E.M.
Madison	44 00. 3	97 04. 8	Au 11, 12	10 55. 8	73 10. 5	17972	20	78. 12	H.E.M.
Flandreau	44 04. 2	96 34. 7	Au 9, 10	10 34. 2	73 27. 7	17650	20	78. 12	H.E.M.
Woonsocket	44 04. 6	98 16. 4	Au 14	12 10. 3	72 59. 9	18073	20	78. 12	H.E.M.
Wessington Springs	44 05. 2	98 33. 0	Au 16	12 51. 6	72 52. 6	18196	20	78. 12	H.E.M.

TENNESSEE.

	° ′	° ′		East ° ′	° ′	γ			
Lawrenceburg	35 14. 5	87 20. 8	Jy 14	3 39. 2	66 10. 8	23502	19	23. 34	W.M.H.
Athens	35 26. 6	84 36	My 3, 4	0 30. 0	66 16. 7	23581	19	23. 34	W.M.H.
Franklin	35 55. 1	86 52. 6	Jy 16	4 01. 6	67 00. 7	22856	19	23. 34	W.M.H.
				West					
Knoxville	35 56. 3	83 56. 6	Ap 30–My 1	0 21. 2	66 54. 0	22995	19	23. 34	W.M.H.
				East					
Gallatin	36 24. 0	86 26. 1	Jy 23, 24	4 19. 2	67 22. 3	22733	19	23. 34	W.M.H.
Springfield	36 30. 2	86 54. 2	Jy 19	3 41. 9	67 42. 4	22466	19	23. 34	W.M.H.

TEXAS.

	° ′	° ′		East ° ′	° ′	γ			
Kerrville	30 01. 3	99 07. 6	Ja 24	9 00. 7	59 28. 7	27574	29	30. 12	W.H.B.
El Paso (old)	31 45. 0	106 29. 5	My 31	12 28. 0	59 27. 6	27508	19	23. 34	W.M.H.
El Paso (new)	31 47. 8	106 25. 4	Je 2, 3	12 05. 4	59 28. 6	27472	19	23. 34	W.M.H.
Odessa	31 51. 5	102 23. 1	My 27, 28	11 15. 0	60 33. 2	27009	19	23. 34	W.M.H.
Sweetwater	32 28. 4	100 24. 1	Ja 17	10 25. 8	61 33. 2	26536	29	30. 12	W.H.B.
Mineola	32 40. 9	95 29. 8	My 25, 26	8 01. 9	62 29. 4	25980	19	23. 34	W.M.H.

VERMONT.

	° ′	° ′		West ° ′	° ′	γ			
North Hero	44 49. 1	73 17. 5	Au 2, 4	14 15. 0	75 17. 2	15556	29	30. 12	W.H.B.

TABLE I.—*Magnetic observations on land, July 1, 1909, to June 30, 1910*—Continued.

VIRGINIA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	DC	
	° ′	° ′		*West* ° ′	° ′	γ			
Bristol	36 36.2	82 10.5	Ap 29	0 42.4	68 06.9	21823	19	23.34	W.M.H.
Lynchburg (new)	37 24	79 08	Ap 26, 27	3 06.7	69 25.8	20812	19	23.34	W.M.H.
Lynchburg (old)	37 24.6	79 09	Ap 23	2 53.1	69 16.2	20915	19	23.34	W.M.H.
Charlottesville	38 02.4	78 30.3	Ap 20, 21	4 03.3	69 55.0	20238	19	23.34	W.M.H.

WASHINGTON.

	° ′	° ′		*East* ° ′	° ′	γ			
Steilacoom	47 10.3	122 36.0	Fe 19	23 42.9	.. ....	.....	*15*	.....	E.E.M.
Von Gelderns Cove	47 16.3	122 45.4	Ja, Fe	23 31.4	.. ....	.....	*15*	.....	R.B.D.
Peters Point	47 28.5	122 29.8	Mh 5	24 05.4	.. ....	.....	*15*	.....	R.B.D.

FOREIGN COUNTRIES.

	° ′	° ′		*East* ° ′	° ′	γ			
British Columbia:									
Union 2	49 35.8	124 54.0	Ap 20*	26 26.4	71 14.5	19038	8	32.12	P.C.W.
Union 2	49 35.8	124 54.0	Oc 7	26 31.6	71 21.5	19028	IIII	34.56	S.W.T.
Union 2	49 35.8	124 54.0	Ap 21, 22	26 33.2	71 18.0	*18986*	C	32.23	S.H.S.
Union 2	49 35.8	124 54.0	My 5	26 28.3	71 18.7	19042	18	34.56	S.W.T.

TABLE II.—*Magnetic observations at sea, July 1, 1909, to June 30, 1910.*

ATLANTIC OCEAN.

Locality	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Total intensity	Ship	Headings	Sea
	° ′	° ′		*East* ° ′	° ′	*c.g.s.*	*c.g.s.*			
At sea	30 43	81 19	Mh 16	1 31	62 27	0.2556	0.5527	Bache	16	Hvy. sw.
				West						
Off Charleston	32 40	79 43	My 27	0 52	64 39	.2421	.5655	Do.	8	Sm.
Chesapeake Bay	36 59	76 11	Fe 16	4 24	68 54	.2101	.5835	Do.	16	Sm.
Do.	36 59	76 12	Fe 16	4 54	68 57	.2093	.5827	Do.	16	Sm.
Mouth of Patuxent	38 20	76 22	Jy 10	5 30	69 59	.2057	.6009	Do.	16	Choppy.
Near Vineyard Sound	41 17	71 09	Jy 15	12 45	72 12	.1813	.5929	Do.	8	Sm.
Salem Entrance	42 32	70 50	No 18	14 25	73 34	.1719	.6076	Do.	16	Choppy.

* Observations of 1908, not heretofore published.

TABLE II.—*Magnetic observations at sea, July 1, 1909, to June 30, 1910*—Continued.

PACIFIC OCEAN.

Locality	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Total intensity	Ship	Headings	Sea
	° ′	° ′		East ° ′	° ′	c.g.s.	c.g.s.			
San Francisco Bay	37 46	122 21	Ap 23	18 02	62 00	0.2542	0.5415	Explorer	16	Sm.
Off Elliott Bay	47 37	122 30	Ap 20	23 39	.. ..	.....	.....	Gedney	16	Sm.
Off Stewart Island	48 37	123 13	Ap 22	24 09	.. ..	.....	.....	Do.	16	Sm.
Active Pass	48 56	123 12	Ap 22	24 20	.. ..	.....	.....	Do.	16	Sm.
Off Gabriola Reef	49 08	123 36	Ap 22	24 51	.. ..	.....	.....	Do.	8	Sm.
Union Bay	49 35	124 53	My 4	25 57	71 28	.1902	.5985	Explorer	16	Sm.
Do.	49 36	124 52	Ap 21*	25 45	71 10	.1916	.5936	Patterson	16	Sm.
Do.	49 36	124 52	Ap 22	26 16	71 24	.1904	.5969	Do.	16	Sm.
Do.	49 38	124 53	Oc 6	26 05	71 30	.1897	.5980	Explorer	16	Sm.
Georgia Strait	49 54	125 07	Ap 23	25 32	.. ..	.....	.....	Gedney	8	Sm.
Do.	49 56	125 08	Ap 23	25 46	.. ..	.....	.....	Do.	16	Sm.
Discovery Passage	50 16	125 25	Ap 23	24 46	.. ..	.....	.....	Do.	8	Sm.
Johnstone Strait	50 22	125 40	My 6	26 06	.. ..	.....	.....	Explorer	3	Sm.
Do.	50 28	126 02	Ap 23	24 33	.. ..	.....	.....	Gedney	16	Rough.
Do.	50 29	126 12	Oc 6	26 31	.. ..	.....	.....	Explorer	3	Sm.
Queen Charlotte Sound	50 40	127 14	Ap 25	26 04	.. ..	.....	.....	Gedney	16	Sm.
Do.	50 59	127 45	Ap 25	27 12	.. ..	.....	.....	Do.	8	Rough.
Fitzhugh Sound	51 24	127 52	My 7	.. ..	72 16	.1799	.5906	Explorer	8	Sm.
Millbank Sound	52 22	128 32	My 7	28 09	.. ..	.....	.....	Do.	3	Choppy.
Tolmie Channel	52 43	128 34	Oc 4	.. ..	73 24	.1677	.5871	Do.	8	Sm.
At sea	52 44	133 00	Ap 25	.. ..	72 28	.1714	.5690	Patterson	8	Mod. sw.
Grenville Channel	53 44	129 51	My 8	28 52	73 07	.1723	.5934	Explorer	8	Sm.
Iliuliuk Bay	53 55	166 29	Se 25	17 35	67 15	.2061	.5329	Do.	16	Lt. sw.
Cardena Bay	53 59	130 11	Ap 28	28 43	.. ..	.....	.....	Gedney	16	Sm.
Off Akun Head	54 19	165 39	My 14	.. ..	66 58	.2052	.5244	Explorer	8	Sm.
At sea	54 23	162 38	My 13	18 52	.. ..	.....	.....	Do.	3	Sm.
Dixon Entrance	54 27	132 05	My 8	28 28	.. ..	.....	.....	Do.	3	Lt. sw.
Chatham Sound	54 38	130 44	Ap 28	28 42	.. ..	.....	.....	Gedney	16	Sm.
Near Cape Pankof	54 44	162 53	Se 26	19 11	68 23	.1949	.5290	Explorer	8	Lt. sw.
At sea	54 44	135 08	My 9	29 12	73 18	.1673	.5822	Do.	8	Mod. sw.
Off Mary Island	55 06	131 10	Ap 28	29 09	.. ..	.....	.....	Gedney	16	Sm.
At sea	55 11	140 53	My 10	.. ..	72 10	.1748	.5709	Explorer	8	
Do.	55 11	164 05	Se 22	16 42	.. ..	.....	.....	Do.	3	Mod. sw.
Off Seal Cape	55 20	161 19	Se 26	21 03	.. ..	.....	.....	Do.	3	Choppy.
At sea	55 23	143 29	My 10	26 15	.. ..	.....	.....	Do.	3	Sm.
Do.	55 24	159 50	My 13	18 54	68 45	.1948	.5374	Do.	8	Rough.
Do.	55 32	156 51	My 12	20 26	.. ..	.....	.....	Do.	3	Sm.
Do.	55 32	157 40	Se 27	20 56	69 13	.1922	.5416	Do.	8	Lt. sw.
Do.	55 36	153 52	My 12	22 24	70 06	.1870	.5494	Do.	8	Sm.
Off Chirikof Island	55 42	155 30	Se 27	22 18	.. ..	.....	.....	Do.	2	Mod. sw.
At sea	55 43	147 19	My 11	24 40	71 14	.1799	.5591	Do.	8	Sm.
Do.	55 56	151 56	Se 28	23 13	70 45	.1822	.5526	Do.	8	Choppy.
Do.	56 03	161 56	Se 22	18 20	68 57	.1943	.5409	Do.	8	Lt. sw.
Sumner Strait	56 03	133 57	Oc 1	29 46	74 24	.1581	.5880	Do.	8	Lt. sw.
At sea	56 04	150 03	Se 28	25 13	.. ..	.....	.....	Do.	3	Mod. sw.
Do.	56 39	159 34	My 19	20 06	69 46	.1891	.5467	Do.	8	Sm.
Do.	57 26	158 34	Se 21	21 03	71 29	.1750	.5509	Do.	8	Choppy.
Do.	57 45	140 22	Ap 27	.. ..	74 04	.1565	.5700	Patterson	8	Mod. sw.
Icy Strait	58 05	135 03	Ap 28*	30 01	.. ..	.....	.....	Do.	3	Sm.
Bristol Bay	58 28	158 03	Je 5	22 01	71 26	.1761	.5531	Explorer	8	Sm.
Nushagak Bay	58 31	158 39	Je 22	21 23	71 20	.1764	.5511	Do.	16	Sm.
Do.	58 50	158 33	Se 7	21 40	71 37	.1739	.5514	Do.	16	Choppy.

* Results of observations in 1909, not heretofore published.

TABLE III.—*Magnetic observations at sea in Philippine Islands.*

Locality	Latitude	Longitude	Year	Date	Declination	Ship	Headings	Sea
	° ′	*East* ° ′			*East* ° ′			
Off Maasin	10 00	124 52	1907	Mh 9	2 11	Marinduque	16	Sm.
East of Bohol Island	10 01	124 37	1909	Ja 21	1 38	Romblon	16	Sm.
Lion Bay	10 18	125 00	1909	Je 29	1 41	Do.	16	Sm.
Calangaman Island	11 04	124 15	1907	Ap 19	1 34	Marinduque	16	Sm.
Off Tablas Island	12 20	121 54	1909	De 9	1 00	Fathomer	8	Lt. sw.
Off Sangelan Point	12 32	121 55	1909	De 9	1 25	Do.	16	Choppy.
Romblon Harbor	12 35	122 16	1907	De 8	1 08	Romblon	16	Sm.
Off Duyagan Point	12 35	121 38	1909	Oc 5	1 08	Fathomer	16	Lt. sw.
Off Punta Gorda	12 39	122 10	1909	My 24	0 50	Do.	16	Sm.
Off Simara Island	12 45	121 59	1909	Oc 27	0 45	Do.	16	Sm.
Off Mayllague Point	12 49	121 32	1909	Oc 5	1 19	Do.	16	Sm.
Off Banton Island	13 00	122 07	1909	Oc 29	1 13	Do.	16	Sm.
Off Pinamalayan	13 03	121 34	1909	Oc 4	1 10	Do.	16	Long. sw.
Off Point Dumali	13 08	121 39	1906	De 14	1 16	Marinduque	16	Sm.
At sea	13 17	122 27	1909	Ja 25	1 03	Fathomer	32	Sm.
Do.	13 29	122 24	1909	Mh 10	0 54	Do.	16	Lt. sw.
East of Varadero Bay	13 30	121 02	1907	My 23	1 01	Marinduque	16	Sm.
Catanauan Bay	13 34	122 18	1908	Ap 10	0 41	Romblon	16	Sm.
Near Pitoyo	13 46	122 01	1907	No 15	1 04	Do.	16	Sm.
At sea	14 08	123 03	1907	My 22	1 03	Do.	16	Sm.
Do.	14 08	123 03	1907	Au 31	0 58	Do.	16	Sm.
Manila Bay	14 26	120 43	1907	Oc 22	0 34	Marinduque	16	Sm.
Do.	14 27	120 46	1909	De 23	1 04	Fathomer	8	Sm.
Do.	14 30	120 54	1908	My 18	0 59	Romblon	16	Sm.
Do.	14 31	120 54	1907	Oc 25	0 59	Do.	16	Sm.
Do.	14 32	120 53	1908	Oc 17	0 51	Marinduque	16	Sm.
Do.	14 32	120 55	1908	Ap 12	0 43	Romblon	16	Sm.
Do.	14 32	120 51	1906	De 13	1 07	Marinduque	11	Sm.
Do.	14 34	120 55	1907	Ap 22	0 16	Do.	16	Sm.
Do.	14 34	120 56	1907	My 10	0 38	Romblon	16	Sm.
Do.	14 34	120 57	1908	Oc 22	0 37	Do.	16	Sm.
Do.	14 34	120 56	1908	De 10	1 02	Fathomer	8	Sm.
Do.	14 34	120 55	1909	Mh 16	0 56	Do.	16	Sm.
Do.	14 34	120 56	1909	My 20	0 35	Do.	16	Sm.
At sea	14 34	122 47	1908	Jy 31	0 53	Romblon	16	Sm.
Manila Bay	14 35	120 56	1907	Se 9	0 55	Do.	16	Sm.
Do.	14 36	120 58	1908	De 22	0 52	Do.	16	Sm.
Do.	14 36	120 58	1909	Jy 9	1 05	Do.	16	Sm.
Do.	14 36	120 54	1907	My 22	0 47	Marinduque	16	Sm.
At sea	14 39	121 37	1908	Oc 8	1 02	Do.	16	Sm.
Do.	14 57	121 42	1908	Je 6	0 38	Do.	16	Sm.

DESCRIPTIONS OF STATIONS.

Magnetic observers are instructed to mark every station in as permanent a manner as possible, either with a stone or a post of some durable wood, so that it may be available for future occupation. They are also required to furnish a sufficiently detailed description to locate the station, even if the marking should be destroyed, and to determine the bearing of two or three prominent objects in addition to the one used as reference mark in the azimuth and declination observations. The information is given in abridged form on the following pages for each of the stations occupied during the year. Further details can usually be obtained upon application to the Superintendent

Descriptions of stations—Continued.

of the Coast and Geodetic Survey. The usual method of marking a station is by a stone post about 3 feet long and 6 or 8 inches square, set so as to project an inch or two above ground and lettered on top U. S. C. & G. S., with a drill hole in the center to mark the exact point. Whenever the local authorities desired, and were willing to bear the expense, a second stone was set to denote the true meridian.

The descriptions are arranged alphabetically by States and by names of stations.

ALABAMA.

Florence, Lauderdale County.—As the old station could not be occupied, observations were made at a point about 70 feet east of its location and 450 feet east of an electric trolley railroad line running about north and south.

A new station was located in the southeastern corner of the grounds of the Baptist University, about 2 miles northwest of the town's center. It is 78 feet southwest from the fence bordering the grounds on the northeast, 115.3 feet from the fence bordering the grounds on the southeast, and 171 feet east from the eastern corner of the university building. The station is marked by a limestone post 6 by 6 by 33 inches, projecting about 6 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Lower edge of town's water tank taken on the abutment supporting the base (mark)	40	25.2	west of north
Ball over circular window at top of center of south front of university building	71	54.9	west of south

A hole in the top of a post of Georgia marble, 4 by 6 by 42 inches, projecting 10 inches above ground and 300 feet north marks the north end of a meridian.

Huntsville, Madison County.—The station of 1906 was reoccupied as near as possible, the old mark having been plowed up. It is in the southwestern part of the public-school grounds, about one-half mile northeast of the court-house square. The station is 75.5 feet from the southwest corner of the schoolhouse, 18.4 feet south and east from a large oak tree 4 or 5 feet in diameter, and 50.9 feet from the center of the brick sidewalk on Calhoun street. It is marked by a limestone post 5 by 5 by 24 inches, lettered U. S. 1910, and projecting 1 inch above ground. The following true bearings were determined in 1910:

	°	′	
Cross on spire of Episcopal Church (mark)	30	51.5	west of south
Lower southwest corner of schoolhouse	32	59.0	east of north

Scottsboro, Jackson County.—The station of 1903 was reoccupied. It is in the southwest corner of the campus of Scottsboro Baptist Institute, about 250 feet from the southwest corner of the college building. It is 38 feet from the south fence, 39 feet from the west fence, and 17.6 feet from a small hickory tree north of east. It is marked by a limestone post 6 by 6 by 38 inches, lettered U. S. C. & G. S., 1903, and set flush with the ground. The following true bearings were determined in 1903:

	°	′	
Apex of court-house dome (mark)	47	53.6	west of north
North gable of Jackson County Flour Mills	72	36.0	west of south

Tuscaloosa, Tuscaloosa County.—The station of 1905 was reoccupied. It is on the grounds of the State University, 20.3 feet west of a board fence, 227.4 feet and 166.3 feet, respectively, from the southeast and northeast corners of Garland Hall, and 180.7 feet from the southeast corner of the boys' dormitory. The station is marked by a limestone post 5 by 6 by 30 inches, set 28 inches in the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1905:

	°	′	
Base of flagstaff on main dome of State Hospital for the Insane (mark)	57	54.8	east of north
Point of small cupola left of main dome	55	52.3	east of north
Point of second cupola left of main dome	55	23.8	east of north

Descriptions of stations—Continued.

ALASKA.

Anchor, Cordova Bay.—Magnetic observations were made at a point exactly between the triangulation station Anchor and the triangulation station Rhea about 50 feet from Anchor. The triangulation station is on the highest part of the rock on the southwest end of the second island northeast of Eureka Narrows. Shipwreck Point bears due west (magnetic). The station is marked by a ⅝-inch drill hole in a dike of sandstone and quartz about 6 to 8 inches wide running through the rock in a southwesterly and northeasterly direction. The hole is about 3 or 4 feet above high-water mark.

Beluga, Cook Inlet.—The triangulation station is on the low flat ground of the shore line about 1¼ miles northeast of the mouth of the Beluga River. It is about 150 feet inside and 2 feet above ordinary high-water mark. The station is marked by a pint bottle buried 4 feet underground and a spruce hub 5 inches by 2 feet projecting 3 inches above the surface, with a copper tack in it to mark the exact spot.

Birch Hill, Cook Inlet.—Observations were made 49 feet from the triangulation station on line with the triangulation station Boulder. The triangulation station is on a conspicuous point of the bluff line of the east shore at a point about 11 miles south of Point Possession and about 16 feet from the edge of the cliff on a grassy knoll which crowns the bluff at this point. It is marked by a pint bottle buried 3 feet below the surface of the ground and a hub 5 inches by 2 feet set flush with the ground, with a copper tack in it to mark the exact spot.

Boulder, Cook Inlet.—Observations were made at a point 15 feet from the triangulation station on line with East Foreland. The station is on the first point about 5 miles north 27° east from East Foreland, on the east shore of Cook Inlet, about 500 feet south of the extreme end of the point and at the top of a steep bluff which rises about 160 feet above the high-water line. It is marked by a quart bottle buried 2 feet below the surface and a 3-by-4 hub set flush with the ground having a copper tack in it to mark the exact spot.

Clark Point, Nushagak Bay.—The magnetic station of 1909 was reoccupied. It is about one-half mile south of the cannery at Clark Point, on the beach some 30 feet from the water's edge and on a line between hydrographic signal "Uno" and hydrographic signal "Can," which is a smokestack on a cannery near Ekuk Point. The trail from Clark's cannery to the native village near the bluff to the south passes a few feet to the west of the station. The station is marked by a buried bottle and a concrete block 1½ feet square at bottom, about 10 inches square on the top, and 15 inches deep, set with its top flush with the ground. A wooden peg one-half inch in diameter set in the concrete marks the exact spot. The true bearing of station "Can," determined from the triangulation station, is 2° 34′.1 west of south.

Controller Bay.—The magnetic station is at the entrance between Kayak Island and the south end of Wingham Island, near the northern end of a low spit north of Kayak Island, on a line between the triangulation stations Spit and West Base. It is 50 feet above high-water mark, in the direction of Okalu Spit. The station is marked by a section of stovepipe filled with cement, set upright in the ground and projecting 4 inches above the surface.

Dutch Harbor.—The station is on Amaknak Island on the hill just southeast of the village of Dutch Harbor, near the station of 1908. It is about 164 feet south of a water tank covered with sod, and 98 feet south of the azimuth mark, on a line from the azimuth mark to the astronomical station in Unalaska. The station is marked by a bottle with its top 1 foot below the surface and by a bowlder 6 by 10 by 16 inches, with a 1-inch drill hole to mark the exact spot. The astronomical station bears 0° 01′.0 west of true south.

Kodiak.—The station of 1907 was reoccupied. It is on a bluff on the north side of St. Paul roadstead and about three-fourths of a mile east of Kodiak. East of the bluff is a small bight. The bluff is about 15 feet high and 200 feet long and slopes back about 100 feet to low ground where are some huts. A small stream comes down behind the bluff. The station is marked by a green bottle set in cement, with the neck about 3 inches below the turf. On the bluff are two spruce trees and the stump of a third, marked with a blazed triangle of nails. The distance to the easterly one is 28.6 feet; to the northerly one, 43.4 feet; to the westerly one, 94 feet, and to the east end of the bluff, 75.5 feet.

Descriptions of stations—Continued.

ALASKA—Continued.

The station is about 6 feet from the south side of the bluff. The following true bearings were determined in 1907:

	°	′	
Spire of Greek Church (mark)	36	00.3	east of south
Spire of Baptist Church	29	43.0	east of south
Middle gable of large building on Woody Island	28	35.5	east of south
Northeast gable of left North American Commercial Company building on Woody Island	25	54.0	east of south
Northwest gable of North American Commercial Company ice house	24	48.6	east of south
Inner Humpback rock	15	18.9	east of south

Little, Cook Inlet.—The station is on the low ground at the mouth of the Little Susitna River, about 9 miles west of Point Mackenzie at the entrance to Knik Arm. It is on the east bank of the river about one-half mile above the point which defines its mouth at ordinary high water and about 25 feet inside and 2 feet above the high-water mark. The station is marked by a pint bottle set 4 feet underground and a hub 5 inches by 2 feet projecting 3 inches above ground, with a copper tack in it to mark the exact spot.

Moose Point, Cook Inlet.—Magnetic observations were made 108 feet from the triangulation station on line with the triangulation station Possession. The triangulation station is on the projecting low wooded point of the shore line about 8 miles south of Point Possession. It is on the edge of the tree line, about 15 feet above and 33 feet inside of high-water mark. A low grassy flat extends about one-third mile beyond the station in a southwesterly direction. The station is marked by a pint bottle buried 3 feet beneath the surface and a spruce hub 6 inches by 2 feet set 18 inches in the ground, with a copper tack in it to mark the exact spot.

Port Moller.—The station is on the highest ground on the long narrow spit at Port Moller, about 25 feet above high-water mark and about 1½ miles from Harbor Point. It is about 250 feet south of an eroded dark sand bluff, which is about as high as the station and noticeable from offshore to westward. The station is marked by a glass bottle buried neck upward and a stone about 18 inches long projecting about 2 inches above ground and having a small conical hole drilled in its apex to mark the exact spot. A cement pier 10 inches square surrounds the stone and is lettered U. S. C. S. The following true bearings were determined:

	°	′	
Hydrographic signal "Entrance" (mark)	7	06.9	west of north
Hydrographic signal "Black"	4	27.7	east of north
Hydrographic signal "Bear"	29	17.7	east of north
Hydrographic signal "Spit"	31	43.5	west of south

Protection Point, Nushagak Bay.—Magnetic observations were made at a point 27 feet from the triangulation station "Pro" in the direction of and in line with triangulation station "Tec." The magnetic station is marked by a pine hub having a V-shaped cross section with an 8-penny nail for center. The triangulation station is on the southwestern side of the entrance to Nushagak Bay, on the spit extending out from the general bluff line. It is on a low grass-covered sand ridge, about 200 feet from the high-water line. The triangulation station is marked by a small granite bowlder buried 1.7 feet below the surface and a long granite stone projecting 5 inches above ground and having a small triangle cut on its seaward face and a small drill hole in the top to mark the center. The following true bearings were determined from the triangulation:

	°	′	
Hydrographic signal "Goon" (mark)	28	59.4	west of south
Triangulation station "Tec"	71	45.1	west of north
Triangulation station "Nichols"	33	26.6	west of north

Race Point, Cook Inlet.—The triangulation station is on the west side of Fire Island on the point of the bluff projecting farthest on that side and at a point about midway between the ends of the island.

Descriptions of stations—Continued.

ALASKA—Continued.

It is about 16 feet from the edge of the bluff, at an elevation of 165 feet. The station is marked by a pint bottle buried 3 feet underground and a hub 5 inches by 2 feet set 20 inches in the ground, with a copper tack in it to mark the exact spot.

Rhea, Cordova Bay.—Magnetic observations were made 100 feet from triangulation station Rhea on range to the triangulation station Anchor. The triangulation station is on the highest rock of an outlying reef between Hunters Bay and Tah Bay. The ledge is a prominent line of rocks extending in a northwesterly and southeasterly direction, about 300 feet long and 75 feet wide. The station is on the west side about 100 feet from the northwest end, on the summit of a very prominent bowlder. It is marked by a ½-inch hole drilled 3 inches deep.

Sitka Magnetic Observatory, Sitka.—In the absolute building. For description of the observatory see Appendix 5, Report for 1902.

Turn, Cordova Bay.—Magnetic observations were made 17 feet from the triangulation station on range with the triangulation station Rhea. The triangulation station is on the summit of Turn Island, which is 1 mile southwest of the entrance to Hunter Bay. It is on the south end of the island, about 130 feet above high-water mark, on a grassy knoll 6 feet square and about 165 feet southeast of a clump of five trees. The station is marked by a ½-inch drill hole 4 inches deep.

ARIZONA.

Benson, Cochise County.—The station of 1903 was reoccupied. It is on the grounds of the Industrial School, in line with the north side of the building and 195.4 feet from the northeast corner of the building. The station is marked by a post of black marble 5 by 5 by 28 inches, set so as to project 2 inches above ground, and lettered on top U. S. C. & G. S., 1903. The following true bearings were determined:

	° ′	
Bell on public school (mark)	85 16.0	east of north
Light switch at railroad station	51 08.7	east of north
Northeast corner of Industrial School building	76 31.2	west of north

Tucson, Pima County.—The observations were made in the building for absolute observations at the Tucson magnetic observatory, about 8 miles east of the city of Tucson.

Yuma, Yuma County.—The station of 1905 was reoccupied. It is on the military reservation, which is to be turned into an irrigation plant and experimental farm. It is about 800 feet southeast of the government office building and west of the reservoir and water tank near the Southern Pacific Railroad station and 132 feet northeast of an iron post which marks the southern point of a meridian line. The station is marked by a field stone about 3 feet long, showing 6 inches above ground, and having a cross cut in the top to mark the exact spot. The following true bearings were determined in 1910:

	° ′	
Highest point on Cago Muchacho Mountain (mark)	39 50.8	west of north
Lowest point to be seen on flag pole at Indian school	34 03.3	east of north

CALIFORNIA.

Barstow, San Bernardino County.—The station of 1906 was reoccupied. It is nearly in line with the east end of the new Harvey Hotel and the top of the small hill to the south. It is between a line of fence posts just north of town and a fence on the southern boundary of a field immediately on the south bank of the river. The station is marked by a rough piece of red tufa rock, 5½ by 6½ by 30 inches, showing about 6 inches above ground, with the highest point marking the exact spot. The following true bearings were determined in 1910:

	° ′	
Upper east edge of eastern one of three iron tanks (mark)	43 19.1	east of south
North gable of roof of building marked Barstow Ice Company	61 17.8	east of south
North gable on roof of small windowless cabin	52 28.7	east of south

Descriptions of stations—Continued.

CALIFORNIA—Continued.

Goat Island, San Francisco County.—The station of 1904 was reoccupied. It is near the center of the plateau just west of the hill at the extreme eastern end of the island, on ground belonging to the army. The station is 50 feet north of the line of the two flag poles, one of which is on the highest part of the island and the other on the southern part of the lawn in front of the officers' quarters. The station is marked by a rough stone 6 by 6 by 12 inches, projecting about 1 inch above ground and having a flat top in which there is a small hole to mark the exact spot. The following true bearings were determined in 1904:

	°	′	
Flagstaff on highest part of island	44	59.5	west of south
Base of flagstaff on lawn	42	47.3	west of south

Indio, Riverside County.—The station of 1905 was reoccupied. It is on Indian land about 700 or 800 feet a little east of south of the Southern Pacific Railroad station. It is east of the schoolhouse and north of a road running east and west. It is 187.7 feet from a fence to the south and 235.8 feet from a fence to the west and about 213 feet northeast of a plank shack used as a jail. The station is marked by two terra-cotta chimney tops fastened end to end by copper wire, and buried so that the point of one chimney top shows 3 inches above ground. The following true bearings were determined in 1910:

	°	′	
Rod at top of Southern Pacific Railroad water tank (mark)	11	10.7	west of north
Top of a windmill about one-half mile distant	28	02.5	east of south
Highest point on mountain south of west	75	57.7	west of north

San Bernardino, San Bernardino County.—The station of 1897 was reoccupied. Observations were made as near as possible to the old site, which is located near the middle of the west half of the city park, between E and F streets and south of Sixth street. It is about 52 feet from the fence line on F street and about 164 feet from the fence line on Sixth street, in line with the north fence of the pavilion, which is located in the center of the park. It is 4 feet from the border of the nearest walk way through the park.

The old station being unsuited for further occupation, another station was established in the southwest corner of the grounds of the County Hospital, about 1 mile southwest of the court-house. It is 70.3 feet east of a fence made with posts of driven piles and 76.5 feet north of another fence. The station is marked by a granite post 6 by 8 by 40 inches, projecting about 12 inches above ground, and lettered U. S. C. & G. S., 1910. The following true bearings were determined:

	°	′	
Upper northwest corner of main hospital building sighted on the bricks (mark)	59	08.9	east of north
East gable on roof of small tool house	3	59.7	west of north
Upper northwest corner of cement house southwest of main building, under eaves of roof	66	22.3	east of north

A similar stone to that used as the marking stone, cut with a hole in the top and placed 240 feet distant, marks the north end of a meridian line.

Stockton, San Joaquin County.—The station of 1906 was reoccupied. It is in the northwestern corner of the rural cemetery, about 2¼ miles north of the county court-house. The azimuth station is marked by a smooth white marble post 4 inches square on top and 4 feet long, projecting 18 inches above the ground. The post is lettered on its vertical faces: Magnetic Station, U. S. C. & G. S., 1897. The post is placed on a dike, 16 feet from the north fence of the cemetery and 30.5 feet from the northwest corner, as measured along the fence line. The magnetic station is in the line joining the center of the marble post with the top of the statue on the court-house dome and is 10 feet from the center of the post. The following true bearings were determined in 1906:

	°	′	
Top of statue on court-house (mark)	5	35.9	east of south
Spire of Central Methodist Episcopal Church	6	22.2	east of south
Pole on roof of a square tank house	14	52.7	west of south

Descriptions of stations—Continued.

CONNECTICUT.

New Haven, New Haven County.—The station of 1904 was reoccupied. It is on the grounds of the Yale Astronomical Observatory, about 200 feet north of the transit house, and due north of the eyepiece of the transit instrument. It is marked by a cedar post bearing a brass screw to mark the exact spot.

New London, New London County.—The station of 1904 was reoccupied. It is on the grounds of the city almshouse, about 1 mile west of the city hall. It is in a small pasture, about 600 feet due west of a water tank and 59 feet from the west post of the gate leading into this pasture. It is 44.6 feet from the nearest point of the north wall and is in line with the northeast corner of the pasture fence and southeast corner of Detention Hospital, which is about 75 yards away. The pasture is about 80 by 85 yards and is full of granite bowlders. A second stone, marking a meridian line is 222.8 feet south from the station. It is 21.7 feet from the top of a bowlder in the south wall in line with the meridian. This bowlder is 25.6 feet from the southwest corner of the pasture. The north stone is 2½ feet long and 6 inches square and has its top about 1 inch above ground. The south stone is 27 inches long and 6 inches square and is set flush with the ground. Both stones are lettered U. S. C. S. The following true bearings were determined in 1904:

	°	′	
Gable on house (mark)	13	10.2	east of south
Tip of weather vane, south end of Memorial Hospital	50	13.5	east of north
Weather vane on private barn	0	32.4	east of north
South meridian stone	0	02.0	west of south
North edge of top of water tower	80	14.5	east of north

FLORIDA.

Fernandina, Nassau County.—The station of 1908 was reoccupied. It is on the Indian mound about 1,200 feet north of Center street and three-fourths mile west of the Amelia Island Light-house. The station is 52 feet south of the remains of a hedge, 300 feet north of Broome street, and about 300 feet east of the street running north by the water works. It is marked by a limestone post 5 by 8 by 30 inches, projecting about 2 inches above ground, and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Top of Amelia Island Light-house (mark)	86	44.0	east of south
West edge of standpipe	20	42.0	west of south
Cupola on county court-house	63	21.0	west of south
Cupola on small wooden church	75	41.0	west of south

GEORGIA.

Brunswick, Glynn County.—The station is in the middle of Winsor Park, at the northeast end of Mansfield street, almost in line with the north curb, and about 600 feet beyond the last house on the street. It is 60 feet south of one oak tree and 45 feet southeast of another, and almost opposite the end of Lee street. The station is marked by wooden stake driven well into the ground. The following true bearing was determined:

	°	′	
Flagstaff on top of custom-house	86	50.8	west of north.

HAWAII.

Honolulu Magnetic Observatory, Oahu Island.—The observatory is about 12½ miles west of Honolulu and about three-quarters of a mile south of the station Sisal, on the Oahu Railway. The observatory is described in Appendix 5, Report for 1902.

ILLINOIS.

Carlyle, Clinton County.—The station is in the high-school grounds toward the northeast corner. It is 154.5 feet northeast of the northeast corner of the school building and approximately 45 feet from the eastern boundary of the grounds. The station is marked by a Bedford limestone post 6 by 6 by 24

Descriptions of stations—Continued.

ILLINOIS—Continued.

inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Left edge of water standpipe (mark)	39	30.2	west of south
Cupola of barn	2	08.5	west of south
Highest pinnacle on schoolhouse	31	40.9	west of south

Dixon, Lee County.—The station is in the northeast corner of Assembly Park, about 1½ miles northeast from the court-house, on a river bank 5 paces east of the row of elm trees standing between the driveway and the river. It is 37 paces from the front of Mrs. Cates's cottage and 31 paces southeast from Mr. Bennett's cottage. The station is marked by a Bedford stone 6 by 6 by 32 inches, projecting 6 inches above ground, and lettered on top U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Flag pole on Steinmann Military Academy (mark)	10	52.9	east of north
South gable on Sandusky Cement Factory	55	39.6	east of north
Gable on a two-story frame farmhouse	73	14.1	east of south

Eureka, Woodford County.—The station is near the center of a pasture belonging to J. H. Klopfenstein, east of the main road, and about one-half mile due north of the court-house. The station is west of a small stream, and is 219.2 feet from the fence between the pasture and the main road, 241.3 feet from a fence to the south, 174.5 feet from a fence to the north, and 80.5 from a tree to the northwest. It is marked by a Bedford limestone post 8 by 15 by 18 inches, set 1 foot below the surface of the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
West edge of court-house tower at roof (mark)	2	19.9	west of south
North edge of old brick water tower at top	65	26.5	west of south
West edge of base of pole on Toledo, Peoria and Western Railway water tank	19	35.5	east of south

Galena, Jo Daviess County.—The station is on the county farm about 2 miles southeast of the town, and in the pauper burying ground at the northwest corner of the farm. It is 69.5 feet from the west fence of the farm, and 54 feet from the north fence. The station is marked by a Bedford stone 6 by 6 by 32 inches, projecting 6 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Staff on high-school tower (mark)	48	25.8	west of north
Cross on highest church steeple	43	53.0	west of north
Southwest edge at top of large smokestack on county farm	56	24.5	east of south

Joliet, Will County.—The station of 1905 was reoccupied and is in a pasture 6 miles southwest from the town, lying between the Chicago, Rock Island and Pacific Railway and the old Michigan Canal. It is nearly due east and about 40 rods distant from the northeast corner of the fence around Rock Run Park. It is 100 paces from the Chicago, Rock Island and Pacific Railroad fence and 82 paces from the edge of the canal. The Chicago, Rock Island and Pacific Railroad semaphore post No. 460 is 230 paces northeast from the station, or 210 paces east along the track from the foot of a perpendicular line drawn from the station to the track. The station is marked by a marble post 4 by 8 by 27 inches, projecting 4 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1909:

	°	′	
Tall stack of Joliet Enterprise Wire Mills (mark)	65	47.6	east of north
Smokestack of Joliet Crematory	71	39.8	east of north
Chicago, Rock Island and Pacific Railroad semaphore post No. 460 (stands south of track)	34	19.6	east of north

Descriptions of stations—Continued.

ILLINOIS—Continued.

Moline, Rock Island County.—The station is north of Moline, about 4 miles east of the Rock Island court-house. It is in a pasture belonging to John Hemmingson and known as "Davenport's pasture." It is 301 feet south from the south fence of the road along the Mississippi River, 330 feet from the bank of the Mississippi River, 150 feet north from the Chicago, Minneapolis and St. Paul Railroad, 63.7 feet from the northwest corner of a house belonging to Mr. Cady, 136 feet north of a fence south of Mr. Cady's house, and about 400 feet west of "Cemetery ditch." The station is marked by a Bedford limestone post 6 by 6 by 36 inches, projecting 4 inches above the surface and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Southeast corner of top of brick chimney of old roundhouse (mark)	11	08.0	west of south
Northeast edge of south white brick chimney of factory across the river	21	22.8	west of north
Apex of high obelisk in Moline cemetery	9	05.0	west of south

Morrison, Whiteside County.—The station is in the county fair grounds, about 1 mile to the south rom the court-house. It is in the oval inclosed by the race track, slightly east from the longer axis of the ellipse and near the south end. It is 21 paces from the inside fence of the track on the south and 35 paces from it on the east, measuring along the line to the azimuth mark. The station is marked by a Bedford stone 6 by 6 by 32 inches, projecting 5 inches above ground and lettered on the top U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Northwest edge of large brick smokestack at the greenhouse, just below the enlargement at top of stack (mark)	83	01.0	east of north
Northwest corner post in the timekeepers' stand (opposite grand stand)	11	26.5	west of north

Quincy, Adams County.—The station is in Indian Mound Park, south of the town and just south of Woodland Cemetery. It is 90 feet west of the drive in the east side of the park, 350 feet southwest of a brick house belonging to Mr. Bredenbeck at the corner of Fifth and Harrison streets, and 47.2 feet west of the northwest one of five elm trees and 51.7 feet northwest of the southwest one of the trees. The station is marked by a Bedford stone 6 by 6 by 20 inches, lettered U. S. C. & G. S., and sunk level with the ground. The following true bearings were determined:

	°	′	
Left edge of small chimney on old workhouse (mark)	12	21.6	west of north
Catholic Church spire	46	43.1	east of north
Right edge of southeast chimney on Mr. Saunder's house, about two blocks northeast of station	75	53.4	east of north

Watseka, Iroquois County.—The station is on the county farm, about 2½ miles east and one-half mile south of the town's center. It is about one-fourth mile east of the farm buildings and about 175 feet north from the road, in an old apple orchard. It is distant 175.3 feet from the fence to the south, 201.5 feet from the fence to the west, 149 feet from the corner of the fence to the northwest, and 42.5 feet from an apple tree to the northeast. The station is marked by a Bedford limestone post 8 by 8 by 36 inches, projecting about 4 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
North edge of brick chimney between barns at county farm (mark)	83	32.6	west of north
North gable of Jim Rhodes's house	81	50.9	east of south
South gable of Mrs. Hatfield's barn	39	17.4	east of north
West gable of Harry Warren's barn	13	26.7	west of south

Yorkville, Kendall County.—The station is at the foot of the hill at the south of Elm Wood Cemetery. It is down the hill almost due south from a massive gray monument bearing the name Marshall, which is seen while walking westward into the cemetery from the main gate. It is about 60 feet south from

Descriptions of stations—Continued.

ILLINOIS—Continued.

the cemetery fence on a low embankment, at one time thrown up for a mill race. The station is marked by a Bedford stone 6 by 6 by 34 inches, projecting 6 inches above ground, and lettered on top U. C. S. & G. S., 1909. The following true bearings were determined:

	°	′	
Flag pole on court-house (mark)	31	57.5	east of south
Southeast corner of south chimney on Knight's farmhouse	56	52.0	west of south
Northwest edge on red granite Dixon monument	78	18.5	east of north

INDIANA.

Boonville, Warrick County.—The station is in the southwestern corner of the city park, about 1 mile southwest of the town's center. It is 39.9 feet from the fence bounding the park on the south and 89 feet from the west fence. The station is marked by a limestone post 6 by 8 by 32 inches, projecting about 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Top of cupola on Turley Taylor's house (mark)	80	27.4	west of north
West gable of T. P. Tillman's house	19	46.4	east of north

A hole in the top of a second limestone post 5 by 7 by 26 inches, projecting 2 inches above ground, indicates the north end of a meridian line. This post is about 180 feet due north of the first.

Brazil, Clay County.—The station is in the southeastern part of the grounds surrounding the "Orphans' Home" about 2 miles east of the town's center. It is 67.7 feet from the south fence and 69 feet from the east fence. The station is marked by a limestone post 6 by 6 by 30 inches, projecting about 6 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Top of steeple of Methodist Church in Harmony (mark)	43	54.8	east of north
South end of gable of Mr. Phillip's barn	60	25.4	east of north
Center of northwest chimney on Ross Carruther's house	39	35.0	west of south

A hole in a marble post 6 by 6 by 36 inches and 8 inches above ground marks the north end of a meridian line. It is 336 feet due north.

Corydon, Harrison County.—The station is in the northwestern corner of the county fair grounds, about one-half a mile south of the town's center. It is inclosed in a space bounded by the road around the race track, the fence on the southwest border of the fair grounds, a row of posts separating the space from the exhibition buildings, and a wire fence along a stream on the north border of the fair grounds. It is 54.5 feet northeast from the row of posts spoken of above, 105 feet west from the fence around the outside of the race track, and 68.6 feet a little west of north from the northeast corner of the poultry house. The station is marked by a limestone post 5 by 7 by 30 inches, projecting about 4 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
West gable of grain elevator (mark)	40	50.2	east of north
West gable of house containing the Fair Association office	83	50.8	east of north

Covington, Fountain County.—The station is in the southeastern part of the county fair grounds, about three-fourths mile a little east of north of the town's center. It is 133.9 feet from the fence bounding the fair grounds on the east, 120.9 feet southwest of the southeast corner and 107.4 feet southeast of the southwest corner of the sheep shed. The station is marked by a limestone post 6 by 6 by 30 inches, projecting about 2 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Base of cross on Catholic Church steeple (mark)	20	08.8	west of south
Northeast corner of iron fence around top of Normal School cupola	19	40.5	east of south
Upper northeast corner of large square cupola just under eaves	63	20.5	east of south

Descriptions of stations—Continued.

INDIANA—Continued.

Decatur, Adams County.—The station is in the northwestern corner of a piece of ground belonging to the county, and called the old fair grounds, about 1 mile southeast of the town's center. It is near the southeast corner of the intersection of Grant and High streets. It is 104.9 feet from the north fence, and 149.5 feet from the west fence. The station is marked by a limestone post 5 by 7 by 30 inches, projecting about 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Spire on steeple of Evangelical Church (mark)	42	12.7	west of north
Top of cupola of South Ward public school	83	54.7	west of north
Lower southwest corner above stone foundation of a brick building which is sixth from the southwest corner of Grant and High streets	40	00.8	west of south

Delphi, Carroll County.—The station is in the northern part of the school gardens in the city park, which was formerly an old cemetery, about 1 mile northeast of the town's center. It is 240.7 feet due north of a south meridian stone which is 6 by 6 by 40 inches, projecting about 12 inches above ground, and set 58.5 feet northeast of the northeast corner of John Best's barn, and 56.6 feet from the fence bounding the park on the south. The station is marked by a stone 6 by 6 by 32 inches, projecting about 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
North point on gable of Doctor Gouchenau's house (mark)	39	40.1	west of south
Lower southeast corner of John Best's house above foundation	5	55.7	east of south

English, Crawford County.—The station is in the northeastern part of a field belonging to Mr. Jerry Suddarth and which surrounds the statue of Congressman English. It is about one-fourth of a mile southwest of the town's center and about 171 feet north of the English statue. It is 139.5 feet from the fence bounding the field on the east, 201 feet from the fence bounding the field on the north, and about 150 feet southwest of a mineral spring. The station is marked by a marble slab 2 by 8 by 24 inches, projecting about 2½ inches above ground, and lettered U. S. A small hole in the top indicates the exact spot. The following true bearings were determined:

	°	′	
Spire of Methodist Episcopal Church (mark)	72	05.0	east of south
Top of cupola on schoolhouse	11	57.2	west of north
Ornamental point at top of clock window of cupola of county court-house	41	05.5	east of south

Evansville, Vanderburg County.—The station of 1900 on the grounds of the Southern Indiana Hospital for the Insane, about 3 miles east of the town, was reoccupied. It is about 600 feet south of west of the main building, on the roadside. It is marked by a white limestone post 6 inches square, lettered on top U. S. C. & G. S., and projecting about 4 inches above the surface of the ground. The mark or range used was the middle of the foot of the flagstaff on the main building, and bears 23° 52′.5 east of true north.

Fowler, Benton County.—The station is in the northwestern corner of a piece of ground laid out in the form of a park or square which belongs to Mr. Daniel W. Osborn. It is at the intersection of Tenth and Park streets, and about one-half mile southeast of the county court-house. It is 94 feet from the fence on the west border of the ground, and 76.5 feet from the fence on the north. The station is marked by a limestone post 6 by 6 by 32 inches, projecting about 3 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Base of flagstaff on cupola of county court-house (mark)	53	10.6	west of north
Top of a pointed roof between the smokestack of power house and city standpipe	80	30.6	west of north
North end of gable of Mr. William Albertson's house	66	21.1	west of south

Descriptions of stations—Continued.

INDIANA—Continued.

Franklin, Johnson County.—The station is in the fair grounds near the center of the space inclosed by the race track. It is 283 feet east of the inside race-track fence on the west, and 98 feet south of a large tree. The station is marked by a stone post 6 by 6 by 24 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Court-house flag pole (mark)	67 21.2	east of south
Left edge of large smokestack (at the top)	83 55.5	east of north
Flag pole of judges' stand	51 04.2	west of south

Huntington, Huntington County.—The station is in the eastern part of the oval within the race track at the county fair grounds, about 1 mile southeast of the town's center. It is 124.5 feet southwest of the fence around the outside of the race-track to the northeast, and 276 feet southeast of the southeast corner of the grand stand. The station is marked by a limestone post 6 by 6 by 32 inches, projecting about 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Base of flagstaff on cupola of public school (mark)	52 28.2	east of south
Top of a pyramid-shaped cupola to the south	6 34.5	east of south
Rod at top of a large water tank	78 13.1	west of north
South end of gable of building to north of grand stand	54 04.6	west of north

La Porte, La Porte County.—The station is on the county farm 2 miles southwest from the court-house, on the edge of a low bank which skirts the western side of a marsh that lies to the southwest of the county asylum for the poor. From the asylum to the station is a distance of 40 rods or more. It is about 50 rods south from the public road which crosses the farm. In the field west of the marsh is an east and west fence which would pass 10 feet north of the station if extended to the marsh. A gate-post at the east end of this fence is noticeable for its great circumference, and from this post the station is 116.3 feet in a direction slightly south of east. A pasture fence passes some 80 feet west of the station. The station is marked by a Bedford stone 6 by 6 by 34 inches, projecting 7 inches above ground, and marked in the center and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
West edge of smokestack on C. N. Y. E. A. L. R. R. power station (mark)	21 06.1	east of south
Knob on center of county home	54 10.3	east of north
Tip on elevated water tank	56 27.0	east of north

Lebanon, Boone County.—The station is in the cemetery east of town. It is about 125 feet south of the road on the north side of the cemetery and about 150 feet southwest of the superintendent's house. It is 42.3 feet northeast of the Tyre monument and 43.5 feet south of the south edge of the drive running east to the house and greenhouses. The station is marked by a Bedford stone 5 by 5 by 30 inches, lettered U. S. C. & G. S. and sunk level with the ground. The following true bearings were determined:

	° ′	
Left edge black iron smokestack on interurban power station (mark)	49 17.0	west of south
Left edge standpipe	67 23.3	west of south
Catholic Church spire	79 49.3	west of south

Logansport, Cass County.—The station of 1907 was reoccupied. It is in the southern portion of the Spencer Park race track grounds 175.8 and 94.6 feet, respectively, from the centers of two large trees, one to the northeast and the other to the northwest. The station is marked by a Bedford limestone post 5 by 6 by 28 inches, projecting about 1 inch above the surface of the ground and lettered U. S. C. & G. S., 1907. The following true bearings were determined in 1909:

	° ′	
Rod on east cupola of large barn (mark)	40 28.3	west of north
Flag pole on judges' stand	52 43.8	west of north

Descriptions of stations—Continued.

INDIANA—Continued.

Noblesville, Hamilton County.—The station is in the cemetery northeast of the town. It is near the center of the northern part of the older portion of the cemetery, 27.5 feet south of the base of the Spannuth monument, 31.2 feet west and a little north of the base of the Peck monument, and 35.5 feet north and a little east of the base of the Virgin monument. It is marked by a Bedford stone 5 by 5 by 30 inches, lettered U. S. C. & G. S., and sunk level with the ground. The following true bearings were determined:

	°	′	
Right edge of largest smokestack at carbon factory (mark)	25	12.3	west of south
Right edge of south chimney on county farmhouse	84	06.0	east of north
Left edge of north chimney on county farmhouse	79	59.9	east of north

Petersburg, Pike County.—The station is in the eastern part of Hornaday's Park about 1½ miles southwest of the town's center. It is about 414 feet almost due south of the iron gate at the northeast corner of the park, 74 feet west from the fence bordering the park on the east, and 129.5 feet southwest of the point where a barbed-wire fence joins a picket fence on the east boundary of the park. The station is marked by a limestone post 6 by 6 by 33 inches, projecting about 7 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Steeple on Presbyterian Church (mark)	69	40.4	east of north
North edge of town standpipe	69	15.8	east of north
Cupola of county court-house	72	28.9	east of north
North edge at top corner of chimney of glassworks	78	32.2	east of south

Portland, Jay County.—The station is in the northwestern part of the oval within the race track at the county fair grounds, about ¾ of a mile northeast of the town's center. It is 151.5 feet southwest from the lower eastern corner of the judges' stand, and 131.2 feet southeast from the lower western corner of a similar stand west of the first. The station is marked by a limestone post 6 by 6 by 30 inches, projecting about 4 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
East end of gable of elevator of Hayne Milling Company (mark)	80	30.8	west of south
Base of flagstaff on cupola of keeper's house at main entrance to fair grounds	58	40.7	west of south
West end of gable of a red barn at east end of race track	84	21.5	east of south

Rockport, Spencer County.—The station is in the southwestern part of the infield within the race track at the county fair grounds, about 1 mile west of the town's center. It is 58.8 feet from the fence around the inside of the race track to the south and 116.3 feet from the west fence. The station is marked by a limestone post 6 by 6 by 36 inches, projecting about 7 inches above ground and lettered U. S. C & G. S., 1909. The following true bearings were determined:

	°	′	
Spire on Methodist Church (mark)	83	45.1	east of north
Spire on small red-topped cupola	78	22.6	east of north
East gable on roof of Mr. Well's house	78	34.6	west of north

A hole in the top of a second limestone post 6 by 6 by 36 inches, projecting about 9 inches above ground and placed about 430 feet due north on a bank about 15 feet high on the north side of the race track indicates the north end of a meridian line.

Rockville, Parke County.—The station is in the eastern part of Beechwood Park, between the base-ball field and the fence bounding the park on the east, and about one-half mile southwest of the town's center. It is 40.5 feet northeast of the south corner of the bleacher, 117.6 feet southwest of the southeast corner of the grand stand and 70.9 feet from the fence bounding the park on the east. The station is

Descriptions of stations—Continued.

INDIANA—Continued.

marked by a limestone post 8 by 8 by 34 inches, projecting about 9 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
South end of gable of house at northeast entrance of park (mark)	7	14.8	east of north
Top of white cupola	47	15.9	east of north
Point of south roof of gable on white house	51	14.3	east of north

Spencer, Owen County.—The station is on a farm immediately north of the town. This farm was formerly an experiment station and is now managed by Mr. Humphreys. The station is on the slope of a hill 90 rods northwest of the house and across the road. It is about 125 feet south of the hill, 53 feet south of a honey locust tree, and 63 feet southeast of another locust tree. The station is marked by an irregular limestone post sunk level with the ground and wedge shaped on the top, with a small notch in the center. The following true bearings were determined:

	°	′	
Highest steeple of Christian Church (mark)	35	36.2	west of south
Railroad water tank	47	40.4	west of south
Left edge of brick smokestack	55	02.4	west of south

Valparaiso, Porter County.—The station is on the county farm 1½ miles southwest from the court-house and is indicated by the north stone of a meridian line. This stone is on the east bank of the creek, some 30 rods northeast from the county home, and about 400 feet northwest from the bridge at the public highway. A second magnetic station was placed in the azimuth line 14 paces to the northeast from the north stone. The south stone is 568 feet from the north one and on the west bank of the creek 113 feet south from the middle of the highway. The meridian line is marked by two Bedford stone slabs having two sawed faces. They are dressed to 8 by 18 inches at the top and taper to 8 by 14 inches at the bottom and are 4½ feet long and project about 4 inches above ground with the broader sides in the meridian. These stones are lettered U. S. C. & G. S., 1909. The following true bearing was determined:

	°	′	
Flag pole on court-house tower (mark)	32	10.5	east of north

IOWA.

Algona, Kossuth County.—The station is in the fair grounds at the southeast edge of the city of Algona and very near to the exact center of the field surrounded by the race track. It is 8 feet to the east from a north and south line passed through the center of the main exhibition building, 27 paces south of a line passed along the south end of the amphitheater, and 130 paces from the southwest corner of the same. The station is marked by a gray sandstone 5 by 8 by 30 inches, projecting 5 inches above ground and lettered on top U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
East flag pole on main exhibition building (mark)	2	19.3	east of north
Outer edge of northwest post in amphitheater	32	35.9	east of north

Audubon, Audubon County.—The station is in the Arlington Heights Cemetery, belonging to the Independent Order of Odd Fellows, about one-half mile northeast of the center of the town. It is in the southwestern part of the cemetery 35.5 feet east of the top of the bank at the east edge of the westernmost road in the cemetery and 39 feet north of the top of the bank at the north edge of the southernmost road. It is also 30.1 feet southeast of the southeast corner of the base of the Russell monument and 18.7 feet east-northeast of the northeast corner post of the Wilson lot. The station is marked by a Bedford sandstone post 6 by 6 by 24 inches lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Cross on Catholic Church (mark)	36	09.0	west of south
Peak of city water tank	3	59.5	west of south
Tip of tower of residence west of Catholic Church	41	01.4	west of south

Descriptions of stations—Continued.

IOWA—Continued.

Bedford, Taylor County.—The station is in the New Fairview cemetery, about 1 mile southwest of the court-house. It is 350 feet from the cemetery gate, at the west edge of the easternmost road, 54 feet west of the east fence of the cemetery, and 39 feet nearly east of the Dickerson monument. The station is marked by a granite post 6 by 6 by 24 inches, set flush with the ground, and lettered U. S C. & G. S. The following true bearings were determined:

	°	′	
Peak of belfry of public school (mark)	26	48.3	east of north
Spire of First Presbyterian Church	40	08.2	east of north
Peak of court-house tower (bottom of flag pole)	43	37.5	east of north
Weather vane on fire-engine house	46	35.3	east of north

A meridian line was determined and marked by a similar stone 600 feet south of the magnetic station.

Chariton, Lucas County.—The station is in the Chariton cemetery, about three-quarters of a mile south of the court-house, at a point reached by the northernmost road in the cemetery about 990 feet from the gate. This point is at the south edge of the pathway south of the Mallory lot and north of the Stuart lot. It is 19 feet southeast of the southeast corner of the Mallory monument and 33 feet north of the north face of the Bonnet monument. The station is marked by a Bedford sandstone post 6 by 6 by 20 inches, projecting about one-half inch above ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
City water tower (mark)	14	37.0	east of north
Near end of the ridge pole of the large barn about one-half mile to the west	76	32.5	west of south

Clarinda, Page County.—The station is in the grounds of the Chatauqua Association, about three-quarters of a mile east of the court-house, and about 800 feet east of the Chicago, Burlington and Quincy Railroad station. It is 209 feet east of the west fence of the grounds and 62 feet south of the south edge of the sidewalk north of the main road entering the grounds. The station is marked by a marble post 6 by 6 by 24 inches, projecting 1 inch above ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Peak of cupola of north schoolhouse (mark)	55	00.6	west of north
Peak of court-house (bottom of flag pole)	84	57.2	west of north
Tower of south schoolhouse	77	00.0	west of south
Center of windmill about one-half mile east of station	74	21.7	east of south

A stone similar to the above 600 feet to the south of the station determines a meridian line.

Corning, Adams County.—The station is in the county fair grounds, about one-half mile east of the court-house. It is near the right field of the baseball grounds in the western part of the ring within the race track. It is 41.8 feet east of the fence inside the race track and 62.6 feet southeast (nearly) of the small wooden building (with a bell in its upper story and used for storing clay pigeons) inside the race track. The station is marked by a St. Lawrence stone post 6 by 6 by 20 inches, set with its face level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Top of steel framework supporting flag pole (base of flag pole) in front of court-house (mark)	62	30.7	west of south
Tip of tower on yellow-brick building north of court-house	71	19.9	west of south
Tip of water tower	75	13.6	west of north

Cresco, Howard County.—The station is on what is known as "Baldwin's Hill," in a pasture about 1½ miles northeast from the court-house. It is on Doctor Connely's farm, three-eighths mile northeast from his house, close to the north brow of the hill, and 20 paces west from the pasture fence which runs north and south. The station is marked by a Bedford stone 6 by 12 by 24 inches, set in limestone,

Descriptions of stations—Continued

IOWA—Continued.

projecting 8 inches above ground, and roughly lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Steel windmill tower (distant) mark	52	25.4	west of south
Ornamental tower on Doctor Connely's house	53	54.2	west of south
Steel windmill about 1 mile away	65	54.9	west of north

Denison, Crawford County.—The station is in the Roman Catholic cemetery, about 1½ miles east-northeast of the court-house. It is about 150 feet north-northwest of the gate of the cemetery in the pathway west of the McMahon and Burke lots, 8.9 feet north-northwest of the northwest corner of the Burke lot, and 8 feet south-southwest of the southwest corner of the McMahon lot. The station is marked by a Bedford sandstone post 6 by 6 by 24 inches, set flush with the ground. The following true bearings were determined.

	°	′	
Peak of main building of Denison Normal College (mark)	12	04.8	west of south
Tip of court-house tower	61	38.5	west of south
North edge of top of city standpipe	71	48.9	west of south

Des Moines, Polk County.—The station of 1907 could not be occupied. A new station was established in the state fair grounds, about one-fourth mile east of the old station. It is on the slope of the hill below and about 275 feet northwest of the poultry building, about in the place Grand avenue would run if extended east through the grounds. It is 63.0 feet northwest of a large hickory tree, which stands between the station and the Polk County headquarter's building, and 74.5 feet southwest of another hickory tree near a small building. The station is marked by a large rough stone lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Lower cupola on Drake Sanitarium (mark)	17	35.2	west of north
Higher cupola on Drake Sanitarium	16	34.1	west of north
Main cupola on state capitol building	83	14.0	west of south
Center of base of rod on poultry building	39	12.2	east of south

Elkader, Clayton County.—The station is on the fair grounds, about one-half a mile east from the court-house. It is inside the race track, near the east end of the half-mile course, 171.3 feet from the north fence of the grounds. It is 2 feet west of a north and south line along the east end of the amphitheater and 140 paces north from the northeast corner of the same. The station is marked by a Bedford stone 6 by 6 by 30 inches, projecting 3 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Cross on Catholic Church steeple (mark)	88	55.8	west of north
Staff on city reservoir	76	29.8	west of north
Artesian well on fair grounds	57	35.3	west of south

Glenwood, Mills County.—The station is in Glenwood Park, about one-half mile east of the court-house. It is 200 feet south of the north end of the artificial lake, 65 feet east of the east edge of the lake, and 8 feet west of the west edge of the roadway running east of the lake. It is also 34.5 feet west of the east fence of the park, and 39 feet from the obtuse angle of the fence. The station is marked by a Bedford sandstone post 5 by 5 by 24 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Peak of schoolhouse west of town, base of flag pole (mark)	85	30.6	west of south
Steeple of church southwest of court-house	89	06.4	west of north
Belfry of south building of school east of court-house	78	24.2	west of north

Greenfield, Adair County.—The station is in the Greenfield cemetery, about 1¼ miles south of the court-house. It is in the old part of the cemetery about 385 feet west of the main entrance and about 190 feet north-northwest of the tool house. It is at the center of the intersection of the pathways south and east of the Mathews lot, 18.9 feet southeast of the southeast corner of the base of Mathews monu-

Descriptions of stations—Continued.

IOWA—Continued.

ment, 26.1 feet northwest of the northwest corner of the base of the Sevasin monument, and 24.8 feet northeast of the northeast corner of the base of the Stewart monument. The station is marked by a concrete post 2 feet long and of nearly triangular cross section, 5 inches on each side, set flush to the ground. The following true bearings were determined:

	°	′	
East point of gable of court-house tower (mark)	17	40.9	west of north
Steeple of wooden church south of the court-house	21	16.4	west of north
South side of top of railroad water tank near Chicago, Burlington and Quincy Railroad station	57	06.6	west of north

Guthrie Center, Guthrie County.—The station is in the county fair grounds, about one-half mile west of the court-house. It is across the creek 12 feet east of the edge of the race track in the northwest part of the infield, 75.5 feet east of the iron pump at the north end of the south shed just outside of the track, and 75.3 feet southeast of the end of the fence at the outer edge of the track. The station is marked with a marble post 2 by 8 by 20 inches, projecting about 1 inch above ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
North side of top of smokestack on electric light-station (mark)	50	36.4	east of north
Center of top of windmill just south of grand stand	81	18.6	east of south
Center of top of windmill on fair grounds	59	07.6	east of south

Harlan, Shelby County.—The station is in the Harlan cemetery, about one-half mile west of the court-house. It is in the western or new part of the cemetery in the pathway between the Byers lot, No. 76, and the Huber lot, No. 77, at the intersection of the pathway with the principal road. It is about 150 feet north of the tool house, 15.2 feet west of the west face of the monument of Frank Byers, and 18.8 feet north of the north face of the base of the monument of Thessa M. Reynolds. The station is marked by a marble post 6 by 6 by 24 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Peak of high-school tower (mark)	59	32.1	east of south
Tip of Presbyterian Church steeple	62	24.1	east of south
West edge of top of water tower (just below the flange)	8	34.7	east of south

Indianola, Warren County.—The station is in the Indianola cemetery belonging to the Independent Order of Odd Fellows, about three-quarters of a mile south of the court-house. It is 54 feet north of the fence north of the main road into the cemetery and about 150 feet west of the tool house. It is at the south side of the pathway at the northwest corner of the Madden lot (lot 456), 14.3 feet north of the north face of the base of the Madden monument, and 5.9 feet south of the south face of the base of the tombstone of Robert Cooper Brown. The station is marked by a marble post 6 by 6 by 19 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearing was determined:

	°	′	
Peak of court-house tower (mark)	6	56.5	west of north

Jefferson, Greene County.—The station is in the Jefferson cemetery, about one-half mile east of the court-house in "Potter's field" in the southwest corner of the old part of the cemetery. It is just off the east edge of the fourth pathway from the western boundary of the cemetery, running north and south. It is 107.6 feet east of the west fence of the cemetery, 39.5 feet northwest of the northwest corner of the base of the tombstone of G. Frederick Hotchkiss, and 13.5 feet south of a pine tree at the edge of the pathway. The station is marked by a marble post 5 by 5 by 20 inches, projecting about one-half inch above ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Peak of court-house tower (mark)	78	35.6	west of north
Peak of city water tower	89	01.5	west of south

Leon, Decatur County.—The station is in the Leon cemetery about 1 mile west of the court-house at a point reached by the easternmost road in the cemetery about 500 feet from the gate. It is 6 feet east

Descriptions of stations—Continued.

IOWA—Continued.

of the edge of this road at the north edge of the path south of the Sanders's lot, 47 feet west of the east fence of the cemetery, and 90 feet southwest (nearly) of the tool house. The station is marked by a marble post 6 by 6 by 20 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Peak of court-house tower, bottom of flag pole (mark)	65 45.3	east of south
Steeple of Methodist Church	54 51.9	east of south
Water tank	7 48.9	east of south

Mason City, Cerro Gordo County.—The station is in the northeast corner of the National Memorial University campus, 1 mile south from the court-house. It is exactly in line with the north wall of Barton Hall and 863 feet (by wheel measure) east from the northeast corner of the building. It is 51 paces south from the center of the street at the north side of the campus. The station is marked by a Bedford stone post 6 by 6 by 30 inches, projecting 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Tip on court-house tower (mark)	19 48.4	west of north
Extreme north edge of the roof on Barton Hall	89 45.0	west of north
Southeast edge of lower story wall of Barton Hall	80 13.2	west of south

Mount Ayr, Ringgold County.—The station is in the Rose Hill Cemetery about one-half mile southeast of the court-house. It is 181 feet south of the north fence of the cemetery, 24 feet west of the west edge of the principal road in the cemetery, and 16 feet northeast of the Kinsell monument at the south edge of the pathway north of the Kinsell lot. The station is marked by a Bedford sandstone post 6 by 6 by 24 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearing was determined:

	° ′	
Peak of court-house tower just below weather vane (mark)	52 10.2	west of north

Nevada, Story County.—The station is in the county fair grounds, about three-fourths of a mile northeast of the court-house. It is 58 feet northeast of the inside edge of the race track in the southwest part of the infield, and 152 feet southeast (nearly) of the southeast corner post of the grand stand. The station is marked by a Bedford sandstone post 6 by 6 by 24 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Center of cross on Catholic Church steeple (mark)	17 29.6	west of south
Center of head of statue on top of court-house	34 54.9	west of south
Peak of city water tank	40 06.7	west of south

Osage, Mitchell County.—The station is on the county fair grounds about one-half mile east and one-half mile south of the town's center. It is within the race course at the southwest corner and is 108.5 feet west of south from the flagpole within the race course, 93 feet north of south fence around the race course, 12 feet west of a fence south of the exhibition sheds, if fence were produced north, 247.5 feet northeast of the northeast corner of the sheds in the southwest corner of the grounds, and 362 feet southwest from the southwest corner of the judges' stand. The station is marked by a Bedford limestone post 6 by 6 by 36 inches, set level with the surface of the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Base of flagstaff on steel water tank (mark)	45 51.4	west of north
Base of cross on Catholic Church steeple	26 06.6	east of north
East edge of base of flagstaff on fair-grounds office	35 41.7	west of north
East edge of base of flagstaff on judges' stand	14 34.9	east of north

Red Oak, Montgomery County.—As the station of 1900 was not suitable for reoccupation a new one was established in the Evergreen (New City) Cemetery within the "ornamental circle," nearly southwest from the center of the soldiers' monument. It is 26.9 feet from the southwest corner of the base

Descriptions of stations—Continued.

IOWA—Continued.

and 31.6 feet from the southeast corner of the base of the monument. The station is marked by a limestone post 6 by 6 by 24 inches, tapering to about 2 by 2 inches at the bottom, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Tip of court-house tower base of flag pole (mark)	29	54.2	west of south
Tip of belfry of north ward schoolhouse	39	17.2	west of south
East edge of top of standpipe	5	38.5	east of south

Rockwell City, Calhoun County.—The station is in the northern part of the cemetery, 1 mile northeast of the town. It is 40 feet east of the west fence and 126.5 feet north of the south fence. It is 115 feet north of the northeast corner of the tool house and about 115 feet north and a little west of the large Brower monument. The station is marked by a cement block 7 by 7 by 18 inches, roughly lettered U. S. C. & G. S. and sunk level with the ground. The following true bearings were determined:

	°	′	
South edge of standpipe (mark)	63	48.3	west of south
Center of smokestack on factory north of Chicago, Milwaukee and St. Paul Railway depot (canning factory)	84	03.2	west of south
Center of windmill 1 mile northwest	39	28.7	west of north

Sibley, Osceola County.—The station of 1891 was reoccupied. It is just southeast of the Sibley Hotel, 121.4 feet south of the fence along the main street of the town and 14.2 feet west of the fence along the road leading to the prairie. It is marked by a drill hole in the top of a dressed-marble post 4 inches square, sunk flush with the surface of the ground. The point of the cupola on the rear of the Sibley Hotel bears 64° 47′.5 west of true north.

A new station was occupied about three blocks east of the northeast corner of the county court-house square, in the city park. It is 114.7 feet north from the new cement walk running east along the south edge of the park. It is 62.7 feet east from the row of maple trees at the east side of the drive that enters the park at the south side, or about 80 feet east from the center of the north and south street which passes on the east side of the high-school block. The station is marked by a cement post 6 by 6 by 24 inches, set 1 inch below the surface, and very dimly lettered U. S. C. & G. S., 1909, on the top with a countersink mark at the center. The following true bearings were determined:

	°	′	
Northwest corner of the brick wall of high school just below the cornice (mark)	28	22.2	west of south
Intersection of north edge of north walk with west edge of east walk (cement) east side of street east of park	64	11.3	east of south

Sidney, Fremont County.—The station is in the Sidney cemetery, about one-half mile southeast of the court-house. It is at the east edge of the pathway west of the Bickel lot; 107 feet south of the north fence of the cemetery, 91 feet east of the east edge of the main road into the cemetery, and 16.5 feet south of the south face of the tall marble monument in the Jordan lot. The station is marked by a concrete post 5 by 5 by 20 inches, projecting about 1 inch above ground, and lettered U. S. The following true bearing was determined:

	°	′	
West edge of top of water tower (mark)	36	01.3	west of north

Spencer, Clay County.—The station is in a pasture lot on Mr. F. B. Felt's farm at the north edge of the city of Spencer. It is directly in line with a row of elms that line the west side of Prairie avenue, and also in line with the gable or ridge pole of Mr. Felt's carriage barn, so that the intersection of these two lines meeting at right angles locates the station. It is 195 feet north from Mr. Felt's fence on the south line of his farm. The station is marked by a Bedford limestone post 8 by 8 by 30 inches, projecting3 inches above ground, and lettered on top U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Staff on Spencer city elevated water tank (mark)	0	34.6	west of south
Cross on a church steeple	4	42.6	east of south
Smokestack at the Spencer brick and tile factory	33	51.5	west of north

Descriptions of stations—Continued.

IOWA—Continued.

Spirit Lake, Dickinson County.—The station is in the parade ground of the Templar's Park, 2½ miles north of the town. It is 28.5 feet south from a line along the south wall of the west wing of the Apartment Building, and 222.6 feet east from the fence along the east side of the highway which passes by the park. The station is marked by a Bedford limestone post 8 by 10 by 28 inches, set flush with the surface, and lettered on top U. S. C. & G. S., 1909. The following true bearing was determined:

	° ′	
Wooden staff on gable of west wing of Apartment Building, (mark)	81 52.9	east of south

Webster City, Hamilton County.—The station is in the cemetery, about one-half mile south of the court-house in the central park belonging to the Grand Army of the Republic just south of the road in the cemetery nearest the north fence. It is 70.4 feet south of the north fence, 51.1 feet south-southeast of the southeast corner of the base of the tombstone to Electa Hammitt, and 88 feet west-southwest of the west post of the principal gateway into the cemetery. The station is marked by a Bedford stone post 5 by 6 by 24 inches, set level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Flag pole at center of court-house tower (mark)	27 54.3	east of north
Steeple of high school	22 00.7	east of north
Letter "I" in the word "CITY" on inscription above Webster City Mausoleum	29 54.5	west of south

Winterset, Madison County.—The station is in the Rock City cemetery, about one-half mile south of the court-house. It is on the roadway nearest the north fence of the cemetery, 76.6 feet south of the north fence and 100 feet west of the west edge of the principal road. It is 10.8 feet north-northwest of the northwest corner of the base of the Knight monument, and 26.9 feet north-northeast of the northeast corner of the base of the tombstone of Mary Whitmore Smith. The station is marked by a Bedford sandstone post 6 by 6 by 24 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Peak of court-house tower, base of weather vane (mark)	29 33.3	west of north
Tip of tower of the south ward school building	60 42.0	west of north
Tip of water tower	15 39.1	west of north

KANSAS.

Baldwin, Douglas County.—Observations were made in the absolute house of the magnetic observatory. The flagstaff on Science Hall, Baker University, was used as a mark. Its true bearing is 48° 20′.6 west of north. When the observatory was discontinued in October, 1909, a cement reference stone was set 36.25 feet due south of the declination pier in the absolute house. It is in a field belonging to J. G. Brockway, 207.1 feet from his well and 143 feet from the corner of the building in which the variation instruments had been mounted. The stone is lettered U. S. C. & G. S., 1909. From it the following true bearings were determined:

	° ′	
Howard monument in cemetery	54 09.3	west of south
South edge of south chimney of a house	62 53.2	west of south
South edge of north chimney of the same	63 04.7	west of south
Brockway's well	83 06.9	west of south

Council Grove, Morris County.—The station is within the race track in the fair grounds north of the town. It is 171 feet northeast of the north gatepost at the entrance to the space inclosed by the race track, and 151.5 feet east of the nearest point on the outside race track fence, 4 posts south of the one mentioned above. It is about 130 yards south of the judges' stand. The station is marked by a stone 6 by 6 by 24 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
North edge of water standpipe (mark)	67 59.7	west of south
Base of flag pole on judges' stand	3 29.7	east of north

Descriptions of stations—Continued.

KANSAS—Continued.

Iola, Allen County.—The station is in the fair grounds southwest of the town, near the river. It is near the south side of the space inclosed by the race track. It is 21.5 feet from the inside race track fence south of the station, 321.5 feet west of the judges' stand, and about 300 feet east and a little north of the Driving Club stables. The station is marked by a limestone post 6 by 6 by 24 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Court-house cupola (mark)	54	13.8	east of north
Base of flag pole on judges' stand	87	05.9	east of south
South edge of chimney on school	82	53.5	east of south

Leavenworth, Leavenworth County.—The station is on the government reservation west of Fort Leavenworth Post buildings, east of the national cemetery, and east of the road leading to the fort from Broadway in town. It is 80 feet north from a large oak tree, and 273 feet east of the northeast corner of the stone fence around the cemetery. The station is marked by a marble post 6 by 6 by 18 inches, lettered U. S. C. & G. S., and sunk level with the ground. The following true bearings were determined:

	°	′	
Spire of German Catholic Church (mark)	8	42.2	east of south
Left edge of smokestack at United States penitentiary	18	39.3	west of south
Clock tower at the fort	87	46.5	east of north

Lincoln, Lincoln County.—The station is on the school grounds in the southern part of the town, 150.5 feet northwest from the northwest corner of the school building, and 24.5 feet south from the inner edge of the stone walk along the north side of the grounds. The station is marked by a marble slab sunk level with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
East gable of Union Pacific station house (mark)	83	04.7	west of south
West one of two cupolas on a barn	75	08.9	west of north
Flag pole on schoolhouse	57	54.3	east of south

Oskaloosa, Jefferson County.—The station is about in the center of the cemetery north of the town, in a driveway, 28.5 feet southeast of the base of the large Sands monument, and 13.5 feet northwest from the base of the Lohmann monument. The station is marked by a limestone post about 6 by 6 by 24 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Cupola of barn one-half mile north (mark)	4	07.5	west of north
Tip of west iron gatepost at entrance to cemetery	13	28.0	east of south

Salina, Saline County.—The station of 1904 was reoccupied. It is on the grounds of the Kansas Wesleyan University at a point 327.6 feet northeast of the northeast corner of the main building, 209.2 feet south and a little east of the southeast corner of the dwelling across the street, and 300 feet (about) west of the tracks of the McPherson Branch, Union Pacific Railroad. It is marked by a limestone post 6 by 6 by 30 inches, set flush with the ground, and lettered U. S. C. & G. S., 1904. The following true bearings were determined in 1909:

	°	′	
Figure 1 on corner stone of the university building (mark)	62	04.2	west of south
East gable of ladies' dormitory	65	57.5	west of north

KENTUCKY.

Bowling Green, Warren County.—The station is in the eastern corner of the grounds surrounding Ogden College, about 1 mile southwest of the town's center. It is 45.8 feet from a fence bounding the ground on the northeast, 51.4 feet from the fence on the southeast, 157.2 feet due east of a south meridian stone, and 289.4 feet southeast of a north meridian stone. The station is marked by a neck of a white glass bottle, about 4 inches under the surface of the ground. The following true bearings were determined:

	°	′	
Corner at center of base post at northeast corner of northeast piazza of college building (mark)	85	45.7	west of north
Upper northeast corner of John R. Drake's house, under eaves	65	08.6	east of south

The meridian line mentioned above was set by request of the county authorities.

Descriptions of stations—Continued.

KENTUCKY—Continued.

Brownsville, Edmonson County.—The station is in the eastern part of a piece of land belonging to D. A. Logan and is near the top of small hill about 600 feet east of the county court-house. It is 107.4 feet a little west of north of the fence bounding this ground on the southeast, 104.5 feet north of east of the northeast corner of a small cabin on the west side of the ground, and about 63 feet west of the edge of a large mass of rock at the top of the hill. The station is marked by a limestone post 5 by 8 by 30 inches, projecting about 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
East gable of roof of J. P. Reed's residence (mark)	56	53.5	west of south
Base of spire on cupola of county court-house	50	12.2	west of south
Top of steeple of Baptist Church	83	42.8	west of south

Elizabethtown, Hardin County.—The station is in Elizabethtown cemetery, about 30 yards from the main entrance or northeast gate. It is in the edge of the driveway, near the northeast corner of the Wintersmith lot, 5.9 feet from the northeast edge of a large square stone marking the northeast corner of the lot, and 23.5 feet from the northwest edge of a similar stone marking the northwest corner of the lot. No permanent mark was considered necessary. The following true bearings were determined:

	°	′	
Court-house cupola (mark)	33	55.7	west of north
City standpipe	74	05.4	west of south
Elizabethtown College cupola	71	24.6	west of north
Methodist Episcopal Church cupola	44	20.1	west of north
Catholic Church cupola	44	08.8	west of north
Presbyterian Church cupola	41	25.8	west of north
Baptist Church cupola	40	44.1	west of north

Franklin, Simpson County.—The station is in the southwestern corner of the ground surrounding the Trade School, about one-fourth mile south of the town's center. It is 91.5 feet from the fence across the road on the south side of the ground, and 115.8 feet east of the east edge of the sidewalk on the west border of the ground. The station is marked by a limestone post 5 by 7 by 33 inches, projecting about 6 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Upper northwest edge of a small brick stable under eaves (mark)	16	53.1	east of north
West ball at top of tower of Female College	60	58.9	west of south
Northwest corner of stone cornice just above foundation of grade school building	59	55.7	east of north

A hole in the top of a stone 6 by 6 by 30 inches, projecting about 5 inches above ground and set 240.9 feet due north marks the north end of a meridian.

Munfordville, Hart County.—The station is a little northwest of the center of the ground surrounding the grade school, about 1,000 feet southwest of the county court-house. It is 25.6 feet northwest of the fence between the boys' and girls' playgrounds, and 103.8 feet southwest from the western corner of the school building. The station is marked by a limestone post 5 by 7 by 30 inches, projecting about 6 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Cupola on south corner of tower of Presbyterian Church (mark)	23	40.3	east of north
Southeast gable of Mr. Campton's house	35	25.5	west of north
Southeast gable of Mrs. William White's house	64	14.3	west of south

About 350 feet due north in the north corner of Doctor Adams's orchard a hole placed in the top of a second limestone post indicates the north end of a meridan line. This post is 5 by 8 by 30 inches and projects about 5 inches above ground.

Descriptions of stations—Continued.

LOUISIANA.

Ruston, Lincoln Parish.—The station of 1904 was reoccupied. It is on the meridian line established by Dr. G. D. Harris in 1902 on the grounds of the State Industrial College. It is 55 feet north of the south monument and is marked by an ash stake driven flush with the ground. The following true bearings were determined in 1910:

	° ′
Lower northwest corner of main building	38 03.4 west of south
Top of pyramidal roof on a frame house	80 44.5 west of north

Shreveport, Caddo Parish.—The station of 1904 was reoccupied. It is in the northeastern part of the space inside the Caddo Downs race track, which is about 3 miles southwest of the court-house. The inner fence about the race track is distant from the station 38.1 feet, measuring due north, and 34.4 feet measuring in the direction of the Mulkaupt House. There is a small pear orchard about 15 rods north and west of the station and across the race track. The station is marked by a Bedford limestone post 5 inches square, projecting 5 inches above the general surface, and having a hole filled with lead to mark the center. Two other similar stones mark the meridian, the south stone being 600 feet south of the magnetic station and 6 feet inside the inner fence of the race track, while the north stone is 940 feet north of the magnetic station and is 6 feet inside the high board fence surrounding the race-track grounds. The spire of the Jewella Christian Church bears 76° 59′.4 west of true south.

Tallulah, Madison Parish.—The station of 1904 was reoccupied. It is in the southeastern part of the parish farm and about three-fourths of a mile south of Tallulah. It is 31 feet from the fence along the west edge of the road by the bayou and 23.7 feet from a fence to the southwest. The station is marked by the neck of a bottle embedded in a 6-inch tile filled with cement and surrounded by a mass of concrete. A similar monument, 252.5 feet north, marks the meridian line. This north monument is north of a small peach orchard, 63.7 feet from the northwest corner of a small house and 54.5 feet from the southwest corner of a small fenced lot. The south gable of the Frisco section house bears 4° 37′.6 east of true north.

MAINE.

Auburn, Androscoggin County.—The station is in Auburn Heights near the top of Merrill Hill, about 1 mile west of the town's center. It is in line with the east side of a cement reservoir and nearly in line with the northwest side. It is 121.5 feet north of the northeast corner of the reservoir, 213.4 feet northeast from the nearer northwest corner of the same, 92 feet east of an ash tree, and 102 paces southeast of a birch tree. The station is marked by an exposure of granite with a cross and drill hole cut in it to mark the exact spot. The following true bearings were determined:

	° ′
St. Joseph's Catholic Church spire in Lewiston (mark)	88 41.2 east of south
East gable of distant barn	11 12.0 east of south
Ball on north tower of Poland Springs Hotel	51 02.0 west of south
Cupola on distant barn	2 37.5 west of north
Spire on north tower Summit House	64 35.6 west of south

Bethel, Oxford County.—The station is near the top of Pine Hill, about three-fourths mile west of the town's center. It is near the southern extremity of the top of the hill, about 250 paces from Grover Hill road, 200 paces from the extreme top of the hill, 48 feet northwest of a pine tree, 35 feet northeast of a second pine tree, and 108 feet southwest of the corner of a stone fence. It is marked by a cross and a drill hole cut on the face of a rounded granite bowlder projecting a little above ground. The following true bearings were determined:

	° ′
Universalist Church spire (mark)	63 00.7 east of north
South edge of south chimney on Dr. J. G. Gehring's house	85 07.6 east of south
West edge, near ground of large stone on meadow 1 mile away	18 46.5 west of south
Center of chimney on west end of J. A. Hughes' house	61 02.1 west of south

Capens, Piscataquis County.—The station is about one-fourth mile west of the hotel, near the center of a pasture covered with very large bowlders and belonging to Mr. Capens. It is 149 feet from a fence on the southeast, 125.8 feet southeast from the southeast corner of a bowlder projecting 10 feet above ground. Observations were made over the center of a rounded bowlder projecting about 6 inches above

Descriptions of stations—Continued.

MAINE—Continued.

ground, and cut with a cross and drill hole to mark the exact spot. The following true bearings were determined:

	°	′	
Base of weather vane on barn west of hotel (mark)	63	21.3	east of south
West gable of hotel	48	12.5	east of south
West gable of camp No. 5	89	15.4	east of north

An iron bolt set in a rock 253 feet to the north marks the north end of the meridian line.

Fort Kent, Aroostook County.—The station is on the point on which stands the old Block House of 1838, on land owned by Mr. Dickey, collector of customs at Fort Kent, and across a small branch from his residence. It is 136 feet south of the southeast corner of the Block House and 24 feet west of the edge of the bank and west of the trail leading to the Block House. The station is marked by a 4-inch sewer tile which projects about 4 inches above ground. The following true bearings were determined:

	°	′	
Flagstaff on east end of G. H. Page's store (mark)	13	18.8	east of south
Southeast corner of Block House	5	38.6	west of north
Center of chimney on new hotel near depot	33	24.0	east of north
Cross on Catholic Church	74	36.9	east of north

Greenville Junction, Piscataquis County.—The station of 1887 could not be occupied. A new one was established about one-fourth mile west of Greenville Junction on Squaw Mountain. It is near the east end of a pasture belonging to Mr. A. A. Craft, about 43 paces west of the brow of the hill, 27 feet north of a pine tree, 24 paces northwest from a large bowlder, and 341 feet southeast from a very large bowlder near the ball diamond. The station is very nearly in line with the Canadian Pacific Railroad, extended. Observations were made over a large field stone which projected a few inches above ground. A cross and drill hole mark the exact spot. The following true bearings were determined:

	°	′	
Weather vane on cupola of south barn belonging to Mr. Charles Jackson (mark)	62	33.2	east of south
Ball on cupola of house in village	80	41.3	east of south
West gable of Moosehead Hotel	83	51.8	east of north
West gable of house in village	75	51.9	east of south

Kineo, Piscataquis County.—The station is on the south slope of Mount Kineo and about 2 100 feet northwest of the west end of the Kineo Hotel, in line with the center of the hotel and Sandbar Island. It is about 80 feet from the edge of the timber line on the east, and 240 feet from the timber line on the west, on grounds at present used for golf links. Observations were made over a flint bowlder, projecting 6 inches above ground, and cut with a cross mark and drill hole to mark the exact spot. The following true bearings were determined:

	°	′	
Apex of cupola on southwest corner of Kineo Hotel (mark)	31	58.9	east of south
Weather vane on south cupola of large barn at Kineo station (Rockwood)	12	13.9	west of south
Spire on east end of Kineo store	51	37.9	east of south
Spire on west end of Kineo store	49	45.1	east of south

Kittery Point, York County.—The station is on Gerrishe's Island, on the north side of the entrance of the harbor of Portsmouth, N. H. It is near the Pocahontas Hotel, and almost directly in line with the east gable of the hotel and Whales Back Light-house. The station is 120 feet from the west corner of the piazza, 110 feet from the south corner, and 75.3 feet from the flagstaff. It is marked by a concrete post, projecting about 2 inches above ground, and lettered U. S. C. & G. S., 1909. The point is marked by an old tool handle, with a brass end, embedded in the cement. The following true bearings were determined:

	°	′	
Whales Back Light-house (mark)	43	33.6	west of south
Gable, Pocahontas Hotel	43	32.8	east of north
Cupola, life-saving station	80	06.8	west of south
Portsmouth breakwater light-house	68	07.7	west of north

Descriptions of stations—Continued.

MAINE—Continued.

Oakland, Kennebec County.—The station is in a pasture belonging to Mr. John Fish, about three-fourths mile west of the town. It is near the north center of the pasture, on the highest point, and 11 feet southwest of a very large bowlder. It is 192.4 feet south of a fence, 150 paces east of an elm tree, at the base of which is a large pile of field stones, and one-fourth mile south of the reservoir. Observations were made over a field stone projecting a little above ground. A cross and drill hole marks the exact spot. The following true bearings were determined:

	°	′	
Baptist Church spire (mark)	48	43.7	east of south
Base of weather vane on Universalist Church cupola	50	29.7	east of south
West gable of Mr. Pullen's house	23	51.6	east of south
Cupola on Mr. Fred Mitchell's house	86	50.1	east of north

MARYLAND.

Cheltenham, Prince George County.—The station is at the Coast and Geodetic Survey magnetic observatory, on the grounds of the state reform school.

Greenbury Point, Anne Arundel County.—Magnetic observations were made at the triangulation station Greenbury Point, near Annapolis.

MASSACHUSETTS.

Boston, Suffolk County.—The 1906 station was reoccupied. It is on Castle Island south of Fort Independence, about 50 feet northwest of the station of 1905. It is 143 paces from the south entrance to the fort, and is 6 feet west of a direct line from the south entrance of fort to a large tank on a distant hill to the south. It is also 142 paces from the southeast corner of the fort, 153 paces from the southwest corner, and 63 paces from a small walk, in a direct line to the south entrance. The station is marked by a limestone post 6 by 6 by 32 inches, projecting 1 inch above ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1906:

	°	′	
Central flag pole on Marine Park headhouse (mark)	67	36.4	west of south
White spire in South Boston	81	40.6	west of south
Southwest corner of fort, above stone foundation	18	02.5	west of north
Southeast corner of fort, below top coping	38	23.5	east of north
Long Island Light-house	80	56.4	east of south
Spectacle Island Light-house	64	48.4	east of south

Dedham, Norfolk County.—The station is in Fairbank's Park, near the middle of Central avenue, produced. It is about three-fourths mile almost due south of the Memorial Hall, 111 feet 7.8 inches southwest from a hydrant, and 121 feet 5.5 inches southeast from the southeast corner of Mrs. Campbell's house. The station is marked by a granite post 6 by 6 by 24 inches, round on top, center-marked and lettered U. S., and set level with the ground. The following true bearings were determined:

	°	′	
Flag pole on Memorial Hall (mark)	15	34.5	west of north
Top of northeast side of Blue Hill observatory	60	42.3	east of south

Lawrence, Essex County.—The station of 1905 was reoccupied. It is the south stone of a meridian line established by Essex County in 1874 in the city common. It is nearly in line with the center of Garden street extended and is 71.1 feet due west of the curbstone on the west side of Jackson street. The north stone is a few feet south of the sidewalk on Haverhill street. There is a third stone midway between the two. These monuments are of granite and project about 18 inches above ground. They are hexagonal in shape and have a circular brass plate bolted in the top. A cross is cut in the plate, and the center of the cross marks the exact spot. The following true bearings were determined in 1905:

	°	′	
Middle meridian stone (mark)	0	04.6	west of north
North meridian stone	0	05.8	west of north
Congregational Church spire	30	07.4	west of north

Descriptions of stations—Continued.

MASSACHUSETTS—Continued.

Plymouth, Plymouth County.—The station is on Long Beach, about 98 feet from high-water mark on the east side of the point and exactly on the line between the Plymouth national monument and the North Tower of the Gurnet Light-house. It is marked by a wooden stake, about 3 by 3 inches on top, driven into the sand, and projecting about 4 inches above ground.

The North Tower of Gurnet Light-house bears 52° 20′.3 east of true north.

Salem, Essex County.—The station of 1906 was reoccupied. It is on the government reserve around Fort Pickering Light-house. The fort has been torn down and only the embankments now remain. The station is on the south embankment, almost due east from the light-keeper's dwelling. It is 82 paces from the light-house and bears 15° west of north and is 42 paces from the head of the steps leading down from the embankment to the light-house. The station is marked by a limestone post 6 by 6 by 32 inches, projecting 1 inch above ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1906:

	°	′	
Catholic Church spire in Salem (mark)	71	32.6	west of south
Prominent spire in Salem	76	46.0	west of south
Church spire	76	16.8	west of south
Spire in Beverly	29	06.5	west of north
Spire in Marblehead	11	05.2	east of south

Vineyard Haven, Dukes County.—The station of 1906 was reoccupied. It is on the reservation of the United States Marine-Hospital Service on the lawn in front of the building. It is 88.5 feet southeast from the flagstaff and 193 feet east-northeast from the northeast corner of the brick basement of the building. It is 1.5 feet southeast from the line of tangency of the east end of the hospital building and the east end of the attendants' quarters to the rear. The station is marked by a granite post 5 by 5 by 30 inches, set flush with the ground. The following true bearings were determined in 1906:

	°	′	
Center of East Chop Light-house (mark)	49	01.7	east of north
Town hall spire	44	29.6	west of north
Center of standpipe	55	09.0	east of south

MICHIGAN.

Alpena, Alpena County.—The station of 1907 was reoccupied. It is in the southwest part of the oval within the race track at the county fair grounds, about 1½ miles southwest of the center of the town. It is 120.2 feet north of the fence around the inside of the race track at the south end, 106.5 feet east of the inside fence on the west, and 232.4 feet west of the fence on the east. The station is marked by a Bedford limestone post, 5 by 6 by 36 inches, projecting about 6 inches above ground, and lettered U. S. C. & G. S., 1907. The following true bearings were determined:

	°	′	
Flagstaff to the south (mark)	1	38.8	west of south
Spire of only church steeple in sight	45	20.4	east of south
Flagstaff on cupola of Garfield School	30	15.3	east of south
Flagstaff on grand stand	49	50.7	east of north

Iron River, Iron County.—The station is near the west side of the large playground on the north side of the public-school building. Observations were made over a wooden stake driven flush with the ground, 50.5 feet from the permanent mark and in an exact line from the spire on the Catholic Church produced eastward through the permanent mark. The permanent station mark is a 6-inch sewer tile filled with cement and inscribed on top U. S. C. & G. S. It projects 7 inches above ground and is 2.2 feet from the west fence of school grounds and 153 feet from the northwest corner of the school building. The following true bearings were determined:

	°	′	
Ball on tall flag pole on First National Bank Building (mark)	2	34.4	west of south
Catholic Church spire	48	23.4	west of south
Small cupola on residence of Doctor Libby	56	23.2	east of south

Descriptions of stations—Continued.

MINNESOTA.

Ada, Norman County.—The station is in the cemetery, 1 mile east and slightly south from the county court-house. It is in the end of the east-and-west driveway, 48.9 feet southeast from the base of the W. S. Levalley monument, 71.1 feet northeast from the base of the Roesch monument, 29.4 feet southwest from the Bullock monument, and 55 feet from the cemetery fence by the highway on the east. The station is marked by a glazed clay marker, 4¾ inches in diameter and 16 inches in length, with a cross mark in the top, and set 3 inches below the surface. The following true bearings were determined:

	°	′	
Tip on high-school cupola (mark)	73	42.9	west of north
Barn cupola, ½ mile	71	46.0	east of south
Distant barn cupola	79	39.4	east of north

Aitkin, Aitkin County.—The station is in the central driveway of the Lakeview Cemetery, 1½ miles west of the city. It is 16.8 feet southwest from the base of the John C. Polley monument, 65 feet east of the Almon F. Stearnes monument, 44.7 feet northeast of the Nils Shank monument, and 39.5 feet northwest from the Charles W. Cluff monument. The station is marked by a hexagonal brick tile, 4 inches across and 12 inches in length, set in the sand 12 inches below the surface of the drive. The following true bearings were determined:

	°	′	
Cross on Aitkin Catholic Church spire (mark)	58	42.8	east of north
High-school cupola	56	41.2	east of north

Austin, Mower County.—The station is in the fair grounds, 1¼ miles west from the court-house, in the field surrounded by the race track exactly in line with the east wall of the amphitheater, 357.5 feet from the southeast corner of the same. It is also due east on a line with the ridge pole of the poultry exhibit building, so that the intersection of the line from this with the line along the east end of the amphitheater locates the station. The station is marked by a Bedford stone 7 by 7 by 32 inches, projecting 5 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Court-house tower (mark)	65	49.4	east of north
Cross on Catholic Church steeple	49	19.2	east of north
Smokestack at cement factory (very distant)	24	23.8	east of south

Bagley, Clearwater County.—The station is in the new cemetery, 1 mile north from the village of Bagley. It is in the driveway and quite near the center of the 10-acre plat, 259.4 feet east of an iron stake which marks the center of the west end of the driveway, 19.8 feet from the lot stakes on the north edge of the driveway, or 20.2 feet from the lot stakes on the south edge of the driveway. The station is marked by a glazed clay marker, 4¾ inches in diameter and 16 inches long, with a cross-mark in the top, and set 3 inches below the natural surface (very sandy loam). The following true bearings were determined:

	°	′	
Northeast edge of Ole M. Rolland monument above the base (mark)	80	57.0	west of north
Apex on Caroline Brown monument	48	48.4	west of south

Breckenridge, Wilkin County.—The station is in the south side of the county court-house yard, 22.6 feet from the tree row on the south and 78.5 feet from the cement walk on the west side of the yard. It is marked by a limestone post 6 by 6 by 24 inches, set flush with the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Northwest corner above the water table on the St. Francis Hospital (mark)	61	22.4	west of south
Cross on cupola of St. Francis Hospital	48	56.5	west of south

Carlton, Carlton County.—The station is in the cemetery, approximately 1 mile south of the town. It is in the edge of the driveway adjoining the county poor lot at the southwest corner of the old part of the cemetery. The station is 102.5 feet and 174.4 feet, respectively, from the south and west fences

Descriptions of stations—Continued.

MINNESOTA—Continued.

of the cemetery, measuring in each case from the thirtieth post from the southwest corner post of the cemetery fence adjoining the highway. The station is marked by a field stone, egg-shaped, small end up, one flat face at the south, about 2 feet in depth, and set flush with the ground. The following true bearings were determined:

	° ′	
Cloquet city steel water tower (mark 6 miles distant)	21 58.7	west of north
New Catholic Church steeple at Carlton	10 03.0	east of north
Apex of Freelove Adelaide Owens monument	22 43.8	east of north

Center City, Chisago County.—The station is in the west end of a vacated street at the south side of the county court-house grounds, 84 feet from the northwest corner of the Bee Bee cottage, and 150.5 feet west from the west corner of the fire-proof vault at the court-house. The station is marked by a granite stone 6 by 6 by 26 inches, set three inches above the surface, and lettered on the top U. S. C. & G. S., 1909. The following true bearing was determined:

	° ′	
North cupola of barn on John Smith's estate (mark)	84 03.3	west of north

Ely, St. Louis County.—The station is 73.9 feet south 11° east from the southwest corner of concrete fence surrounding the "Ely High School 1905" and in a line due south from the center of a concrete pier (16 by 24 by 40 inches high) erected for transit station, this pier being 6 paces east and 2 paces south of southwest corner of concrete fence mentioned. The ground is not fenced in and has numerous bowlders scattered over it. The station is marked by a small wooden stub. The following true bearings were determined:

	° ′	
Flagstaff on hospital	58 25.0	west of north
Water tower (standpipe)	49 25.6	west of north
Catholic church steeple	31 42.0	west of north

Montevideo, Chippewa County.—The station is on the campus of Windom Institute at the north edge of the town. It is 521 feet from the northeast corner of Jones Hall. A line along the east wall of the building passes 61 paces west of the station. The station is marked by a marble block 5 by 10 by 20 inches, set 1 inch above the surface of the prairie sod, and lettered on the top U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Camp Release monument (mark) (3 miles away)	36 47.9	west of south
German country church (3 miles away)	75 49.7	east of north
Church steeple at Watson (7 miles away)	44 00.6	west of north
Northwest corner of Jones Hall (approximately)	26 53	west of south

Morris, Stevens County.—The station is on the grounds of the old Indian school one-half mile northeast from the county court-house. It is in the west edge of the grounds some 30 paces north of the gateway and 307.4 feet west from the southwest corner of the brick building known as the girls' dormitory, located exactly in line with the south wall of the building. It is 35.8 feet from the west fence of the grounds. The station is marked by a limestone post approximately 4 by 5 by 24 inches, set 2 inches above the surface of the ground, and lettered on the top U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
County court-house cupola (mark)	61 34.4	west of south
Cross on Devenney monument (massive granite)	78 49.9	west of north

New Ulm, Brown County.—The station is in the county fair grounds 1¼ miles northwest from the court-house in the field surrounded by the half-mile race track and exactly in line with the north wall of the west wing of the brick exposition building (new 1909). It is 366.6 feet to the west from the northwest corner of said wing of the building. The station is marked by a Bedford stone 8 by 8 by 27 inches, set 1 inch above the surface, and lettered on the top U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Herman's monument (mark)	6 21.9	east of south
Central cross on Catholic chapel	13 01.2	west of south
Church spire at St. George	32 05.7	west of north

Descriptions of stations—Continued.

MINNESOTA—Continued.

Owatonna, Steele County.—The station is about three-fourths mile southwest of the town's center, in the southwest corner of a hay field belonging to R. H. Chapin, which overlooks the valley of the Straight River to the west and north. The Chicago, Rock Island and Pacific Railroad runs along the base of the hill, west of the station. It is 517 feet west of the hedge along the road, 122.3 feet from the fence to the southwest, 112.8 feet from the fence to the south, and 17.4 feet from the tree to the north. The station is marked by a Bedford limestone post 6 by 6 by 36 inches, projecting 2 inches above the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Base of flagstaff on cupola of northeast brick building at state school (mark)	10 00.2	west of north
Center of base of flagstaff on city hall	30 59.9	east of north
Apex on cupola on court-house	35 29.7	east of north
Extreme west edge of top of brick chimney of city water plant	14 27.2	east of north

Park Rapids, Hubbard County.—The station is in the cemetery 1 mile east of town. It is at the south end of the 26-foot driveway upon which the Davis, the Winship, and the Phipps monuments front. It is 114.6 feet from the southeast corner of the base of the Phipps monument, 168.8 feet from the southeast corner of the base of the Winship monument, and 13.5 and 12.5 feet, respectively, from the lot lines on the east and the west sides of the driveway. The station is marked by a large countersink in the end of a brick set in the sand 9 inches below the surface of the natural sod. The following true bearings were determined:

	° ′	
Apex of Davis monument (mark)	6 49.7	west of north
Apex of McKinley monument	20 35.4	west of north

Pine City, Pine County.—The station is in the Protestant portion of the cemetery at the west edge of the town. It is on a reserve space at the south end of the central driveway, 43.7 feet westward from the southwest corner of the base of the Kowalke monument, 43.9 feet northwest from the base of the Glasow monument, and 40.6 feet northeast of the base of the Kick monument. The station is marked by a chiseled hole in the top of a sandstone 5 by 5 by 14 inches, set 8 inches below the surface of the ground. The following true bearings were determined:

	° ′	
High-school tower (mark)	72 49.9	east of south
Barn cupola	74 53.2	west of south

Pipestone, Pipestone County.—The station is near the southeast corner of the campus of the Pipestone Indian Training School, about 1½ miles due north of the town's center. It is 54.4 feet north of a lattice fence on the south edge of the campus, 126 feet east of the center of a road running north and south through the campus, and 124.5 feet northeast of the east edge of the main gate to the campus. The station is marked by a Bedford limestone post 8 by 8 by 42 inches, projecting about 3 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Base of flag pole on city hall (mark)	0 22.8	west of south
East edge of standpipe near base	3 14.7	east of south
Center of base of statue on court-house	2 02.4	west of south

Redwood Falls, Redwood County.—The station is in the Redwood Cemetery 1¼ miles northeast from the county court-house. It is in the center of the main drive one block east from the gateway. It is 51.9 feet southeast of the Schmall monument, 43.8 feet south of the Jaehning monument, 37.3 feet northeast of the Henry D. Chollar monument, and 63.8 feet from the Rev. T. T. Vandollar monument. The station is marked by a block of marble 8 by 8 by 17 inches, set 3 inches below the surface of the prairie sod, and lettered on top U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
City water tank or tower (mark)	36 47.8	west of south
Southwest edge of monument opposite the name Fleischer	76 01.6	west of north

Descriptions of stations—Continued.

MINNESOTA—Continued.

Rochester, Olmsted County.—The station is on the fair grounds, about 1 mile south and one-half mile east of the town's center. It is within the race course at the west end, on a small meadow, 16.6 feet east from the inner board fence of the race course, and 63.6 feet east from the outer board fence of the race course. The station is marked by a Bedford limestone post 6 by 8 by 30 inches, projecting 6 inches above ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Base of flagstaff on city water tank (mark)	42	55.1	west of north
Base of flagstaff on State Hospital for Insane	42	05.9	east of north
Base of flagstaff on central school building	20	19.2	west of north
North edge of base of flagstaff on judges' stand	55	56.8	east of north

Slayton, Murray County.—The station is about 1½ miles west and 1 mile north of the town's center, near the northwest corner of a pasture belonging to Mr. Mark Tisdal. It is 156.4 feet south of a fence south of a road leading to Mr. Tisdal's house, 35.3 feet south from a long row of maple trees, and 179.6 feet southeast of Mr. Tisdal's barn. The station is marked by a Bedford limestone post 8 by 8 by 24 inches, projecting one inch above the surface, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flagstaff on court-house (mark)	50	35.0	east of south
Center of base of flagstaff on high school	49	30.5	east of south
Apex of steeple on Lutheran church	54	00.0	east of south
Center of base of pole on water tank	61	44.3	east of south

St. James, Watonwan County.—The station is in the Protestant cemetery 1 mile south from the county court-house. It is about 100 feet from the north fence of the cemetery and about the same distance from the public road on the east. The station is in the driveway 102 paces due north from the Thornton vault, 75.5 feet northwest from the northwest corner of the base of the Dr. C. R. Bacon monument, 81.7 feet due east from the base of the Weymouth monument, and 52 feet due east from the northeast corner of the base of the H. Hendrickson monument. The spot is marked by a brick tile 5⅛ inches in diameter and 12.8 inches in length, set two inches below the surface of the driveway. The following true bearings were determined:

	°	′	
County court-house tower (mark)	13	56.6	west of north
Front face of base of pillar of Thornton vault	00	15.9	east of south

Stillwater, Washington County.—The station is on the new state prison farm site 2 miles south from Stillwater. It is in the ravine 175.8 feet south of the east corner of the brick valve house at the concrete dam for the water supply of the new prison and on the east side of the ditch leading away from the dam. The station is marked by a limestone 8 by 8 by 24 inches, set 4 inches above the surface of the ground, and lettered on the top U. S. C. & G. S., 1909. The following true bearing was determined:

	°	′	
East edge of valve house (mark)	19	06.2	west of north

Wabasha, Wabasha County.—The station is in the River View Cemetery, approximately 2 miles west of the city. It is on the edge of the bank in what will be the north drive of the new part of the cemetery, at the present time not staked off. It is 140.5 feet southeast of the Dezell monument and 194.5 feet east of the Haines monument. The station is marked by a Bedford stone, 7 by 7 by 26 inches, set flush with the surface of the ground, and lettered on the top U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
South edge above base of Dugan and James families' monument (mark)	82	36.4	west of north
Dan Kopman's barn cupola (on bluff several miles distant)	20	50.6	east of south

Waseca, Waseca County.—The station is within the race course at the county fair grounds, about three-fourths mile northeast of the town's center. It is 84 feet from a tree on the northwest, 66.4 feet from a tree on the southwest, and 29.1 feet north of the northwest corner of the exhibition hall. The station is

Descriptions of stations—Continued.

MINNESOTA—Continued.

marked by a Bedford limestone post, 8 by 8 by 24 inches, sunk level with the surface and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
East edge of base of flagstaff on court-house (mark)	27	17.2	west of south
Center of base of flagstaff on central school building	6	36.1	east of south
Methodist Church steeple	3	28.1	east of south

Windom, Cottonwood County.—The station is in the county fair grounds at the northwest edge of the town. It is near the center of the field, surrounded by the half-mile race course, and is in a line between the one-eighth-mile and three-eighths-mile posts, and slightly south from a line between the quarter-mile post and the judges' stand. It is 85 paces from the center of the north track and 70 paces from the center of the south track. The station is marked by a rough sandstone, 6 by 12 by 18 inches, tapering to 6 by 6 inches at the bottom, set 1 inch above ground, with a ⅝-inch hole in the top and lettered U. S. The following true bearings were determined:

	°	′	
Cross on Catholic Church tower (mark)	78	49.5	east of north
County court-house dome	36	26.5	east of south
High-school tower	24	26.2	east of south
Judges' stand (approximate)	73	08.0	east of south

Winona, Winona County.—The station is in Bluffside Park, 2 miles southwest of the city's center. It is on the grassy slope about 100 feet south from the public road along the north of the park, and is approximately 40 rods from the northeast corner of the park. The station is marked by a Bedford stone, 7 by 7 by 34 inches, projecting 8 inches, and lettered on the top U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Tower on post-office building (mark)	60	41.8	east of north
Tower on a brick building	5	33.0	west of north
Dome on Polish Catholic Church	80	00.4	east of north

Worthington, Nobles County.—The station is in the park on the lake shore about one-half mile southwest from the county court-house. It is 10 paces west from the southernmost point of the park and 10 feet from the edge of the bank at the lake shore. It is 160 feet from the west fence of the park (the present boundary) and 84.2 feet from the pavilion building. The station is marked by a brick tile, 5⅛ inches in diameter and 12½ inches long, set 1 inch below the surface of the ground. The following true bearings were determined:

	°	′	
Barn cupola (mark)	84	03.1	west of south
East edge of passageway in overhead railroad bridge	24	48.3	west of south
West pole on pavilion	18	39.4	east of north
Smokestack at city pumping and light plant	72	24.8	east of south

MISSISSIPPI.

Jackson, Hinds County.—The station of 1908 was reoccupied. It is about 2 miles from the town, on the grounds of Millsaps College, on the south side of Observatory Hill, about 300 feet south of the observatory and 224.5 feet east of a board fence. The station is marked by a limestone post, 6 inches square, projecting 3 inches above the ground. A hole in the top marks the exact spot. The following true bearings were determined:

	°	′	
Lower east edge of cupola on main college building (mark)	8	44.5	east of south
Point on cupola of main college building	8	10.4	east of south
Base of rod on cupola of Orphans' Home	40	06.4	west of north

Meridian, Lauderdale County.—The station of 1901 was reoccupied. It is about 2 miles from the town, on the grounds of the State Asylum for the Insane. It is about 150 feet south of the walk leading

Descriptions of stations—Continued.

MISSISSIPPI—Continued.

to the front of the main building and 260 feet from the southeast corner of this building. The station is marked by a stone post, 6 inches square, projecting 3 inches above the surface of the ground. The following true bearings were determined:

	° ′	
Upper northwest corner of building farthest to the southwest, under eaves (mark)	57 24.3	west of south
Lower south edge of main building	81 18.0	west of south
Flagstaff on main building	58 55.2	west of north

MISSOURI.

Lebanon, Laclede County.—The station is in the high-school playgrounds 197 feet east from the northeast corner of the building, and 121.5 feet from the east edge of the cement walk which runs north and south in front of the building between the building and the playgrounds. It is 177 feet from the northeast corner of the block on which the building stands at the north end of the cement walk. The station is marked by a Bedford limestone post, 6 by 6 by 20 inches, sunk level with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Southeast corner of schoolhouse (mark)	79 51.0	west of south
Court-house flag pole	36 07.1	east of south
Congregational Church spire	69 25.4	east of south

Rolla, Phelps County.—The station is located on the campus of the Missouri State School of Mines, 211.5 feet due north of the northwest corner of Norwood Hall, and 125 feet east of the east edge of the cement walk which runs north and south west of Norwood Hall. It is 21.5 feet southwest of a cement marking stone established by "1909" civil engineering students. The station is marked by a Bedford limestone post, 6 by 6 by 20 inches, sunk level with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Northwest corner of house across street, southwest of Norwood Hall (mark)	11 20.0	west of south
Right (north) edge of tallest smokestack at power plant	68 01.2	west of south
Northeast corner of metallurgy building	71 59.3	east of south

NEBRASKA.

Alma, Harlan County.—The station is on the high-school square in the north part of town. It is 131.5 feet north and a little west of the northwest corner of the schoolhouse, and 48 feet south and a little east of the electric-light pole at the northwest corner of the grounds. The station is marked by a Bedford limestone post, 6 by 6 by 22 inches, sunk level with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Court-house flag pole (mark)	19 41.5	west of south
Evangelical Church spire	18 10.6	west of south
Water standpipe tip	4 21.0	east of south

Auburn, Nemaha County.—The station is within the space inclosed by the race track in the fair grounds north of the town. It is 133.5 feet northeast from the outside race-track fence at the northeast corner of the grand stand and 112 feet north of the northeast post of the judges' stand. The station is marked by a Bedford limestone post, 6 by 6 by 18 inches, sunk level with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Left edge of iron smokestack (mark)	3 21.1	west of north
East gable of house at northwest corner of fair grounds	21 38.4	west of north
Left edge of chimney on cottage	57 10.6	west of north

Descriptions of stations—Continued.

NEBRASKA—Continued.

Bloomington, Franklin County.—The station is in the northeast corner of the court-house yard. It is 110 feet northeast from the northeast corner of the court-house and 112.5 feet east of the cement walk running north to the street from the center of the court-house. The station is marked by a Bedford limestone post, 6 by 6 by 22 inches, sunk level with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Flag pole Helfferich Hotel (mark)	14	03.1	east of south
Base of cross on church spire	68	15.1	east of south
Spire of brick church	16	31.6	east of north

Central City, Merrick County.—The station is situated near the southeastern corner of the cemetry, about one-half mile east and 1½ miles north of the town's center. It is in the center of a north-south alley, 141.1 feet north of the cemetery fence, 142.8 feet northwest from the northwest corner of the office, 15.5 feet northwest from the northwest corner of the Conner monument, and 142 feet from the middle of the road on the east. The station is marked by a Bedford limestone post, 6 by 6 by 28 inches, set level with the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Northwest corner of the capstone on G. A. R. monument (mark)	14	44.1	east of north
West edge of extreme top of standpipe	22	35.7	west of south
Cross on Catholic Church steeple	23	11.1	west of south
Spire on cupola of high school	8	58.7	west of south

Columbus, Platte County.—The station is situated near the northeast corner of the cemetery, about 1 mile east and one-fourth mile south of the town's center. It is 156.7 feet southwest from the south rail of the Union Pacific Railroad, 156.3 feet west of the cemetery fence, and 38.2 feet northwest from the northwest corner of the Oppliger monument. The station is marked by a Bedford limestone post, 6 by 6 by 28 inches, set level with the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
North edge of gilded ball at base of cross on Catholic Church steeple (mark)	56	30.2	west of north
North edge of black ball at base of cross on cupola of hospital	50	59.0	west of north
Northeast corner of top of the H. S. Elliott monument	7	11.3	west of south

Dakota City, Dakota County.—The station is situated near the southeast corner of the cemetery, about 1 mile north of the town's center. It is 216 feet from the west cemetery fence, 85.1 feet from the east fence, and 87.9 feet from the south fence. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1909, and set level with the ground. The following true bearings were determined:

	°	′	
West edge of top of monument to Adam J. Sides (mark)	2	55.0	east of north
Northwest corner near center of basestone of L. A. Harte's monument	68	54.1	west of south
Northwest corner of base of brick chimney on F. Wasmond's house	79	43.9	east of north

Falls City, Richardson County.—The station is in the city park at the west side of town. It is 103 feet northwest from the northwest corner of the west end of the Auditorium and 77 feet west from the fence running north from the west end of the same. It is about 300 or 325 feet west and a little south of the main entrance to the park. The station is marked by a Bedford limestone post 6 by 6 by 18 inches, lettered U. S. C. & G. S., and sunk level with the ground. The following true bearings were determined:

	°	′	
East edge of smokestack at waterworks power-house (mark)	40	39.0	west of south
East gable of a brick house	55	17.8	west of north
Right edge of chimney on Doctor Hahn's residence	56	11.8	east of north

Descriptions of stations—Continued.

NEBRASKA—Continued.

Fremont, Dodge County.—The station is situated near the north center of the cemetery, about one-fourth mile north and 1¾ miles west of the town's center. It is 86.6 feet from the center of the road on the south, 57 feet northeast from the northeast corner of Haubensak monument, and 143.6 feet northwest from the northwest corner of the Springer monument. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set level with the ground, and lettered U. S. C. & G. S., 1909. The following true bearing was determined:

	°	′	
North edge of top of standpipe (mark)	73	41.2	east of south

Greeley, Greeley County.—The station is situated on the county fair grounds, about one-half mile south of the town's center, near the north end of the space within the race track. It is 196.7 feet from the fence on the north, 222 feet from the fence east of the Burlington and Missouri River Railroad, 318.5 feet northwest from the northwest corner of the judges' stand, and 328.8 feet southwest from the northwest corner of the Floral Hall. The station is marked by a limestone post 6 by 8 by 20 inches, sunk 4 inches below the surface of the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Spire on steel water tank (mark)	14	05.0	east of north
Spire on cupola of high school	7	18.4	east of north
East edge of ball at base of cross on Catholic Church steeple	9	24.6	west of north

Hebron, Thayer County.—The station is in the school grounds in the northeastern part of town, at the northwest corner of the grounds. It is 141 feet northwest from the northwest corner of the school building and 32.5 feet northeast from a small elm tree standing on the west line of the grounds. The station is marked by a Bedford limestone post 3 by 8 by 18 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Presbyterian Church spire (mark)	52	47.2	west of south
Court-house flag pole	64	49.8	west of south
Right edge of chimney on a residence on the hill northwest of station	47	40.8	west of north

Nebraska City, Otoe County.—The station is in the grounds of the State Institution for the Blind, north of the town. It is 196 feet west from the southwest corner of the main building and 66.5 feet south from the fence along the orchard. The station is marked by a Bedford limestone post 6 by 6 by 18 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Northwest corner of brick cottage (mark)	16	42.1	west of south
Flag pole on institute cupola	82	54.4	east of south
Left edge of institute building	74	34.4	east of north

Nelson, Nuckolls County.—The station is in the fair grounds south of the town, just outside the race track and north of the grand stand. It is 74.5 feet north and a little east from the northwest corner post of the grand stand (new addition) and 28 feet west from the outside race-track fence. The station is marked by a cement block 8 by 10 by 15 inches, unlettered, with a hole drilled in the center of the top, and sunk level with the ground. The following true bearings were determined:

	°	′	
Court-house flag pole (mark)	21	26.9	west of north
Schoolhouse flag pole	34	36.8	west of north
Flag pole on square building on the fair grounds	60	48.1	west of south

Ord, Valley County.—The station is situated near the south center of the cemetery, about three-fourths mile northwest from the town's center. It is near the center of a north-south avenue, 21 feet east from the northeast corner of lot 228, 23.6 feet west from the northwest corner of lot 219, and 200 feet

Descriptions of stations—Continued.

NEBRASKA—Continued.

from the south cemetery fence. The station is marked by a Bedford limestone post 6 by 6 by 28 inches, set level with the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flagstaff on court-house (mark)	42	49.4	east of south
Center of base of flagstaff on cupola of high school	38	26.5	east of south
South edge of ball at base of cross on Catholic Church steeple	50	26.6	east of south

Pawnee City, Pawnee County.—The station is on the school grounds 133.5 feet northwest from the northwest corner of the primary school building, and 26.5 feet east from the inside fence on the west, and 80 feet south from the fence on the north. The station is marked by a cement block 6 by 10 by 24 inches, sunk level with the ground, and roughly lettered U. S. C. & G. S. The following true bearings were determined.

	°	′	
Cupola on academy building (mark)	2	35.7	east of north
Gable on southwest corner of academy building	1	45.9	east of north
Flag pole in cemetery	78	26.7	west of south

Pierce, Pierce County.—The station is situated near the northwest corner of the county fair grounds, about 1 mile south of the town's center. It is on the right-hand side of the road leading into the fair grounds, in line with the main gate and the judges' stand. It is 113.4 feet south of a fence on the north, 164.6 feet southwest of a large tree north of the main gate, and 172.5 feet northwest of a board fence around the race track. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set level with the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flagstaff on steel water tank (mark)	5	57.8	west of north
Southeast corner of barn at fair ground (4 feet from the ground)	86	19.3	east of north
Southwest corner of top of brick chimney on house of John Druebert	3	19.0	west of north

Plattsmouth, Cass County.—The station is on the eastern part of the school grounds on the hill west of the business part of town. It is 147 feet east from the schoolhouse and 126.5 feet north from the inside edge of the cement walk running east and west on the south side of the grounds. The station is marked by a rough limestone rock about 7 by 7 by 14 inches, unlettered, with a small hole drilled in the center, and sunk level with the ground. The following true bearings were determined:

	°	′	
Right edge of chimney on house on hill 1 mile south (mark)	2	10.1	west of south
Southwest corner of church	3	01.1	east of south
Southeast corner of high school	68	03.2	west of south

Red Cloud, Webster County.—The station is on the old school grounds northeast of the court-house block. It is in the southwest corner of the block, 132 feet southwest of the southwest corner of the school building and 53 feet north from the inside edge of the walk on the south side of the grounds. The station is marked by a Bedford limestone post 6 by 6 by 22 inches, sunk level with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Northwest corner of the Congregational Church (mark)	0	19.0	west of south
Southeast corner of school	50	18.5	east of north

Stanton, Stanton County.—The station is situated near the south center of the cemetery, about 1½ miles northeast of the town's center. It is 44.5 feet northwest from the northwest corner of the Sharp monument, 48 feet from the center of the road on the west, and 51 feet southwest from the southwest

Descriptions of stations—Continued.

NEBRASKA—Continued.

corner of the Mack monument. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Top of spire on Lutheran Church (mark)	38	42.4	west of south
Center of ball on court-house dome	37	14.7	west of south
Southeast corner of base of east brick chimney on house of Mr. Perry	34	10.4	west of north

Wayne, Wayne County.—The station is situated near the southeast corner of the cemetery, about three-fourths mile northwest of the town's center. It is in the center of a north-south alley, 116.2 feet from the south cemetery fence, 249.6 feet from the east fence, and 132.4 feet from the southeast corner of the cemetery office. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set level with the ground, and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flagstaff on court-house (mark)	67	22.9	east of south
North edge of top of standpipe	78	24.0	east of north
Spire on large water tank at normal school	53	40.0	east of north

Wilber, Saline County.—The station is in the northeast part of the court-house grounds, 25 feet south from the inside edge of the brick walk running along the north side of the grounds, and 85 feet southwest from the outside corner of the walks at the northeast corner of the grounds. It is marked by a cement block 8 by 10 by 12 inches, sunk level with the ground and roughly lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Northwest corner of house south of station (mark)	0	58.4	west of south
Court-house flag pole	51	09.2	west of south
Northwest corner of court-house	67	46.6	west of south

NEW HAMPSHIRE.

Concord, Merrimack County.—The station is on city property about three-fourths mile northeast of the town's center. It is near the east bank of the Merrimack River, 100 paces north of the north walk on Bridge street, 120 feet from a tree on the bank of the river, and 143.6 feet east of a corner stone projecting 6 inches above ground. The station is marked by a granite post 8 by 8 by 40 inches, lettered U. S. C. S., center marked, and set level with the ground. The following true bearings were determined:

	°	′	
Spire on Congregational Church (mark)	73	57.0	west of north
Spire on First Methodist Church	83	34.0	west of north
Apex of dome on statehouse	72	29.0	west of south
Spire on Catholic Church	22	16.3	west of south

Gorham, Coos County.—The station is near the center of a pasture belonging to Mrs. Hitchcock, about three-fourths mile southeast of the town's center. Observations were made on a granite field stone, rounded on top, and with a half-inch hole marking the exact spot. The station is 29.15 feet from the point of an arrow pointing toward it, which was cut on the top of a very large stone to the southwest. It is in line with two large stone piles about 340 feet apart. The following true bearings were determined:

	°	′	
Ball on Methodist Church spire (mark)	53	33.8	west of north
Northwest corner of cement power house	54	22.6	east of north
Chimney at top of Mount Washington	43	00.1	west of south
Monument on apex of Mount Madison	58	15.5	west of south
Cross on Catholic Church spire	61	09.0	west of north

Descriptions of stations—Continued.

NEW HAMPSHIRE—Continued.

Plymouth, Grafton County.—The station of 1905 was reoccupied. It is west of the village, on Mr. D. M. Tenney's farm, and near the top of a knoll, back of a wood of small trees. Observations were made over the exposed top, level with the ground, of a granite stone or portion of the bed rock, which was marked with the letters U. S. From the station to the end of an arrow cut across the top of a large rounded stone is 19.7 feet, bearing 79° 40′ west of south. The north face of a stone is 67.7 feet a little west of south and another stone is 80.1 feet a little east of south. The following true bearings were determined in 1905:

	°	′	
West gable of distant large barn (mark)	58	06.9	east of north
West gable of house in village	84	43.6	east of south
Northeast gable of Mr. C. Preece's house	64	29.8	west of north
East edge of large stone in pasture 1 mile away	4	24.9	west of north

Woodsville, Grafton County.—The station is in a meadow belonging to Mr. E. B. Mann, about one-fourth mile south of the town's center. It is about east of the middle of an island in the Connecticut River and in line with the chimneys of a row of cottages and a barn on the east side of Court street. It is 36 feet from the east bank of the Connecticut River, 70 feet northeast from a willow tree on the bank of the river, 128 paces (374 feet) from an elm tree at the foot of the hill to the east. The station is marked by a granite post 6 by 6 by 30 inches, center marked with a ½-inch hole. The stone is not lettered. It is set flush with the surface of the ground. The following true bearings were determined:

	°	′	
Spire Congregational Church, Wells River, Vt. (mark)	79	56.3	west of north
Cupola on High school, Wells River, Vt	75	45.8	west of north
Ball on court-house tower	46	57.8	east of north
Spire Methodist Church	62	35.0	east of south
Ball at base of weather vane on large barn	3	22.1	east of south

NEW JERSEY.

Boonton, Morris County.—The station is near the northern corner of the Presbyterian cemetery on the hill about three-fourths mile northeast of the Delaware, Lackawanna and Western Railroad station. It is near the middle of the pathway running parallel to the northeast wall of the cemetery at a point about 50 feet southwest of the wall and about 100 feet southeast of the northwest wall. The station is 17.6 feet northeast of the north corner of the Looker monument and 12 feet south of the southeast edge of the tombstone of Elizabeth Steventon. The station is marked by a block of concrete 6 by 8 by 9 inches (unlettered), with a hole in the center and buried flush with the path. The following true bearings were determined:

	°	′	
Tip of Hill monument about 150 feet away	16	33.6	east of south
West side of chimney on distant house (mark)	23	13.2	east of south

Trenton, Mercer County.—The station of 1903 was not recovered. A new one was established as near as possible to the old one. It is on the front lawn of the grounds of the State Hospital for the Insane, about 400 feet southeast and in front of the main building. It is about 94 feet east of the large tulip tree in the center of the lawn, 61 feet about west-southwest of a maple tree near the pathway, and about 77 feet southwest of another maple tree near the pathway. The station is marked by a marble post 6 by 6 by 18 inches (unlettered), buried flush with the ground, and having a hole in its center to mark the exact point. The following true bearings were determined in 1910:

	°	′	
Tip of sundial near fountain in front of main building (mark)	63	58.7	west of north
Peak of central tower on main building	56	22.6	west of north
Peak of west tower on main building	80	09.6	west of north

Descriptions of stations—Continued.

NEW MEXICO.

Deming, Grant County.—The station of 1905 was reoccupied. It is in the northwest corner of a lot owned by Mr. W. C. Wallis, about 1 mile south of the Presbyterian Church and one-half mile west of a water tank and windmill at a ranch house. It is 150.4 feet a little south of east of a stone at the intersection of the road along the south limit of the town and a line of telephone poles. It is 99 feet south of the southern town section line, and about 132 feet east of a property line to the west, running north and south. The station is marked by a stone 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1905, and projecting 6 inches above ground. The following true bearings were determined in 1905:

	°	′	
Cross on Catholic Church (mark)	39	49.2	east of north
Flag pole on public school	32	24.8	east of north
Top of belfry Presbyterian Church	20	32.2	east of north
Highest point on Cook's Peak	6	18.1	east of north

Lordsburg, Grant County.—The station of 1903 was reoccupied. It is in the vacant space on the south side of the railroad, being south of the Methodist Church, 232.1 feet from the southeast corner of the adobe across the street from Mrs. Marble's house, and nearly in line with this adobe and the cupola of the church. The station is marked by a limestone post 4 by 11 by 24 inches, projecting 4 inches above ground. The following true bearings were determined in 1910:

	°	′	
Point at top of Southern Pacific Railroad water tank (mark)	13	31.5	west of north
Base of flagstaff on the schoolhouse	3	53.1	west of north
Steeple of Methodist Church	16	55.8	east of north

NEW YORK.

Carmel, Putnam County.—The station is on ground belonging to New York City, as a part of the Croton water system, near the northwest corner of Lake Gleneida close to the channel connecting it with reservoir D. The station is 17 feet north of the edge of the lake, 14.8 feet east of the west edge of the masonry wall east of the channel. It is marked by a granite post 6 by 6 by 42 inches, buried with its face about 1 inch above ground, and having a cross cut in its center to mark the exact spot. The following true bearings were determined:

	°	′	
Tip of northeast gable of railroad station (mark)	34	22.8	east of south
Belfry of schoolhouse	37	04.1	east of south
North side (farthest projecting brick) of north chimney of Mr. Weeks's house, about 500 feet distant	83	55.8	west of south

Lake Placid, Essex County.—The station of 1907 was reoccupied as nearly as could be determined from the measured distances, the stone having been removed or buried in grading. It is 20 feet from the water's edge, on the south shore of Lake Placid. It is on the Schell property, 83.3 feet north and slightly west from the northwest corner of the house porch. It is 102.7 feet west from the United States land survey monument No. 262, which is set in a granite rock near the water's edge. Observations were made over a wooden stake. The following true bearings were determined in 1909:

	°	′	
Tall flag pole west of new house on north shore of Lake Placid (mark)	7	52.0	east of north
Episcopal Church spire	14	05.7	east of south
Flag pole on Bide a Wee House	25	57.8	west of south
Flag pole across lake	28	56.1	east of north

Descriptions of stations—Continued.

NEW YORK—Continued.

Potsdam, Saint Lawrence County.—The station of 1874 could not be recovered. A new station was located in the north-central part of the city park lying just west of the state normal school. The grounds are thickly covered with trees and surrounded by a low fence of stone posts with chain railing. The station is 40 feet south, 115.5 feet east, and 86 feet west of the fence. It is marked by a 3-inch sewer tile filled with cement and projecting 1 inch above ground. The following true bearings were determined:

	°	′	
Large head of screw in center of white doorknob	10	58.1	east of south
Methodist Church spire	71	10.3	west of south
Spire on northwest corner of Baptist Church	16	35.3	east of north
Presbyterian Church spire	57	58.3	east of north
Normal school spire	55	25.8	east of south

Wilson, Niagara County.—The station is in the southwest corner of the grounds of the Wilson Union School. It is 32 feet 3 inches from the west fence, 46 feet 2 inches from the south fence, 97 feet 11 inches from the southwest corner of the schoolhouse, and 7 feet 6 inches north of the south face of the rear part of the schoolhouse produced westward. The station is marked by a sewer tile 3 by 26 inches, the upper part filled with cement, and lettered U. S. C. & G. S., projecting 3 inches above ground. The following true bearings were determined:

	°	′	
South end of gable on residence of Mr. George Hamblin	5	57.0	east of north
Spire on Methodist Church	37	40.4	east of north
Flag pole on Wilson Union School	82	04.0	east of north
Northeast corner post of cupola on residence of Mr. Wm. Albright	65	58.0	east of south

NORTH DAKOTA.

Pembina, Pembina County.—The station of 1905 was recovered. It is about 700 feet southward from the junction of the Pembina and Red rivers, on land held by the city and now used as a baseball park. It is 536 feet from the west side of the county road and 73 feet from the board fence inclosing the park, measured in prolongation of the line perpendicular to the county road. From a point 6 feet west of the station a flag pole and the Catholic Church spire appear in line. The station is marked by a cement block 6 by 10 by 24 inches sunk flush with the ground, and marked U. S., 1905. The following true bearings were determined in 1905:

	°	′	
Icelandic Lutheran Church spire (mark)	41	53.8	west of south
Catholic Church spire	9	56.0	west of north
East dormer gable of Oliver's house	70	26.1	west of south

OHIO.

Dayton, Montgomery County.—The station of 1905 was reoccupied. It is in the grounds of the National Soldiers' Home, 103.2 feet from a double ash tree, 155.3 feet from a 12-inch ash tree to the northeast, and 65.4 feet from the middle of West Virginia avenue. The station is marked by a marble post 6 by 6 by 21 inches, set flush with the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1910:

	°	′	
Right edge of standpipe (mark)	51	45.8	east of south
Left edge of standpipe	52	30.6	east of south
Cupola on headquarters	88	03.7	east of south
Protestant chapel steeple	81	34.4	east of north
South cupola on hospital	56	50.3	east of north

Descriptions of stations—Continued.

PENNSYLVANIA.

Easton, Northampton County.—The station of 1902 could not be recovered. A new one was established in the northwest part of the March athletic field of Lafayette College, 38 feet southeast of the concrete wall surrounding the field, 12 feet northwest of the outer edge of the running track, and 1 foot southwest of the continuation of one of the sides of the baseball diamond. The station is marked by a marble post 6 by 6 by 15 inches, lettered U. S. C. & G. S., and buried with its face flush with the ground. The following true bearings were determined in 1910:

	°	′	
Church spire 2 miles away (mark)	37	26.8	west of south
Tower of another church about 1 mile away	23	29.1	west of south
Peak of clock tower on campus	36	44.7	east of south

Meadville, Crawford County.—The station of 1908 was reoccupied. It is in St. Bridget's Catholic cemetery, in the south edge of the cinder drive, 81.6 feet from the northeast corner of the base of the Geary monument, and 96.7 feet from the northeast corner of the base of the Lyons monument. The station is marked by a white marble stone 7½ by 7⅜ inches on top, which is lettered U. S. C. & G. S., 1902, and projects 1 inch above the ground. The following true bearings were determined:

	°	′	
Right edge of right (south) chimney on Mr. Lark's dwelling (mark)	33	55.7	east of north
Tower on Hulings Hall of Allegheny College	18	47.2	west of north

Norristown, Montgomery County.—The station is in Riverside cemetery, about 1 mile northwest of the court-house. It is near the northeast corner of the cemetery, about 300 feet northwest of the inner gate and about 1,500 feet from the outer entrance, at the street-car tracks. It is 30 feet south of the north fence and 126 feet west of the east fence, and 52 feet west of the southwest corner of a barn belonging to the cemetery. The station is marked by a Bedford limestone post 5 by 5 by 20 inches, buried with its face flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Tip of pyramidal column marking grave of John C. Hambrecht, distant about 300 feet (mark)	13	03.8	east of south
Peak of Rittenhouse country home (about 1 mile away)	49	51.3	west of north
West gable of cemetery caretaker's house	89	13.8	east of south

PORTO RICO.

Porto Rico, Magnetic Observatory, Vieques Island.—Since April, 1907, the observatory has been in operation at the new site, about five-eighths mile west of old Fort Isabel, the former location. The buildings comprise an absolute observatory, variation observatory, seismograph house, and an office.

RHODE ISLAND.

Kingston, Washington County.—The station of 1904 was reoccupied. It is on the grounds of the Rhode Island Agricultural College, on the open square south of Lippitt Hall. It is 236.3 feet east of the northeast corner of the dormitory and 175 feet southwest of the flag pole. The station is marked by a marble post 10 by 10 by 30 inches, set about 2 inches below the level of the ground, and lettered U. S. C. S. A one-half inch hole in the center marks the exact spot. The following true bearings were determined in 1904:

	°	′	
Congregational Church spire (mark)	12	19.5	east of south
Boarding hall lightning rod	66	32.5	west of south
Cap of north tower Davis Hall	82	51.9	west of north
Experiment station weather vane	51	56.0	west of north
Dairy barn weather vane	14	42.5	west of north

Descriptions of stations—Continued.

RHODE ISLAND—Continued.

A second stone marking a meridian line was set 290 feet south of the station and 51.3 feet slightly southeast of a tree. This stone is of granite, 7 by 7 by 36 inches, set flush with the ground, and unlettered. It has a 1-inch hole about 2 inches deep in the center of top, which bears 0° 02′.6 west of south from the magnetic station.

Providence, Providence County.—The station of 1904 was recovered. It is on city property on the grounds of the Socanosset reservoir, about 5 miles (air line) southwest of city hall. It is in a pasture south of the center of the reservoir, and about 125 yards west from a house where the gatekeeper lives, and about 120 yards from the nearest wall of the reservoir. It is 36.4 feet from a wire fence on the north side and 47.1 feet due east of an oak tree. It is also 61.3 feet due west of an ash tree. A second stone marking a meridian line was set 251.7 feet due south of the station. This stone is 18.1 feet northeast of an ash tree and 188.7 feet from the south wall of a pasture. The stones are each 4 feet long, 12 inches square at bottom, and 6 inches square at top, set flush with the ground, and lettered U. S. C. S. A small hole 1½ inches deep marks the exact spot. The following true bearings were determined:

	°	′	
Tower main hall Rhode Island Reform School for Boys (mark)	37	53.9	east of south
Flag pole Socanosset School	50	43.8	east of south
Northeast spire on gatehouse to reservoir	18	56.0	east of north

SOUTH CAROLINA.

Charleston, Charleston County.—The station is at the eastern end of Sullivan's Island, near Breach Inlet, and is reached by the car line which runs to the Isle of Palms. It is almost on a direct line between station No. 29 and an embankment and pit used in rifle target practice, about 750 feet from the trolley line and 500 feet from the embankment. The Fort Moultrie water tank and a red steeple on a Catholic church are almost in line at the station. The station is marked by a wooden stake about 1 by 5 inches, set so that its top projects about 3 inches above ground. The following true bearings were determined:

	°	′	
Charleston Light-house (mark)	36	25.4	west of south
Cupola beyond Fort Moultrie	63	50.4	west of south
Red church steeple	64	46.4	west of south
Ferris wheel	56	01.4	east of north

SOUTH DAKOTA.

Armour, Douglas County.—The station is situated on the fair grounds, about one-half mile north of the town's center, near the northwest corner of the space enclosed by the race course. It is 180.3 feet east of the fence west of the race course, 229.3 feet south of the fence north of the race course, and 536.7 feet north from the northeast corner of the grand stand. The station is marked by a Bedford limestone post, 6 by 6 by 30 inches, projecting 1½ inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flag pole on high school (mark)	0	26.6	east of south
Center of base of cross on Catholic Church	3	00.7	east of south
Apex of steeple on Methodist Church	17	05.0	east of south

Flandreau, Moody County.—The station is near the southeast corner of the campus of the Flandreau Indian School, about 1 mile due north of the town's center. It is 254.5 feet northeast of the superintendent's house, 352.2 feet southwest of the dining hall, and 144.5 feet south of the band stand. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set level with the surface and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of pole on water tank (mark)	18	39.0	east of south
Apex of Methodist Church steeple	2	26.6	east of south
Center of base of flag pole on high school	26	14.8	west of south

Descriptions of stations—Continued.

SOUTH DAKOTA—Continued.

Madison, Lake County.—The station is on the fair grounds, about three-fourths mile east of the town's center, in the northwest corner within the race course. It is 141.5 feet south and a little west from the judges' stand, 200.5 feet south from the southwest corner of the grand stand, and 310 feet east from the north barn west of the race track. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 1 inch above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flag pole on court-house (mark)	83	55.4	west of north
North edge of standpipe at top	74	13.8	west of north
Apex of cupola on "east hall" of normal school	55	14.9	west of north

Mitchell, Davison County.—Observations were made on the grounds of the Dakota Methodist University, on the high ridge about one-half mile south of the Chicago, Milwaukee and St. Paul Railway passenger station, at a point about 16 feet to the westward of the 1896 station. The 1909 station is 222.0 feet west of the west face of college hall, 44.2 feet north of the north face of college hall, and 22.8 feet north of the north edge of the walk running along the north side of the building. The station is marked by a concrete block 4 by 4 by 12 inches with a hole in its side and lying horizontally 1 foot below the ground. A vertical concrete block 4 by 4 by 12 inches rests on the lower block and projects about three-fourths inch above ground. A hole in the top marks the exact point. The following true bearings were determined in 1909:

	°	′	
Cross on Catholic Church (mark)	29	11.5	east of north
South gable of house	80	23.2	east of north
Spire on college hall	79	52.4	east of south

Plankinton, Aurora County.—The station is situated near the south center of the cemetery, near the center of a north-south alley, and about 1½ miles northeast of the town's center. It is 84.6 feet northwest from the northwest corner of Mulliran monument, 78.2 feet west from the northwest corner of Groves's monument, and 86.7 feet southeast from the southeast corner of Lindsey's monument. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 1 inch above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flagstaff on court-house (mark)	76	34.4	west of south
Center of base of flagstaff on high school	58	43.5	west of south
Center of base of cross on Catholic Church	65	53.8	west of south
East edge of steel ball on steel tank at Reform School	29	37.8	west of north

Tyndall, Bonhomme County.—The station is situated near the east center of the cemetery, about 1 mile west of the town's center. It is 164.4 feet from the north fence of the cemetery, 171.9 feet from the east fence, and 158.2 feet east and a little south from the southeast corner of the base stone of the Grand Army of the Republic monument. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting half an inch above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flagstaff on high school (mark)	61	06.7	east of south
Center of base of cross on Catholic Church	88	12.9	east of north
Center of base of pole on city water tank	80	02.3	east of north

Vermilion, Clay County.—The station is situated on the campus of the State University, about one-half mile northeast of the town's center. It is near the southwest corner of the campus, 36 feet north from the cement walk on the south and 114 feet east from the cement walk on the west. The station is marked by a Bedford limestone post 10 by 10 by 36 inches, projecting about 3 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Northwest corner of College of Law, top of fourth stone from ground (mark)	79	59.9	east of north
West edge of base of flagstaff on main college hall	37	48.0	east of north
Southwest corner of College of Law, center of tenth stone from ground	89	59.4	east of north

Descriptions of stations—Continued.

SOUTH DAKOTA—Continued.

A second stone of equal size and similarly lettered was set 400 feet due north of the first to mark a meridian line.

Wessington Springs, Jerauld County.—The station is situated near the south central part of the cemetery, about one-half mile southeast of the town's center. It is 30.3 feet northwest from the northwest corner of the base stone of the Barret monument, 27 feet west from the southwest corner of the base stone of the Hall monument, 40.6 feet southwest from the southwest corner of the base stone of the Toofelmire monument, and 136.5 feet northeast from the southwest corner of the cemetery fence. The station is marked by a Bedford limestone post 6 by 6 by 30 inches set level with surface and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of base of flag pole on high school (mark)	32	24.9	west of north
Flagstaff on seminary, on a level with top of chimney	44	31.2	west of north
Center of base of cross on Catholic Church steeple	22	33.0	west of north

Woonsocket, Sanborn County.—The station is situated near the west center of the cemetery, about one-half mile northwest of the town's center. It is near the center of a north-and-south alley, 118.5 feet from the board fence on the east, 237 feet from the board fence on the south, and 44.1 feet north and a little west from the northwest corner of the base stone of the tombstone to the Briggs family. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set level with the surface and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Rod on cupola of high school (mark)	29	54.0	east of south
Southeast corner of base stone of tombstone to Mr. Reese	56	57.9	west of south
Northwest corner of base stone of tombstone to the Willis family	14	04.8	west of south

Yankton, Yankton County.—The station of 1905, on Observatory Hill of the Yankton College grounds, about three-fourths mile north of the town's center, was reoccupied. It is 205.1 feet southeast from the southeast corner of the observatory, 46.1 feet northwest of an elm tree, and 860 feet south of the main hall of the college. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting 4 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1909:

	°	′	
Pinnacle on southeast corner of tower below dome on new court-house (mark)	25	28.6	west of south
Flag pole on old court-house	7	11.9	west of south
Ball on spire, southwest corner of main college hall	5	09.6	east of north

TENNESSEE.

Athens, McMinn County.—The station of 1903 was reoccupied. It is on a hill north of the town, about 800 feet northeast of the railroad station and about 600 feet south of the standpipe. It is 43 feet east of an apple tree and 118 feet southeast of the lower road from Athens to Sweetwater. The station is marked by a stone 3 by 8 by 16 inches, lettered U. S. C. & G. S., 1903, on top, in the center of which there is a drill hole. The following true bearings were determined in 1903:

	°	′	
Spire on Baptist Church (mark)	35	06.3	east of south
Cupola of the Bandfield Home	28	05.6	east of south

Franklin, Williamson County.—The station is in the southwestern corner of the ground surrounding the People's Academy, about 1 mile a little west of south of the town's center. It is about 69 feet from the fence on the south and about 400 feet southwest of the southwest corner of the main academy building. The station is marked by a blue limestone post 6 by 8 by 35 inches, projecting about 7 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
South cupola on tower of Episcopal Church (mark)	18	48.9	east of north
Upper southern corner of tower on Cumberland Presbyterian Church, under eaves	17	45.2	east of north
Spire on the cupola of parsonage of Methodist Episcopal Church	63	24.5	east of north

Descriptions of stations—Continued.

TENNESSEE—Continued.

Gallatin, Sumner County.—The station is in the northwest corner of the ground surrounding Hawkins's Training School, about 1 mile east of north of the town's center. It is 72 feet from the fence to the north, 260.3 feet northwest of the northwest corner of the horse shed, and about 324 feet northwest of the northwest corner of the school building. The station is marked by a blue limestone post 7 by 7 by 26 inches, projecting about 3 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
North gable of barn on the William Allen farm (mark)	59	38.9	east of south
Upper northeast corner of gymnasium, under eaves	17	44.5	east of south
West point at top edge on roof of small yellow house with red roof	37	49.9	east of south

Knoxville, Knox County.—The station of 1907 was reoccupied. It is on the University of Tennessee experiment farm, about 1½ miles from the court-house in a southwesterly direction. It is about 3 feet from the eastern edge of the lawn east of the dwelling house, 42.7 feet from the northeast corner of the house, and 62.7 feet from the east post of the south piazza. It is marked by a square marble post, projecting about 2 inches above the lawn and lettered U. S. C. S. The following true bearings were determined in 1907:

	°	′	
Spire on Daniel Briscoe's residence (mark)	44	47.5	east of north
Cupola of public school	75	32.6	east of north
Southeast corner of dormitory	64	24.8	west of south
Center of south gable of gray house	18	19.5	west of north
Center of east chimney of same house	17	53.4	west of north

Lawrenceburg, Laurence County.—The station is in the southwest corner of the ground surrounding the high school, about one-half mile south of east of the town's center. It is 115.6 feet from the fence bounding the ground on the west and 107.3 feet from the fence on the south. The station is marked by a blue limestone post 6 by 8 by 33 inches, projecting about 5 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
East gable on Jim Crew's barn, about 1 mile to the northeast (mark)	39	09.6	east of north
Lower southwest corner of brick foundation of high school	17	57.7	east of north

Springfield, Robertson County.—The station is in the southeastern part of the grounds of the Peoples and Tucker Academy, about one-half mile west of the town's center. It is 170.7 feet a little south of west from a fence bounding the grounds on the northeast, and 247 feet southeast from the southeast corner of the academy building. It is marked by a blue limestone post 6 by 8 by 35 inches, projecting about 7 inches above ground and lettered U. S. C. & G. S. 1909. The following true bearings were determined:

	°	′	
South point on gable of only gabled house to the southeast, running north and south (mark)	40	10.0	east of south
Upper northeastern edge of most eastern of 4 large white columns	69	40.0	east of south
Lower northeastern corner of foundation of academy building	6	47.9	west of north

TEXAS.

El Paso, El Paso County.—The station of 1905 was reoccupied as nearly as could be determined. It is on ground formerly owned by the El Paso Water Company, about 1½ miles west of the town's center. It is east of reservoir No. 2, and about 1,000 feet a little north of east of a Geological Survey bench mark.

As the station of 1905 was no longer suited for magnetic observations, a new station was established in the southern part of the parade ground at Fort Bliss, about 5½ miles northeast of the town's center. It is 334 feet west of the northwest corner of the fence surrounding the old hospital, 431 feet southwest from the northwest corner of the new hospital, 79 paces north of a row of trees along the south border of

Descriptions of stations—Continued.

TEXAS—Continued.

the parade ground, and 20 paces northwest of the center of a road running northeast and southwest across the parade ground. The station is marked by a limestone post 6 by 6 by 30 inches, projecting about 5 inches above ground and lettered U. S. C. & G. S., 1910. The following true bearings were determined:

	°	′	
Rod at top of band stand on parade ground (mark)	7	12.7	west of north
West gable on roof of headquarters	9	00.9	east of north
Upper southeast corner of El Paso Country Club	59	09.5	west of north
Top of northwest tower of pumping station	7	28.4	east of south

Kerrville, Kerr County.—The 2 monuments of the meridian line established in 1901 were recovered and found in good condition, except that the north monument has part of the top knocked off. Magnetic observations were made in 1910 over a point 87.6 feet from the north meridian mark and in an exact line with the south meridian mark. The station is 63.3 feet from the iron fence and is marked by a wooden stake and three instrument stubs. The following true bearings were determined in 1910 from the meridian line:

	°	′	
East gable on residence of Mr. Joseph Gardiner, three-eighths mile north near depot (mark)	12	13.8	east of north
Spire on Presbyterian Church	70	40.8	east of south
Spire on residence of Charles Shreiner	22	59.0	west of south

Mineola, Wood County.—The station of 1902 was reoccupied. It is in the northwestern corner of a grove belonging to the village, which grove formed part of the old fair grounds. It is about one-half mile west of the town's center. The station is 113 paces south of the fence bounding the grove on the north and 42 paces east of the fence bounding it on the west. It is 22.4 feet from the center of the trunk of an oak tree to the northeast blazed with a cross, and 66.4 feet from the center of the trunk of an oak tree to the west blazed with a cross. The station is marked by the neck of a quart glass bottle buried 6 inches under ground. The following true bearings were determined:

	°	′	
Top of steeple of St. Paul's colored Baptist Church (mark)	3	57.4	east of south
Top of steeple of white Baptist Church	59	34.7	east of south
North gable of Christian Church	23	14.8	east of south
Lower southeast corner of a house at southwest corner of grove	32	39.6	west of south

Odessa, Ector County.—The station of 1905 was reoccupied. It is in the northeast corner of the grounds surrounding the county court-house, about in the center of the town. It is 60 feet from the fence to the north, 61.7 feet from the fence to the east, and 138.8 feet northeast of the northeast corner of the court-house. The station is marked by an oak stake 1 by 1½ by 18 inches, projecting 4 inches above ground, with a small rod of silver in the top to mark the exact spot. The following true bearings were determined in 1905:

	°	′	
Eastern corner at extreme top of water tank on store opposite railroad station (mark)	24	36.7	east of south
Top of windmill tower 1 mile distant	68	45.5	east of south
Bell tower of church	55	00.4	west of north

Sweet Water, Nolan County.—The station is located in the southeast corner of the park of the Grogan Mineral Wells, which is the property of Sweet Water Mineral Springs Company, and it is about one-half mile southeast of the Texas and Pacific Railway depot in Sweet Water. It is 89.6 feet from the east fence and 80.4 feet from the south fence, on rising ground southeast of the park bath house.

The station is marked by a concrete post 6 by 8 by 24 inches, trimmed to 6 by 6 inches on the top with a drill hole to mark the point, and projecting about 4 inches above ground. The following true bearings were determined:

	°	′	
Cupola on schoolhouse (mark)	2	08.4	east of north
Spire on Texas and Pacific depot	61	43.9	west of north
Spire on Methodist Church	30	26.7	west of north

Descriptions of stations—Continued.

VERMONT.

North Hero, Grand Isle County.—The station is in the northeast corner of the court-house grounds. It is 30.5 feet from the southeast corner post of the lot of Mr. Kingsbury, 95.5 feet from the northeast corner of the court-house, and in line with and 10.5 feet from the north tree of the west row in front of the court-house. The station is marked by a concrete block 5½ by 5½ by 20 inches, projecting 6 inches above ground. It has a small hole in the top to mark the exact spot. The following true bearings were determined:

	° ′	
West end of gable ridge on residence of Colonel Watson (mark)	5 56.7	west of north
Northeast corner of Captain Hudson's house	85 55.2	east of south
Northeast gable of Mr. Brook's house on Knights Island	68 27.1	east of south
Court-house spire	45 20.4	west of south

VIRGINIA.

Bristol, Washington County.—The station of 1906 was reoccupied. It is on the grounds of the Southwestern Virginia Institute, 107 feet from the front line of the grounds and 60 feet to the right from the center of the walk leading to the main entrance of the building. It is marked by a limestone post projecting 3 or 4 inches and lettered U. S. C. & G. S., 1898. A similar but unlettered stone 120.5 feet to the south determines a meridian line. One hundred and twenty-six feet to the north is a hole in the granite step of the institute, also in the meridian. The following true bearings were determined in 1906:

	° ′	
Flagstaff on public school	34 39.7	west of south
Spire on First Baptist Church	6 53.0	west of south
Spire on First Christian Church	8 21.1	west of south
Spire on Mary Street Church	3 27.0	west of south
Southeast side smokestack Columbian Paper Company	59 03.3	east of south

Charlottesville, Albemarle County.—The station of 1906 was reoccupied, as nearly as could be determined. It is on the tennis courts of the Young Men's Christian Association of the University of Virginia, to the rear of Madison Hall. It is 88.6 feet south of the north meridian stone and 81 feet east of the northwestern edge of the third tennis backstop from the Young Men's Christian Association Building. The station is marked by the neck of a quart glass bottle sunk 6 inches under ground. The following true bearings were determined:

	° ′	
Northeast weather vane on museum (mark)	6 59.2	east of south
Spire on Young Men's Christian Association building	17 45.4	west of south
Northwest corner of Anthony's Hall	88 19.5	east of south

Lynchburg, Campbell County.—The station of 1901 was reoccupied, but found unsuitable for magnetic observations, and a new station was established in the southeastern corner of the county fair grounds, about 1½ miles southeast of the town's center. It is 111.7 feet northwest from the fence bounding the grounds on the southeast and 141 feet northeast from the fence on the southwest. The station is marked by a granite post 5 by 10 by 24 inches, projecting 2 inches above ground, and lettered U. S. C. & G. S., 1910. The following true bearings were determined:

	° ′	
Base of flagstaff on Odd Fellows' Home (mark)	2 17.2	west of south
Southwest corner of grand stand, just under eaves	53 22.0	west of north
Upper shaft of a windmill	84 58.3	west of south

Descriptions of stations—Continued.

WASHINGTON.

Peter Point (Vashon Island), Colvos Passage.—The station is on a grassy spot 33 feet from the high-water line, on the outer point of a broad gravel spit at Peter Point. It is at the highest part of the spit. A low swampy area extends from the station 164 feet inland to an abrupt rising hill, which is cleared of trees at this point, and has two houses on its crest. The station is marked by a white glass quart flask buried in the soil with its cork 8 inches below the surface. A 2-inch stub extends 2 inches above ground. The following true bearings were determined:

	°	′	
Lone tree on next point to the southward (mark)	26	17.6	west of south
Northwest corner of pier	16	57.6	west of south
North corner of wharf across the passage	62	47.6	west of south
Outer face of pier at gravel spit	35	04.6	east of north
Center of shed on bluff	84	15.9	east of south
Apex of face of store	39	02.4	east of south

Steilacoom, Pierce County.—The station is on Union avenue between Lafayette street and the beach, about 28 feet from the fence. It is marked by a stake driven firmly into the ground and projecting 2 inches above the surface. A nail is set in the center of the upper face of the stake. A witness stake alongside projects 6 inches above the surface of the street. The following true bearings were determined:

	°	′	
Spire Congregational Church on Lafayette street (mark)	64	08.1	east of north
Southwest corner of small brown cottage distant 60 feet	46	34	east of north
Northwest corner of cottage on corner of Lafayette street and Union avenue	37	54	east of south
Telegraph pole distant 70 feet	53	16	west of south
Corner of fence distant 65 feet	79	32	west of north
Second telegraph pole distant 100 feet	32	14	west of north

Von Gelderns Cove, Carrs Inlet.—The station is on the eastern side of Von Gelderns Cove in Carrs Inlet on a sand spit which is on the broad running point, about 2 000 feet from the outer point which separates this cove from Mayo Cove (locally known as Lake Bay). It is directly opposite the wharf of Home, the settlement in this cove. The station covers 1 foot at high water and is marked by a green bottle buried deep in the sand, over which, near the surface, was set a cylindrical tin can with a small hole marking the center of its upper face. The can was covered with about 1½ feet of sand and a stake driven alongside, projecting a foot above the surface. It is about 80 feet from the tree line of the point. Between the station and the tree line is a flat area about 3 feet lower than the crest of the spit on which the station is located. The following true bearings were determined:

	°	′	
Apex of the southern truss of the county bridge No. 41 crossing the head of the cove (mark)	64	49.7	west of south
Wharf across cove	23	43	west of north
Bowlder on beach, 184 feet distant	69	07	east of north
Blazed tree, with nail in center of blaze, 81 feet distant	66	44	east of south
Nail in center of blaze on tree 78 feet distant	43	47	east of south

BRITISH COLUMBIA.

Union Bay.—The new station of 1906 was reoccupied. It is about 1 000 feet north of the old one, in a direct line to the church spire at Comox, on a low shingle spit across the small stream. It is marked by a dressed fir post 3 inches square, set about 30 inches underground, and projecting about 8 inches above the surface. A small heap of stones is placed around the post and the letters U. S. and a cross are cut in the top surface. The following true bearings were determined in 1909:

	°	′	
Light-house at southeast end of Baynes Sound (mark)	33	34.7	east of south
Church spire at Comox	18	44.8	west of north
Northeast corner of chimney of brick kiln	0	35.5	west of south

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APPENDIX 4

REPORT 1910

PRIMARY BASE LINES AT STANTON, TEX., AND DEMING, N. MEX.

By

WILLIAM BOWIE

Inspector of Geodetic Work; Assistant, Coast and Geodetic Survey

CONTENTS.

ILLUSTRATIONS.

PRIMARY BASE LINES AT STANTON, TEX., AND DEMING, N. MEX.

By WILLIAM BOWIE,

Inspector of Geodetic Work; Assistant, Coast and Geodetic Survey.

GENERAL STATEMENT.

As the nickel-steel or invar base tapes were satisfactory in the measurement of six primary bases in 1906,* it was decided to use them in measuring the two primary base lines, one at Stanton, Tex., and one at Deming, N. Mex., on the Texas-California arc of primary triangulation. The invar tapes held their lengths well during the season of 1906, and because of their small coefficients of expansion it was possible to do the measuring in the hours of daylight. The average coefficient of expansion of the invar tapes used on primary bases by this Survey is only about 0.04 that of steel, hence an error of 2.°5 in the temperature of an invar tape would make only the error caused by an erroneous reading of 0.°1 in the temperature of the steel tape.

As it was found, during the campaign of 1906, to be unnecessary to standardize the tapes in the field, it was decided to have the base lines on the Texas-California arc measured by the triangulation party when the triangulation had progressed to the vicinity of the bases.

There are only two base lines on the Texas-California arc. This triangulation extends about 1 200 miles from the ninety-eighth meridian triangulation in the vicinity of Weatherford, Tex., to the Pacific coast primary triangulation near San Diego, Cal. The locations of the base lines were made to depend upon the summation of the strength of the individual figures rather than upon the number of figures or the length of the scheme between bases. The average distance between bases on the ninety-eighth meridian is about 120 miles, while the distance between the nearest base on the ninety-eighth meridian to the Stanton base is 254 miles, from the Stanton base to the Deming base is 399 miles, and from the Deming base to the Los Angeles base is 628 miles. The average of these three distances is 427 miles. The two base lines are shown in their relation to the scheme of triangulation in Fig. 1.

It is interesting to note that no extra stations or lines were used as a base net to connect the Stanton base line with the main triangulation, as the base is one of the lines of the main scheme. Such a condition is very unusual and there is no similar case in primary triangulation in the United States.

* Appendix 4, Report for 1907, "Six primary bases measured with steel and invar tapes."

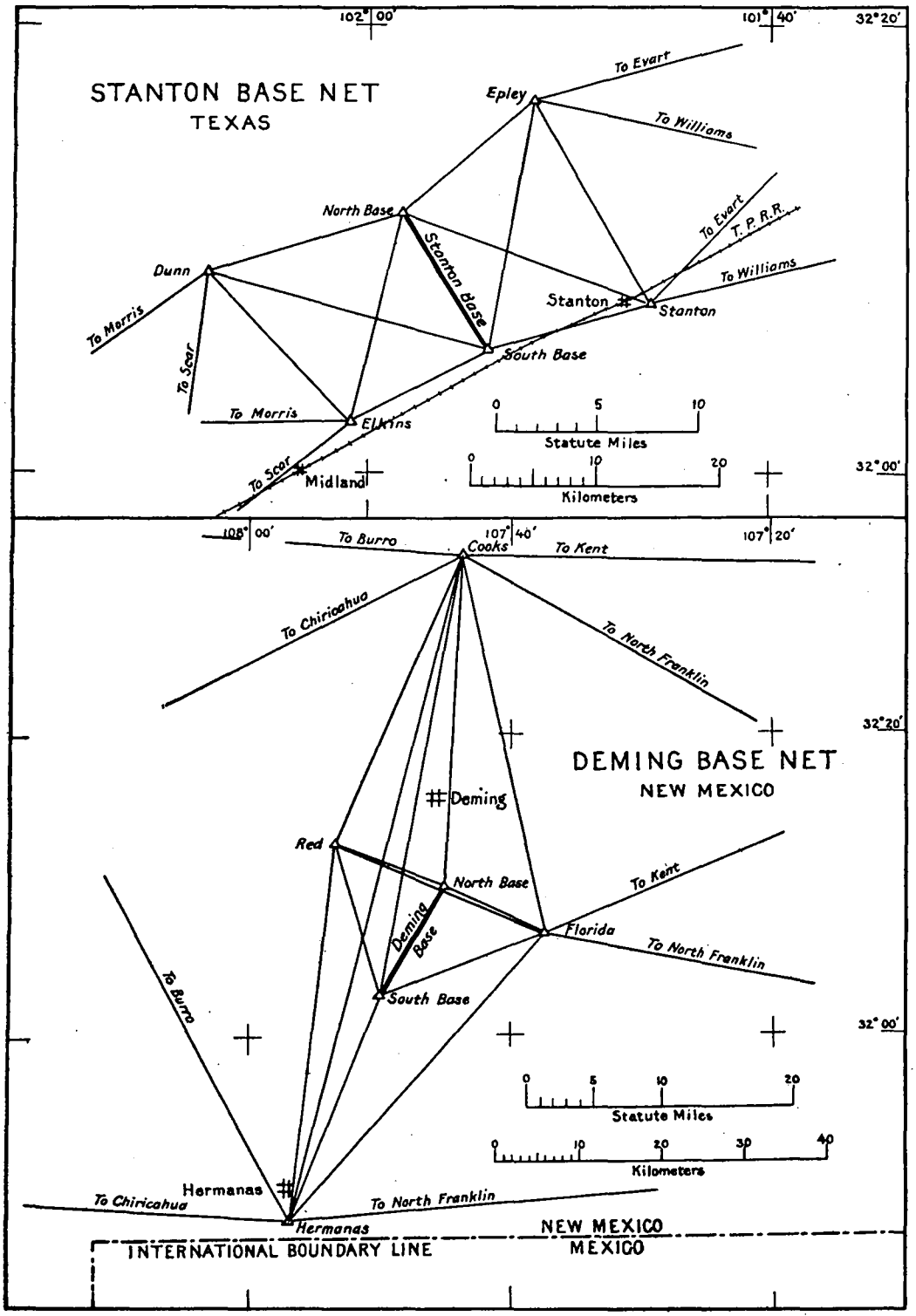

FIG. 1.—Stanton and Deming base nets.

METHODS USED ON THE STANTON AND DEMING BASE LINES.

The instructions issued to Assistant J. S. Hill, who was in charge of the triangulation party working on the Texas-California arc during the season of 1908–9, provided that:

During the progress of the triangulation you will measure the Stanton base with invar tapes.

Very little increase in the average accuracy of the lengths of the triangle sides in the triangulation connected with this base will result from increasing the accuracy of the base measurement beyond that represented by a probable error of 1 part in 500 000 in the length of the base. The following limits of accuracy are selected with a view of attaining a probable error but little, if any, greater than 1 part in 500 000. You will strive to keep as far within these limits as is possible by the use of good judgment and skill, but you will restrict the time and money expended upon each operation substantially to that required to keep barely within them.

Four invar tapes are to be standardized at the Bureau of Standards, both before and after the base measurement. The base is to be measured with three of these invar tapes used in daylight. The base shall be measured in sections approximately 1 kilometer in length, except that one shorter section may be used. Each section of the base shall be measured with at least two different invar tapes. Different pairs of invar tapes shall be used on different sections, so that the three tapes used on the base shall thereby be thoroughly intercompared. Two, and only two, measurements of each section shall be made, unless the discrepancy between these two measurements exceeds 20 millimeters $\sqrt{K}$ (in which K is the length of the section in kilometers), in which case additional measurements must be made until two are obtained which agree within this limit. The fourth invar tape standardized is to be retained for use in case of serious damage to any of the three tapes with which the measurements would otherwise be made.

Such precautions should be taken to secure accurate horizontal and vertical alignment of the tapes and the determination of the tension applied to the tapes as is necessary to insure that the errors arising from these sources on the base shall each be less than 1 part in 1 000 000.

STANDARDIZATION OF TAPES.

The tapes were standardized at the Bureau of Standards, at Washington, D. C., both before and after the measurement of each of the two bases. The length of the 50-meter comparator was measured with iced bar B_{17} just before and after the comparison of the tapes with the comparator. In the determinations at the Bureau of Standards the tapes were used in practically the same manner as in the field. They were supported at the ends and at the middle point with all three supports in a straight line. Two thermometers were attached to each tape about 1 meter from the graduation mark at each end, and the fixed tension of 15 kilograms was applied. The tapes were suspended under the end microscopes of the comparator, using the cut-off cylinders for the end supports. For a full description of the standardization of base tapes, see pages 115–119 of Appendix 4, Report for 1907.

STANTON BASE LINE.

The Stanton base line was located by the reconnaissance party in 1907–8 about 9 miles west and a little north of the town of Stanton, on the Texas and Pacific Railway. The land is level and smooth, and partly covered by small brush, with no ravines of sufficient size to interfere in any way with the preparation or measurements. The base was measured over the prairie, except for a short distance, which was over cultivated land.

SIZE OF PARTY.

The triangulation party which measured the Stanton base consisted of Assistant J. S. Hill, the chief of party, Signalman J. S. Bilby, and 7 other persons—9 in all. The actual measurement with the tapes was made by Mr. Hill, Mr. Bilby, and 4 other persons. Mr. Hill was in charge, making the forward contact and reading the forward thermometer, and Mr. Bilby making the rear contact and reading the rear thermometer. Two men held the forward and rear tape stretchers, one man recorded the observations, and one man stood at the center stake during the time the tape was on its supports and assisted in carrying the tape forward.*

The party lived in camp pitched close to the base line, and consequently only a small amount of time was consumed in going to and from the work.

DIVISIONS OF THE BASE.

There were three main divisions in the Stanton base; the first extending from south base to the end of the fourth kilometer, the second from the beginning of the fifth kilometer to the end of the eighth kilometer, while the third section extended from the beginning of the ninth kilometer to north base, which is just beyond the thirteenth kilometer. The total length of the base is 13 193 meters. Each main division of the base was measured at least twice, with two tapes, a different pair of tapes being used on each division; hence an intercomparison of the three tapes used could be made. The following table shows the divisions of the base with the tapes used on each and the approximate length of the divisions:

Division	Tapes used	Length of divisions
	Numbers	*Meters*
No. 1	516 and 521	4 000
No. 2	516 and 517	4 000
No. 3	521 and 517	5 193

The southern end of the base line is on level prairie land, 7½ miles west of Stanton and about two-thirds of a mile north of the railroad. The upper mark is a cylinder of concrete 30 inches long and 20 inches in diameter, with its top flush with the surface of the ground. In the center of the concrete was placed a 3-inch iron pipe, on the top of which is fastened a round brass cap triangulation station mark. A small hole drilled into the center of this station mark indicates the Stanton south base triangulation station and the southern end of the Stanton base line. The underground mark is a small drill hole in a metal disk triangulation station mark, cemented into bed rock 3 feet below the surface of the ground.

The northern end of the base is situated about 11 miles northwest of Stanton, on the highest point of a small bare knoll in the pasture owned by Mr. J. E. Henson. The surface mark is similar to that at south base, except that the cylinder of concrete is 24 inches in diameter. The underground mark is a cylinder of concrete 12 inches in

* See Appendix 3, Report for 1901, and Appendix 4, Report for 1907, for the field procedure while making actual measurements with base tapes.

height and 12 inches in diameter, with its top 36 inches below the surface of the ground. In the center of this cylinder was placed an iron pipe 12 inches long and 1½ inches in diameter. The projecting point of a large wire nail, cemented into the pipe with its head down, marks the station and the northern end of the base line.

APPARATUS USED.

The invar tapes used on the Stanton and Deming bases were similar to those used in 1906, and described on pages 111–113 of Appendix 4, Report for 1907, "Six primary bases measured with steel and invar tapes."

Each tape was kept on an aluminum reel 16 inches in diameter, a reel of this size being found, by experiments in 1906, to be large enough not to injure the tape nor to cause any change in its length. During the measurement of the base the tape in use was seldom allowed to touch the ground, being held up by the several members of the party while moving forward or being supported by the stakes while the actual measurements were being made. Care was taken to protect the tape from shocks and sharp bends. This was especially the case while passing obstructions, such as wire fences and ditches.

The tape stretcher shown and described on pages 414 and 415 of Appendix 8, Report for 1892, was used on the measurements of the nine primary base lines along the ninety-eighth meridian in 1900–1901 (Fig. 2). It weighed 46¾ pounds. In 1906 this stretcher was modified by taking off the platform on which the operator stood and substituting a steel point bolted to the rod. Instead of being held in position by the weight of the operator on the platform, the stretcher was held by the point, driven into the ground. Even this modified stretcher was heavier than necessary and not easily operated. An entirely new stretcher was used during the measurements of the Stanton and Deming bases. It is shown in Fig. 3 and was designed by Signalman J. S. Bilby and made under his direction. It consists of an iron tube 1.35 meters long and 34 millimeters in diameter, with a shallow longitudinal groove into the bottom of which is drilled a number of holes about 12 millimeters apart. A short collar, fitted with a frame to support the spring balance and a weight to balance it, and sliding over the long tube, carries a pin which, pressed into one of the holes by a spring, fixes the position of the collar on the tube. When the spring is released by a handle this collar may be quickly raised or lowered and placed in any desired position on the tube. The bottom of the tube ends in a round conical point which permits it to rotate on its axis, thus allowing the tension to put the balance into alignment with the tape. This stretcher, which weighs but 17¾ pounds, has a short iron rod near the bottom of the tube to give a hold for the foot in forcing the point into the ground.

The general principle embodied in this tape stretcher has been retained in a new one made in the Instrument Division of this Survey for use in the future. It differs from the former stretcher only in being lighter in weight and in that its sliding collar can be quickly brought to a desired position at any point on the tube by means of a friction lever device. It is shown in Fig. 4. The length of the tube of the new stretcher is 1.35 meters and its diameter is 32 millimeters. Its total weight is only 11½ pounds.

As in previous base measurements, the rear end of the tape was held by a simple wooden staff, fitted with a metal shoe, the end of the tape being fastened to the staff by a strap. (See Fig. 5.)

On all base lines measured with tapes, previous to the Stanton base, the observer made the rear contact using his bare or gloved hand to place the mark on the tape in exact coincidence with the mark on the metal strip of the tape support after an approximate contact had been made by the holder of the rear end of the tape. An efficient method of making the exact contact was found in having the graduation on the tape

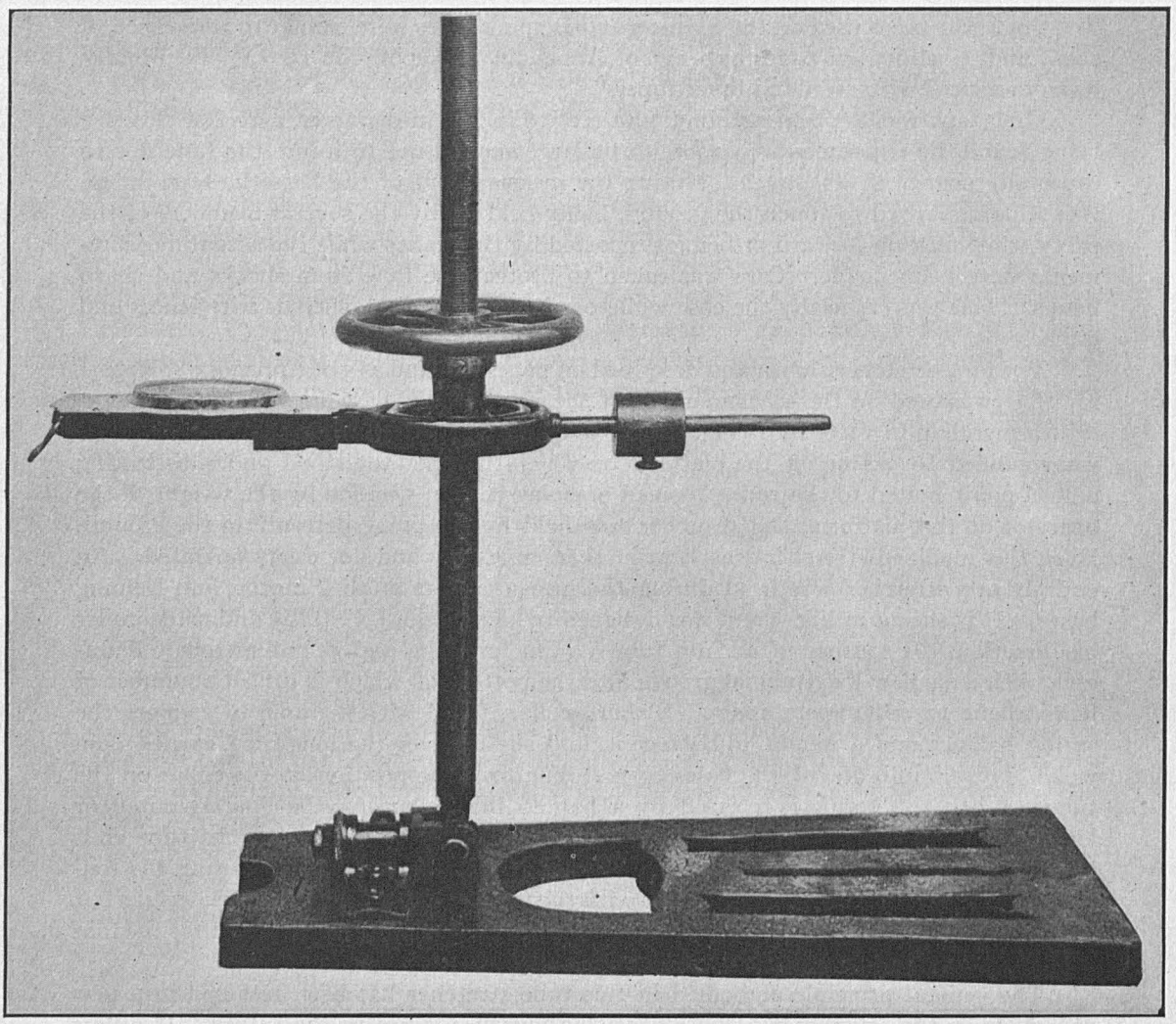

FIG. 2.—Tape stretcher used on the ninety-eighth meridian in 1900-1901.

brought close to but slightly forward of the mark on the copper strip. Then the observer, by grasping and flexing the tape with his hand, brought the mark on the tape into exact coincidence with the mark on the stake. Of course it is understood that this flexure is put into the tape between its rear end and the mark. It was found that by using this method a sensitive and certain control of the tape could be maintained, but

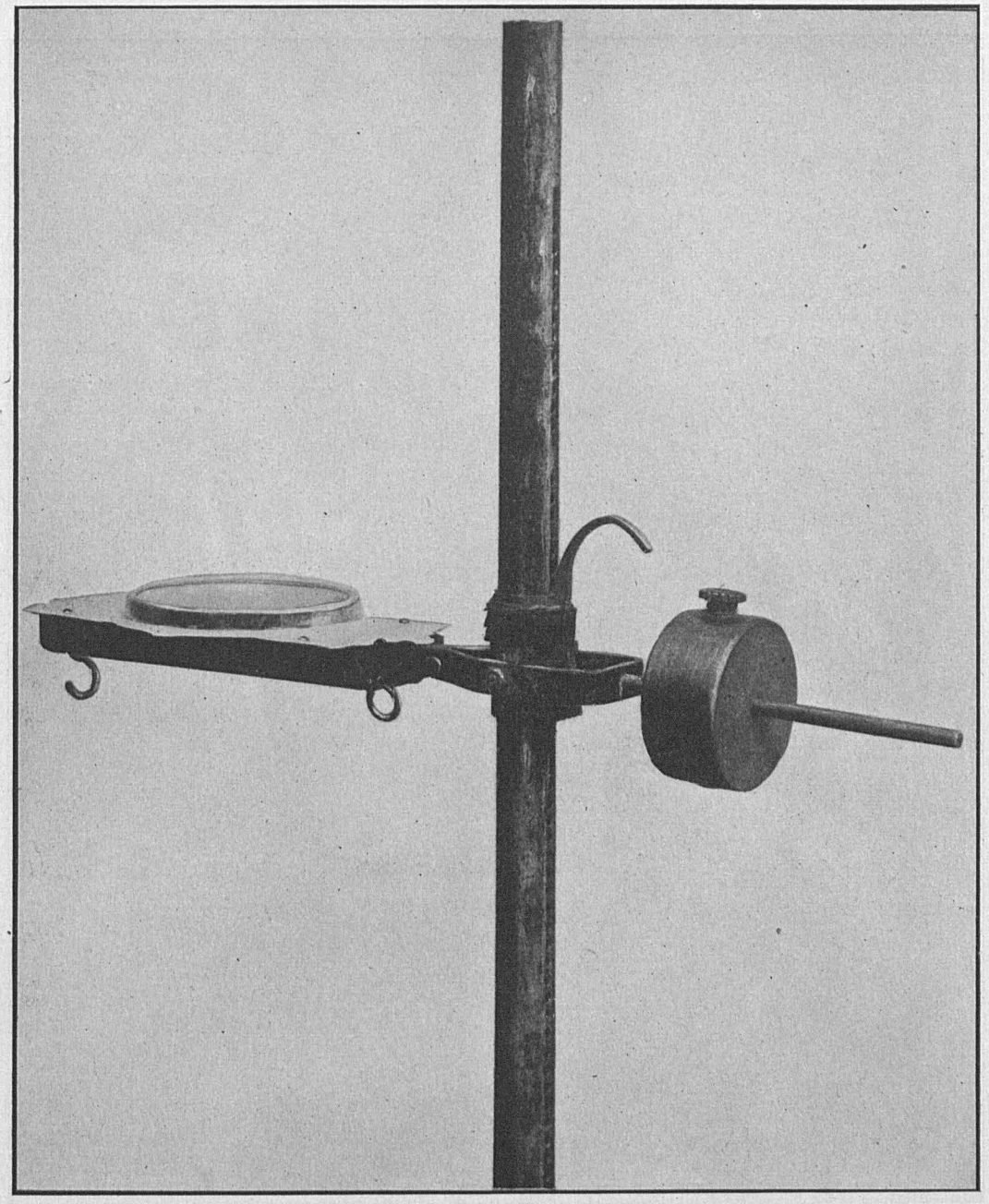

FIG. 3.—Tape stretcher used on the Stanton and Deming bases.

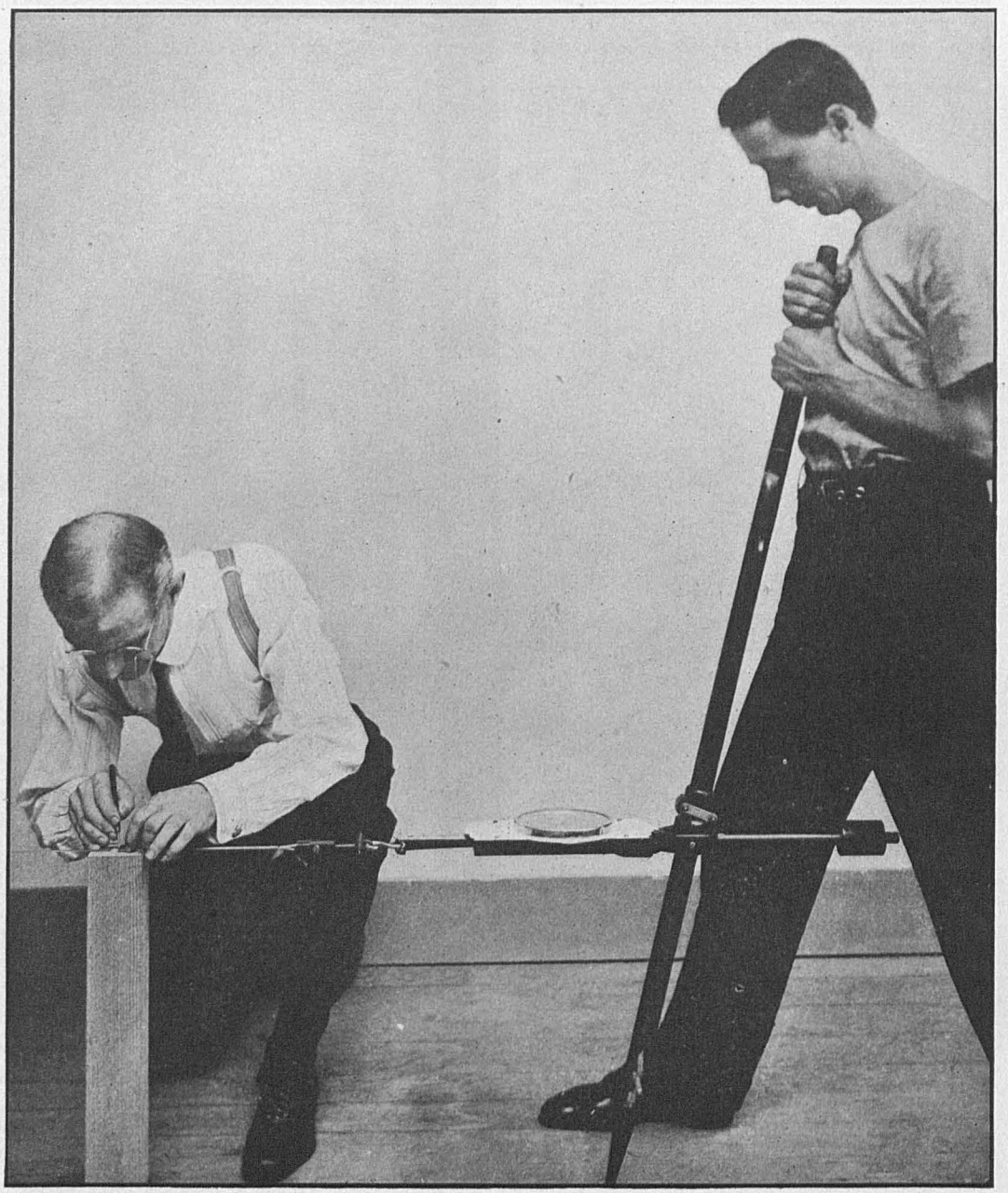

FIG. 4.—Improved form of tape stretcher.

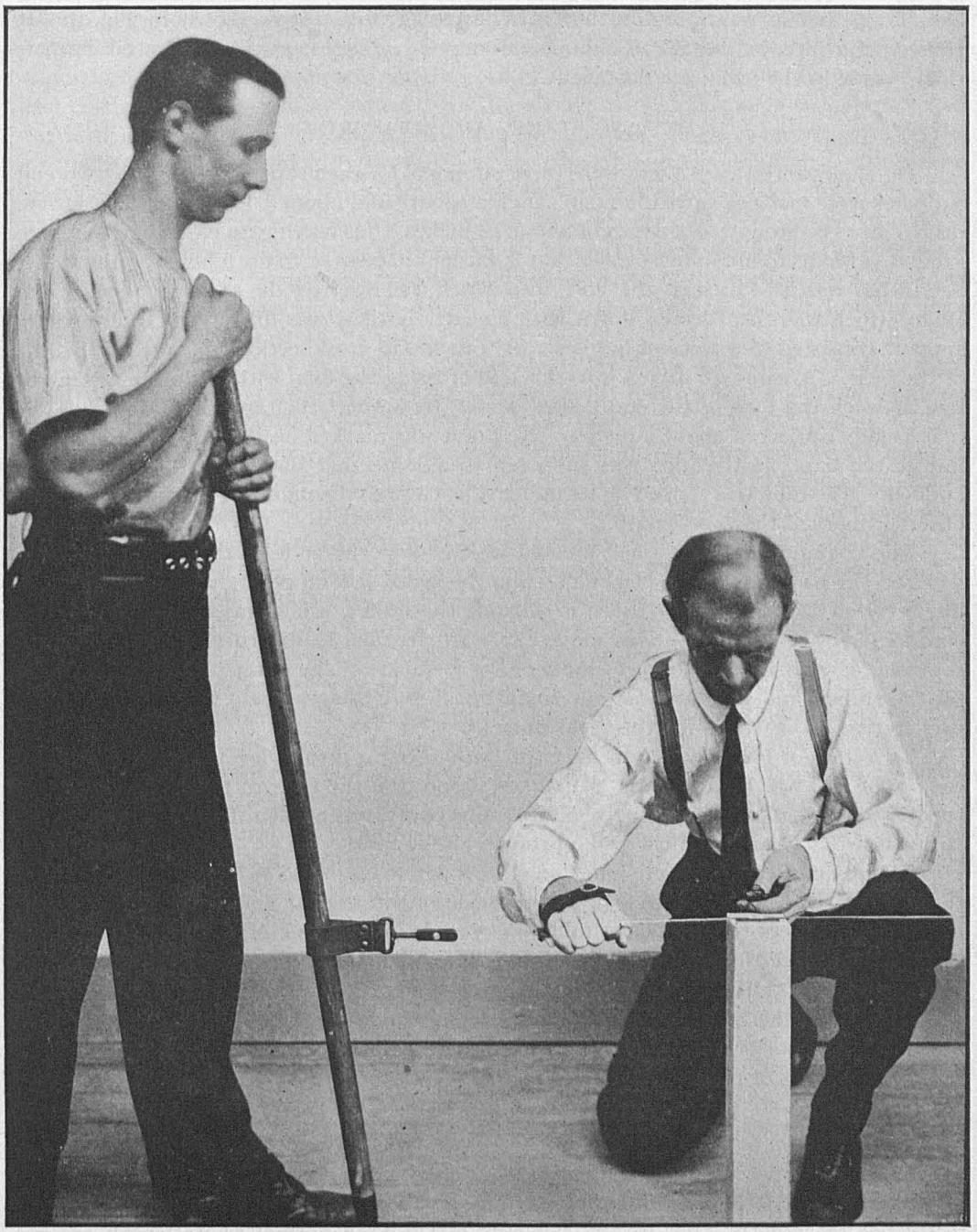

FIG. 5.—Making the rear contact.

it was also found that the hand needed some protection from the tape. For this purpose a device called a "tape-stretching hand guard" was used on the Stanton and Deming base lines, and it was found to be entirely satisfactory. It is shown in Fig. 5. It consists of a piece of metal 110 millimeters long, 25 millimeters wide, and 3 millimeters thick, made in the form of a flattened "S."

SETTING STAKES AND MEASURING.

On the Stanton base there were three supports for each tape length. The two end supports were made of sawed lumber 4 inches square and about 3 feet long. They were driven into the ground to a depth of about 18 inches, thus leaving an equal length above ground. It was found in most cases that it was not necessary to dig a hole for the stake. A crowbar was used to start the hole, into which was inserted the sharpened end of the stake, which was then driven down with a sledge until it was firm. The intermediate support consisted of a piece of lumber 2 by 4 inches in cross section, set just off the line of the base. A wire nail driven into this and crossing the line, with its top in a straight line between the tops of the end stakes, served to support the tape at its center. The nail usually projected about 2 inches. No point was marked on the nail to indicate the line of the base, as the tape was supposed to assume that line when the tension was applied. The tape was tapped on its under side, close to the nail, just before the forward observer marked the tape length.

The triangulation party had erected signals over the ends of the base before any work on the base was done. Upon starting this work several points were located in the line between the base ends to assist in aligning the stakes, which was done with a 6-inch theodolite. The theodolite was moved forward frequently in order to secure a good control of the alignment. One or more of the members of the party preceded those who set the stakes, and cleared away the small brush, but this was only a small part of the preparation of the base for the measurement.

Two lines of levels were run over the base, using a precise level and a self-reading rod. The rod was held only on the stakes supporting the ends of the tapes, except in the few cases where the grade between the end supports was broken at the middle support. In such cases the rod was held also on the middle support.

Set-ups and set-backs were made on the copper strips nailed to the stakes supporting the ends of the tapes. These strips were made of soft copper and were 55 millimeters long, 2 millimeters thick, and 12 millimeters wide. One edge of the strip was placed about half the width of the tape from the line of the base. The thickness of the strip was exactly the thickness of the sleeves on the ends of the tapes, which made it very easy to extend the line from the mark of the tape onto the strip. The lengths of the set-ups and set-backs were measured by means of a pair of hairspring dividers and a scale reading to tenths of millimeters.

WIND EFFECT ON TAPES.

During the measurement of the Stanton base, and especially during the day, there was usually wind of considerable force. The invar tape has a tendency not to lie perfectly flat or smooth—that is, the elements of the tape normal to its length are not horizontal when suspended with tension applied and ready for measurement. With

this peculiarity, it is more sensitive to wind effects than the steel tape. The effect of wind on the latter is to cause it to vibrate or flutter. This makes it difficult to mark its forward end on the copper strip; but the length of the tape, or rather the distance between its end marks, is not materially shortened. With the invar tape, however, where a portion of its length is approximately normal to the moving air, the distance between the end marks is materially lessened during strong winds, although the mark on the forward end of the tape remains fairly steady. No two single measures of a section of the Stanton base differed by as much as the allowable maximum limit. The chief of party, however, noticing that a strong wind had a decided effect on the lengths of the tapes, decided to measure certain sections in both strong and light winds, in order to form an estimate of the amount of this effect. In each case it was found that the measurement during the strong wind gave a value for the length of the section larger than that obtained during moderate or light winds. In fact, the effect of the wind on the tapes seemed to be a function of its velocity or strength.

Having found that there was a constant error in all the sections which were measured during strong winds, all of those sections were remeasured when the wind was light or moderate. A light wind was considered to be one which did not in any way interfere with the measurements of the base. A moderate wind was one which disturbed the tape, but not sufficiently to interfere seriously with the progress of the measurements. A strong wind interfered materially with the accuracy of the measurement and made necessary the remeasurement of a number of sections. In every case where the wind was moderate or strong, it was blowing at right angles to the line of the base.

With a certain velocity it is probable that the effect on the tape decreases as the direction of the wind approaches the line of the base. The effect of wind blowing in the exact direction of the base is probably small, but no experiments were made to show whether that effect is positive or negative.

In order to obtain favorable conditions, some of the measurements were made at night, when generally the wind was not strong. The office computation verified the conclusion reached by the chief of party in the field regarding the effect of strong wind, and in computing the final length of the base line the measurement of any section which was made in a strong wind was rejected, provided that there were at least two other measures of that section which were made in a light or moderate wind, or when there was no wind.

EQUATIONS OF TAPES.

The equations of tapes, furnished by the Bureau of Standards and resulting from standardization in January, 1909, are:

T_{521}=50 m+(9.678 mm±0.018 mm)+(0.0205 mm±0.0008 mm)×(t−17°.7 C)
T_{516}=50 m+(9.480 mm± .017 mm)+(.0178 mm± .0007 mm)×(t−17°.7 C)
T_{517}=50 m+(9.679 mm± .018 mm)+(.0160 mm± .0007 mm)×(t−17°.7 C)
T_{522}=50 m+(10.322 mm± .019 mm)+(.0614 mm± .0011 mm)×(t−17°.6 C)

The equations of these same tapes, furnished by the Bureau of Standards and resulting from the restandardization in May, 1909, are:

T_{521}=50 m+ (9.907 mm±0.021 mm) at 24°.7 C
T_{516}=50 m+ (9.518 mm± .028 mm) at 24°.8 C
T_{517}=50 m+ (9.840 mm± .025 mm) at 24°.8 C
T_{522}=50 m+(10.781 mm± .024 mm) at 24°.7 C

The standardizations from which the preceding equations were obtained were made as far as practicable under field conditions. Each tape was supported at both ends and at the middle point and under a tension of 15 kilograms.

Tape No. 522 was carried to the field but was not used in any of the measurements.

No determination of the coefficients of expansion was made at the time of the second standardization.

The adopted equations of the tapes used in the final computation of the Stanton base are:

$$T_{521}=50\text{ m}+(9.775\text{ mm}\pm 0.014\text{ mm})+(0.0205\text{ mm}\pm 0.0008\text{ mm})\times(t-21^{\circ}.2\text{ C})$$
$$T_{516}=50\text{ m}+(9.490\text{ mm}\pm .016\text{ mm})+(.0178\text{ mm}\pm .0007\text{ mm})\times(t-21^{\circ}.2\text{ C})$$
$$T_{517}=50\text{ m}+(9.734\text{ mm}\pm .015\text{ mm})+(.0160\text{ mm}\pm .0007\text{ mm})\times(t-21^{\circ}.2\text{ C})$$

These values were obtained by taking a weighted mean of the equations of January and May, 1909. Each determination was given a weight inversely proportional to the probable error of the length of the tape.

In order to compare the lengths of the tapes, as obtained by the two standardizations of January and May, 1909, just before and after the measurement of the Stanton base, the values of the lengths were reduced to the mean temperature, 21°.2. The table below shows the comparison:

Jan. 22, T_{516}	= 50 m + 9.542 mm	± 0.017 mm,	v = −0.044 mm
May 25,	= 50 m + 9.454 mm	± .028 mm,	+ .044 mm
Mean =	+ 9.498 mm		
Jan. 22, T_{517}	= 50 m + 9.735 mm	± .018 mm,	+ .023 mm
May 25,	= 50 m + 9.782 mm	± .025 mm,	− .024 mm
Mean =	+ 9.758		
Jan. 22, T_{521}	= 50 m + 9.750 mm	± .018 mm,	+ .042 mm
May 25,	= 50 m + 9.835 mm	± .021 mm,	− .043 mm
Mean =	+ 9.792 mm		
Jan. 22, T_{522}	= 50 m + 10.543 mm	± .019 mm,	+ .011 mm
May 25,	= 50 m + 10.566 mm	± .024 mm,	− .012 mm
Mean =	+ 10.554 mm		

In no case was the residual for a given tape length as much as three times the probable error of its length from a single standardization, and it may therefore be inferred that the tapes underwent no permanent changes in length between the two standardizations, thus justifying the assumption that the differences were due to accidental errors of standardization. This assumption is certainly true for tape 522, which was not unreeled in the field between the two standardizations.

The thermometers used during the measurements of the base line were graduated to half degrees and read to tenths of degrees. Their corrections are shown in the following table:

Correction to—	No. 7175	No. 7180	No. 7183	No. 7184	No. 7188
0° C	−0.05	−0.05	−0.05	0.00	0.00
10° C	.00	− .05	.00	.00	− .10
20° C	− .10	− .05	− .10	− .10	− .10
30° C	− .05	− .05	− .05	.00	− .10
40° C	− .05	.00	− .05	.00	− .05

REDUCTION TO SEA LEVEL.

The best available elevations were those furnished by the field computation of the trigonometric leveling through the scheme of triangulation from the ninety-eighth meridian. This gave 821 meters as the elevation of Stanton south base. A line of precise leveling is being carried along the Texas and Pacific Railway within the scheme of triangulation, and it will be connected with Stanton south base. When the resulting elevation is available, the true correction to the length of the base for reduction to sea level can be applied. The formula used in reducing the base to sea level is

$$C = -S\frac{h}{r} + S\frac{h^2}{r^2} - S\frac{h^3}{r^3} \text{ \&c}$$

where C is the reduction to sea level for a section of length S and mean height h, r being the radius of the earth's curvature for this line. All but the first term on the right-hand side of this equation are negligible. The reduction to sea level for each section of the base is given in the following table:

Corrections for reduction to sea level.

Section	Correction	Section	Correction	Section	Correction
	Meters		*Meters*		*Meters*
I	−0.1289	VII	−0.1301	XIII	−0.1333
II	− .1293	VIII	− .1305	XIV	− .0200
III	− .1296	IX	− .1309	XV	− .0054
IV	− .1298	X	− .1315		
V	− .1300	XI	− .1324	Total	−1.7245
VI	− .1300	XII	− .1328		

RESULTS OF THE MEASUREMENT.

The results of the measurement of the Stanton base are given in the following table:

Stanton Base Line.

Section	Date and hour	Direction of measure	Tape No.	Weather and wind *	Temperature		
					R, F, or S †	Mean corrected	Correction to T_o
	1909.						*m*
I	Feb. 11, 10.40 a. m.	S	521	C, L SW	R, F	16. 29	−0. 0020
S.B.–20	11, 11.37 a. m.	N	516	C, L SW	S	16. 72	− . 0016
II	11, 9.56 a. m.	S	521	C, L SW	R	12. 92	− . 0034
20–40	11, 11.55 a. m.	N	516	C, M SW	R	18. 08	− . 0011
III	11, 2.16 p. m.	N	516	Cy, M SW	S	20. 39	− . 0003
40–60	11, 3.54 p. m.	S	521	Cy, L SW	F	20. 11	− . 0004
IV	11, 2.48 p. m.	N	516	Cy, M SW	S	19. 30	− . 0007
60–80	11, 3.30 p. m.	S	521	Cy, L SW	S	20. 14	− . 0004
V	13, 11.09 a. m.	S	517	Cy, VS W	R, F	22. 34	+ . 0004
80–100	13, 11.54 a. m.	N	516	Cy, M W	S	20. 96	− . 0001
	19, 9.26 p. m.	S	517	C, L SW	R	09. 45	− . 0038
	19, 10.16 p. m.	N	516	C, L W	F	09. 78	− . 0041
VI	13, 10.30 a. m.	S	517	Cy, S W	R	19. 58	− . 0005
100–120	13, 12.18 p. m.	N	516	Cy, M W	R	20. 97	− . 0001
	19, 8.58 p. m.	S	517	C, L SW	R	09. 32	− . 0038
	19, 10.44 p. m.	N	516	C, L W	S	09. 01	− . 0043
VII	13, 9.53 a. m.	S	517	Cy, L W	R	17. 27	− . 0013
120–140	13, 12.40 p. m.	N	516	C, M W	F, R	22. 57	+ . 0005
	19, 8.30 p. m.	S	517	—, L	R	07. 25	− . 0045
VIII	13, 9.16 a. m.	S	517	Cl, L W	R	15. 70	− . 0018
140–160	16, 8.59 a. m.	N	516	C, O+ W	R	00. 82	− . 0073
IX	16, 9.35 a. m.	N	521	C, O+SW	R	04. 35	− . 0069
160–180	16, 1.56 p. m.	S	517	C, S SW	R	18. 46	− . 0009
	19, 7.32 p. m.	S	517	C, O	S	10. 36	− . 0035
X	16, 10.12 a. m.	N	521	C, L SW	R	07. 97	− . 0054
180–200	16, 1.34 p. m.	S	517	C, S SW	S	17. 98	− . 0010
	19, 7.06 p. m.	S	517	C, O	F	12. 27	− . 0029
	20, 9.16 p. m.	S	517	C, L NW	R	12. 43	− . 0028
XI	16, 10.38 a. m.	N	521	C, L SW	R	10. 63	− . 0043
200–220	16, 1.12 p. m.	S	517	C, S SW	S	17. 44	− . 0012
	19, 6.40 p. m.	S	517	C, O	R	14. 67	− . 0021
	20, 8.47 p. m.	S	517	C, O+W	F	13. 38	− . 0025
XII	16, 10.58 a. m.	N	521	C, L SW	R	12. 67	− . 0035
220–240	16, 11.38 a. m.	S	517	C, M SW	S	14. 99	− . 0020
XIII	19, 7.52 a. m.	N	521	C, L NW	R	03. 29	− . 0073
240–260	20, 8.56 a. m.	S	517	C, M W	R	13. 20	− . 0026
	20, 9.51 a. m.	N	521	C, M W	R	18. 59	− . 0011
	20, 10.40 a. m.	S	517	—, VS W	R	21. 37	+ . 0001
	21, 12.37 p. m.	S	517	C, O+SW	R	04. 40	− . 0054
260–263	19, 8.10 a. m.	N	521	C, L NW	R	06. 27	− . 0009
	19, 8.42 a. m.	S	517	C, L NW	R	09. 70	− . 0006
263–N. B.	20, 8.00 a. m.		517	—, L W		08. 51	− . 0002

* These letters represent the following: C, clear; Cy, cloudy; O, calm; L, light; M, moderate; S, strong; VS, very strong; W, west; SW, southwest; and NW, northwest.

† These letters R, F, and S indicate whether the temperature was rising, falling, or stationary.

Stanton Base Line—Continued.

Set-up or set-back	Grade correction	Tape correction	Reduction to sea level	Reduced lengths of sections	Means by tapes	Adopted length of section.	(v)	(vv)
m	*m*	*m*	*m*	*m*	*m*	*m*	*mm*	*mm*
−0.0168	−0.0575	+0.1955	−0.1289	999.9903	.....	.....	+2.6	6.76
− .0063	− .0575	+ .1898	− .1289	999.9955	.....	999.9929	−2.6	6.76
+ .0208	− .0147	+ .1955	−. 1293	1000.0689	.....	.....	+1.1	1.21
+ .0263	− .0147	+ .1898	−. 1293	1000.0710	.....	1000.0700	−1.0	1.00
− .0112	− .0047	+ .1898	−. 1296	1000.0440	.....	.....	−0.8	0.64
− .0184	− .0047	+ .1955	−. 1296	1000.0424	.....	1000.0432	+0.8	0.64
− .0635	− .0018	+ .1898	− .1298	999.9940	.....	.....	−0.4	0.16
− .0702	− .0018	+ .1955	− .1298	999.9933	.....	999.9936	+0.3	0.09
+ .0803	− .0155	+ .1946	− .1300	‡1000.1298	.....	.....	.....	.....
+ .0697	− .0155	+ .1898	− .1300	1000.1139	.....	.....	.....	.....
+ .0706	− .0155	+ .1946	− .1300	1000.1159	1000.1159	.....	−2.5	6.25
+ .0674	− .0155	+ .1898	− .1300	1000.1076	1000.1108	1000.1134	+2.6	6.76
− .0070	− .0156	+ .1946	− .1300	‡1000.0415	.....	.....	.....	.....
− .0123	− .0156	+ .1898	− .1300	1000.0318	.....	.....	.....	.....
− .0148	− .0156	+ .1946	− .1300	1000.0304	1000.0304	.....	−0.8	0.64
− .0141	− .0156	+ .1898	− .1300	1000.0258	1000.0288	1000.0296	+0.8	0.64
+ .0389	− .0673	+ .1946	− .1301	1000.0348	.....	.....	.....	.....
+ .0464	− .0673	+ .1898	− .1301	1000.0393	1000.0393	.....	−3.1	9.61
+ .0390	− .0673	+ .1946	− .1301	1000.0317	1000.0332	1000.0362	+3.0	9.00
+ .0133	− .0084	+ .1946	− .1305	1000.0672	.....	.....	−3.8	14.44
+ .0161	− .0084	+ .1898	− .1305	1000.0597	.....	1000.0634	+3.7	13.69
+ .0218	− .0113	+ .1955	− .1309	1000.0682	.....	.....	−0.4	0.16
+ .0254	− .0113	+ .1946	− .1309	‡1000.0769	.....	.....	.....	.....
+ .0184	− .0113	+ .1946	− .1309	1000.0673	.....	1000.0678	+0.5	0.25
+ .0052	− .0234	+ .1955	− .1315	1000.0404	1000.0404	.....	−1.6	2.56
+ .0076	− .0234	+ .1946	− .1315	‡1000.0463	.....	.....	.....	.....
− .0013	− .0234	+ .1946	− .1315	1000.0355	.....	.....	.....	.....
+ .0020	− .0234	+ .1946	− .1315	1000.0389	1000.0372	1000.0388	+1.6	2.56
− .0240	− .0257	+ .1955	− .1324	1000.0091	1000.0091	.....	−2.6	6.76
− .0177	− .0257	+ .1946	− .1324	‡1000.0176	.....	.....	.....	.....
− .0344	− .0257	+ .1946	− .1324	1000.0000	.....	.....	.....	.....
− .0262	− .0257	+ .1946	− .1324	1000.0078	1000.0039	1000.0065	+2.6	6.76
− .0515	− .0162	+ .1955	− .1328	999.9915	.....	.....	+0.3	0.09
− .0515	− .0162	+ .1946	− .1328	999.9921	.....	999.9918	−0.3	0.09
− .0465	− .0345	+ .1955	− .1333	999.9739	.....	.....	.....	.....
− .0368	− .0345	+ .1946	− .1333	999.9874	.....	.....	.....	.....
− .0481	− .0345	+ .1955	− .1333	999.9785	999.9762	.....	+2.8	7.84
− .0300	− .0345	+ .1946	− .1333	‡999.9969	.....	.....	.....	.....
− .0449	− .0345	+ .1946	− .1333	999.9765	999.9819	999.9790	−2.9	8.41
	− .0126	+ .0293	− .0200	149.9958	.....	.....	+0.1	0.01
	− .0126	+ .0292	− .0200	149.9960	.....	149.9959	−0.1	0.01
−9.0821	− .0024	+ .0097	− .0054	40.9196	.....	40.9196	.....	.....

‡ These measures rejected, having been made in a strong wind.

The length of the Stanton base line = 13 191.3417 meters.
± 52

The logarithm of this length = 4.1202889
± 2

The probable error of the length = 5.15 mm, which corresponds to 1 part in 2 561 000.

COMPUTATION OF PROBABLE ERRORS.

The following table shows the various probable errors for each section of the base:

Section	Probable error due to—			Combined probable error of each section
	Uncertainties in the lengths of the tapes	Uncertainties in the coefficients of expansion	Accidental errors of measure	
	mm	*mm*	*mm*	*mm*
I	±0.21	±0.05	±1.75	±1.76
II	± .21	± .06	± .71	± .74
III	± .21	± .01	± .54	± .58
IV	± .21	± .02	± .24	± .32
V	± .22	± .09	±1.72	±1.74
VI	± .22	± .09	± .54	± .59
VII	± .22	± .04	±2.06	±2.07
VIII	± .22	± .13	±2.53	±2.54
IX	± .21	± .15	± .30	± .40
X	± .21	± .11	±1.08	±1.11
XI	± .21	± .09	±1.75	±1.76
XII	± .21	± .08	± .20	± .30
XIII	± .21	± .12	±1.92	±1.94
XIV	± .03	± .02	± .07	± .08

The probable error of the base from all sources = ±5.15 mm.

The probable error of the weighted mean of a tape was computed as if a direct and not a weighted mean had been taken—that is, $e = \frac{1}{2}\sqrt{e^2_1 + e^2_2}$, where e is the probable error of the mean value of the length of the tape, and e_1 and e_2 the probable errors of the January and May values of the length of the tape. The probable error obtained in this way differs not more than 0.001 millimeter from what it would be had weights been used.

In writing the expansion term of the tape equations, the coefficient determined at the January standardization was used with t_0 (the standard temperature), denoting the direct mean of the temperatures of the two standardizations.

In computing the probable error of each section of the base, three causes of uncertainty in the length were considered. (*a*) The uncertainty of the lengths of the tapes. The probable error of the length of a section due to this cause was assumed to be the number of tape lengths in the section multiplied by one-half the square root of the sum of the squares of the probable errors of the lengths of the two tapes used in measuring the section. (*b*) The uncertainty caused by not knowing the true temperature coefficient. The probable error of the length of a section due to this cause was assumed to be $n\,(t_0 - t)$ multiplied by one-half the square root of the sum of the squares of the probable errors of the temperature coefficients of the two tapes used in the measurement of the section. In this expression n is the number of tape lengths in the section,

t_o the temperature of standardization, and t the temperature of the tapes. (*c*) The accidental errors of measurement. The probable error of the measurement of a section from the accidental errors was computed from the residuals using the formula $r_o = 0.6745\sqrt{\frac{[v^2]}{n(n-1)}}$, v being a residual and n the number of measures of a section.

The final probable error of the length of a section was obtained by taking the square root of the sums of the squares of the three probable errors obtained as indicated in the preceding paragraph, while the probable error of the length of the entire base was taken to be equal to the square root of the sums of the squares of the probable errors of all the sections.

COST OF STANTON BASE.

The triangulation party was engaged on the preparation and measurement of the Stanton base line seventeen days, from February 7 to February 23, 1909. This was the period during which no triangulation was done. It came between the last observations of horizontal directions at south base station and the beginning of observations at station Elkins. The total field expenses of the party, including the salary of its chief, for the month of February were $1 214. These expenses included transportation of light keepers both by rail and by hired teams between the triangulation stations and to and from the base line. It is believed that a fair estimate of the cost of the field work during the measurement of the Stanton base line is $739. This estimate was obtained by multiplying the average cost per day during the month, $43.50, by the total number of days on the base line. This made the field cost per kilometer $56 and the cost per mile $90.

The average cost of the field work per kilometer of measurements with steel tapes in 1900–1901 was $89. The average field cost per kilometer measured by tapes or bars during that season was $145. The average cost of the measurement of a kilometer in 1906, using both steel and nickel-steel (invar) tapes on each section, was $99. In the 1906 cost the expense of standardizing at the Bureau of Standards was not included. During both of those seasons standardizations in the field were made at the beginning and at the end of the work. The low cost of the work on the Stanton base line was due largely to the following causes: (*a*) There was only the expense of local travel; (*b*) the party was well trained, though it had never worked together on the measurement of a base line; (*c*) there was no standardization of the tapes in the field; (*d*) the chief of party and his assistant were experienced in base line measurements; and (*e*) there was no unproductive period before and after the actual work on the base. To the cost of the Stanton base line should be added $400, the approximate expense to the Bureau of Standards of standardizing four tapes both before and after the measurement.*

The cost of the office computation of the Stanton base line was $129. Hence the total cost of that base line, including all expenses except that involved in preparing results for publication and the printing of this appendix, was $1 268. This made a cost of $96 per kilometer and $147 per mile. The total cost per kilometer, measured with steel tapes in 1900–1901, was $98, and that of a kilometer measured with both steel and invar tapes in 1906 was $115. The chief of party who conducted the work

* The charge made by the Bureau of Standards to foreign governments or to private individuals for the standardization of base tapes is $50 per tape.

in 1906 stated that the cost would have been $94 per kilometer if invar tapes only had been used.

DEMING BASE LINE.

The Deming base line was measured by a primary-triangulation party, which was also under the direction of Assistant J. S. Hill, during the season of 1909–10 on the Texas-California arc.

This base line is located in the valley south of Deming, Grant County, N. Mex., the northern end of the base being about 6½ miles due south of that town. The approximate length of the base is 15 554 meters. From the north base to the south base the line has a general direction of south 26° west, while the land over which it runs is level and smooth and crosses no ravines or other obstructions and there is no grade of more than 1 per cent for any one tape length. Portions of the line had to be cleared of sagebrush, greasewood, and mesquite, but this work was not difficult.

SIZE OF PARTY.

The triangulation party which measured the Deming base consisted of Assistant J. S. Hill, the chief, Signalman J. S. Bilby, and 10 other persons—12 in all. On the base line work the party was reduced to an average of 9 persons. There were 12 persons engaged on the base the first few days, while during the latter part of the work there were only 6. Being able to reduce the size of the party, it being at the end of the season on triangulation, decreased the cost of the base.

After the base had been prepared, the actual measurements with the tapes were made in three days by the 2 observers and 4 men. The leveling along the base in both directions was done by an observer and 3 men in three and one-half days. As was the case on the Stanton base, the party camped close to the base line in order to make the time of getting to and from work a minimum.

DIVISIONS OF THE BASE.

As in the Stanton base line, this line had three main divisions: The first extended from north base to the end of the fifth kilometer, the second from the beginning of the sixth kilometer to the end of the tenth kilometer, while the third was from the beginning of the eleventh kilometer to south base.

Each main division of the base was measured twice, with two tapes, a different pair of tapes being used on each division; hence an intercomparison of the three tapes could be made.

The following table shows the divisions of the base line, the tapes used, and the approximate length of each division:

Division	Tapes used *	Length of division
	Numbers	*Meters*
No. 1	516 and 521	5 000
No. 2	516 and 517	5 000
No. 3	517 and 521	5 554

* These tapes were also used on the Stanton base.

The north end of the base is marked by a drill hole in the center of a metal station mark (see description of Stanton south base, p. 148) embedded in a cylinder of concrete 24 inches long by 20 inches in diameter, the top of concrete being even with the surface of the ground. An underground mark consisting of a metal disk set in concrete was placed 30 inches below the surface mark.

The south end of the Deming base is located about 1½ miles east of the Midland switch on the Deming branch of the El Paso and Southwestern Railroad and about 15 miles to the southward of Deming. It was marked in exactly the same manner as the north base.

The instructions to the chief of party were identical with those issued to him for the measurement of the Stanton base, except that they called for 5 supports—2 for the ends and 3 intermediate—for a tape length. It was decided to adopt this number of supports owing to the difficulty with the wind on the Stanton base when using only 3 supports. Five supports used on the Deming base proved to be very effective in eliminating most of the effect of wind on the tapes. It prevented the wind causing errors in two ways—it reduced the catenary, or the distance between any two supports, and it made the tape assume more nearly a horizontal position, and consequently the wind pressed only against the edge of the tape instead of on its broad surface. The wind effect was not entirely eliminated, but it was believed to be so small as to be negligible.

The measurement of the Deming base was made in a manner similar to that of the Stanton base, except as noted above. The intermediate supports of the tape were nails driven into pieces of lumber 2 inches by 4 inches in cross section, set into the ground at intervals of 12½ meters between the end supports and just off the line of the base. These nails were driven in horizontally with their tops placed approximately on the straight line joining the top of the end supports of the tape, except where it was necessary to break the grade of the tape in crossing an obstruction. In such a case the elevation of the point at which the tape length changed grade was determined during the leveling of the base. In the normal cases, where all of the supports were in the same straight line, the leveling rod was held only on the end supports.

STANDARDIZATION AND EQUATIONS OF THE TAPES.

The results obtained on the Stanton base showed that in using invar tapes it is desirable to have the interval between supports considerably less than 25 meters, and accordingly, in May, 1909, the 50-meter invar tapes were standardized, using 5 as well as 3 supports.

The equations of the 4 tapes using the 5 supports, as determined by the May, 1909, standardization, are given below. The base was measured with tapes 516, 517, and 521, while tape 522 was taken to the field for use in case of accident to one of the other tapes.

May 25, 1909.

T_{516}=50 m+12.410 mm±0.026 mm, at 24°.8 C
T_{517}=50 m+12.785 mm± .026 mm, at 24°.8 C
T_{521}=50 m+13.012 mm± .021 mm, at 24°.7 C
T_{522}=50 m+13.922 mm± .020 mm, at 24°.7 C

The coefficients of expansion for these various tapes, for both this standardization and the one of March 10, 1910, were assumed to be unchanged from the standardization of January, 1909 (p. 155).

The equations of these tapes, furnished by the Bureau of Standards and resulting from the standardization in March, 1910, using 5 supports, are:

March 10, 1910.

T_{516}=50 m+12.37 mm±0.017 mm, at 26°.8 C
T_{517}=50 m+12.768 mm± .015 mm, at 26°.8 C
T_{521}=50 m+13.066 mm± .015 mm, at 26°.8 C
T_{522}=50 m+14.029 mm± .017 mm, at 26°.8 C

Values were also obtained at this time with the tapes on 3 supports. These values were not used on the Deming base, but are shown in the table on page 169 for the purpose of making a comparison with other values.

The adopted equations of the tapes used in the final computation of the Deming base are:

T_{516}=50 m+(12.382 mm±0.016 mm)+(0.0178 mm±0.0007 mm) (t−25.8 C)
T_{517}=50 m+(12.772 mm± .015 mm)+(.0160 mm± .0007 mm) (t−25.8 C)
T_{521}=50 m+(13.048 mm± .013 mm)+(.0205 mm± .0008 mm) (t−25.8 C)

These values were obtained by taking the weighted means of the equations furnished by the standardizations in May, 1909, and March, 1910. Each determination was given a weight inversely proportional to the probable error of the length of the tape. See page 160, which gives a statement regarding the manner of deriving the probable errors of the mean values of the equations of the tapes used on the Stanton base.

In order to compare the lengths of the tapes obtained by two standardizations, before and after the measurement of the Deming base, values of the lengths were reduced to the mean temperature of standardizations, 25°.8 C. The following table shows the comparison:

May 25, T_{516}	=50 m+12.428 mm	±0.026 mm,	v=−0.038 mm
Mar. 10,	=50 m+12.352 mm	± .017 mm,	+ .038 mm
Mean	= +12.390 mm		
May 25, T_{517}	=50 m+12.801 mm	± .026 mm,	− .025 mm
Mar. 10,	=50 m+12.752 mm	± .015 mm,	+ .024 mm
Mean	= +12.776 mm		
May 25, T_{521}	=50 m+13.034 mm	± .021 mm,	+ .006 mm
Mar. 10,	=50 m+13.046 mm	± .015 mm,	− .006 mm
Mean	= +13.040 mm		
May 25, T_{522}	=50 m+13.989 mm	± .020 mm,	− .011 mm
Mar. 10,	=50 m+13.968 mm	± .017 mm,	+ .010 mm
Mean	= +13.978 mm		

As tape 522 was not used at all in the field, the length of that tape is assumed to be constant and the difference in its values to be due to the accidental errors of the two standardizations.

It is seen from the above table that in no case was the residual of a tape length from the mean of the two standardizations as much as three times the probable error of a single determination of that tape length, and we may therefore conclude that no one tape underwent any permanent change in length between the standardizations before and after the measurement of the Deming base.

We are justified in assuming, as in the case of the Stanton base, that the differences shown are due to the standardizations; hence in forming the adopted equation of each tape a mean of the two values was taken.

The thermometers used during the measurements of the Deming base were similar to those used on the Stanton base. Their corrections are given in the following table:

Correction to—	No. 14109	No. 14128	No. 14130	No. 14131	No. 14135
−10° C	0.0	0.0	+0.1	0.0	+0.1
0° C	−.1	.0	.0	.0	.0
15° C	−.1	.0	−.1	.0	−.1
30° C	.0	.0	.0	.0	−.1
45° C	.0	.0	.0	−.1	.0

REDUCTION TO SEA LEVEL.

Elevations referred to mean sea level were carried by spirit leveling from the Pacific coast to Deming, N. Mex., by the United States Geological Survey, using precise methods on a greater portion of the work; the remainder of the leveling was of a grade slightly less accurate than the precise leveling. The elevation at Deming was carried to the northern end of the Deming base by trigonometric leveling, the adopted value of the elevation of the surface mark at Deming north base being 1 278.582 meters. (See page 157 for the formula used in making the reduction to sea level.)

The corrections for reducing the lengths of the sections to sea level are shown in the following table:

Corrections for reduction to sea level.

Section	Correction	Section	Correction	Section	Correction
	Meters		*Meters*		*Meters*
I	−0.2010	VIII	−0.2001	XV	−0.1982
II	−.2005	IX	−.1999	XVI	−.1088
III	−.2011	X	−.1994	XVII	−.0016
IV	−.2010	XI	−.1991		
V	−.2008	XII	−.1988	Total.	−3.1080
VI	−.2004	XIII	−.1986		
VII	−.2002	XIV	−.1985		

RESULTS OF THE MEASUREMENT.

The results of the measurement of the Deming base are given in the table following.

Deming Base Line.

Section	Date and hour	Direction of measure	Tape No.	Weather and wind *	Temperature		
					R, F, S.†	Mean corrected	Correction to t_o
	1910						*m.*
I	Jan. 14, 12.02 p. m.	N	516	—, M NNE	S	6.82	—0.0068
N. B.–20	14, 1.34 p. m.	S	521	—, M NNE	F	8.34	— .0072
II	14, 11.15 a. m.	N	516	—, M NNE	R	6.13	— .0070
20–40	14, 2.06 p. m.	S	521	—, M NNE	R	8.54	— .0071
III	14, 10.32 a. m.	N	516	—, M NNE	S	4.97	— .0074
40–60	14, 2.39 p. m.	S	521	—, L NNE	F	9.08	— .0069
IV	14, 9.44 a. m.	N	516	—, L NNE	F	5.41	— .0073
60–80	14, 3.12 p. m.	S	521	—, L NNE	S	9.04	— .0069
V	14, 8.54 a. m.	N	516	C, L NNE	R	5.68	— .0072
80–100	14, 3.41 p. m.	S	521	—, L NNE	F	8.88	— .0069
VI	14, 9.30 p. m.	S	516	—, O	R	7.97	— .0063
100–120	15, 2.33 p. m.	N	517	C, O	S	15.91	— .0032
VII	15, 10.03 a. m.	S	516	C, O	R	8.78	— .0061
120–140	15, 2.06 p. m.	N	517	C, O	R	14.86	— .0035
VIII	15, 10.34 a. m.	S	516	C, O	R	10.92	— .0053
140–160	15, 1.39 p. m.	N	517	C, O	F	14.00	— .0038
IX	15, 11.04 a. m.	S	516	C, O	S	10.82	— .0053
160–180	15, 1.15 p. m.	N	517	C, O	S	14.66	— .0036
X	15, 11.33 a. m.	S	516	C, O	R	11.84	— .0050
180–200	15, 12.49 p. m.	N	517	C, O	R	13.64	— .0039
XI	17, 8.34 a. m.	S	517	C, L W	R	8.45	— .0056
200–220	17, 4.21 p. m.	N	521	C, L–M W	S	13.24	— .0051
XII	17, 9.02 a. m.	S	517	C, L W	R	10.07	— .0050
220–240	17, 4.00 p. m.	N	521	C, M–L W	F	14.18	— .0048
XIII	17, 9.28 a. m.	S	517	C, L W	R	11.22	— .0047
240–260	17, 3.36 p. m.	N	521	—, S–M W	S	14.83	— .0045
XIV	17, 9.55 a. m.	S	517	—, M W	R	13.28	— .0040
260–280	17, 12.38 p. m.	N	521	—, S–VS W	R	16.18	— .0039
XV	17, 10.24 a. m.	S	517	C, M W	S	14.49	— .0036
280–300	17, 12.08 p. m.	N	521	—, S–VS W	F	16.17	— .0039
XVI	17, 10.47 a. m.	S	517	C, S W	R	14.72	— .0019
300–311	17, 11.46 a. m.	N	521	C, S W	S	16.12	— .0022
311–S.B.	17, 2.50 p. m.	S	490	C, S W	.....	15.5	— .0008
	17, 2.53 p. m.	N	490	C, S W	.....	15.5	— .0008

* These letters represent the following: C, clear; O, calm; L, light; M, moderate; S, strong; VS, very strong; W, west; SW, southwest; and NNE, north-northeast.

† These letters R, F, and S indicate whether the temperature was rising, falling, or stationary.

Deming Base Line.

Set-up or set-back	Grade correction	Tape correction	Reduction to sea level	Reduced lengths of sections	Adopted lengths of sections	v	v
m.	*m.*	*m.*	*m.*	*m.*	*m.*	*mm.*	*mm.*
−0.4415	−0.0134	+0.2476	−0.2010	999.5849	.....	−5.3	28.09
−.4641	−.0134	+.2599‡	−.2010	999.5742	999.5796	+5.4	29.16
−.3697	−.0191	+.2476	−.2010	999.6508	.....	−5.2	27.04
−.3923	−.0191	+.2599‡	−.2010	999.6404	999.6456	+5.2	27.04
−.2292	−.0091	+.2476	−.2011	999.8008	.....	−4.0	16.00
−.2500	−.0091	+.2599‡	−.2011	999.7928	999.7968	+4.0	16.00
−.3174	−.0187	+.2476	−.2010	999.7032	.....	−4.3	18.49
−.3387	−.0187	+.2599‡	−.2010	999.6946	999.6989	+4.3	18.49
−.2069	−.0303	+.2476	−.2008	999.8024	.....	−4.4	19.36
−.2283	−.0303	+.2599‡	−.2008	999.7936	999.7980	+4.4	19.36
−.1863	−.0164	+.2465‡	−.2004	999.8423	.....	+1.5	2.25
−.1952	−.0164	+.2554	−.2004	999.8454	999.8438	−1.6	2.56
−.3429	−.0007	+.2476	−.2002	999.6977	.....	+1.7	2.89
−.3500	−.0007	+.2554	−.2002	999.7010	999.6994	−1.6	2.56
−.2324	−.0054	+.2476	−.2001	999.8044	.....	+1.1	1.21
−.2395	−.0054	+.2554	−.2001	999.8066	999.8055	−1.1	1.21
−.2532	−.0214	+.2476	−.1999	999.7678	.....	+2.4	5.76
−.2580	−.0214	+.2554	−.1999	999.7725	999.7702	−2.3	5.29
−.3088	−.0034	+.2476	−.1994	999.7310	.....	+1.4	1.96
−.3148	−.0034	+.2554	−.1994	999.7339	999.7324	−1.5	2.25
−.2768	−.0065	+.2554	−.1991	999.7674	.....	−1.4	1.96
−.2857	−.0065	+.2610	−.1991	999.7646	999.7660	+1.4	1.96
−.2648	−.0028	+.2554	−.1988	999.7840	.....	−0.9	0.81
−.2724	−.0028	+.2610	−.1988	999.7822	999.7831	+0.9	0.81
−.2373	−.0030	+.2554	−.1986	999.8118	.....	−0.7	0.49
−.2445	−.0030	+.2610	−.1986	999.8104	999.8111	+0.7	0.49
−.2217	−.0015	+.2554	−.1985	999.8297	.....	+2.5	6.25
−.2223	−.0015	+.2610	−.1985	999.8348	999.8322	−2.6	6.76
−.2937	−.0045	+.2554	−.1982	999.7554	.....	+1.2	1.44
−.2965	−.0045	+.2610	−.1982	999.7579	999.7566	−1.3	1.69
−.1579	−.0010	+.1404	−.1088	549.8708	.....	+1.1	1.21
−.1585	−.0010	+.1435	−.1088	549.8730	549.8719	−1.1	1.21
−.0082	−.0002	+.0022	−.0016	8.1914	.....	0.0	0.00
−.0082	−.0002	+.0022	−.0016	8.1914	8.1914	0.0	0.00

‡ These quantities have had applied to them a correction of −.0011 meter for change in length due to change in tension.

The length of the Deming base line = 15 554.3825 meters.
± 79

The logarithm of this length = 4.1918528.
± 2

The probable error of the length = 7.93 mm, which corresponds to 1 part in 1 961 000.

PROBABLE ERRORS.

The following table shows the various probable errors for each section of the base:

Section	Probable error due to—			Combined probable error of each section
	Uncertainties in the lengths of the tapes	Uncertainties in the coefficients of expansion	Accidental errors of measure	
	mm	*mm*	*mm*	*mm*
I	±0.21	±0.18	±3.61	±3.62
II	± .21	± .19	±3.51	±3.52
III	± .21	± .20	±2.70	±2.72
IV	± .21	± .20	±2.90	±2.91
V	± .21	± .20	±2.97	±2.98
VI	± .22	± .14	±1.05	±1.08
VII	± .22	± .14	±1.11	±1.14
VIII	± .22	± .13	± .74	± .78
IX	± .22	± .13	±1.58	±1.60
X	± .22	± .13	± .98	±1.01
XI	± .19	± .16	± .94	± .97
XII	± .19	± .14	± .61	± .65
XIII	± .19	± .14	± .47	± .52
XIV	± .19	± .12	±1.72	±1.73
XV	± .19	± .11	± .84	± .87
XVI	± .10	± .06	± .74	± .75
Fraction	± .00	.....	± .00	± .00

The probable error of the length of the base from all sources = ±7.93 millimeters. The methods of computing the probable errors are shown on pages 160 and 161.

COST OF DEMING BASE.

The triangulation party was engaged on the measurement of the Deming base line from the time of finishing the observations for horizontal directions at the south base on January 8, to and including January 21, when the party moved from the base line to Deming to store the outfit and disband. It is believed that a fair estimate of the cost of field work during the measurement of the Deming base line is $600. This estimate was obtained from the accounts of the party and includes the pay and subsistence of the officers and men and the feed and care of teams between January 9 and 21 and the pay and subsistence of temporary employees while on the measurement of the base line and for several days previous to January 8 while clearing the line, also the cost of the lumber for the stakes forming the tape supports, and the expressage of tapes and other base apparatus from the office to the field. This made the cost per kilometer measured $39 and the cost per mile $62, which is 30 per cent lower than the cost of the Stanton base line, shown on page 161 of this publication.

Some of the reasons for the small field cost of the Deming base line were: (1) The base was measured in the vicinity of the town at which the triangulation party would have been disbanded, hence no traveling expenses of light keepers from the several triangulation stations to Deming were included in the cost of the base; (2) The base was measured after the completion of the triangulation, and the party was reduced in number to only what was needed for the base measurement; (3) Five supports were used for each tape length, thus permitting accurate measurements to be made under conditions which should prevent measuring when only three supports are used. No section was measured more than twice, and all measurements were made in daylight.

The total cost of the Deming base line was as follows: Field expense, $600; standardizing* 4 tapes before and after measuring the base, $400 (see cost of Stanton base line, page 161), and office computations, $92—a total of $1,092.

This made a cost of $72 per kilometer and $116 per mile, which is 25 per cent less than the total cost per kilometer of the Stanton base line, 27 per cent less than the average total cost of the measurement of a kilometer in 1900–1901 † (both bars and tapes were used in measuring nine bases during that season and the total average cost of the work was $160 per kilometer), and 38 per cent less than the average total cost of a kilometer measured in 1906.‡

SUMMARY OF TAPE VALUES.

In the following table are shown the values for the lengths of the base tapes resulting from the three standardizations of January 22 and May 25, 1909, and March 10, 1910, reduced to a common temperature of 21°.2 C. These values are for the lengths of the tapes when resting on three points of support, and subjected to a fixed tension of 15 kilograms. There are shown also the probable errors of the lengths from the various standardizations, and the residuals from the straight mean of the lengths for each tape.

At temperature of 21°.2 C.

Date of standardization	T_{616} —		T_{617} —		T_{621} —		T_{622} —	
	50 m+	v	50 m+	v	50 m+	v	50 m+	v
	mm *mm*	*mm*	*mm* *mm*	*mm*	*mm* *mm*	*mm*	*mm* *mm*	*mm*
Jan., 1909	9. 542±0. 017	−0. 072	9. 735±0. 018	+0. 017	9. 750±0. 018	+0. 071	10. 543±0. 019	+0. 024
May, 1909	9. 454± . 028	+ . 016	9. 782± . 025	− . 030	9. 835± . 021	− . 014	10. 566± . 024	+ . 001
Mar., 1910	9. 415± . 017	+ . 055	9. 738± . 015	+ . 014	9. 878± . 015	− . 057	10. 593± . 018	− . 026
Means,	9. 470		9. 752		9. 821		10. 567	

An examination of the above table will show that no residual is as large as five times the probable error of a single standardization, while the first and last standardizations give values which for no one tape differ as much as 1 part in 400 000. For tape

* The full price of $200 for a standardization of 4 tapes has been added to the cost of both the Stanton and Deming base lines for the standardization of the tapes in May, 1909.

† Appendix 3, 1901, "On the measurement of nine primary bases."

‡ Appendix 4, 1907, "Six primary bases measured with steel and invar tapes."

522 this difference amounts to 0.050 millimeter, and as that tape was carried in the field as a reserve, not being unreeled at either base line, we must assume this difference to be due to the accidental errors of standardization. From the above we may conclude that this assumption holds good for the other tapes.

SPEED.

The following table shows the speed attained in the measurements of the two base lines. The times given are from the time of the first observation to that of the last on each day. There are included the times occupied in changing from one tape to another and in placing copper strips on the end stakes. Delays of long duration, such as stopping for luncheon, are not included in the column under the heading "Time."

Speed with invar tapes.

STANTON BASE.

Date	Time	Distance	Kilometers per hour
1909	*h m*	*Kilometers*	
Feb. 11	4 33	8.00	1.76
13	3 55	7.00	1.79
16	4 11	9.00	2.15
19	5 02	9.15	1.82
20	2 21	4.00	1.70
21	0 26	1.00	2.33
DEMING BASE.			
1910			
Jan. 14	6 30	10.00	1.54
15	4 41	10.00	2.13
17	4 53	12.00	2.46

The mean kilometers per hour on the Stanton base was 1.86, and on the Deming base, 1.99. The average (weighted) speed on the two bases is 1.91 kilometers per hour.

CONCLUSIONS.

Some of the conclusions which may be drawn from the measurements of the Stanton and Deming base lines are:

The cost of measuring a single base line, or several base lines widely scattered, by the triangulation party when in the vicinity of each base line, will be much less than when measured by a party organized especially for measuring base lines. Where there are a number of base lines to be measured, which are not widely separated, as was the case on the ninety-eighth meridian, the cost would not be very different whether they were measured by the triangulation party or by a party organized for base-line measurements only. When a base is measured by a triangulation party, what may be called the unproductive periods, before and after the measurement, are eliminated. Such periods are usually occupied by traveling to and from the base and in organizing and disbanding the base party.

The 50-meter tape has been found to be both convenient and satisfactory, thus confirming the conclusions based upon previous tape work in this survey.

Invar tapes, with measurements made in daylight or at night, give results which have probable errors comparable with those obtained by the duplex base bars, which were used to measure the Salt Lake base, and in 1900–1901, in connection with steel tapes, in the measurement of 9 bases along the ninety-eighth meridian.

It is not necessary to standardize invar tapes in the field.

Owing to their smaller coefficients of expansion, invar tapes are better than steel tapes for measuring primary base lines.

With proper care during measurements in the field, the invar tape does not appreciably change in length. While not so elastic as steel, yet it is sufficiently strong to withstand the ordinary shocks due to excessive tension, and no change in its length should be caused by using a reel which has a diameter of 16 inches or more. During the measurements, the tape should not be dragged along the ground but should be carried forward by the members of the measuring party. Caution is necessary to prevent giving the invar tapes sharp bends, as they are not so elastic as steel tapes.

To minimize the effect of winds, the 50-meter invar tape should be supported by 5 stakes, equally spaced, 2 of these being the end supports on which the markings of the tape lengths are made and the other 3 being the intermediate supports from which the tape is suspended. By using this number of supports, measurements may be made with an invar tape during wind which would make it impracticable to secure good results were the tape on only 3 supports, 1 at each end and 1 in the center. It is believed that more than 5 supports should not be used for a 50-meter tape, for with a decrease in the distance between supports the difficulty of obtaining the grade corrections is increased.

The information contained in the reports of Assistant Hill was largely used in preparing this publication.

The office, or final, computations of the two bases were made under the direction of Computer H. C. Mitchell. He also assisted the writer with valuable suggestions while preparing the manuscript for publication.

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APPENDIX 5

REPORT 1910

TRIANGULATION IN CALIFORNIA

PART II

By

C. R. DUVALL and A. L. BALDWIN

Computers, Coast and Geodetic Survey

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CONTENTS.

ILLUSTRATIONS.

TRIANGULATION IN CALIFORNIA, PART II.

By C. R. DUVALL and A. L. BALDWIN,
Computers, Coast and Geodetic Survey.

GENERAL STATEMENT.

In Appendix 9, Report of the Coast and Geodetic Survey for 1904, "Triangulation in California, Part I," there is published upon the United States Standard Datum the results of the primary triangulation along the coast from Point Arena to the Mexican boundary and along the thirty-ninth parallel from the Pacific coat to the eastern boundary of the State, together with the results of the subordinate triangulation along the shore line between Monterey Bay and the southern boundary.

The aim of the present appendix is to give upon the United States Standard Datum and in a convenient form for the use of the engineer, surveyor, and cartographer, the geographic positions of all additional triangulation stations from Monterey Bay northward to Trinidad Head, for which the computations are completed. Descriptions and elevations are given for these points as far as available. By means of the sketches and the index to positions, descriptions, and elevations, pages 399 to 429, any information herein contained may readily be found.

In addition to the results that have already been published in the appendix referred to above and those contained in the present publication, there remains for future publication upon the United States Standard Datum triangulation in three localities in California, as follows: (1) A chain of primary triangulation following the Sacramento Valley from the vicinity of the thirty-ninth parallel to the Oregon boundary and thence to Tacoma, Wash., the results of which will soon be published; (2) the tertiary triangulation along the eastern boundary of the State, which was published on the Yolo Datum as Appendix 3, Report of the Coast and Geodetic Survey for 1900, under the title, "The oblique boundary line between California and Nevada;" (3) the tertiary triangulation along the coast line from Trinidad Head to the Oregon boundary. During the field season of 1908 the observations connecting the tertiary triangulation in this third locality with the primary and secondary triangulation of Oregon were completed. The final computations of this triangulation can now be made with the desired check.

The earliest observations of the triangulation under consideration in this appendix were made in 1851, and the latest in 1907. The points are located principally along the tide-water shore line from Monterey Bay to Trinidad Head. The positions are given, however, of a number of far inland astronomic stations and their local connection with the triangulation, together with those of a few mountain peaks in the interior and near the eastern boundary of the State. Besides these interior points just mentioned, some of the primary and subprimary stations, which control the smaller triangulation, are 75 kilometers or more from the coast; but with these comparatively few exceptions the points of this appendix are the subordinate triangulation stations used in the hydrographic and topographic surveys of the shore line.

63481°—11——12

For convenience of reference and discussion, the points are treated in the following order: (1) Triangulation executed between July 12, 1906, and July 2, 1907; (2) the primary triangulation of 1906–7; (3) the secondary triangulation of 1906–7; (4) tertiary triangulation in the vicinity of Colma, 1907; (5) tertiary triangulation of Tomales Bay, 1906; (6) tertiary triangulation in the vicinity of Fort Ross, 1906; (7) tertiary triangulation in the vicinity of Point Arena, 1906; (8) the old triangulation and the earthquake of 1906; (9) the earthquake of 1868; (10) from Monterey Bay to San Francisco, San Pablo, and Suisun bays and tributaries, 1851–1905; (11) Golden Gate to Point Arena, 1854–1891; (12) Point Arena to Shelter Cove, 1870–1897; (13) Shelter Cove to Trinidad Head, 1854–1872; (14) inland peaks and astronomic stations.

Triangulation Executed Between July 12, 1906, and July 2, 1907.

[The 1906–7 positions should be used in preference to those determined before the earthquake of 1906, when the best values of the present relative positions are desired.]

This triangulation was done primarily to determine the effect of the earthquake of April 18, 1906, on the relative positions of points in the disturbed area and to replace that part of the old triangulation which might be found so distorted as to destroy its value. The results of this investigation are published as Appendix 3, Report of the Coast and Geodetic Survey for 1907, "The earth movements in the California earthquake of 1906." This paper is limited to a discussion of the earth movements, as is indicated by the title, so it remains for the present appendix to give the complete tables of positions, with the accompanying sketches and descriptions of the 1906–7 triangulation. In all, 61 old points were recovered and their positions redetermined. In the table of positions two or three values are given for each of these 61 points. The values in italics are for the 1906–7 position and are to be used when the present relative positions of the points are desired. The other values, for one or two positions, as the case may be, are the positions before the earthquake of 1906, the affixed date showing whether the values are for the position before or after 1868. It was found on making the computations that observations made before and after 1868, when computed separately, showed that there had been a real change in the relative positions during the interval in which the earthquake of 1868 occurred. For details of these movements, see tables 2 and 3 of Appendix 3 of 1907.

Primary Triangulation of 1906–7.

[Sketches 2, 3, 6.]

The adjustments of this work were made in two figures. The first, sketch 2, is based on the two fixed lines, Mount Diablo to Mocho and Mocho to Santa Ana. The positions of these three points are held as given in Appendix 9, Report of the Coast and Geodetic Survey for 1904, "Triangulation in California, Part I."

The angles at Mount Toro, Gavilan, and Loma Prieta were measured with a 10-inch Gambey repeating theodolite. As a general thing, ten measures of six repetitions each were made of the separate angles, with the single condition of closing the horizon, though there was an occasional departure from this rule. The angles at Sierra Morena and Mocho were measured with a 12-inch direction theodolite in sixteen positions.

In the two closed triangles the closing error is for Loma Prieta, Sierra Morena, and Mocho, 0″.06; and for Gavilan, Mount Toro, and Loma Prieta, 4″.88. The probable error of an observed direction, resulting from the adjustment of the seven conditions involving twenty directions, is ±0″.88. The corrections to the separate direc-

tions are given in the following table, the numbers of the directions in the table corresponding to the numbers on the lines in sketch 2:

Primary triangulation 1906–7.

Number of direction	Correction to direction	Number of direction	Correction to direction	Number of direction	Correction to direction
	"		"		"
1	−0.039	8	+1.743	15	+0.062
2	−0.377	9	−0.505	16	−0.074
3	−0.262	10	+0.321	17	+0.055
4	+0.623	11	−0.163	18	−0.145
5	−1.560	12	+0.778	19	+0.090
6	+1.415	13	−0.615	20	+0.332
7	−1.469	14	+0.011		

The second primary figure adjustment, sketch 3, is based on the line Sierra Morena to Mount Diablo, as fixed in the preceding adjustment. The angles at Sierra Morena and Red Hill were measured with a 12-inch direction theodolite in sixteen positions. At the other occupied points of the figure the angles were measured with a 12-inch Gambey repeating theodolite. Twenty-six measures of six repetitions each were made of the primary angles at these stations, with the single condition of closing the horizon.

Farallon Light-house was not observed as a primary. From Sierra Morena it was observed on in five of the sixteen positions of the direction instrument, while at the other five stations angles were observed on it varying in number from ten to twenty-four sets of six repetitions each. The corrections to the directions arising from the figure adjustment do not show that these lines were of an inferior grade of accuracy.

There are 5 closed triangles in the figure, with an average closing error of 1″.35 and a maximum of 1″.70. The probable error of an observed direction is ±0″.32. The number of conditions satisfied is 13, and the number of directions 36. The following table shows the corrections to the separate directions, the numbers of the directions in the table corresponding to the numbers on the lines in sketch 3:

Primary triangulation, 1906–7.

Number of direction	Correction to direction	Number of direction	Correction to direction	Number of direction	Correction to direction
	"		"		"
1	+0.0329	14	−0.4843	27	+0.3205
2	+0.3647	15	+0.3295	28	+0.2118
3	−0.2792	16	−0.1075	29	+0.0490
4	−0.0590	17	+0.1592	30	−0.1661
5	+0.0970	18	−0.3148	31	−0.0951
6	+0.0632	19	−0.2722	32	+0.0785
7	.....	20	+0.6135	33	−0.0781
8	−0.1370	21	+0.2856	34	+0.3311
9	−0.0436	22	+0.0140	35	+0.0860
10	+0.3330	23	−0.3778	36	−0.2575
11	−0.6408	24	+0.1855	37	−0.1596
12	+0.3281	25	−0.6415		
13	+0.1548	26	+0.1354		

SECONDARY TRIANGULATION, 1906–7.

[Sketches 4, 5, 6.]

San Bruno Mountain, Pulgas east base, Pulgas west base, Pise Hill, Ridge 2, and Guano Island were adjusted at one time (sketch 4). The heavy lines of the sketch represent, as is customary, the lines fixed by previous adjustments. Four observers took part in measuring the angles of this figure, though the greater part of the work was done by one. The eight closed triangles have an average closing error of 4″.38 and a maximum of 8″.44. The probable error of an observed direction is ±1″.66, the number of directions involved being 34 and the number of conditions satisfied 17. The numbers of the directions in the following table correspond to the numbers on the lines in sketch 4:

Secondary triangulation, 1906–7.

Number of direction	Correction to direction	Number of direction	Correction to direction	Number of direction	Correction to direction
	″		″		″
1	−2.032	13	−0.937	24	−0.973
2	−2.253	14	+1.827	25	+2.524
3	+3.333	15	−1.634	26	+0.608
4	+2.020	16	+1.344	27	−1.950
5	−0.676	17	−0.433	28	+1.704
6	−0.221	18	+0.723	29	+0.041
7	+1.998	19	+0.342	30	−0.046
8	−2.468	20	+1.264	31	+0.251
9	+3.020	21	+0.441	32	−1.951
10	−4.178	22	−2.047	33	−0.122
11	+0.574	23	−1.526		
12	−0.305	23a	+2.084		

Santa Cruz Azimuth Station, Point Pinos Light-house, and Pajaro Mouth 2 were adjusted together on the line Loma Prieta to Gavilan, as fixed in the first primary figure (see sketch 5). The single closed triangle has a closing error of 2″.50. The probable error of an observed direction resulting from the figure adjustment of the three conditions is ±1″.27. Following are the corrections to the 11 directions, the numbers in the table corresponding to the numbers on sketch 5.:

Secondary triangulation, 1906–7.

Number of direction	Correction to direction	Number of direction	Correction to direction	Number of direction	Correction to direction
	″		″		″
1	−0.600	5	−0.205	9	−0.503
2	+0.931	6	+1.963	10	+0.955
3	+0.207	7	−1.361	11	−1.278
4	−0.397	8	+0.826		

Black Mountain was determined as an intersection point from the four stations—Ridge 2, Red Hill, Sierra Morena, and Loma Prieta. The probable error of an observed

direction resulting from satisfying the two conditions is ±1″.20, with a maximum correction to a direction of 2″.24. (See sketch 6.)

Lick Observatory small dome was observed from only four points, viz: Mocho, Loma Prieta, Sierra Morena, and Red Hill. The adjustment of the two conditions gave ±1″.40 as the probable error of an observed direction, with a maximum correction to a direction of 2″.52. (See sketch 6.)

Tertiary Triangulation in the Vicinity of Colma, 1907.

[Sketch 7.]

The occupied stations of this triangulation and one unoccupied station, Black Ridge 2, were adjusted at one time, there being 32 directions in the figure with 13 conditions to satisfy. The adjustment is based on the position of San Bruno Mountain, as fixed by the secondary triangulation of 1906–7, holding the direction of the line San Bruno Mountain to Black Ridge 2 from the 1907 observations, but using the length of this line as fixed by the triangulation of 1899. The maximum correction to a direction is 2″.2, while the average closing error of 11 triangles is 4″.0, with a maximum error of closure of 10″.2.

Tertiary Triangulation of Tomales Bay, 1906.

[Sketch 8.]

This work is based on the line Tomales Bay to Bodega, as fixed in the second primary figure of 1906–7. The occupied stations were adjusted in four steps, two of 10 conditions each, one of 11, and one of 4. The maximum correction to a direction is 8″.0. Thirty-one triangles have an average closing error of 8″.2 and a maximum of 26″.1.

Tertiary Triangulation in the Vicinity of Fort Ross, 1906.

[Sketch 9.]

The principal adjustments, based on the line Ross Mountain to Bodega Head of 1906–7, were made in four figures—one of 12 conditions, one of 10, one of 5, and one of 4. The maximum correction to a direction is 5″.9. There are 20 closed triangles with an average closing error of 3″.7 and a maximum of 12″.3.

In the table of positions the date 1891 is given to some of the old 1861 points of this vicinity for purposes of earthquake movement comparisons. The corresponding position depends on the primary work of 1891, though the point was established in 1861. In such cases the description shows when the station was established.

Tertiary Triangulation in the Vicinity of Point Arena, 1906.

[Sketch 10.]

This triangulation is based on the line Fisher to Cold Spring, as fixed by the triangulation of 1891 and published in Appendix 9, Report of the Coast and Geodetic Survey for 1904, "Triangulation in California, Part I." The connection with the other triangulation of 1906–7 is through the primary work done before the 1906 earthquake.

There is a possibility that the line Fisher to Cold Spring was displaced at the time of the earthquake of 1906, though it is very improbable that it was appreciably changed in length or azimuth. Hence the present relative positions of the new points in this

locality are very probably correctly expressed in the tables of positions. All the latitudes and longitiudes, however, of the 1906 triangulation stations on Point Arena are in error by as much as the line Fisher to Cold Spring has been displaced. Evidence afforded by a comparison of the old and new triangulation between Monterey Bay and Ross Mountain shows that such displacement must have been very small and is most likely masked by the errors of observation of the triangulation. See Appendix 3, Report of the Coast and Geodetic Survey for 1907, "The earth movements in the California earthquake of 1906."

The principal points of this work are fixed by four figure adjustments—one of 8 conditions, one of 3, and two of 2 each. The maximum correction to a direction is 4″.3, and the average closing error of 7 triangles is 2″.9, with a maximum of 5″.5.

Old Triangulation and the Earthquake of 1906.

In the tables of positions for the 1906–7 work the values both before and after the earthquake of 1906 will be found, one just preceding the other. A comparison will show that many of the lines have undergone large changes in length and azimuth. The line Hans to Foster, for example, one of the Tomales Bay lines, determined both before and after the 1906 earthquake, has been changed in length by about one part in 1 000 and in azimuth by about 5′.1. The latitudes and longitudes are changed by corresponding amounts. Since 95 per cent or more of the positions given in the present appendix depend entirely on observations made before the earthquake of 1906, and since such large changes are known to have taken place in the positions of the re-determined points, it is important to determine whether similar changes have taken place in the positions of this large percentage of old points, and to derive the probable values of such changes as far as the information at hand permits.

The method of deriving these changes is based on the results arrived at in Appendix 3, Report of the Coast and Geodetic Survey for 1907, "The earth movements in the California earthquake of 1906," summarized on pages 81, 82, 91, and 92, as follows:

> First, points on opposite sides of the fault moved in opposite directions, those to the eastward of the fault in a southerly direction, and those to the westward in a northerly direction. Second, the displacements of all points were approximately parallel to the fault. Third, the displacements on each side of the fault were less the greater the distance of the displaced points from the fault. Fourth, for points on opposite sides of the fault and the same distance from it, those on the western side were displaced on an average about twice as much as those on the eastern side. * * *
>
> On the eastern side of the fault, ten points at an average distance of 1.5 kilometers (0.9 mile) from the fault have an average displacement of 1.54 meters (5.1 feet), three points at an average distance of 4.2 kilometers (2.6 miles) have an average displacement of 0.86 meter (2.8 feet), and one point, Mount Tamalpais, at 6.4 kilometers (4 miles) from the fault, has a displacement of 0.58 meter (1.9 feet). These fourteen points are the only ones on the eastern side of the fault for which the observed displacements were determined with reasonable certainty. For no point to the eastward of the fault at a greater distance than 6.4 kilometers (4 miles) was any displacement detected with certainty. To the westward, twelve points at an average distance of 2 kilometers (1.2 miles) from the fault have an average displacement of 2.95 meters (9.7 feet). Seven at an average distance of 5.8 kilometers (3.6 miles) have an average displacement of 2.38 meters (7.8 feet). The only other point to the westward of the fault of which the displacement was determined with certainty was Farallon Light-house, distant 37 kilometers (23 miles) and displaced 1.78 meters (5.8 feet).

For convenience of reference and to serve also as a warning, this fault line of 1906 is shown on all the sketches for both the old and the new triangulation. Running

southward, it crosses the shore line just north of Point Arena and reaches a maximum inland distance in this locality of about 7 kilometers. Continuing nearly parallel to the coast line which it slowly approaches, the fault crosses out to sea again in the vicinity of Fort Ross. It is next traced where it crosses Bodega Head at a distance of about 2.5 kilometers from the extreme point. Then, following Bodega and Tomales bays southward, it crosses the land to Bolinas Bay and is again lost in the sea. The land is finally entered in the vicinity of Colma, from which locality the fault has been traced southward to San Juan in San Benito County.

In the second paragraph quoted, it is stated that no displacement was discovered with certainty at a greater distance east of the fault than 6.4 kilometers. This extreme eastern displacement is for Mount Tamalpais, a primary station, determined with the highest degree of accuracy both before and after the earthquake of 1906. For Ross Mountain, another primary station, also determined with the highest grade of accuracy before and after the 1906 earthquake, the displacement of 0.53 meter is doubtful; that is, for this primary station, only 7 kilometers east of the fault, the observed displacement is not much larger than the uncertainty of position arising from errors of observation. Hence, for the 80 per cent or more of old points in the present appendix which are east of the fault and at a greater distance than 7 kilometers, it is reasonable to assume that there has been no disturbance large enough to be detected by the triangulation. These old points are, as a rule, determined with a low grade of accuracy, and the consequent uncertainty of position is much larger for them than for a primary triangulation station like Ross Mountain. It will be necessary, then, to compute corrections to be applied to the old positions, only for those points east of the fault that are within a distance of 7 kilometers. It is believed, however, that all the old points on the San Francisco peninsula and in the vicinity of Pulgas base should be used with caution, and they are so marked in the tables of positions.

Practically all the old points in this appendix that lie west of the fault have been disturbed. At Farallon Light-house 37 kilometers west the displacement is certain. All the other points to the westward, for which displacements have been determined with certainty, are much nearer the fault than Farallon Light-house. The assumption that the general movement extended as far west as 37 kilometers seems to be justified, though it rests on the evidence furnished by this single point. Over against the fact that the motion near the fault is determined from the mean of a number of points, so that the effect of errors of observation is presumably eliminated, is to be placed the fact that the two determinations of Farallon Light-house, before and after the 1906 earthquake, are much stronger than the average for points near the fault. The question of corrections for earthquake movements is to be considered, therefore, for all old points as far west of the fault as Farallon Light-house and for all old points less than 7 kilometers distant on the eastern side. This includes all old points west of the fault except a few island summits and rocks among the Farallon Islands, which are slightly farther west than the light-house. The corrections are computed only for definitely marked points, determined with a check, for which it may reasonably be assumed that the markings are still in existence. For other points that lie in the disturbed area, such as no-check points, points that are lost or probably lost, summits and rocks, attention is called to the fact that the positions have probably been disturbed, without attempting

to give the amount of disturbance. In the case where a new point of 1906–7 has been established in the near vicinity of an old point, no corrections have been computed, even though the old point may not be lost.

Referring again to the second paragraph quoted, it is seen that the magnitude of the displacement is given for three different distances from the fault, for both the eastern and western sides. Take the case for either side and plot three points with abscissæ proportional to the three distances from the fault, and ordinates proportional to the three corresponding displacements, draw a smooth curve through the three points thus plotted, and the ordinate corresponding to any abscissa, or distance from the fault, will be the displacement for that distance. Two such curves were drawn one for the eastern side of the fault and one for the western, and the magnitudes of the displacements for the different points were thus graphically computed. These displacements, all assumed parallel to the fault, were then transformed into changes in latitude, longitude, length, and azimuth. The results arrived at by applying these corrections are placed in a separate table and referred to by footnotes to the original tables of positions. Only those corrections are taken account of that are appreciably larger than the uncertainties in the corresponding values, arising from errors of observation. In all other cases a note of warning is given.

No attempt has been made to apply these corrections so as to maintain the consistency between the two systems of coordinates; that is, after the corrections have been applied the latitudes and longitudes may not agree with the lengths and azimuths out to the last figure.

The general plan, outlined above, of inferring displacements and deriving the resulting corrections was departed from in the following three cases: (1) Owing to the conflicting evidence and uncertainty of displacement at the southern end of San Francisco Bay, no displacements were computed for that locality, though a number of points on the eastern side were nearer the fault than 7 kilometers; (2) between the triangulation stations Pescadero and Santa Cruz Light-house the general method was modified so as gradually to conform to the actually observed displacement at Santa Cruz Light-house; (3) points in the vicinity of Monterey Bay were not corrected, owing to the uncertainty of displacement.

The Earthquake of 1868.

In a preceding paragraph it has been stated that there was an appreciable disturbance of the relative positions of many of the points given in this appendix at about the time of the earthquake of 1868. The information at hand concerning the movement indicates that a large block of the earth's crust, from the Golden Gate to some distance north of Ross Mountain, was bodily displaced in a northerly direction, without rotation or distortion. In the vicinity of the southern part of San Francisco Bay the motion was somewhat irregular and uncertain. Farther south, toward Monterey Bay, there was a large and unquestionable motion in a southerly direction.

It is not thought that any of the results in the present appendix are seriously in error on account of this 1868 disturbance. The relative positions of points within the large area that moved to the northward have not been affected, and the effect of the motion on the positions of these points with respect to points outside the disturbed region has been largely compensated for by the method of adjustment. The primary

triangulation which controls this whole region has all been done since 1868. The old work, done before 1868, was made to conform to the new primary triangulation done between 1868 and 1892. In the same way, it is believed that the effect of the disturbances to the southward has been largely eliminated by making the work done before 1868 fit that done between 1868 and 1892. The adjustments that fix the old points given in this appendix were made in this manner without any reference to earthquake disturbances, but with the sole object of bringing the results into accord. It was known that the old work received much larger corrections than the observations seemed to warrant, but for only one station, Mount Tamalpais, was it recognized, when the adjustments were made, that the earthquake motion must be taken into consideration. For this point two positions were used in the old adjustments that fix the old positions—one for the position before 1868, and one for that after 1868. In this way, also, the effect of the earthquake of 1868 on the results in this appendix was partly eliminated.

From Monterey Bay to San Francisco, San Pablo, and Suisun Bays and Tributaries, 1851–1905.

[Sketches 11 to 21.]

This triangulation has a wide range of accuracy. Some of the larger controlling triangulation of 1851–1854 is of the primary grade, with an average error of closure of triangles not much in excess of one second. Much of the smaller triangulation, done for use in hydrography and topography, falls below the present standard for tertiary triangulation, which is that the average error of closure of triangles shall be from four to five seconds.

A large part of the area covered by this triangulation lies within the region known to have been disturbed by the earthquake of 1906. Having this fact in view, and remembering also the large number of stations involved, some occupied ten or more times by as many different observers, and the complicated overlapping of the triangles, it is deemed impracticable to go into details concerning the procedure in adjustments and the accuracy of results.

Golden Gate to Point Arena, 1854–1891.

[Sketches 22 to 25.]

A large part of this area is covered by the new triangulation of 1906–7, the positions of which are to be used whenever the best values of the present relative positions are desired. The old points of this whole section have, no doubt, been disturbed by the earthquake of 1906. The fault line accompanying this earthquake crosses the lines of the triangulation in many places, and is nowhere far enough away from the scheme of old points in this locality to leave them undisturbed. Corrections have been computed for all these old points and are referred to in footnotes to the tables of positions.

In view of the complications arising from the proximity of all the old points of this section to the fault line of 1906, it is useless to go into details in regard to the accuracy. All that need be said is that this triangulation is well controlled by the primary, with which it is connected in several places.

POINT ARENA TO SHELTER COVE, 1870–1897.

[Sketches 26 to 29.]

It is not believed that the earthquake disturbance of 1906 has appreciably affected the relative positions at a greater distance than 15 to 20 kilometers north of Point Arena. Corrections have been computed accordingly, and are referred to in footnotes to the tables of positions, for all points from Point Arena to the triangulation station Cavanaugh.

In addition to the starting length from the Point Arena base there is in this chain the further control of three bases, viz, Navarro Ridge base, Ten Mile River Beach base, and the Shelter Cove base. The discrepancies in length at Ten Mile River Beach base, as brought from the north and south, were 34 and 25 in the sixth decimal place of the logarithms, or one part in 13 000 and 17 000, respectively. The discrepancy in length between the Point Arena base and the Navarro Ridge base was about one part in 250. The final corrections to the directions showed that this extremely large ratio was mostly due to the unfavorable shape of the triangles through the small angles of which the length had to be computed.

The latitudes, longitudes, and azimuths, as brought from the south, were made to conform to the primary triangulation station, Chemise Mountain, which is at the northern extremity of this section. The discrepancies at this point in latitude, longitude, and azimuth were 0″.221, 0″.031, and 34″.4, respectively. The mean error of closure of 327 triangles is 7″.6, with a maximum of 42″.2.

The scheme connecting points in Ukiah with the main body of the triangulation (sketch 36) is based on the primary line Paxton to Mount Sanhedrin, the lengths being checked by a local base.

SHELTER COVE TO TRINIDAD HEAD, 1854–1872.

[Sketches 30 to 33.]

This section is controlled at the southern end by the length of the Shelter Cove base and the latitude, longitude, and azimuth at the primary station, Chemise Mountain. The length is further held by the base at Humboldt bay, while the latitude, longitude, and azimuth are subject to the conditions of bringing out those at the primary station, Bear Ridge. The discrepancies were as follows: In length, 113 in the sixth decimal place of the logarithms, or one part in 4 000; in azimuth, 63″; in latitude, 0″.469; and in longitude 0″.230. The mean error of closure of 288 triangles is 13″.9, with a maximum of 112″.5. This maximum value occurs in a triangle with one side barely over 200 meters long, and the large mean error is due, in great part, to the many short lines over which observations were made.

INLAND PEAKS AND ASTRONOMIC STATIONS.

[Sketches 34 to 40.]

The positions of the mountain peaks given in this appendix are determined principally from the primary stations of which the positions were published in Appendix 9, Report of the Coast and Geodetic Survey for 1904, "Triangulation in California, Part I." When the final results are published for the primary triangulation following the Sacra-

mento Valley northward from the thirty-ninth parallel of latitude the positions of a number of additional peaks will be given, and others still will be available when the final computations are made for the tertiary triangulation along the oblique boundary between California and Nevada.

An astronomic station is always either near or identical with a triangulation station, generally a primary station. The connection with the triangulation is often made by a measurement of the distance and direction to the astronomic station. In several cases the connection is made by a small local triangulation. The positions are given for the points of such connecting triangulation, though these points are often not permanently marked. This small triangulation is shown, on separate sketches, for Marysville, Mount Helena, Mount Hamilton, and Mount Conness.

Adjustment of the Subordinate Triangulation.

All inconsistencies have been eliminated by least square adjustments from the results set forth in the tables of positions. That is, the sum of the three adjusted angles of each triangle is equal to 180° plus the spherical excess; from whatever line and through whatever chain of triangles the length and azimuth of a given line are computed the results will be the same as those given in the tables of positions for that line, and from whatever point and through whatever chain of lines the latitude and longitude of a given point are computed the results will be the same as those given in the tables of positions for that point. In the preceding statements no account is taken of those small discrepancies in the last place that arise from accumulations of neglected figures in the next place to the right of the last place used.

The process of adjustment is to start from the large primary work and gradually come down to the triangulation of the lower grades of accuracy. The points selected at each step, to be fixed by one figure adjustment, are somewhat arbitrarily chosen, the general aim being to get the best results from the observations at hand, without unduly extending the amount of computation. At each stage in the process, then, those points are taken for the next adjustment that are most strongly determined, the number of points taken and the consequent amount of computation involved corresponding in a general way to the importance of the results to be attained. Thus, the important points of the larger, controlling triangulation are adjusted, several at a time, in figures involving a large number of conditions, using all the available observations. Points of less importance are adjusted one or two at a time, often not making use of every observed line. In case only a part of the observations are used, those selected are for the lines that give the least uncertainty of position for a given uncertainty of direction. The lengths and azimuths of the remaining lines, the observations of which have received no weight in the adjustment, are computed to fit the position thus fixed by the selected lines. Hence, the azimuths and lengths of all lines observed over, whether from both ends or from one end only, are to be found in the tables of positions.

In the case of unoccupied points, determined by intersections, such as chimneys, smokestacks, flagstaffs, cupolas, and spires, the general rule followed has been to make the determination depend upon not more than four lines; that is to say, upon not more than two conditional equations. More than two conditions have occasionally been used for such points, when their positions were to be used further in fixing other points.

When a chain of subordinate triangulation closes upon itself or upon previously fixed primary work, there arise discrepancies in latitude and longitude, or in latitude, longitude, azimuth, and length, according as the loop is closed on a point or on a line. This introduces either two or four conditions, in addition to the usual angle, side, and length equations, viz, a latitude equation and a longitude equation; or a latitude equation, a longitude equation, an azimuth equation, and a length equation. In subordinate triangulation, these additional circuit-closure conditions, two or four, as the case may be, are satisfied in a separate adjustment, after a preliminary adjustment has been made of a part or all the other conditions. The least laborious process used is to close up a continuous chain of the best-shaped triangles, connecting the two fixed extremities of the network, by applying one-third of the error of closure of each triangle to each separate angle of the triangle. This is a least square adjustment of the angles (not directions) of this selected chain of triangles. Through the chain of triangles thus adjusted the discrepancies of circuit closure are computed and a least square adjustment is made of the results of the preliminary adjustment, satisfying the conditions of circuit closure. This second adjustment gives the final positions for a chain of triangles fitting between the originally fixed extremities. All other observed lines and points of the chain, in addition to those thus fixed, are now computed either by the simple solution of triangles in the case of the undetermined diagonal of a fixed quadrilateral, or by a least-square adjustment in the case of a point not in the selected chain. A plan more often followed is to satisfy all the angle and side conditions by preliminary adjustments, in several steps, as a rule, and then to satisfy the conditions of circuit closure, in the same way as just described by making a least-square adjustment of a selected chain of these closed triangles. The adjustments are then completed as described above.

The United States Standard Datum.

All of the positions and azimuths have been computed upon the Clarke spheroid of 1866, as expressed in meters, which has been in use in the Coast and Geodetic Survey for many years.

After a spheroid has been adopted and all the angles and lengths in a triangulation have been fully fixed, it is still necessary, before the computation of latitudes, longitudes, and azimuths can be made, to adopt a standard latitude and longitude for a specified station and a standard azimuth of a line from that station. For convenience the adopted standard position (latitude and longitude) of a given station, together with the adopted standard azimuth of a line from that station, is called the geodetic datum.

The primary triangulation in the United States was commenced at various points, and existed at first as a number of detached portions in each of which the geodetic datum was necessarily dependent only upon the astronomic stations connected with that particular portion. As examples of such detached portions of triangulation there may be mentioned the early triangulation in New England and along the Atlantic coast, a detached portion of the transcontinental triangulation centering on St. Louis and another portion of the same triangulation in the Rocky Mountain region, and three separate portions of triangulation in California in the latitude of San Francisco, in the vicinity of Santa Barbara channel, and in the vicinity of San Diego. With the lapse of time these separate pieces have expanded until they have touched or overlapped.

The transcontinental triangulation, of which the office computation was completed in 1899, joins all of the detached portions mentioned and makes them one continuous triangulation. As soon as this took place the logical necessity existed of discarding the old geodetic data used in these various pieces and substituting one datum for the whole country, or at least for as much of the country as is covered by continuous triangulation. To do this is a very heavy piece of work, and involved much preliminary study to determine the best datum to be adopted. On March 13, 1901, the Superintendent adopted what is now known as the United States Standard Datum, and it was decided to reduce the positions to that datum as rapidly as possible. The datum adopted was that formerly in use in New England, and therefore its adoption did not affect the positions which had been used for geographic purposes in New England and along the Atlantic coast to North Carolina, nor those in the States of New York, Pennsylvania, New Jersey, and Delaware. The adopted datum does not agree, however, with that used in "The transcontinental triangulation" and in "The eastern oblique arc of the United States," publications which deal primarily with the purely scientific problem of the determination of the figure of the earth and which were prepared for publication before the adoption of the new datum.

As the adoption of such a standard datum is a matter of considerable importance, it is in order here to explain the desirability of this step more fully.

The main objects to be attained by the geodetic operations of the Coast and Geodetic Survey are, first, the control of the charts published by the Survey; second, the furnishing of geographic positions (latitudes and longitudes), of accurately determined elevations, and of distances and azimuths, to officers connected with the Coast and Geodetic Survey and to other organizations; third, the determination of the figure of the earth. The first two of these objects are purely practical; the third is purely scientific. For the first and second objects it is not necessary that the reference spheroid should be accurately that which most closely fits the geoid within the area covered, nor that the adopted geodetic datum should be absolutely the best that can be derived from the astronomic observations at hand. It is simply desirable that the reference spheroid and the geodetic datum adopted shall be, if possible, such a close approximation to the truth that any correction which may hereafter be derived from the observations which are now or may become available shall not greatly exceed the probable errors of such corrections. It is, however, very desirable that one spheroid and one geodetic datum be used for the whole country. In fact, this is absolutely necessary if a geodetic survey is to perform fully the function of accurately coordinating all surveys within the area which it covers. This is the most important function of a geodetic survey. To perform this function it is also highly desirable that when a certain spheroid and geodetic datum have been adopted for a country they should be rigidly adhered to without change for all time, unless shown to be largely in error.

In striving to attain the third object, the determination of the figure of the earth, the conditions are decidedly different. This problem concerns itself primarily with astronomic observations of latitude, longitude, and azimuth, and with the geodetic positions of the points at which the astronomic observations were made, but is not concerned with the geodetic positions of other points fixed by the triangulations. The geodetic positions (latitudes and longitudes) of comparatively few points are therefore concerned in this problem. However, in marked contrast to the statements made in

preceding paragraphs, it is desirable in dealing with this problem that, with each new important accession of data, a new spheroid fitting the geoid with the greatest possible accuracy, and new values of the geodetic latitudes, longitudes, and azimuths of the highest degree of accuracy, should be derived.

The United States Standard Datum was adopted with reference to positions furnished for geographic purposes, but has no reference to the problem of the determination of the figure of the earth. It is adopted with reference to the engineer's problem of furnishing standard positions, and does not affect the scientist's problem of the determination of the figure of the earth.

The principles which guided in the selection of the datum to be adopted were: First, that the adopted datum should not differ widely from the ideal datum for which the sum of the station errors in latitude, longitude, and azimuth should each be zero; second, it was desirable that the adopted datum should produce minimum changes in the publications of the Survey, including its charts; and, third, it was desirable, other things being equal, to adopt that datum which allowed the maximum number of positions already in the office registers to remain unchanged, and therefore necessitated a minimum amount of new computation. These considerations led to the adoption as the United States Standard of the datum which had been in use for many years in the northeastern group of States and along the Atlantic coast as far as North Carolina.

An examination of the station errors available in 1903, on the United States Standard Datum, at 246 latitude stations, 76 longitude stations, and 152 azimuth stations, scattered widely over the United States from Maine to Louisiana and to California, indicated that this datum approaches closely the ideal with which the algebraic sum of the station errors of each class would be zero.

The adopted United States Standard Datum, upon which the positions and azimuths given in this publication depend, may be defined in terms of the position of the station Meades Ranch as follows:

		°	′	″
ϕ	=	39	13	26.686
λ	=	98	32	30.506
α to Waldo	=	75	28	14.52

Points are then said to be upon the United States Standard Datum when they are connected with the station Meades Ranch by a continuous triangulation, through which the corresponding latitudes, longitudes, and azimuths have been computed on the Clarke spheroid of 1866, as expressed in meters, starting from the above data.

Appendix 9, Report of the Coast and Geodetic Survey for 1904, entitled "Triangulation in California, Part I," and Appendix 3, Report of the Coast and Geodetic Survey for 1907, "The earth movements in the California earthquake of 1906," are the only publications of this Office, previous to the present one, in which California positions are given upon the United States Standard Datum. Appendices 9 and 3, Reports of the Coast and Geodetic Survey for 1885 and 1900, respectively, and special publication No. 4, "The transcontinental triangulation, 1900," give positions in California which are not upon the United States Standard Datum. The principal lists of positions heretofore published upon the Standard Datum throughout the whole United States are contained in the following publications of the Coast and Geodetic Survey and of other organizations:

Appendix 8 of the Report for 1885, positions in Massachusetts and Rhode Island; Appendix 8 of the Report for 1888, positions in Connecticut; Appendix 8 of the Report for 1893, positions in Pennsylvania, Delaware, and Maryland; Appendix 10 of the Report for 1894, positions in Massachusetts; Appendix 6 of the Report for 1901, positions in Kansas and Nebraska; Appendix 3 of the Report for 1902, positions in Kansas, Missouri, Nebraska, and Colorado; Appendix 4 of the Report for 1903, positions in Kansas, Oklahoma, and Texas; Appendix 9 of the Report for 1904, positions in California; Appendix 5 of the Report for 1905, positions in Texas; Appendix 3 of the Report for 1907, positions in California; in Appendix EEE, pages 2905–3031, Annual Report of the Chief of Engineers, 1902, positions of points on and near the Great Lakes; in publications of the Massachusetts Harbor and Land Commission; and in various bulletins of the United States Geological Survey.

LENGTHS.

The lengths from Monterey Bay to the vicinity of Point Arena, for the triangulation both before and after the earthquake of 1906, are controlled by the Yolo base, the Pulgas base, and the Los Angeles base. From Point Arena northward the lengths of the small shore line triangulation are controlled principally by five small bases, viz, Point Arena base, Navarro Ridge base, Ten Mile River Beach base, Shelter Cove base, and Humboldt Bay base. As far north as the primary station Bear Ridge, which is north of Cape Mendocino, positions of this small shore line triangulation are controlled by the primary triangulation, and to some extent the lengths are thus indirectly controlled by the primary work.

The lengths as given are all reduced to sea level. If the actual length of a line simply reduced to the horizontal is desired, it may be obtained with all the accuracy ordinarily needed by adding to the sea level length as given a correction=(length of line as given) $\left(\frac{\text{Mean elevation of two ends of line in meters}}{6370000}\right)$. The maximum value of this correction does not exceed $\frac{1}{1600}$ of the length for any portion of the triangulation here published. The maximum error made in the use of the above approximate formula for the correction does not exceed $\frac{1}{8000000}$ of the length for any portion of this triangulation.

For the convenience of those who may wish to compare the lengths here given with others which are expressed in feet, or vice versa, the following conversion table is here inserted:

Meters	Feet	Feet	Meters
1	3. 280833	1	0. 3048006
2	6. 561667	2	0. 6096012
3	9. 842500	3	0. 9144018
4	13. 123333	4	1. 2192024
5	16. 404167	5	1. 5240030
6	19. 685000	6	1. 8288037
7	22. 965833	7	2. 1336043
8	26. 246667	8	2. 4384049
9	29. 527500	9	2. 7432055
10	32. 808333	10	3. 0480061

TABLES OF POSITIONS.

In the tables of positions the latitude and longitude of each point are given and also the length and azimuth of each line observed over, whether one or both ways. This is, in a way, a duplication, as the lengths and azimuths are implicitly contained in the corresponding latitudes and longitudes, while, on the other hand, from the latitude and longitude of a single point all the remaining latitudes and longitudes may be derived by means of the given lengths and azimuths. The amount of computation involved in transforming one of these systems of coordinates into the other is so great that it is necessary to have the double system for the convenient use of tables of positions. Along with the latitude and longitude of each point the lengths and azimuths are given of all lines from that point to other points of the triangulation, except that lengths and azimuths already given are not repeated.

For the convenience of the draftsman a column of "seconds in meters" is given, in which is placed the length (in meters) of each small arc of meridian or parallel corresponding to the seconds of a given latitude or longitude. To facilitate further the use of the tables of positions, a column is given for the logarithms of the lengths.

The rule followed in recent publications of this Office has been to give the latitudes and longitudes to thousandths of seconds for all points the positions of which are fixed by fully adjusted triangulation. In the present publication exceptions have been made in the following two cases: (1) Points not definitely marked or which are not in themselves well-defined objects for pointing upon, such as most of the mountain summits, rocks, and points of land; (2) astronomic stations that are not triangulation stations proper, but connected therewith by linear measurements or by small local triangulation. These exceptions are made in the present case to save the labor of changing computations already made. The latitudes and longitudes are given to hundredths of seconds, then, in the present appendix for the two classes of points mentioned above and also for points determined without a check.

In the columns giving azimuths, distances, and logarithms of distances various numbers of decimal places are given, the intention being to indicate the accuracy to a certain extent, it being understood that in each quantity two doubtful figures are given. In some cases there is very little doubt of the correctness of the second figure from the right, and in a few cases some doubt may be cast upon the third figure.

These tables may be conveniently consulted by using as finders the forty sketches at the end of this appendix, and the index, on pages 399 to 429. In the third column of the index will be found for each point a reference to the page on which its description is given, in the fourth column the sketches on which it occurs, and in the fifth column the page on which its elevation above sea level may be found.

Primaries and Secondaries for 1906–7 and older positions of same points.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Sierra Morena	37 24 38.266	1179.7	263 23 39.45	83 51 06.64	Mocho	67011.26	4.8261478
1883	122 18 28.006	688.7	156 03 23.27	335 52 49.43	Mount Tamalpais	62422.54	4.7953414
			213 30 32.29	33 44 59.40	Mount Diablo	62842.01	4.7982501
Sierra Morena	*37 24 38.305*	*1180.9*	*213 30 37.68*	*33 45 04.82*	*Mount Diablo*	*62841.70*	*4.7982479*
1907	*122 18 28.054*	*689.9*	*263 23 43.47*	*83 51 10.69*	*Mocho*	*67012.32*	*4.8261547*
Loma Prieta	37 06 40.971	1263.0	130 40 36.75	310 29 35.73	Black Mountain	35483.63	4.5500280
1854	121 50 36.521	901.8	200 31 35.15	20 35 26.95	Masters Hill	26900.06	4.4297533
Loma Prieta	37 06 40.912	1261.3	129 01 13.52	308 44 21.46	Sierra Morena	52911.85	4.7235530
1884	121 50 36.423	899.3	175 52 59.49	355 50 26.13	Mount Diablo	85760.84	4.9332890
			212 04 03.95	32 14 32.67	Mocho	48021.28	4.6814337
Loma Prieta	*37 06 40.895*	*1260.8*	*129 01 13.83*	*308 44 21.72*	*Sierra Morena*	*52914.49*	*4.7235746*
1906	*121 50 36.390*	*898.5*	*175 52 57.07*	*355 50 24.29*	*Mount Diablo*	*85761.43*	*4.9332920*
			212 03 59.84	*32 14 28.54*	*Mocho*	*48021.30*	*4.6814339*
			292 37 25.26	*112 50 28.70*	*Santa Ana*	*58068.62*	*4.7706209*
Mount Toro	36 31 34.712	1070.0	162 12 31.32	342 04 05.43	Loma Prieta	68212.25	4.8338624
1885	121 36 32.276	803.0	182 34 42.13	2 36 38.58	Mocho	105688.3	5.0240270
			218 31 04.10	38 44 33.91	Santa Ana	53847.56	4.7311660
Mount Toro	*36 31 34.742*	*1070.9*	*162 12 32.85*	*342 04 06.98*	*Loma Prieta*	*68210.45*	*4.8338515*
1906	*121 36 32.284*	*801.3*	*182 34 42.61*	*2 36 39.07*	*Mocho*	*105687.37*	*5.0240231*
			218 31 06.92	*38 44 36.72*	*Santa Ana*	*53847.96*	*4.7311612*
Gavilan	36 45 21.068	649.4	143 56 22.65	323 44 42.60	Loma Prieta	48865.98	4.6890066
1854	121 31 11.504	285.3	180 09 11.72	0 09 14.29	Murphy	39551.38	4.5971616
Gavilan	*36 45 20.961*	*646.1*	*17 24 34.20*	*197 21 22.66*	*Mount Toro*	*26686.58*	*4.4262930*
1906–7	*121 31 11.341*	*281.3*	*143 56 22.23*	*323 44 42.16*	*Loma Prieta*	*48867.18*	*4.6890173*
			236 58 19.93	*57 08 30.52*	*Santa Ana*	*30520.50*	*4.4845916*
Santa Cruz	36 58 42.106	1298.0	231 50 57.63	51 58 36.81	Loma Prieta	23930.71	4.3789556
1854–1864	122 03 18.728	463.2	297 11 26.89	117 30 43.15	Gavilan	53743.68	4.7303274
Santa Cruz	*36 58 42.027*	*1295.4*	*231 51 10.99*	*51 58 50.23*	*Loma Prieta*	*23932.82*	*4.3789038*
1906	*122 03 18.702*	*462.5*	*297 11 23.72*	*117 30 40.06*	*Gavilan*	*53747.10*	*4.7303550*
Point Pinos L. H.	36 38 01.551	47.8	164 07 28.30	344 03 04.82	Santa Cruz	39764.17	4.5994919
1854–1866	121 55 58.939	1464.3	188 32 27.51	8 35 40.97	Loma Prieta	53600.54	4.7291692
Point Pinos L. H.	*36 38 01.309*	*43.1*	*164 07 16.84*	*344 02 53.29*	*Santa Cruz*	*39767.15*	*4.5995244*
1906	*121 55 58.795*	*1460.6*	*188 32 24.95*	*8 35 38.40*	*Loma Prieta*	*53602.79*	*4.7291874*
			240 43 35.36	*69 58 24.19*	*Gavilan*	*30332.75*	*4.5047543*
Pajaro Mouth 2	36 51 14.150	436.2	122 25 30.35	302 16 41.47	Santa Cruz	25800.52	4.4116284
1906	121 48 38.179	945.8	174 10 00.41	354 08 49.30	Loma Prieta	28717.33	4.4581441
			292 40 22.43	112 50 49.57	Gavilan	28141.43	4.4493462
Point Pinos Latitude Sta.	36 37 59.413	1831.4	163 13 20.40	343 08 40.59	Santa Cruz	40017.79	4.6022531
1854–1866	121 55 31.685	787.1	249 17 38.67	69 32 11.19	Gavilan	38720.60	4.5879421
Point Pinos Latitude Sta.	*36 37 59.279*	*1827.2*	*163 13 13.02*	*343 08 33.17*	*Santa Cruz*	*40019.96*	*4.6022767*
1906	*121 55 31.578*	*784.5*	*240 17 37.19*	*69 32 09.75*	*Gavilan*	*38722.21*	*4.5879602*
Santa Cruz Magnetic Station	36 57 06.145	189.4	138 29 58.68	318 28 55.10	Santa Cruz	3946.98	3.5962644
1907	122 01 32.959	815.5	222 25 54.84	42 32 30.26	Loma Prieta	24026.01	4.3806816
			295 34 04.75	115 52 17.31	Gavilan	50090.05	4.6997514
			321 36 40.92	141 51 38.58	Mount Toro	60121.38	4.7790289
Santa Cruz L. H.*	36 57 08.82	271.9	222 35 36.4	42 42 12.2	Loma Prieta	23976.9	4.379793
1884	122 01 33.67	833.0	321 28 50.4	141 53 48.5	Mount Toro	60197.8	4.779581
Santa Cruz L. H.	*36 57 08.837*	*272.4*	*347 50 24.*	*167 50 24.8*	*Santa Cruz Mag. Sta.*	*84.805*	*1.92888*
1906–7	*122 01 33.682*	*833.4*					
Mount Tamalpais	37 55 27.455	846.4	133 02 20.97	312 49 23.38	Tomales Bay	42007.3	4.6233250
1854	122 35 45.228	1104.6	182 25 39.63	2 26 27.38	Sonoma Mountain	44348.7	4.6468808
Mount Tamalpais	37 55 27.507	848.0	177 46 54.317	357 45 32.153	Mount Helena	82806.00	4.91806179
1882	122 35 45.242	1104.9	274 15 19.460	94 40 28.809	Mount Diablo	60205.71	4.77963767
			298 03 15.847	118 41 27.018	Mocho	104307.60	5.0183159
Mount Tamalpais	*37 55 27.402*	*847.6*	*274 15 17.89*	*94 40 27.23*	*Mount Diablo*	*60205.32*	*4.7706340*
1906–7	*122 35 45.228*	*1104.6*	*335 52 51.85*	*156 03 25.65*	*Sierra Morena*	*62420.30*	*4.7953265*

* No check on this position.

Primaries and Secondaries for 1906–7 and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Red Hill	37 33 04.717	145.4	80 18 00.55	260 07 45.48	Ridge	25154.9	4.4006225
1854	122 05 41.003	1006.5	160 36 54.76	340 31 30.83	Rocky Mound	38985.8	4.5909069
Red Hill	37 33 04.730	145.8	50 25 20.65	230 17 33.92	Sierra Morena	24473.2	4.3886905
1885	122 05 40.982	1006.0	133 17 34.57	312 59 10.27	Mount Tamalpais	60542.9	4.7820631
			160 36 52.65	340 31 28.71	Rocky Mound	38986.1	4.5909094
Red Hill	*37 33 04.738*	*146.1*	*50 25 34.38*	*230 17 47.61*	*Sierra Morena*	*24473.60*	*4.3886078*
1906	*122 05 40.975*	*1005.8*	*133 17 33.33*	*312 59 09.03*	*Mount Tamalpais*	*60542.30*	*4.7820589*
Rocky Mound	37 52 57.237	1764.6	16 01 57.70	195 57 04.11	Ridge	42693.0	4.6303570
1854	122 14 30.510	745.6	98 34 03.83	278 21 00.73	Mount Tamalpais	31484.5	4.4980964
Rocky Mound	37 52 57.253	1765.1	6 21 46.49	186 19 21.43	Sierra Morena	52702.1	4.7218276
1885	122 14 30.507	745.5	98 34 10.47	278 21 07.36	Mount Tamalpais	31485.0	4.4981040
			270 00 27.08	90 12 32.97	Mount Diablo	28888.8	4.4607300
Rocky Mound	*37 52 57.262*	*1765.5*	*340 31 26.06*	*160 36 50.01*	*Red Hill*	*38986.24*	*4.5909114*
1906	*122 14 30.515*	*745.7*	*6 21 50.72*	*186 19 25.63*	*Sierra Morena*	*52701.24*	*4.7218209*
			98 34 06.22	*278 21 03.12*	*Mount Tamalpais*	*31484.38*	*4.4980951*
Sonoma Mountain	38 19 24.539	756.6	309 59 45.62	130 24 13.99	Mount Diablo	75905.21	4.8802716
1855–6	122 34 27.894	677.6	2 26 27.38	182 25 39.63	Mount Tamalpais	44348 69	4.6468808
Sonoma Mountain	*38 19 24.579*	*757.9*	*309 59 48.37*	*130 24 16.74*	*Mount Diablo*	*75905.93*	*4.8802757*
1907	*122 34 27.891*	*677.5*	*329 05 53.68*	*149 18 12.56*	*Rocky Mound*	*57107.17*	*4.7560006*
			2 26 27.68	*182 25 39.03*	*Mount Tamalpais*	*44348.82*	*4.6468820*
Farallon L. H.	37 41 58.210	1794.6	208 16 42.06	28 32 27.78	Sonoma Mountain	78740.80	4.8961998
1854–1860	123 00 03.579	87.7	234 54 23.73	55 09 17.80	Mount Tamalpais	43531.48	4.6388034
Farallon L. H.	37 41 58.250	1795.8	196 33 54.6	16 47 34.2	Mount Helena	112422.7	5.0508540
1891	123 00 03.605	88.3	234 54 23.2	55 09 17.3	Mount Tamalpais	43531.9	4.6388077
			297 25 00.5	117 50 21.8	Sierra Morena	69138.3	4.8397187
Farallon L. H.	*37 41 58.277*	*1796.6*	*234 54 33.28*	*55 09 27.41*	*Mount Tamalpais*	*43532.73*	*4.6388159*
1907	*123 00 03.669*	*89.9*	*208 16 48.24*	*28 32 34.01*	*Sonoma Mountain*	*78741.15*	*4.8962017*
			281 20 26.44	*101 53 38.31*	*Red Hill*	*81681.07*	*4.9121214*
			297 24 59.17	*117 50 20.30*	*Sierra Morena*	*69138.46*	*4.8397197*
Point Reyes Hill	38 04 48.325	1490.0	223 23 20.35	43 34 11.51	Sonoma Mountain	37231.58	4.5709115
1859	122 52 00.801	19.5	305 54 56.79	126 04 57.44	Mount Tamalpais	29420.37	4.4686481
Point Reyes Hill	*38 04 48.470*	*1405.4*	*223 23 43.14*	*43 34 34.36*	*Sonoma Mountain*	*37231.03*	*4.5700050*
1906	*122 52 00.906*	*22.1*	*305 55 05.23*	*126 05 05.05*	*Mount Tamalpais*	*20424.40*	*4.4687076*
			15 38 34.80	*195 33 38.32*	*Farallon L. H.*	*43860.65*	*4.6420750*
Tomales Bay	38 10 55.456	1709.9	244 08 32.81	64 22 21.73	Sonoma Mountain	36139.91	4.5579870
1856	122 56 46.733	1137.4	328 22 31.00	148 25 27.55	Point Reyes Hill	13290.12	4.1235289
Tomales Bay	*38 10 55.606*	*1714.6*	*244 08 56.84*	*64 22 45.82*	*Sonoma Mountain*	*36140.85*	*4.5570984*
1906	*122 56 46.841*	*1140.0*	*312 40 27.13*	*133 02 24.78*	*Mount Tamalpais*	*42011.61*	*4.6233604*
			328 22 31.18	*148 25 27.73*	*Point Reyes Hill*	*13200.29*	*4.1235345*
			5 08 38.74	*185 06 37.72*	*Farallon L. H.*	*53779.44*	*4.7306163*
Ross Mountain	38 30 20.528	633.0	292 51 36.51	113 11 55.18	Sonoma Mountain	51703.36	4.7135187
1859	123 07 09.223	223.5	337 07 29.25	157 13 55.43	Tomales Bay	38974.27	4.5907780
Ross Mountain	38 30 20.583	634.7	246 36 09.171	66 54 21.548	Mount Helena	46133.46	4 6640160
1891	123 07 09.221	223.4	302 51 49.822	123 36 33.990	Mount Diablo	126290.35	5.1013702
			324 27 22.348	144 46 47.824	Mount Tamalpais	79153.78	4.8984717
Ross Mountain	*38 30 20.572*	*634.3*	*292 51 37.64*	*113 11 56.20*	*Sonoma Mountain*	*51703.05*	*4.7135161*
1907	*123 07 09.204*	*223.0*	*337 07 37.69*	*157 14 03.79*	*Tomales Bay*	*38070.07*	*4.5907312*
			353 21 16.10	*173 25 38.68*	*Farallon L. H.*	*90082.90*	*4.9546423*
Bodega	38 18 23.680	730.1	266 59 19.04	87 15 11.23	Sonoma Mountain	37358.30	4.5723871
1860	123 00 03.726	90.5	340 51 55.85	160 53 57.79	Tomales Bay	14626.77	4.1651484
Bodega	*38 18 23.605*	*730.6*	*155 00 02.01*	*334 55 37.68*	*Ross Mountain*	*24306.36*	*4.3873250*
1906	*123 00 03.694*	*89.8*	*266 59 14.57*	*87 15 06.74*	*Sonoma Mountain*	*37357.62*	*4.5723702*
			340 52 22.26	*160 54 24.12*	*Tomales Bay*	*14621.72*	*4.1640985*
Point Reyes L. H.	37 59 45.412	1400.0	171 30 35.1	351 26 59.3	Ross Mountain	57215.3	4.757512
1874	123 01 20.595	502.5	197 52 38.3	17 55 27.2	Tomales Bay	21710.2	4.336663
			204 22 13.4	24 36 43.3	Mount Helena	82186.2	4.914799
			281 50 56.0	102 06 40.4	Mount Tamalpais	38315.5	4.583374

Primaries and Secondaries for 1906–7 and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Point Reyes L. H.	*37 50 45.572*	*1405.1*	*171 30 35.80*	*351 26 50.99*	*Ross Mountain*	*57210.03*	*4.757 4721*
1906–7	*123 01 20.618*	*503.1*	*197 52 27.68*	*17 55 16.57*	*Tomales Bay*	*21709.21*	*4.3306440*
			281 51 15.10	*102 06 59.54*	*Mount Tamalpais*	*38316.75*	*4.5833887*
Lick Observatory small dome	37 20 31.511	971.4	34 57 58.329	214 50 39.898	Loma Prieta	31222.23	4.4944639
1882–1887	121 38 31.707	780.5	97 33 14.341	277 08 59.663	Sierra Morena	59446.34	4.7741251
			120 14 35.79	299 58 05.15	Red Hill	46293.59	4.6655208
			127 47 54.555	307 12 57.967	Mount Tamalpais	106127.90	5.0258296
			158 17 49.069	338 07 53.002	Mount Diablo	64541.51	4.8098391
			207 03 21.736	27 06 31.843	Mocho	16903.50	4.2279766
			322 58 39.693	143 13 29.249	Santa Ana	60603.20	4.7824958
			358 07 12.349	178 08 24.119	Mount Toro	90578.12	4.9570233
Lick Observatory small dome	*37 20 31.511*	*971.4*	*34 57 52.48*	*214 50 34.07*	*Loma Prieta*	*31222.27*	*4.4944645*
1907	*121 38 31.702*	*780.4*	*97 33 17.81*	*277 09 03.10*	*Sierra Morena*	*59447.78*	*4.7741356*
			120 14 36.62	*299 58 05.08*	*Red Hill*	*46203.64*	*4.6655213*
			207 03 20.72	*27 06 30.82*	*Mocho*	*16903.44*	*4.2279751*
Black Mountain	37 19 09.810	302.4	136 49 00.42	316 40 41.48	Ridge	29469.48	4.4693725
1854	122 08 49.462	1217.9	190 11 17.95	10 13 12.51	Red Hill	26152.77	4.4175177
Black Mountain	*37 19 09.761*	*300.9*	*310 29 32.57*	*130 40 33.68*	*Loma Prieta*	*35485.49*	*4.5500508*
1906–7	*122 08 49.402*	*1216.4*	*125 28 24.57*	*305 22 33.43*	*Sierra Morena*	*17473.02*	*4.2423004*
			136 55 06.61	*316 46 47.48*	*Ridge 2*	*20536.03*	*4.4703522*
			190 11 08.74	*10 13 03.28*	*Red Hill*	*26154.74*	*4.4175504*
Pise Hill 2	37 27 42.836	1320.6	114 35 28.04	294 11 22.35	Farallon L. H.	63863.46	4.8052524
1906	122 20 33.188	815.6	190 44 49.86	10 48 31.51	Rocky Mound	47528.12	4.6769506
			245 33 37.77	65 42 41.00	Red Hill	24056.07	4.3812246
Ridge 2 Eccentric	37 30 48.730	1502.3	156 57 28.51	336 49 22.54	Mount Tamalpais	49568.02	4.6952016
1906	122 22 30.868	758.0	195 59 20.39	16 04 14.14	Rocky Mound	42615.74	4.6295700
			224 44 09.77	45 01 06.32	Mount Diablo	57722.95	4.7613485
			260 18 59.11	80 29 14.35	Red Hill	25147.51	4.4004950
			333 13 14.12	153 14 25.74	Pise Hill 2	6418.86	3.8074578
San Bruno Mountain	37 41 16.130	497.3	88 10 53.5	268 08 45.6	Colma	5129.3	3.710060
1899	122 26 05.344	130.9	120 08 37.8	300 06 06.6	Black Bluff	7004.9	3.845404
			157 25 48.4	337 24 38.7	Black Ridge 2	7281.7	3.862232
San Bruno Mountain	*37 41 16.129*	*497.2*	*91 39 40.02*	*271 19 02.73*	*Farallon L. H.*	*40955.33*	*4.6085819*
1906	*122 26 05.334*	*130.7*	*151 30 37.44*	*331 33 41.09*	*Mount Tamalpais*	*20836.16*	*4.4747430*
			218 07 37.12	*38 14 42.84*	*Rocky Mound*	*27501.42*	*4.4303552*
			341 57 52.03	*162 01 14.57*	*Pise Hill 2*	*26364.82*	*4.4210248*
Guano I	37 34 23.655	729.1	279 17 36.23	99 23 43.52	Red Hill	14985.73	4.1756778
1851	122 15 43.475	1066.9	30 16 00.18	210 13 02.08	Pise Hill	14259.27	4.1540973
			56 09 49.94	236 05 41.86	Ridge	12037.50	4.0805364
Guano I.	*37 34 23.640*	*720.1*	*270 17 29.74*	*90 23 37.04*	*Red Hill*	*14085.04*	*4.1756841*
1906–7	*122 15 43.479*	*1067.0*	*29 57 21.96*	*209 54 25.52*	*Pise Hill 2*	*14258.50*	*4.1540739*
			56 30 33.68	*236 26 25.43*	*Ridge 2 Eccentric*	*11996.69*	*4.0790616*
Pulgas East Base	37 28 36.265	1118.0	85 03 32.95	264 55 58.05	Pise Hill	18445.60	4.2658929
1853	122 08 08.143	200.1	92 08 26.88	272 04 06.74	Pulgas W. Base	10511.79	4.0216767
			133 48 21.77	313 43 44.42	Guano I.	15482.40	4.1898394
			203 34 36.60	23 36 06.21	Red Hill.	9031.19	3.9557449
Pulgas East Base	*37 28 36.258*	*1117.8*	*84 55 21.81*	*264 47 48.56*	*Pise Hill 2*	*18382.46*	*4.2644037*
1906–7	*122 08 08.120*	*199.7*	*133 48 17.81*	*313 43 40.45*	*Guano I.*	*15482.81*	*4.1898408*
			203 34 28.67	*23 35 58.28*	*Red Hill*	*9031.55*	*3.9557022*
Pulgas West Base	37 28 48.787	1504.0	176 13 12.52	356 12 55.59	Guano, I.	10346.23	4.0147820
1853	122 15 15.681	385.3	240 44 34.78	60 50 24.76	Red Hill	16169.40	4.2086940
Pulgas West Base	*37 28 48.764*	*1503.3*	*75 25 32.28*	*255 22 19.12*	*Pise Hill 2*	*8062.58*	*3.9064740*
1907	*122 15 15.673*	*385.1*	*176 13 07.57*	*356 12 50.63*	*Guano I.*	*10346.79*	*4.0148057*
			240 44 23.09	*60 50 13.07*	*Red Hill*	*16169.00*	*4.2087072*
			272 03 50.64	*92 08 16.79*	*Pulgas E. Base*	*10511.96*	*4.0216837*
Point Reyes Head 2	37 59 48.370	1491.3	196 05 47.15	16 08 17.64	Tomales Bay	21414.01	4.3306980
1907	123 00 50.785	1239.1	234 20 58.22	54 26 24.73	Point Reyes Hill	15892.68	4.2011971
			282 12 56.35	102 28 22.46	Mount Tamalpais	37622.82	4.5754513
Mount Tamalpais, E. Peak Observatory	37 55 46.050	1419.8	70 58 30.85	250 57 49.10	Mount Tamalpais	1754.87	3.2442440
1907	122 34 37.301	911.0	123 23 16.07	303 12 33.49	Point Reyes Hill	30461.94	4.4837576
			130 58 43.19	310 45 03.62	Tomales Bay	42861.47	4.6320670
			143 34 46.16	323 14 38.61	Ross Mt.	79660.78	4.9012446
			180 17 58.04	0 18 03.84	Sonoma Mt.	43737.16	4.6408506

Primaries and Secondaries for 1906–7 and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Mount Tamalpais, wireless house 1907	37 55 44.714 122 35 11.327	1378.6 276.6	57 19 48.5 144 04 30.3 181 22 50.4	237 19 27.6 323 44 43.8 1 23 17.2	Mount Tamalpais Ross Mt. Sonoma Mt.	983.59 79203.62 43790.57	2.9928131 4.8987450 4.6413806
San Jose Court-house dome, flagstaff * 1884	37 20 19.33 121 53 31.17	595.9 767.3	350 17 43.9 102 21 21.0	170 19 29.6 282 06 12.4	Loma Prieta Sierra Morena	25595.0 37683.7	4.408155 4.576153
*San Jose Court-house dome, flagstaff** 1907	*37 20 19.34* *121 53 31.18*	*506.2* *767.6*	*350 17 35.0* *102 21 25.1*	*170 19 20.8* *282 06 10.4*	*Loma Prieta* *Sierra Morena*	*25596.0* *37684.6*	*4.408172* *4.576164*

Vicinity of Colma, 1907, and older positions of same points.

Black Ridge 2 1899	37 44 54.214 122 27 59.502	1671.3 1456.6	45 28 53.9 137 32 03.7 155 49 36 183 06 48.8 201 32 06.2	225 27 32.3 317 30 35.1 335 49 29.2 3 06 55.7 21 32 40.2	Black Bluff Cement Black Ridge Presidio Hill Lone Mt. Cross	4574.6 5235.4 660.3 5085.8 3725.1	3.660350 3.718946 2.819724 3.706360 3.571139
Black Ridge 2 *1907*	*37 44 54.207* *122 27 59.505*	*1671.4* *1456.7*	*337 24 29.3*	*157 25 30.1*	*San Bruno Mt.*	*7281.7*	*3.862232*
Black Bluff 1899	37 43 10.158 122 30 12.684	313.1 310.5	183 25 57.6 190 25 01.9 218 06 57.8	3 26 08.6 10 25 22.8 38 08 12.6	Point Lobos 2 Sand Knoll Black Ridge	7382.3 4625.2 4843.9	3.868192 3.665135 3.685192
Black Bluff *1907*	*37 43 10.149* *122 30 12.672*	*312.9* *310.3*	*225 27 17.1* *300 06 01.6*	*45 28 38.6* *120 08 32.8*	*Black Ridge 2* *San Bruno Mt.*	*4574.4* *7004.8*	*3.660333* *3.845305*
Colma 2 1907	37 41 10.823 122 29 34.517	333.7 845.8	165 44 52.4 198 39 40.8 268 09 14.9	345 44 29.1 18 40 39.0 88 11 22.8	Black Bluff Black Ridge 2 San Bruno Mt.	3795.7 7269.5 5128.0	3.579293 3.861505 3.709946
Fog Cap 2 1907	37 40 08.218 122 29 11.081	253.4 271.6	163 25 55.4 191 14 24.8 245 16 57.1	343 25 41.1 11 15 08.7 65 18 50.7	Colma 2 Black Ridge 2 San Bruno Mt.	2013.7 8989.7 5010.1	3.304003 3.953746 3.699848
Road 1899	37 37 57.595 122 28 28.512	1775.6 699.1	165 21 25.0 209 48 52.3 327 06 54.9	345 20 58.8 29 50 19.8 147 07 27.4	Fog Cap San Bruno Mt. Flat	4150.5 7055.4 2408.4	3.618095 3.848523 3.381726
Road *1907*	*37 37 57.665* *122 28 28.559*	*1777.8* *700.3*	*165 29 03.1* *209 49 58.0*	*345 28 37.1* *29 51 25.5*	*Fog Cap 2* *San Bruno Mt.*	*4157.7* *7054.2*	*3.618854* *3.848446*
Flat 1899	37 36 51.991 122 27 35 197	1602.8 863.2	158 41 12.8 159 52 05.3 195 07 39.6	338 40 14.1 339 50 52.3 15 08 34.5	Fog Cap Colma San Bruno Mt.	6481.8 8498.9 8436.0	3.811696 3.929360 3.926138
Flat *1907*	*37 36 52.060* *122 27 35.236*	*1605.0* *864.2*	*147 07 17.3* *158 46 27.0* *150 52 50.9* *195 08 22.0*	*327 06 44.7* *338 45 28.4* *330 51 38.0* *15 09 16.9*	*Road* *Fog Cap 2* *Colma 2* *San Bruno Mt.*	*2408.5* *6488.0* *8406.6* *8434.2*	*3.381740* *3.812109* *3.920244* *3.926044*
False Cattle Hill 2 1899	37 36 50.401 122 29 40.926	1553.8 1003.7	186 47 48.6 220 35 52.2 269 04 43.1	6 48 06.6 40 36 36.4 89 05 59.8	Fog Cap Road Flat	6130.3 2728.6 3084.1	3.787480 3.435932 3.489124
False Cattle Hill 2 *1907*	*37 36 50.460* *122 29 40.067*	*1555.6* *1004.7*	*186 51 01.7* *220 35 27.5* *269 04 22.4*	*6 51 20.0* *40 36 11.7* *89 05 39.2*	*Fog Cap 2* *Road* *Flat*	*6140.7* *2728.7* *3084.0*	*3.788218* *3.435055* *3.489121*
San Pedro Rock 1899	37 35 44.158 122 31 22.422	1361.3 550.0	201 33 48.4 226 01 14.3 230 37 42.2 249 24 51.5	21 35 08.4 46 03 00.5 50 38 44.2 69 27 10.2	Fog Cap Road False Cattle Hill 2 Flat	8741.8 5925.9 3220.0 5953.0	3.941603 3.772751 3.507856 3.774735
San Pedro Rock *1907*	*37 35 44.239* *122 31 22.441*	*1363.8* *550.5*	*201 34 51.8* *217 12 03.7* *226 01 07.2* *230 37 55.1*	*21 36 12.0* *37 15 17.4* *46 02 53.3* *50 38 57.0*	*Fog Cap 2* *San Bruno Mt.* *Road* *False Cattle Hill 2*	*8752.6* *12850.6* *5925.1* *3210.2*	*3.942137* *4.108023* *3.772600* *3.507747*

* No check on this position.

Vicinity of Colma, 1907, and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Colma Schoolhouse tower, finial	37 41 23.097	712.1	274 16 51.5	94 18 03.0	San Bruno Mt.	2871.3	3.458079
1907	122 28 02.194	53.8	36 10 50.6	216 10 08.5	Fog Cap 2	2859.9	3.456344
			80 30 38.7	260 29 42.3	Colma 2	2293.5	3.360495
Bonita Point L. H.	37 48 57.447	1771.0	236 22 16.4	56 23 06.5	Diablo Hill	2407.7	3.381608
1894	122 31 43.569	1065.7	254 07 38.7	74 08 34.7	West Diablo	2330.8	3.367502
			280 47 33.5	100 51 46.8	Russian Hill	10292.0	4.012501
			292 47 03.1	112 49 27.3	Presidio Hill	6245.8	3.795586
			295 33 08.2	115 35 04.1	Rob	5128.9	3.710020
			321 23 01.7	141 24 08.4	Point Lobos 2.	4271.6	3.630595
			295 16 29.4	115 18 25.1	Rob 3	5109.8	3.708401
			322 18 56.0	142 19 56.9	Point Lobos	3977.5	3.599615
			322 53 58.0	142 56 08.6	Black Ridge	8644.9	3.936762
			295 27 44.4	115 29 40.5	Rob 2	5135.9	3.710617
			331 49 32.2	151 50 21.0	Cement	4126.5	3.615579
			348 15 20.8	168 16 16.5	Black Bluff	10935.7	4.038847
			272 28 56.6	92 34 57.5	Yerba Buena I.	14409.3	4.158643
			244 27 55.1	64 29 59.2	Point Cavallo 2	5485.1	3.739183
*Bonita Point L. H.**	*37 48 57.363*	*1768.5*	*329 45 38.0*	*149 40 05.0*	*San Bruno Mt.*	*16454.9*	*4.216205*
1907	*122 31 43.554*	*1065.3*	*347 36 08.5*	*167 37 27.5*	*Colma 2*	*14726.4*	*4.168007*
			348 15 13.2	*168 16 08.9*	*Black Bluff*	*10933.5*	*4.038758*
Cliff House tower†	37 46 43.58	1343.5	229 53 28	49 53 43	Cement	764	2.88323
1899	122 30 47.84	1170.7	264 24 48	84 25 04	Sand	645	2.80973
Cliff House turret, highest finial	*37 46 43.422*	*1338.7*	*325 31 59.2*	*145 34 52.1*	*San Bruno Mt.*	*12235.5*	*4.087623*
1907	*122 30 47.047*	*1173.3*	*350 02 53.1*	*170 03 38.0*	*Colma 2*	*10410.6*	*4.017474*
			352 30 53.4	*172 31 15.0*	*Black Bluff*	*6631.8*	*3.821630*
Ingleside race-course building, flagstaff	37 43 35.654	1099.2	326 33 45.8	146 34 56.7	San Bruno Mt.	5154.2	3.712158
1907	122 28 01.248	30.6	14 58 56.8	194 58 14.1	Fog Cap 2	6620.2	3.820868
			27 06 18.5	207 05 21.5	Colma 2	5015.7	3.700333
			76 16 55.1	256 15 34.8	Black Bluff	3313.2	3.520254
Montara Mountain Peak	37 33 42.51	1310.5	164 50 28.6	344 49 49.6	False Cattle Hill 2	6001.6	3.778270
1899	122 28 36.94	906.6	172 22 07.1	352 21 08.6	Black Bluff	17657.4	4.246926
			174 09 55.2	354 09 20.0	Colma	13892.9	4.142792
			182 32 03.1	2 32 26.2	Black Ridge 2	20729.0	4.316578
			181 30 17.3	1 30 22.5	Road	7867.0	3.895807
			194 31 55.3	14 32 33.0	Flat	6034.9	3.780670
Montara Mountain Peak	*37 33 42.540*	*1311.7*	*164 49 33.2*	*344 48 54.1*	*False Cattle Hill 2*	*6002.7*	*3.778343*
1907	*122 28 36.904*	*905.6*	*172 21 57.6*	*352 20 59.1*	*Black Bluff*	*17655.8*	*4.246888*
			174 10 04.7	*354 09 20.5*	*Colma 2*	*13892.2*	*4.142771*
			175 58 13.5	*355 57 52.7*	*Fog Cap 2*	*11010.6*	*4.076261*
			181 29 24.8	*1 29 30.0*	*Road*	*7867.8*	*3.895854*
			104 30 46.8	*14 31 24.5*	*Flat*	*6035.3*	*3.780608*
			104 52 19.3	*14 53 52.0*	*San Bruno Mt.*	*14409.3*	*4.160447*

Tomales Bay, 1906, and older positions of same points.

Bodega Head 2	38 18 29.367	905.5	167 18 52.0	347 16 45.4	Ross Mountain	22479.4	4.351785
1906	123 03 45.469	1104.7	271 50 24.4	91 52 41.9	Bodega	5391.2	3.731682
			323 55 26.8	143 59 45.9	Tomales Bay	17302.3	4.238105
Smith	38 14 51.518	1588.5	7 13 00.2	187 12 36.8	Tomales Bay	7336.5	3.865490
1856	122 56 08.865	215.6	138 54 36.2	318 52 10.7	Bodega	8682.3	3.938633
Smith	*38 14 51.522*	*1588.6*	*7 14 47.0*	*187 14 23.5*	*Tomales Bay*	*7332.5*	*3.865250*
1906	*122 56 08.839*	*214.9*	*121 13 14.8*	*301 08 32.0*	*Bodega Head 2*	*12073.1*	*4.113044*
			138 54 44.4	*318 52 10.0*	*Bodega*	*8682.4*	*3.938639*
Tomales Point	38 12 45.732	1410.1	218 12 43.8	38 14 01.5	Smith	4936.7	3.693440
1856	122 58 14.449	351.5	327 52 27.2	147 53 21.5	Tomales Bay	4014.5	3.603635
Tomales Point	*38 12 45.874*	*1414.5*	*142 48 24.1*	*322 44 59.2*	*Bodega Head 2*	*13300.2*	*4.123858*
1906	*122 58 14.549*	*354.0*	*165 43 00.8*	*345 41 53.3*	*Bodega*	*10748.8*	*4.031358*
			218 16 13.4	*38 17 31.2*	*Smith*	*4935.3*	*3.693313*
			327 52 28.7	*147 53 22.0*	*Tomales Bay*	*4014.2*	*3.603598*

* A much stronger determination of this point in 1909 makes it practically certain that there was no appreciable disturbance of its position at the time of the earthquake of 1906.

† No check on this position.

Tomales Bay, 1006, and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Preston 2	38 12 14.897	459.3	40 55 56.7	220 55 02.8	Tomales Bay	3235.6	3.509961
1906	122 55 19.739	480.3	102 40 19.1	282 38 31.0	Tomales Point	4358.9	3.639380
Mershon	38 10 55.295	1704.9	90 05 11.8	270 03 32.4	Tomales Bay	3911.6	3.592349
1856	122 54 06.016	146.5	143 34 49.0	323 34 02.9	Preston	3053.4	3.484781
Mershon	*38 10 55.284*	*1704.6*	*90 09 33.7*	*270 07 54.3*	*Tomales Bay*	*3014.4*	*3.502663*
1906	*122 54 06.008*	*146.2*	*119 26 10.3*	*299 23 30.6*	*Tomales Point*	*6042.8*	*3.841532*
			143 50 32.1	*323 49 46.6*	*Preston 2*	*3040.5*	*3.482047*
Foster	38 08 13.410	413.5	145 03 24.5	325 01 55.8	Tomales Bay	6096.0	3.785048
1856	122 54 23.271	566.8	184 48 33.7	4 48 44.4	Mershon	5009.0	3.699749
Foster	*38 08 13.577*	*418.6*	*145 03 26.9*	*325 01 58.3*	*Tomales Bay*	*6095.3*	*3.784008*
1906	*122 54 23.308*	*570.0*	*169 33 40.1*	*349 33 05.3*	*Preston 2*	*7505.9*	*3.875858*
			184 51 07.3	*4 51 18.1*	*Mershon*	*5003.8*	*3.699207*
Reynolds 2	38 08 59.251	1827.0	50 39 46.1	230 39 02.5	Foster	2221.3	3.346606
1906	122 53 12.852	312.9	124 34 23.1	304 32 10.9	Tomales Bay	6325.1	3.801066
			160 07 10.6	340 06 37.8	Mershon	3804.4	3.580290
Mike 2	38 07 34.782	1072.5	120 22 09.3	300 21 17.5	Foster	2366.4	3.374095
1906	122 52 59.559	1450.6	172 54 57.4	352 54 49.2	Reynolds 2	2624.4	3.419031
Hans	38 07 58.492	1803.5	97 37 51.0	277 36 23.8	Foster	3469.4	3.540249
1856	122 52 02.072	50.5	137 17 28.9	317 16 45.2	Reynolds	2541.3	3.405056
Hans	*38 07 58.479*	*1803.2*	*62 26 23.5*	*242 25 48.0*	*Mike 2*	*1578.8*	*3.198336*
1906	*122 52 02.093*	*51.0*	*97 42 58.3*	*277 41 31.0*	*Foster*	*3472.6*	*3.540650*
			137 24 17.2	*317 23 33.5*	*Reynolds 2*	*2545.6*	*3.405786*
Frink 2	38 06 59.863	1845.8	110 23 48.4	290 22 35.0	Mike 2	3090.7	3.490052
1906	122 51 00.623	15.2	114 43 42.5	294 41 37.3	Foster	5436.7	3.735338
			138 49 48.6	318 48 27.0	Reynolds 2	4890.9	3.689385
			140 21 53.3	320 21 15.4	Hans	2346.9	3.370493
Agnew 2	38 06 41.381	1276.0	156 05 40.0	336 04 52.2	Reynolds 2	4650.0	3.667451
1906	122 51 55.463	1351.2	176 06 50.8	356 06 46.7	Hans	2382.6	3.377049
			246 53 40.0	66 54 13.8	Frink 2	1452.4	3.162090
Sigvart 2	38 06 08.242	254.1	110 28 01.8	290 26 52.4	Agnew 2	2923.3	3.465878
1906	122 50 03.040	74.1	138 36 43.5	318 36 07.9	Frink 2	2121.6	3.326660
Willow Point 2	38 05 25.525	787.0	137 51 08.4	317 50 14.8	Agnew 2	3154.9	3.498983
1906	122 50 28.561	696.0	164 58 12.5	344 57 52.8	Frink 2	3011.7	3.478816
			205 16 21.2	25 16 37.0	Sigvart 2	1456.5	3.163307
Creek 2	38 04 25.243	778.4	143 42 50.1	323 42 15.5	Willow Point 2	2305.9	3.362846
1906	122 49 32.559	793.6	166 50 15.6	346 49 56.8	Sigvart 2	3261.4	3.513405
Hammond	38 04 45.046	1388.9	114 59 42.5	294 58 32.1	Willow Point	3069.8	3.487117
1856	122 48 34.993	852.8	139 47 15.8	319 46 21.1	Sigvart	3349.0	3.524909
Hammond	*38 04 45.037*	*1388.7*	*66 28 16.3*	*246 27 40.9*	*Creek 2*	*1528.5*	*3.184254*
1906	*122 48 35.064*	*854.5*	*114 18 01.1*	*294 16 51.1*	*Willow Point 2*	*3034.6*	*3.482104*
			140 07 22.5	*320 06 28.3*	*Sigvart 2*	*3343.2*	*3.524168*
Bodega Head	38 18 29.249	901.9	271 48 24.8	91 50 42.2	Bodega	5389.0	3.731506
1856	123 03 45.417	1103.4	323 55 20.8	143 59 40.0	Tomales Bay	17303.9	4.238145
Bodega Head	*38 18 29.417*	*907.1*	*22 11*	*202 11*	*Bodega Head 2*	*1.65*	*0.21854*
1906	*123 03 45.443*	*1104.0*					
Teton 2	38 15 13.551	417.8	329 27 09.3	149 28 31.9	Preston 2	6395.3	3.805863
1906	122 57 33.332	810.6	351 54 09.3	171 54 38.1	Tomales Bay	8033.2	3.904889
			12 25 10.3	192 24 44.8	Tomales Point	4662.3	3.668603
			123 45 21.4	303 41 30.9	Bodega Head 2	10874.8	4.036422
			148 04 30.4	328 02 57.3	Bodega	6908.5	3.839383
			288 17 14.6	108 18 06.9	Smith	2163.9	3.335228
Trainor	38 14 10.514	324.2	141 06 45.8	321 04 01.6	Bodega Head 2	10256.9	4.011017
1906	122 59 20.439	497.1	172 19 57.3	352 19 30.5	Bodega	7876.8	3.896351
			254 48 02.9	74 50 01.5	Smith	4827.9	3.683755
			328 26 20.7	148 27 01.5	Tomales Point	3062.6	3.486087
Hog Island 2	38 11 51.039	1573.7	117 57 56.7	297 56 35.7	Tomales Point	3606.7	3.557113
1906	122 56 03.606	87.8	178 41 24.0	358 41 20.8	Smith	5566.3	3.745566
			235 25 18.9	55 25 46.0	Preston 2	1296.3	3.112710
			300 58 58.2	121 00 10.8	Mershon	3338.5	3.523545

Tomales Bay, 1906, and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Franklin Schoolhouse, flagstaff 1906	38 14 59.003 122 56 31.760	1819.2 772.4	2 48 00.2 31 21 08.6 121 38 27.5 140 47 48.5 292 28 45.2	182 47 50.9 211 20 05.0 301 33 58.9 320 45 37.3 112 28 59.4	Tomales Bay Tomales Point Bodega Head 2 Bodega Smith	7513.6 4806.1 12377.3 8146.7 603.2	3.875847 3.681797 4.092625 3.910981 2.780437
McDonald's house, south chimney 1906	38 11 00.803 122 54 26.295	24.8 640.0	289 01 03.6 359 12 57.8 87 19 47.5	109 01 16.2 179 12 59.6 267 18 20.6	Mershon Foster Tomales Bay	522.2 5156.5 3424.3	2.717872 3.712355 3.534578
Halleck Schoolhouse, cupola 1906	38 11 35.240 122 54 02.469	1086.6 60.1	3 59 58.9 4 41 10.4 73 01 36.8 109 34 13.9	183 59 56.7 184 40 57.3 252 59 55.2 289 31 38.0	Mershon Foster Tomales Bay Tomales Point	1235.0 6238.6 4182.7 6508.6	3.091654 3.795088 3.621456 3.813485
Millerton horse barn, north gable 1906	38 06 33.159 122 50 40.312	1022.4 982.0	352 10 53.0 97 53 23.0 119 16 01.4 148 59 53.9	172 11 00.3 277 52 36.6 299 14 35.5 328 59 41.4	Willow Point 2 Agnew 2 Mike 2 Frink 2	2104.9 1848.3 3887.9 960.6	3.323222 3.266771 3.589712 2.982540
Preston ranch barn, north gable 1906	38 13 21.915 122 55 49.087	675.7 1194.3	340 56 10.4 17 18 25.1 72 34 41.0 170 08 16.7	160 56 28.5 197 17 49.3 252 33 11.0 350 08 04.5	Preston 2 Tomales Bay Tomales Point Smith	2186.2 4724.9 3708.9 2804.3	3.339693 3.674392 3.569248 3.447822
Point Reyes Station Schoolhouse, cupola 1906	38 04 06.424 122 48 26.339	198.1 642.1	109 46 45.0 129 19 09.4 169 52 22.3	289 46 04.2 309 17 54.0 349 52 16.9	Creek 2 Willow Point 2 Hammond	1715.2 3849.9 1209.4	3.234327 3.585448 3.082575
Schoolhouse on hill, cupola * 1906	38 04 19.64 122 48 09.38	605.6 228.6	94 52 43 141 21 36	274 51 52 321 21 20	Creek 2 Hammond	2034.9 1002.6	3.308534 3.001133
Cypress Grove, flagstaff * 1906	38 09 57.47 122 53 59.89	1772.0 1458.0	327 27 40 10 08 03	147 28 09 190 07 48	Reynolds 2 Foster	2129.2 3254.0	3.328223 3.512424
Conte's barn, west gable * 1906	38 11 41.14 122 53 57.71	1268.5 1404.3	8 07 51 71 10 55	188 07 46 251 09 10	Mershon Tomales Bay	1428.1 4348.8	3.154762 3.638370
Huff's house, west gable * 1906	38 12 27.60 122 55 28.68	851.0 697.8	33 51 08 97 57 48	213 50 20 277 56 06	Tomales Bay Tomales Point	3415.1 4074.6	3.533398 3.610086
Inverness post-office flagstaff * 1906	38 05 49.22 122 51 03.91	1517.7 95.3	182 06 18 298 36 11	2 06 20 118 37 43	Frink 2 Hammond	2179.5 4132.0	3.338363 3.616156
Hitchcock ranch barn, cupola * 1906	38 16 58.49 122 58 42.46	1803.5 1032.0	110 51 40 143 05 15	290 48 32 323 04 25	Bodega Head 2 Bodega	7878.3 3286.2	3.896435 3.516694
High sharp peak 1906	38 04 51.790 122 45 53.050	1596.8 1292.9	81 19 14.6 86 59 44.4 98 49 46.5 110 58 10.5 122 39 32.4	261 16 59.2 266 58 04.5 278 46 56.6 290 54 27.0 302 35 44.8	Creek 2 Hammond Willow Point 2 Agnew 2 Hans	5412.3 3954.1 6794.3 9455.2 8480.0	3.733383 3.597048 3.832146 3.975670 3.928398
Lone tree on hill 1906	38 07 50.927 122 49 49.286	1570.3 1200.4	356 19 18.1 12 03 04.7 55 06 30.9 94 07 44.1	176 19 28.4 192 02 40.4 235 05 13.0 274 06 22.1	Creek 2 Willow Point 2 Agnew 2 Hans	6354.8 4584.0 3747.5 3242.9	3.803102 3.661249 3.573747 3.510929
Howard ranch barn, cupola * 1906	38 08 56.29 122 55 09.43	1735.6 229.6	268 08 53 319 35 30	88 10 05 139 35 58	Reynolds 2 Foster	2840.1 1729.4	3.453329 3.237901

Vicinity of Fort Ross, 1906, and older positions of same points.

Peaked Hill 1891	38 25 53.725 123 07 04.450	1656.6 107.9	140 24 51.0 179 11 42.8 321 28 28.5	320 22 26.8 359 11 39.8 141 30 46.8	Chaparral Ross Mountain Bodega Hill	8814.2 8229.2 8682.8	3.945184 3.915356 3.938661
Peaked Hill 1906	*38 25 53.704* *123 07 04.405*	*1655.9* *106.8*	*179 11 25.9* *340 33 57.4*	*359 11 22.9* *160 36 00.9*	*Ross Mountain* *Bodega Head 2*	*8229.5* *14526.7*	*3.915373* *4.162108*

* No check on this position.

Vicinity of Fort Ross, 1906, and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Chaparral	38 29 33.905	1045.4	255 19 57.8	75 22 19.1	Ross Mountain	5685.1	3.754737
1856	123 10 56.207	1362.2	305 09 58.5	125 15 59.0	Redwood	17212.1	4.235835
Chaparral	38 29 33.964	1047.3	255 20 06.0	75 22 27.3	Ross Mountain	5685.3	3.754755
1891	123 10 56.216	1362.4	305 10 07.4	125 16 08.0	Redwood	17212.7	4.235849
			320 54 01.2	140 58 43.7	Bodega Hill	17496.3	4.242946
			332 56 25.2	153 00 52.6	Bodega Head	23006.6	4.361853
Chaparral	*38 29 33.927*	*1046.1*	*255 19 34.2*	*75 21 55.5*	*Ross Mountain*	*5685.3*	*3.754750*
1906	*123 10 56.187*	*1361.6*	*320 22 12.4*	*140 24 36.6*	*Peaked Hill*	*8814.1*	*3.945176*
			332 56 19.6	*153 00 47.2*	*Bodega Head 2*	*23002.4*	*4.361773*
Dixon	38 30 30.735	947.7	272 34 06.8	92 37 04.4	Ross Mountain	6919.2	3.840055
1891	123 11 54.496	1320.4	320 30 49.3	140 33 49.8	Peaked Hill	11063.2	4.043881
			320 54 51.1	141 00 09.8	Bodega Hill	19745.4	4.295466
			321 06 01.1	141 06 37.4	Chaparral	2249.1	3.352015
Dixon	*38 30 30.703*	*946.7*	*272 33 46.7*	*92 36 44.3*	*Ross Mountain*	*6918.6*	*3.840020*
1906	*123 11 54.457*	*1310.4*	*320 30 42.7*	*140 33 43.2*	*Peaked Hill*	*11063.0*	*4.043874*
			321 06 25.2	*141 07 01.5*	*Chaparral*	*2249.1*	*3.352009*
Fort Ro	38 30 46.084	1421.0	275 36 46.4	95 38 49.8	Dixon	4824.4	3.683439
1891	123 15 12.655	306.6	289 40 09.0	109 42 48.7	Chaparral	6599.7	3.819525
			307 15 17.8	127 20 21.6	Peaked Hill	14877.0	4.172515
Fort Ross	*38 30 46.152*	*1423.1*	*275 38 47.0*	*95 40 50.4*	*Dixon*	*4826.9*	*3.683671*
1906	*123 15 12.711*	*308.0*	*289 41 21.5*	*109 44 01.2*	*Chaparral*	*6602.7*	*3.819724*
			307 15 26.9	*127 20 30.7*	*Peaked Hill*	*14880.6*	*4.172620*
Henry Hill	38 32 47.724	1471.5	293 06 03.8	113 10 36.8	Ross Mountain	11545.6	4.062418
1891	123 14 27.513	666.2	318 43 12.1	138 44 47.4	Dixon	5619.6	3.749705
			16 15 24.8	196 14 56.7	Fort Ross	3906.8	3.591821
Henry Hill	*38 32 47.688*	*1470.4*	*293 05 54.6*	*113 10 27.6*	*Ross Mountain*	*11544.8*	*4.062388*
1906	*123 14 27.474*	*665.3*	*318 43 10.0*	*138 44 45.3*	*Dixon*	*5619.5*	*3.749700*
			16 18 07.7	*196 17 30.6*	*Fort Ross*	*3904.4*	*3.591555*
Table Mount 2	38 35 43.948	1355.1	322 01 58.6	142 05 18.7	Ross Mountain	12643.1	4.101853
1906	123 12 30.215	731.2	354 52 27.6	174 52 49.9	Dixon	9697.5	3.986660
			27 35 16.5	207 34 03.4	Henry Hill	6131.6	3.787572
Puncke	38 34 34.972	1078.3	255 20 50.1	75 24 19.4	Table Mount	8393.9	3.923966
1891	123 18 07.323	177.2	301 50 13.9	121 52 30.9	Henry Hill	6265.6	3.796965
Puncke	*38 34 35.029*	*1080.1*	*255 22 28.7*	*75 25 59.0*	*Table Mount 2*	*8432.7*	*3.925969*
1906	*123 18 07.386*	*178.8*	*301 50 51.7*	*121 53 08.8*	*Henry Hill*	*6269.3*	*3.797217*
Lancaster 2	38 37 16.082	495.9	287 22 51.2	107 26 44.8	Table Mount 2	9493.1	3.977409
1906	123 18 44.583	1078.6	323 02 11.3	143 04 51.7	Henry Hill	10354.5	4.015129
			349 43 23.2	169 43 46.4	Puncke	5047.0	3.703029
Salt Point	38 34 00.302	9.3	248 11 51.2	68 13 00.0	Puncke	2879.5	3.459318
1891	123 19 57.771	1398.6	310 54 34.2	130 57 31.8	Fort Ross	9140.2	3.960957
Salt Point	*38 34 00.350*	*10.8*	*248 11 26.7*	*68 12 35.6*	*Puncke*	*2879.5*	*3.459311*
1906	*123 19 57.827*	*1400.1*	*310 54 24.2*	*130 57 21.9*	*Fort Ross*	*9139.8*	*3.960939*
Chamisal	38 34 38.900	1199.5	173 14 18.9	353 14 04.1	Lancaster 2	4880.7	3.688478
1906	123 18 20.830	504.2	290 08 18.6	110 08 27.0	Puncke	346.6	2.539843
			63 09 31.0	243 08 30.5	Salt Point	2631.8	3.420256
Horseshoe Point	38 36 27.969	862.4	300 42 50.4	120 45 21.4	Puncke	6817.6	3.833632
1891	123 22 09.462	228.9	324 59 48.5	145 01 10.6	Salt Point	5558.0	3.744917
Horseshoe Point	*38 36 28.004*	*863.5*	*301 16 33.7*	*121 18 56.3*	*Chamisal*	*6476.4*	*3.811336*
1906	*123 22 09.504*	*230.0*	*324 50 51.2*	*145 01 13.3*	*Salt Point*	*5557.5*	*3.744876*
Henry Tree	38 32 47.722	1471.5	16 12 27.0	196 11 59.0	Fort Ross	3903.6	3.591469
1906	123 14 27.739	671.7	121 54 30.4	301 52 13.5	Puncke	6263.3	3.796801
			143 06 21.0	323 03 40.8	Lancaster 2	10349.8	4.014931
			207 37 31.1	27 38 44.4	Table Mount 2	6133.6	3.787715
			293 05 26.7	113 09 59.9	Ross Mountain	11551.2	4.062626
			318 40 38.6	138 42 14.1	Dixon	5624.5	3.750087
Timber Cove	38 31 59.557	1836.4	244 19 03.7	64 20 23.4	Silvers Tree	3439.8	3.536534
1891	123 16 35.519	860.3	318 27 03.0	138 27 54.6	Fort Ross	3026.8	3.480990
			127 15 33.6	307 13 27.6	Salt Point	6152.0	3.789018

Vicinity of Fort Ross, 1906, and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Timber Cove	*38 31 59.615*	*1838.2*	*127 15 25.6*	*307 13 10.5*	*Salt Point*	*6151.9*	*3.789011*
1906	*123 16 35.573*	*861.6*	*244 23 18.7*	*64 24 38.3*	*Henry Tree*	*3433.0*	*3.535071*
			318 26 51.2	*138 27 42.8*	*Fort Ross*	*3026.6*	*3.480953*
Stockhoff 2	38 32 56.948	1756.0	127 18 01.2	307 16 55.1	Salt Point	3226.8	3.508774
1906	123 18 11.803	285.9	272 58 54.6	93 01 14.2	Henry Tree	5433.4	3.735069
			307 10 27.7	127 11 27.7	Timber Cove	2925.1	3.466147
			312 53 56.0	132 55 47.6	Fort Ross	5923.0	3.772545
Lancaster	38 37 16.134	497.5	287 30 55.8	107 34 48.2	Table Mount	9453.3	3.975584
1891	123 18 44.268	1070.9	323 04 33.7	143 07 13.8	Henry Hill	10349.7	4.014929
			349 47 52.7	169 48 15.7	Funcke	5049.2	3.703221
Lancaster	*38 37 16.086*	*496.0*	*89 15*	*269 15*	*Lancaster 2*	*8.60*	*0.93450*
1906	*123 18 44.228*	*1070.0*					
Pinnacle Rock	38 30 02.982	92.0	128 12 28.4	308 11 45.0	Fort Ross	2149.0	3.332244
1891	123 14 02.956	71.6	254 36 59.6	74 38 19.6	Dixon	3228.1	3.508950
			281 10 06.3	101 12 02.6	Chaparral	4612.9	3.663971
			297 20 25.4	117 23 45	Russian River	8782.0	3.943593
			307 06 29.2	127 10 49.7	Peaked Hill	12728.3	4.104770
Pinnacle Rock	*38 30 03.056*	*94.2*	*128 11 51.3*	*308 11 07.9*	*Fort Ross*	*2140.2*	*3.332282*
1906	*123 14 02.905*	*72.6*	*254 40 51.8*	*74 42 11.8*	*Dixon*	*3229.1*	*3.509082*
			281 12 20.4	*101 14 16.7*	*Chaparral*	*4615.2*	*3.664189*
Stockhoff	38 32 56.969	1756.6	127 18 07.2	307 17 01.1	Salt Point	3223.1	3.508270
1891	123 18 11.870	287.5	283 09 59.0	103 10 55.7	Allston Tree	2264.0	3.354885
			272 55 55.3	92 58 15.1	Silvers Tree	5440.4	3.735629
			307 10 38.8	127 11 38.8	Timber Cove	2929.0	3.466713
			312 53 55.1	132 55 46.7	Fort Ross	5927.1	3.772842
Stockhoff	*38 32 57.016*	*1758.1*	*308 11*	*128 11*	*Stockhoff 2*	*3.38*	*0.52802*
1906	*123 18 11.913*	*288.5*					

Vicinity of Point Arena, 1906, and older positions of same points.

Dunn	39 00 39.986	1233.2	219 11 37.5	39 13 49.1	Fisher	7949.4	3.900333
1891	123 38 40.716	979.6	263 05 27.4	83 10 04.6	Cold Spring	10668.0	4.028083
Dunn	*39 00 39.964*	*1232.4*	*219 11 18.3*	*39 13 29.9*	*Fisher*	*7949.6*	*3.900346*
1906	*123 38 40.699*	*979.2*	*263 05 13.9*	*83 09 51.1*	*Cold Spring*	*10667.7*	*4.028070*
Clark	38 59 37.744	1163.8	149 33 48.1	329 33 18.6	Dunn	2226.2	3.347570
1891	123 37 53.842	1295.8	205 44 50.5	25 46 32.6	Fisher	8970.2	3.952800
			251 18 35.7	71 22 43.3	Cold Spring	9989.8	3.999555
Clark	*38 59 37.721*	*1163.2*	*140 33 47.6*	*329 33 18.1*	*Dunn*	*2226.3*	*3.347580*
1906	*123 37 53.824*	*1295.3*	*205 44 34.2*	*25 46 16.3*	*Fisher*	*8970.6*	*3.952821*
			251 18 19.1	*71 22 26.7*	*Cold Spring*	*9989.6*	*3.999547*
Lane	39 00 34.636	1068.2	267 44 22.8	87 46 12.8	Dunn	4211.0	3.624383
1891	123 41 35.602	856.6	288 10 48.4	108 13 08.0	Clark	5617.2	3.749518
			33 51 19.0	213 49 33.1	Point Arena L. H.	7273.6	3.861749
Lane	*39 00 34.590*	*1066.6*	*267 43 44.7*	*87 45 34.8*	*Dunn*	*4210.9*	*3.624376*
1906	*123 41 35.580*	*856.0*	*288 10 23.5*	*108 12 43.1*	*Clark*	*5616.9*	*3.749496*
Point Arena L. H.	38 57 18.722	577.3	233 02 57.7	53 06 33.5	Dunn	10331.7	4.014171
1891	123 44 23.887	575.2	245 25 30.6	65 29 35.9	Clark	10321.6	4.013747
			328 52 09.5	148 53 44.1	High Bluff	7018.6	3.846252
			331 40 59.7	151 42 07.0	Smith	5444.4	3.735954
			342 58 00.2	162 58 29.8	Arena	3863.5	3.586981
Point Arena L. H.	*38 57 18.707*	*579.6*	*213 51 03.1*	*33 52 40.0*	*Lane*	*7271.2*	*3.861608*
1906	*123 44 23.920*	*576.0*	*233 03 59.6*	*53 07 35.5*	*Dunn*	*10330.9*	*4.014138*
			245 26 35.6	*65 30 41.0*	*Clark*	*10321.5*	*4.013743*
Arena Latitude Station	38 55 18.927	583.6	215 44 14.7	35 47 21.0	Dunn	12201.1	4.086399
1891	123 43 36.908	889.1	225 57 17.4	46 00 53.1	Clark	11486.1	4.060171
Arena Latitude Station	*38 55 19.005*	*586.0*	*162 58 28.8*	*342 57 50.3*	*Point Arena L. H.*	*3863.4*	*3.586967*
1906	*123 43 36.942*	*890.0*	*215 45 02.1*	*35 48 08.4*	*Dunn*	*12199.3*	*4.086336*
			225 58 13.5	*46 01 49.3*	*Clark*	*11484.8*	*4.060124*

Vicinity of Point Arena, 1906, and older positions of same points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Smith 2	38 54 46.965	1448.2	122 38 03.5	302 37 23.2	Arena Lat. Sta.	1832.4	3.263021
1906	123 42 32.885	792.3	150 16 28.7	330 15 18.9	Point Arena L. H.	5392.0	3.731748
			207 09 45.4	27 12 11.4	Dunn	12236.9	4.087672
			216 49 32.1	36 52 27.6	Clark	11204.6	4.049395
Spur 2	38 59 16.465	507.7	58 56 56.7	238 54 19.4	Point Arena L. H.	7030.3	3.846972
1906	123 40 13.787	331.8	140 45 30.2	320 44 38.7	Lane	3111.0	3.492895
Shoemake 2	38 57 59.881	1846.6	75 31 10.3	255 29 02.4	Point Arena L. H.	5060.6	3.704198
1906	123 41 00.430	10.4	169 56 50.5	349 56 28.4	Lane	4845.2	3.685310
			205 25 23.3	25 25 52.7	Spur 2	2614.9	3.417455
Spur	38 59 16.549	510.3	37 31 11.1	217 29 21.6	Hall	6887.0	3.838027
1891	123 40 13.994	336.8	55 59 56.4	235 57 25.4	Pt. Arena NW. Base	6976.1	3.843615
			58 53 26.0	238 50 48.8	Point Arena L. H.	7027.9	3.846823
			140 48 30.2	320 47 38.8	Lane	3107.2	3.492374
			258 06 22.7	78 07 48.3	Adams	3346.7	3.524615
Spur	*38 50 16.509*	*509.1*	*288 30*	*108 30*	*Spur 2*	*4.32*	*0.63548*
1906	*123 40 13.957*	*335.9*					
Shoemake	38 57 58.425	1801.5	45 46 55.1	225 45 33.2	Hall	4378.8	3.641355
1891	123 40 57.846	1392.7	72 28 35.0	252 26 31.5	Pt. Arena NW. Base	4957.5	3.695265
			76 09 16.8	256 07 07.2	Point Arena L. H.	5109.7	3.708393
			169 19 13.5	349 18 49.8	Lane	4902.0	3.690376
			203 39 26.5	23 39 54.1	Spur	2630.2	3.419989
Shoemake	*38 57 58.527*	*1804.8*	*124 15*	*304 15*	*Shoemake 2*	*74.18*	*1.87029*
1906	*123 40 57.883*	*1303.6*					
High Bluff	38 54 03.866	119.2	132 50 52.1	312 49 47.2	Arena Lat. Sta.	3404.1	3.532006
1891	123 41 53.305	1284.5	139 17 54.6	319 17 27.3	Smith	1603.2	3.204981
			200 46 17.9	20 48 19.1	Dunn	13065.6	4.116131
			209 13 55.8	29 16 26.3	Clark	11800.6	4.071905
High Bluff	*38 54 03.950*	*121.8*	*132 50 53.5*	*312 49 48.4*	*Arena Lat. Sta.*	*3403.9*	*3.531974*
1906	*123 41 53.347*	*1285.6*	*144 19 01.1*	*324 18 36.3*	*Smith 2*	*1633.1*	*3.213007*
			200 46 57.4	*20 48 58.5*	*Dunn*	*13063.2*	*4.116048*
			209 14 46.3	*29 17 16.9*	*Clark*	*11798.5*	*4.071827*
Sinclair	38 54 39.582	1220.5	330 33 52.7	150 34 08.9	High Bluff	1264.6	3.101945
1891	123 42 19.095	460.1	105 02 36.6	285 02 25.5	Smith	439.1	2.642603
			148 31 24.3	328 30 05.9	Point Arena L. H.	5754.7	3.760023
Sinclair	*38 54 39.661*	*1223.0*	*330 34 08.3*	*150 34 24.5*	*High Bluff*	*1264.3*	*3.101859*
1906	*123 42 19.120*	*460.9*	*124 12 03.3*	*304 11 54.7*	*Smith 2*	*400.7*	*2.602836*
			148 31 22.8	*328 30 04.4*	*Point Arena L. H.*	*5754.6*	*3.760015*
Point Arena Catholic Church, spire	38 54 45.079	1390.0	313 55 39.3	133 55 46.7	Pt. Arena Long. Sta.	396.4	2.598183
	123 41 36.283	874.2	22 17 53.5	202 17 44.8	Marr	877.0	2.942975
1891			80 40 14.9	260 39 48.0	Sinclair	1045.3	3.019248
Point Arena Catholic Church, spire	*38 54 45.162*	*1302.7*	*80 39 52.0*	*260 30 25.1*	*Sinclair*	*1045.4*	*3.019281*
1906	*123 41 36.315*	*874.0*	*92 20 25.6*	*272 10 50.1*	*Smith 2*	*1364.1*	*3.134840*
Manchester Presbyterian Church, spire *	38 58 32.58	1004.6	224 05 37	44 06 12	Spur 2	1884.5	3.275186
	123 41 08.27	199.1	349 23 50	169 23 54	Shoemake 2	1025.8	3.011062
1906							
Manchester Methodist Church, center of tower *	38 58 43.46	1340.2	233 19 23	53 19 59	Spur 2	1704.3	3.231536
	123 41 10.58	254.7	349 41 39	169 41 45	Shoemake 2	1365.8	3.135383
1906							
Morse's house chimney *	38 58 39.78	1226.7	242 25 54	62 26 51	Spur 2	2445.2	3.388313
1906	123 41 43.85	1055.5	319 38 42	139 39 09	Shoemake 2	1614.3	3.207986
Scott's house, peak of roof *	38 58 03.92	120.9	233 54 06	53 55 27	Spur 2	3798.0	3.579552
	123 42 21.30	512.8	273 39 11	93 40 02	Shoemake 2	1950.8	3.290205
1906							
Cuthbertson's house chimney *	38 59 00.02	0.6	240 46 48	60 47 12	Spur 2	1038.9	3.016565
	123 40 51.46	1238.6	6 38 32	186 38 26	Shoemake 2	1867.0	3.271153
1906							
Kenney's house chimney *	38 58 53.17	1639.6	255 27 18	75 28 31	Spur 2	2861.9	3.456654
1906	123 42 08.89	214.0	314 54 52	134 55 35	Shoemake 2	2327.3	3.366849
Kendall's (A. B.) house, E. chimney *	38 59 28.34	873.9	327 00 27	147 00 34	Spur 2	436.5	2.639969
	123 40 23.66	569.4	17 58 44	197 58 21	Shoemake 2	2867.7	3.457531
1906							

* No check on this position.

San Francisco Bay.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Ridge*	37 30 46.046	1419.5	156 59 16.78	336 51 10.63	Mount Tamalpais	49645.60	4.6958808
1854	122 22 30.006	751.7	195 57 02.00	16 01 55.58	Rocky Mound	42693.28	4.6303595
			224 40 25.93	44 57 22.39	Mount Diablo	57777.21	4.7617566
			260 07 43.38	80 17 58.44	Red Hill	25155.04	4.4006250
Pise Hill*	37 27 44.076	1358.8	153 20 32.56	333 19 22.76	Ridge	6277.72	3.7978019
1854	122 20 35.922	882.8	190 50 06.81	10 53 50.13	Rocky Mound	47502.88	4.6767199
			245 42 33.22	65 51 38.10	Red Hill	24101.22	4.3820391
Contra Costa (1)	37 41 44.480	1371.3	332 52 47.6	152 56 11.7	Red Hill	17998.6	4.255239
1853	122 11 15.240	373.3	25 50 48.0	205 48 04.2	Guano I.	15098.3	4.178927
			39 16 29.9	219 09 37.9	Ridge	26201.0	4.418319
Point Avisadero*	37 43 33.884	1044.5	282 14 01.6	102 20 28.3	Contra Costa (1)	15849.0	4.200002
1851–1903	122 21 47.476	1162.8	309 13 13.2	129 23 03.4	Red Hill	30622.4	4.486040
			332 13 26.4	152 17 08.7	Guano I.	19167.2	4.282559
San Antonio Creek /	37 47 30.040	926.1	334 25 33.0	154 30 50.7	Red Hill	29564.1	4.470765
1853	122 14 20.905	511.5	336 52 39.0	156 54 32.6	Contra Costa (1)	11582.9	4.063820
			21 14 20.3	201 09 21.1	Ridge	33199.1	4.521127
			56 22 20.3	236 17 46.8	Point Avisadero	13133.9	4.118395
			115 13 39.5	295 01 31.2	Mount Tamalpais	34675.0	4.540017
Yerba Buena I.	37 48 36.796	1134.4	280 27 21.5	100 31 59.9	San Antonio Creek	11299.5	4.053061
1851–1897	122 21 55.059	1346.7	358 51 39.0	178 51 43.6	Point Avisadero	9340.8	3.970382
San Leandro Pt. 2	37 44 07.656	236.0	84 04 41.7	264 00 32.2	Point Avisadero	10033.5	4.001454
1894	122 14 59.946	1467.8	129 16 33.1	309 12 18.8	Yerba Buena I.	13117.3	4.117844
			326 06 38.9	146 12 20.2	Red Hill	24606.8	4.391055
Sierra Point*	37 40 28.621	882.4	189 10 52.7	9 11 53.5	Yerba Buena I.	15246.3	4.183164
1851–1894	122 23 34.509	845.8	204 38 57.2	24 40 02.6	Point Avisadero	6284.8	3.798289
			297 22 21.6	117 33 16.7	Red Hill	29673.5	4.472369
			241 46 35.4	61 51 50.1	San Leandro Pt. 2	14299.6	4.155325
			314 12 31.2	134 17 18.8	Guano I.	16125.3	4.207509
Stony Hill*	37 44 05.407	166.7	191 03 01.1	11 03 42.0	Yerba Buena I.	8525.3	3.930708
1851–1903	122 23 01.860	45.5	284 01 57.2	104 09 09.3	Contra Costa (1)	17844.0	4.251493
			298 04 33.9	118 05 19.4	Point Avisadero	2064.5	3.314825
			6 49 35.2	186 49 15.3	Sierra Point	6731.2	3.828094
South	37 49 11.333	349.4	39 46 12.7	219 42 36.2	Point Avisadero	13529.7	4.131289
1851	122 15 54.048	1322.0	83 09 17.5	263 05 36.2	Yerba Buena I.	8894.2	3.949106
North	37 51 48.197	1485.9	337 01 43.7	157 02 35.1	South	5252.5	3.720364
1851	122 17 17.860	436.5	48 58 52.4	228 56 02.4	Yerba Buena I.	8987.0	3.953615
Telegraph Hill 2*	37 48 10.125	312.1	256 45 25.8	76 46 53.4	Yerba Buena I.	3592.8	3.555431
1881–1897	122 24 18.030	441.4	336 35 23.4	156 36 55.6	Point Avisadero	9279.7	3.967532
			346 06 51.2	166 07 38.1	Stony Hill	7771.7	3.890514
Angel I. Peak	37 51 42.734	1317.5	269 11 00.8	89 16 14.2	North	12484.1	4.096357
1851–1881	122 25 48.536	1180.3	315 05 51.4	135 08 14.6	Yerba Buena I.	8090.6	3.907979
			341 20 06.8	161 21 02.3	Telegraph Hill 2	0918.5	3.840010
Point San Jose*	37 48 26.620	820.7	177 36 17.5	357 36 11.2	Angel I. Peak	6051.7	3.781874
1851–1892	122 25 38.190	934.2	206 41 27.9	86 43 44.7	Yerba Buena I.	5467.2	3.737763
Presidio Hill*	37 47 38.930	1200.2	313 10 51.3	133 13 47.0	Stony Hill	9615.6	3.982976
1851–1904	122 27 48.212	1179.5	201 15 50.4	21 17 03.8	Angel I. Peak	8066.4	3.906678
			245 10 90.0	65 12 11.7	Point San Jose	3504.3	3.544600
			258 18 08.2	78 21 44.7	Yerba Buena I.	8821.8	3.945557
Lime Point Bluff	37 49 40.508	1248.8	229 50 06.7	49 51 58.8	Angel I. Peak	5844.4	3.766737
1852–1857	122 28 51.245	1253.3	295 44 16.4	115 46 14.9	Point San Jose	5242.7	3.719556
			337 38 05.8	157 38 44.4	Presidio Hill	4053.1	3.607785
Rocky I.	37 53 48.555	1496.9	302 21 32.8	122 23 59.8	North	6929.2	3.840685
1851	122 21 17.316	423.1	5 29 12.3	185 28 49.2	Yerba Buena I.	9656.0	3.984796
			22 57 53.5	202 56 02.6	Telegraph Hill 2	11330.9	4.054265
			59 41 05.2	239 38 18.7	Angel I. Peak	7679.9	3.885357
Angel I. Peak 2	37 51 42.800	1319.4	239 36 56.1	59 39 42.2	Rocky I.	7670.7	3.884833
1881	122 25 48.146	1176.8	311 26 57.1	131 33 34.3	San Leandro Pt. 2	21175.2	4.325827
			315 09 20.6	135 11 43.5	Yerba Buena I.	8085.3	3.907695
			341 24 55.9	161 25 51.2	Telegraph Hill 2	6917.3	3.839939
			21 20 32.3	201 19 18.6	Presidio Hill	8071.7	3.906967
			77 53 55.9	257 54 06.8	Angel I. Peak	9.8	0.989166
			49 54 40.0	229 52 47.7	Lime Point Bluff	5853.0	3.767376

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Russian Hill*	37 47 54.736	1687.5	83 37 34.0	263 35 44.9	Presidio Hill	4379.2	3.641399
1881	122 24 50.330	1231.3	168 33 27.4	348 32 51.9	Angel I. Peak	7172.1	3.855643
			168 38 08.0	348 37 32.7	Angel I. Peak 2	7172.1	3.855649
			205 30 09.6	25 32 20.4	Rocky I.	12088.0	4.082353
			239 00 55.6	59 01 15.4	Telegraph Hill 2	921.7	2.964592
			253 09 28.3	73 11 15.9	Yerba Buena I.	4479.5	3.651228
			118 58 47.9	298 56 20.3	Lime Point Bluff	6735.0	3.828339
Reservoir*	37 48 07.621	234.9	171 48 59.4	351 48 35.4	Angel I. Peak 2	6702.4	3.826233
1881	122 25 09.116	223.0	259 15 14.9	79 17 13.8	Yerba Buena I.	4831.6	3.684092
			266 27 37.3	86 28 08.6	Telegraph Hill 2	1252.1	3.097655
			310 50 16.6	130 50 28.1	Russian Hill	607.5	2.783529
			77 12 36.0	257 10 58.4	Presidio Hill	3991.6	3.601146
Point Cavallo 2*	37 50 14.088	434.3	233 46 01.3	53 47 34.9	Angel I. Peak	4625.3	3.665141
1881	122 28 21.164	517.5	233 48 58.8	53 50 32.7	Angel I. Peak 2	4634.2	3.665977
			287 35 23.5	107 39 20.2	Yerba Buena I.	9907.9	3.995980
			302 42 29.5	122 44 58.6	Telegraph Hill 2	7068.8	3.849349
			309 40 46.7	129 42 44.4	Reservoir	6104.6	3.785656
			309 46 53.4	129 49 02.6	Russian Hill	6712.0	3.826850
			350 26 00.2	170 26 20.4	Presidio Hill	4851.1	3.685838
			35 23 51.5	215 23 33.1	Lime Point Bluff	1270.0	3.103817
Point Lobos 2*	37 47 09.177	282.9	198 22 30.6	18 23 09.5	Lime Point Bluff	4916.5	3.691653
1852	122 29 54.620	1336.5	201 50 32.5	21 51 29.8	Point Cavallo 2	6142.2	3.788325
			215 31 36.4	35 34 07.6	Angel I. Peak 2	10368.4	4.015710
			259 17 24.6	79 20 31.1	Russian Hill	7576.5	3.879468
			253 28 12.5	73 29 30.0	Presidio Hill	3226.1	3.508679
Fort Point*	37 48 30.082	927.4	168 50 50.8	348 50 40.1	Lime Point Bluff	2213.1	3.344997
1851	122 28 33.742	825.7	271 24 32.5	91 26 20.2	Point San Jose	4295.7	3.633034
			324 45 47.1	144 46 15.0	Presidio Hill	1930.8	3.285729
			38 25 52.4	218 25 02.8	Point Lobos 2	3183.9	3.502960
Point Lobos*	37 47 15.336	472.7	201 43 54.8	21 44 39.5	Lime Point Bluff	4818.4	3.682902
1851	122 30 04.197	102.7	223 49 57.8	43 50 53.2	Fort Point	3195.0	3.504471
			257 39 23.9	77 40 47.2	Presidio Hill	3405.8	3.532224
			309 01 06.5	129 01 12.3	Point Lobos 2	301.6	2.479479
Black Ridge*	37 45 13.752	424.0	144 24 54.0	324 23 50.2	Point Lobos 2	4376.3	3.641104
1852	122 28 10.547	258.1	178 23 38.8	358 23 32.2	Point Cavallo 2	9263.2	3.966761
			186 57 39.0	6 57 52.7	Presidio Hill	4509.2	3.654096
			196 10 55.5	16 12 22.8	Angel I. Peak 2	12490.2	4.096570
			219 37 08.0	39 38 59.2	Reservoir	6960.4	3.842639
			224 36 52.8	44 38 55.6	Russian Hill	6974.4	3.843506
			226 16 47.2	46 19 09.9	Telegraph Hill 2	7870.6	3.896008
Sand Knoll*	37 45 37.707	1162.5	172 02 47.3	352 02 37.4	Point Lobos 2	2847.5	3.454461
1851	122 29 38.518	942.7	215 49 49.6	35 50 57.3	Presidio Hill	4610.3	3.663729
			288 55 21.1	108 56 15.0	Black Ridge	2276.6	3.357277
Green Bluff*	37 41 21.783	671.5	167 14 48.1	347 14 29.2	Black Bluff	3425.8	3.534763
1851	122 29 41.806	1024.3	197 20 48.4	17 21 44.2	Black Ridge	7492.8	3.874642
Abbey Hill*	37 41 22.989	708.7	89 36 06.4	269 33 58.6	Green Bluff	5119.8	3.709255
1851	122 26 12.848	314.8	119 22 24.1	299 19 57.4	Black Bluff	6740.4	3.828088
			157 57 15.1	337 56 03.1	Black Ridge	7676.3	3.885150
Cattle Hill*	37 36 27.320	842.2	172 42 04.7	352 41 35.7	Green Bluff	9152.5	3.961538
1851	122 28 54.349	1333.2	203 27 47.5	23 29 26.2	Abbey Hill	9938.1	3.997302
Cement†	37 46 59.455	1832.9	224 37 31.5	44 37 43.6	Point Lobos	688.0	2.837575
1877	122 30 23.948	586.0	247 19 47.6	67 20 05.6	Point Lobos 2	777.7	2.890832
			252 16 28.3	72 18 03.7	Presidio Hill	4000.2	3.602087
			314 56 05.8	134 57 27.6	Black Ridge	4613.1	3.663992
			357 45 54.5	177 46 01.5	Black Bluff	7074.7	3.849708
			217 39 01.2	37 41 50.3	Angel I. Peak 2	11036.9	4.042847
Lone Mountain Cross*	37 46 46.601	1436.6	310 00 02.3	130 02 30.7	Stony Hill	7728.0	3.888066
1877	122 27 03.625	88.8	29 47 01.5	209 46 20.5	Black Ridge	3298.0	3.518258
			307 29 10.7	127 32 24.5	Point Avisadero	9757.1	3.989319
			94 38 21.3	274 36 18.5	Cement	4918.1	3.691794
			99 27 32.6	279 25 47.8	Point Lobos 2	4241.8	3.627551
			237 12 14.8	57 13 36.7	Russian Hill	3879.5	3.588772
			145 56 10.2	325 55 42.9	Presidio Hill	1947.6	3.289498
			228 16 19.1	48 17 29.3	Reservoir	3753.6	3.574450

* This point is in the area of the 1906 earthquake disturbance.

† See p. 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Colma *	37 41 10.800	333.0	165 46 13.2	345 45 49.9	Black Bluff	3796.4	3.579367
1899	122 29 34.581	847.3	198 40 17.1	18 41 15.2	Black Ridge 2	7270.9	3.861586
Fog Cap *	37 40 07.845	241.8	163 38 22.0	343 38 07.8	Colma	2022.8	3.305958
1899	122 29 11.326	277.6	191 15 49.1	11 16 33.2	Black Ridge 2	9002.4	3.954356
			245 11 24.8	65 13 18.5	San Bruno Mountain	5020.2	3.700720
Pillar Point †	37 29 54.817	1690.0	280 32 11.0	100 34 36.3	Half Moon Bay	5965.9	3.775674
1854	122 29 52.241	1283.2	303 40 51.2	123 45 42.7	Summit	14160.5	4.151079
			322 41 40.5	142 43 45.3	Johnston	8324.6	3.920362
			116 48 29.5	296 30 04.2	Farallon I., H.	49717.0	4.696505
Denniston *	37 31 30.878	952.0	325 50 49.1	145 51 57.3	Half Moon Bay	4898.9	3.690095
1863	122 27 45.442	1115.8	46 26 58.4	226 25 41.2	Pillar Point	4297.4	3.633208
Hogle *	37 31 55.960	1725.3	279 51 08.9	99 52 59.2	Denniston	4512.0	3.654370
1863	122 30 46.483	1141.3	340 21 53.7	160 22 26.7	Pillar Point	3965.2	3.598264
South Peak *	37 33 21.766	671.1	337 08 26.0	157 09 01.6	Denniston	3709.8	3.569352
1863	122 28 44.133	1083.4	14 41 36.9	194 40 55.3	Pillar Point	6595.6	3.819253
			48 38 20.4	228 37 05.8	Hogle	4002.4	3.602318
Piedra *	37 34 33.758	1040.7	307 41 31.6	127 42 43.0	South Peak	3629.3	3.559818
1863	122 30 41.138	1009.5	352 02 55.6	172 03 25.4	Pillar Point	8682.9	3.938666
			1 32 43.5	181 32 40.3	Hogle	4866.6	3.687224
			216 47 56.0	36 49 01.1	Cattle Hill	4372.8	3.640759
Peak Mountain *	37 33 45.306	1396.8	352 04 49.0	172 04 51.5	South Peak	732.7	2.864934
1863	122 28 48.247	1184.2	12 28 27.3	192 27 48.3	Pillar Point	7277.4	3.861978
			178 17 01.5	358 16 57.8	Cattle Hill	4997.1	3.698716
			40 44 17.8	220 43 05.8	Hogle	4448.4	3.648203
			118 20 32.4	298 19 23.6	Piedra	3147.5	3.497961
Point Cavallo	37 50 09.757	300.8	309 04 46.8	129 06 24.9	Point San Jose	5042.6	3.702652
1852	122 28 18.208	445.2	351 01 52.4	171 02 10.8	Presidio Hill	4707.7	3.672800
Angel I. N. W.	37 51 40.902	1260.9	346 10 46.7	166 11 23.6	Point San Jose	6168.3	3.790167
1852	122 26 38.425	939.2	40 58 16.0	220 57 14.8	Point Cavallo	3721.3	3.570695
Sausalito Point	37 51 23.358	720.1	260 12 08.8	80 13 27.5	Angel I. N. W.	3182.0	3.502708
1852	122 28 46.702	1141.7	342 55 52.2	162 56 09.7	Point Cavallo	2373.7	3.375433
Peninsula Hill	37 52 14.482	446.4	298 41 31.4	118 42 18.9	Angel I. N. W.	2155.9	3.333637
1852	122 27 55.793	1363.7	38 17 43.6	218 17 12.4	Sausalito Point	2008.2	3.302805
Strawberry Hill	37 52 46.614	1437.1	119 56 02.5	299 52 25.7	Mount Tamalpais	9946.7	3.997678
1852	122 29 52.301	1278.2	289 10 25.7	109 11 37.2	Peninsula Hill	3014.8	3.479264
			328 00 12.1	148 00 52.4	Sausalito Point	3026.5	3.480937
Richardson	37 51 04.789	147.6	180 14 08.9	0 14 09.2	Strawberry Hill	3139.4	3.496846
1852	122 29 52.829	1291.6	233 04 52.8	53 06 04.6	Peninsula Hill	3577.9	3.553632
Coyote Ridge *	37 52 00.773	23.8	148 37 24.8	328 35 47.1	Mount Tamalpais	7464.7	3.873015
1852	122 33 06.097	149.0	253 22 07.3	73 24 06.3	Strawberry Hill	4942.9	3.693977
			290 03 10.1	110 05 08.7	Richardson	5029.9	3.701558
High Bluff *	37 50 42.604	1313.4	183 25 13.6	3 25 17.2	Coyote Ridge	2414.3	3.382797
1852	122 33 11.990	293.2	261 59 12.6	82 01 14.8	Richardson	4917.0	3.691704
Franks Lagoon *	37 51 45.686	1408.5	260 51 35.7	80 52 48.4	Coyote Ridge	2931.5	3.467089
1852	122 35 04.508	110.2	305 15 09.0	125 16 18.0	High Bluff	3368.8	3.527478
Duxbury *	37 52 43.101	1328.8	177 55 59.2	357 55 54.6	Mount Tamalpais	5070.5	3.705052
1852	122 35 37.742	922.3	289 23 04.0	109 24 37.1	Coyote Ridge	3929.3	3.594318
			335 20 53.9	155 21 14.3	Franks Lagoon	1947.6	3.289504
Point Bonita *	37 49 13.071	402.9	143 43 46.9	323 42 56.1	High Bluff	3424.1	3.534549
1851	122 31 49.139	1201.9	219 32 14.1	39 33 25.4	Richardson	4466.9	3.650001
			285 28 57.1	105 30 56.9	Fort Point	4959.8	3.695460
			323 43 57.0	143 45 07.2	Point Lobos 2	4737.0	3.675502
Read *	37 55 09.995	308.1	339 45 27.4	159 46 08.4	Strawberry Hill	4711.4	3.673149
1852	122 30 59.003	1441.2	28 02 14.2	208 00 56.2	Coyote Ridge	6608.9	3.820131
Lafayette Park *	37 47 31.930	984.4	41 23 11.7	221 21 37.8	Black Ridge	5677.0	3.754117
1881–1896	122 25 37.228	910.8	83 39 58.8	263 37 21.0	Point Lobos 2	6336.9	3.801878
			93 51 48.9	273 50 28.6	Presidio Hill	3212.1	3.506783
			141 16 56.5	321 15 16.0	Point Cavallo 2	6408.9	3.806781
			178 01 25.6	358 01 18.9	Angel I. Peak 2	7739.1	3.888692
			212 00 15.4	32 00 32.6	Reservoir	1297.6	3.113154

* This point is in the area of the 1906 earthquake disturbance.

† See p. 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Heights*	37 47 34.830	1073.8	153 32 05.8	333 31 04.6	Point Cavallo 2	5485.2	3.739195
1896	122 26 41.195	1007.9	189 37 35.4	9 38 07.9	Angel I. Peak 2	7754.4	3.889549
			245 49 22.2	65 50 18.6	Reservoir	2469.2	3.392554
			252 43 43.5	72 45 11.4	Telegraph Hill 2	3667.7	3.564394
			273 15 50.9	93 16 30.1	Lafayette Park	1567.6	3.195243
			94 24 49.3	274 24 08.1	Presidio Hill	1644.6	3.216056
Fort Point L. H.*	37 48 39.246	1209.9	186 50 47.4	6 50 56.1	Point Cavallo 2	2945.1	3.469094
1877	122 28 35.520	868.9	215 51 39.2	35 53 21.8	Angel I. Peak 2	6984.0	3.844106
			283 58 07.4	104 00 25.5	Russian Hill	5677.2	3.754137
			328 05 55.5	148 06 24.4	Presidio Hill	2190.3	3.340512
			34 52 43.5	214 51 55.0	Point Lobos 2	3384.7	3.529516
			39 59 27.1	219 58 32.7	Point Lobos	3376.2	3.528434
			40 46 41.2	220 45 34.7	Cement	4062.3	3.608777
			96 58 18.0	276 56 22.7	Bonita Point L. H.	4633.8	3.665939
Fort Point old L. H.*	37 48 40.386	1245.0	348 26 50.7	168 26 52.3	Fort Point	324.3	2.510893
1857	122 28 36.397	890.3	39 19 52.9	219 18 59.1	Point Lobos	3389.7	3.530155
			168 54 56.2	348 54 47.1	Lime Point Bluff	1888.8	3.276192
East Diablo	37 49 22.016	678.7	318 45 39.3	138 46 49.1	Presidio Hill	4225.9	3.625919
1887	122 29 42.070	1028.9	4 17 17.8	184 17 10.1	Point Lobos 2	4107.0	3.613523
			7 53 33.8	187 53 20.3	Point Lobos	3942.9	3.595819
			13 07 28.7	193 07 03.1	Cement	4513.0	3.654468
New Lime Point	37 49 39.979	1232.5	213 18 05.4	33 18 22.7	Point Cavallo 2	1258.3	3.099777
1887	122 28 49.417	1208.5	338 08 09.7	158 08 47.2	Presidio Hill	4021.1	3.604346
			22 18 37.3	202 17 51.5	Point Lobos	4820.0	3.683049
			25 03 11.4	205 02 13.5	Cement	5462.6	3.737493
			66 43 59.9	246 43 27.6	East Diablo	1401.7	3.146668
West Diablo	37 49 18.114	558.4	311 00 34.8	131 02 02.9	Presidio Hill	4659.0	3.668291
1887	122 30 11.904	291.2	353 55 36.9	173 55 47.5	Point Lobos 2	3997.6	3.601803
			357 08 52.4	177 08 57.2	Point Lobos	3790.0	3.578640
			3 56 37.8	183 56 30.5	Cement	4285.1	3.631959
Diablo Hill	37 49 40.690	1254.4	315 00 09.7	135 01 43.7	Presidio Hill	5307.4	3.724883
1887	122 30 21.594	528.1	341 11 52.6	161 11 58.5	West Diablo	735.2	2.866434
			354 34 26.4	174 34 37.2	Point Lobos	4501.5	3.653356
			0 39 51.0	180 39 49.7	Cement	4971.3	3.696469
Rob*	37 47 45.651	1407.4	280 22 38.7	100 23 07.0	Presidio Hill	1149.9	3.060663
1877	122 28 34.442	842.6	309 19 08.4	129 20 04.0	Lone Mt. Cross	2872.7	3.458291
			352 52 49.1	172 53 03.8	Black Ridge	4719.5	3.673896
			60 11 06.0	240 10 16.9	Point Lobos 2	2261.2	3.354340
			62 00 59.7	241 59 52.6	Cement	3034.4	3.482073
Rob 2*	37 47 45.788	1411.6	280 40 30.7	100 40 58.8	Presidio Hill	1141.0	3.057283
1887	122 28 34.040	832.8	60 12 58.2	240 12 08.8	Point Lobos 2	2271.8	3.356379
			62 02 00.4	242 00 53.0	Cement	3045.1	3.483601
			66 57 12.2	246 56 17.0	Point Lobos	2397.4	3.379741
			139 56 37.8	319 55 37.8	West Diablo	3719.3	3.570465
			143 24 34.7	323 23 28.7	Diablo Hill	4412.6	3.644690
			150 42 59.9	330 42 18.2	East Diablo	3401.6	3.531686
			173 54 10.3	353 54 00.9	New Lime Point	3540.6	3.549079
			183 56 20.6	3 56 28.5	Point Cavallo 2	4583.1	3.661155
Rob 3*	37 47 46.643	1438.0	281 48 07.8	101 48 36.3	Presidio Hill	1162.3	3.065300
1892	122 28 34.711	849.1	59 25 58.1	239 25 09.1	Point Lobos 2	2270.9	3.356197
			61 26 59.3	241 25 52.4	Cement	3043.1	3.483316
			150 44 27.7	330 43 46.3	East Diablo	3370.6	3.527705
			184 10 04.4	4 10 12.7	Point Cavallo 2	4557.9	3.658705
			209 12 39.7	29 14 21.9	Angel I. Peak 2	8342.9	3.921317
Spring Valley*	37 47 25.381	782.4	291 45 39.9	111 46 54.9	Lone Mt. Cross	3223.5	3.508333
1892	122 29 05.965	146.0	67 14 22.7	247 13 52.9	Point Lobos 2	1291.1	3.110960
			126 22 25.3	306 20 48.8	Bonita Point L. H.	4787.7	3.680131
			155 06 33.5	335 05 53.1	West Diablo	3831.7	3.583391
			166 12 12.1	346 11 50.0	East Diablo	3702.8	3.568529
			198 06 26.9	18 06 45.7	Fort Point L. H.	2396.0	3.379486
			229 23 34.5	49 23 53.7	Rob 3	1007.2	3.003109
Point Lobos 3†	37 47 13.804	425.5	217 13 30.5	37 16 08.6	Angel I. Peak 2	10418.4	4.017799
1892	122 30 05.979	146.3	220 01 35.3	40 02 30.8	Fort Point L. H.	3440.5	3.536618
			245 36 14.2	65 37 10.1	Rob 3	2451.9	3.389501
			256 20 01.0	76 20 37.7	Spring Valley	1511.2	3.179330
			257 02 46.6	77 04 11.0	Presidio Hill	3458.7	3.538917
			297 10 02.5	117 10 09.5	Point Lobos 2	312.4	2.494760
			44 49 33.8	224 49 22.8	Cement	623.7	2.794994
			143 14 34.0	323 13 34.2	Bonita Point L. H.	3988.8	3.600842

* This point is in the area of the 1906 earthquake disturbance.

† See p. 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Cemetery*	37 46 57.289	1766.1	212 19 11.8	32 20 01.7	Fort Point L. H.	3720.0	3.570538
1892	122 29 56.828	1390.6	232 51 23.1	52 52 13.4	Rob 3	2520.4	3.401469
			247 47 47.6	67 49 06.4	Presidio Hill	3398.8	3.531331
			188 23 13.2	8 23 14.6	Point Lobos 2	370.5	2.568761
			274 25 51.6	94 27 37.7	Lone Mt. Cross	4251.2	3.628514
			95 44 56.8	275 44 40.2	Cement	667.0	2.824118
Under Cement*	37 47 04.203	129.5	223 04 08.4	43 05 17.1	Fort Point L. H.	4011.7	3.603331
1892	122 30 27.515	673.3	240 40 32.0	60 40 45.2	Point Lobos 3	604.4	2.781333
			259 12 43.5	79 13 03.7	Point Lobos 2	819.4	2.913505
			329 11 34.8	149 11 37.0	Cement	170.4	2.231577
			151 57 08.6	331 56 22.0	Bonita Pt. L. H.	3956.2	3.597281
Highland	37 53 42.659	1315.2	29 50 40.3	209 48 24.6	Yerba Buena I.	10869.8	4.036222
1881	122 18 13.921	340.1	40 59 53.9	220 56 10.5	Telegraph Hill 2	13577.7	4.132826
			42 07 56.3	222 03 53.1	Russian Hill	14456.8	4.160071
			71 37 35.0	251 32 56.2	Angel I. Peak 2	11699.6	4.068171
			71 37 54.0	251 33 14.9	Angel I. Peak	11709.3	4.068532
			92 20 18.4	272 18 25.7	Rocky I.	4484.6	3.651721
High Hill	37 56 33.715	1039.4	301 30 31.8	121 34 08.1	Highland	10082.4	4.003563
1852	122 24 05.729	139.9	321 03 12.8	141 04 56.3	Rocky I.	6546.0	3.815978
			15 35 45.9	195 34 43.3	Angel I. Peak 2	9311.7	3.969030
			15 38 57.7	195 37 54.6	Angel I. Peak	9316.2	3.969240
Point San Quentin	37 56 39.202	1208.6	271 20 28.2	91 23 26.9	High Hill	7096.8	3.851063
1852	122 28 56.294	1374.5	295 06 08.3	115 10 50.4	Rocky I.	12383.7	4.092850
			333 16 54.4	153 18 50.3	Angel I. Peak 2	10229.3	4.009848
			333 20 04.8	153 22 00.2	Angel I. Peak	10226.9	4.009742
Mound	37 56 31.739	978.5	334 33 21.8	154 34 24.2	Highland	5772.4	3.761360
1881	122 19 55.422	1353.2	21 41 19.0	201 40 28.6	Rocky I.	5414.2	3.733537
			90 35 33.0	270 32 59.0	High Hill	6112.2	3.786199
Topog	37 54 46.627	1437.5	337 20 23.0	157 20 43.7	Highland	2137.1	3.329831
1881	122 18 47.619	1163.2	63 55 38.3	243 54 06.3	Rocky I.	4071.9	3.609793
			152 56 24.6	332 55 42.9	Mound	3639.3	3.561016
El Cerrito	37 55 26.451	815.5	206 11 51.6	26 12 16.5	Mound	2243.4	3.350910
1881	122 20 35.983	878.8	294 52 35.9	114 53 42.5	Topog	2917.8	3.465049
			312 40 01.4	132 41 28.7	Highland	4720.5	3.673992
			18 30 00.4	198 29 34.9	Rocky I.	3182.7	3.502793
			112 03 35.0	292 01 25.9	High Hill	5526.0	3.742414
Red Rock	37 55 45.767	1411.0	109 46 59.7	289 45 04.3	Point San Quentin	4871.3	3.687646
1852	122 25 48.565	1186.0	239 30 24.4	59 31 27.6	High Hill	2914.0	3.464492
			298 35 06.9	118 37 53.6	Rocky I.	7547.3	3.877792
			359 55 18.4	179 55 19.0	Angel I. Peak 2	7491.0	3.874538
			359 59 41.3	179 59 41.4	Angel I. Peak	7493.0	3.874654
California Point	37 54 48.843	1505.8	167 57 00.0	347 56 41.7	Point San Quentin	3479.2	3.541481
1852	122 28 26.547	648 4	243 03 54.2	63 06 34.5	High Hill	7143.4	3.853907
Corte Madera†	37 55 56.23	1733.4	231 22 22	51 23 04	Point San Quentin	2122.8	3.326913
1852	122 30 04.21	102.9	311 02 42	131 03 42	California Point	3163.3	3.500137
Point Richmond 2	37 54 36.252	1117.6	33 39 27.3	213 37 58.2	Angel I. Peak 2	6423.8	3.807792
1897	122 23 22.499	549.6	114 58 00.0	294 54 34.7	Point San Quentin	8990.4	3.953781
			121 00 26.4	300 58 56.6	Red Rock	4162.0	3.619297
			163 45 00.7	343 44 34.1	High Hill	3772.3	3.576607
California Point 2	37 54 48.825	1505.2	167 55 43.1	347 55 24.8	Point San Quentin	3480.0	3.541584
1897	122 28 26.489	647.0	243 03 21.8	63 06 02.2	High Hill	7142.4	3.853843
			245 30 51.4	65 32 28.5	Red Rock	4237.9	3.627155
			272 57 44.9	93 00 51.9	Point Richmond 2	7435.9	3.871334
Bluff Point 2	37 53 17.451	538.0	138 42 47.4	318 41 45.2	California Point 2	3749.7	3.573991
1897	122 26 45.203	1104.6	152 46 20.5	332 44 59.9	Point San Quentin	6996.0	3.844852
			196 49 46.3	16 50 21.1	Red Rock	4777.5	3.679200
			212 45 28.3	32 47 06.4	High Hill	7196.4	3.857118
			243 51 06.2	63 53 10.9	Point Richmond 2	5516.3	3.741646
			334 27 16.6	154 27 52.1	Angel I. Peak 2	3234.3	3.509775
Brooks Island	37 53 48.439	1493.3	59 40 25.1	239 37 39.1	Angel I. Peak 2	7666.4	3.884589
1895	122 21 17.435	425.9	5 28 17.2	185 27 54.3	Yerba Buena I.	9652.2	3.984625
			83 13 30.9	263 10 09.5	Bluff Point 2	8065.4	3.906628
			100 06 31.0	280 02 07.2	California Point 2	10645.8	4.027178
			115 12 04.7	295 07 22.7	Point San Quentin	12382.6	4.092812
			115 46 00.1	295 44 43.3	Point Richmond 2	3392.4	3.530507
			118 39 57.1	298 37 10.5	Red Rock	7546.5	3.877743
			141 07 18.0	321 05 34.6	High Hill	6547.0	3.816040

*See page 291.

† No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Marin Island E.	37 57 52.977	1633.2	292 49 10.6	112 51 36.8	High Hill	6295.8	3.799051
1897	122 28 03.389	82.7	319 58 51.7	140 00 14.6	Red Rock	5120.4	3.709308
			5 40 32.1	185 40 17.8	California Point 2	5705.6	3.756301
			29 35 40.1	209 35 07.6	Point San Quentin	2615.7	3.417593
			347 19 28.2	167 20 16.3	Bluff Point 2	8706.8	3.939858
			343 50 41.6	163 52 05.2	Angel I. Peak 2	11881.5	4.074872
Molate Point 2	37 56 50.455	1555.5	287 19 22.9	107 20 04.5	High Hill	1732.8	3.238745
1897	122 25 13.475	329.0	326 45 52.5	146 47 00.7	Point Richmond 2	4946.3	3.694280
			18 50 45.1	198 49 48.6	Bluff Point 2	6938.8	3.841287
			23 15 09.2	203 14 47.6	Red Rock	2170.7	3.336596
			51 30 44.6	231 28 45.8	California Point 2	6023.4	3.779841
			86 22 12.9	266 19 55.8	Point San Quentin	5451.5	3.736518
			114 56 20.8	294 54 36.2	Marin I. E.	4574.1	3.660308
			5 06 20.9	185 05 59.9	Angel I. Peak 2	9523.1	3.978780
San Pablo Ridge	37 57 33.061	1019.2	326 31 12.8	146 31 43.1	High Hill	2193.6	3.341158
1897	122 24 55.287	1349.7	18 40 40.5	198 40 29.3	Molate Point 2	1386.6	3.141961
			21 28 17.7	201 27 44.6	Red Rock	3554.6	3.550792
			45 32 38.6	225 30 28.6	California Point 2	7227.7	3.858999
			74 15 39.5	254 13 11.1	Point San Quentin	6113.9	3.786318
			97 37 58.5	277 36 02.5	Marin I. E.	4632.6	3.665827
Point San Pablo 2	37 57 55.089	1698.3	1 23 09.1	181 23 02.6	Angel Island Peak 2	11481.5	4.059998
1897	122 25 36.786	898.0	4 07 35.3	184 07 28.2	Red Rock	3997.5	3.601792
			11 03 04.4	191 02 22.4	Bluff Point 2	8721.5	3 940590
			35 49 41.5	215 47 57.2	California Point 2	7081.7	3.850140
			64 21 33.1	244 19 30.5	Point San Quentin	5403.5	3.732676
			88 58 12.9	268 56 42.7	Marin I. E.	3579.2	3.553783
			154 33 21.0	334 32 50.0	East Sister	2861.5	3.456592
Point San Pedro	37 59 16.462	507.5	319 15 57.5	139 17 46.4	High Hill	6620.4	3.820884
1852	122 27 02.657	64.8	29 47 01.1	209 45 51.2	Point San Quentin	5585.9	3.747096
E. Brother I. L. H.	37 57 48.876	1506.8	287 40 24.5	107 41 03.1	San Pablo Ridge	1605.6	3.205634
1874–1897	122 25 57.954	1414.7	310 12 51.7	130 14 00.7	High Hill	3588.4	3.554903
			328 54 43.8	148 55 11.2	Molate Point 2	2103.2	3.322880
			7 51 19.2	187 50 50.1	Bluff Point 2	8447.6	3.926731
			356 32 34.2	176 32 40.0	Red Rock	3802.5	3.580072
			33 10 21.2	213 08 49.8	California Point 2	6631.1	3.821585
			63 45 17.0	243 43 27.3	Point San Quentin	4855.1	3.686195
			92 22 32.2	272 21 15.0	Marin I. E.	3064.5	3.486363
			165 35 44.2	345 35 26.2	East Sister	2865.5	3.457204
			227 20 11.5	47 22 39.1	Point Pinole	7953.4	3.900554
Quarry	37 51 44.992	1387.1	172 30 22.6	352 29 57.8	Red Rock	7487.4	3.874330
1895	122 25 08.581	209.8	179 16 22.8	359 16 19.7	Molate Point 2	9418.5	3.973984
			189 46 53.7	9 47 32.1	High Hill	9033.1	3.955837
			206 08 21.4	26 09 26.5	Point Richmond 2	5882.1	3.769535
			236 00 33.6	56 02 55.5	Brooks I.	6811.4	3.833234
			320 47 02.7	140 49 01.5	Yerba Buena I.	7487.2	3.874322
			86 00 19.5	265 59 55.4	Angel I. Peak 2	969.5	2.986555
Judson Point	37 53 06.241	192.4	28 50 49.7	208 48 54.9	Yerba Buena I.	9482.7	3.976930
1895	122 18 48.022	1173.5	74 57 31.8	254 53 38.1	Quarry	9632.3	3.983732
			75 58 12.8	255 53 55.0	Angel I. Peak 2	10585.3	4.024705
			109 37 36.2	289 36 04.4	Brooks I.	3875.7	3.588353
North Brooks	37 54 04.973	153.3	295 09 11.9	115 10 48.8	Judson Point	4258.1	3.629215
1895	122 21 25.750	629.1	338 16 17.5	158 16 22.6	Brooks I.	548.7	2.739375
			51 37 13.9	231 34 57.1	Quarry	6948.3	3.841878
			55 39 59.9	235 37 18.9	Angel I. Peak 2	7767.4	3.890274
Angel I. S. E. 2	37 51 25.658	791.0	233 38 50.2	53 41 20.2	Brooks I.	7430.2	3.870999
1895	122 25 22.358	546.6	315 44 45.8	135 46 52.7	Yerba Buena I.	7266.4	3.861320
			63 13 58.6	243 12 08.9	Point Cavallo 2	4897.0	3.689926
			129 58 40.4	309 58 24.6	Angel I. Peak 2	822.6	2.915196
Alcatraz flagstaff	37 49 37.208	1147.1	104 17 22.6	284 15 30.7	Point Cavallo 2	4611.6	3.663852
1892	122 25 18.406	450.1	169 21 58.9	349 21 40.7	Angel I. Peak 2	3939.8	3.595474
			183 29 18.2	3 29 24.2	Quarry	3947.0	3.596269
			217 13 52.1	37 16 19.8	Brooks I.	9731.0	3.988156
			235 56 07.1	56 00 06.5	Judson Point	11515.6	4.061287
			290 30 47.2	110 32 51.9	Yerba Buena I.	5310.9	3.725164
Belvedere Point	37 51 45.386	1399.2	271 53 12.6	91 54 13.1	Angel I. Peak 2	2411.0	3.382191
1895	122 27 26.724	653.3	305 36 35.3	125 39 58.6	Yerba Buena I.	9979.0	3.999087
			321 32 34.4	141 33 52.9	Alcatraz flagstaff	5045.8	3.702933
			25 18 41.5	205 18 08.1	Point Cavallo 2	3113.6	3.493266

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Peninsula Hill 2	37 52 14.490	446.7	253 23 44.4	73 27 48.6	Brooks I.	10156.5	4.006744
1895	122 27 55.794	1363.7	287 22 36.2	107 23 54.5	Angel I. Peak 2	3269.5	3.514477
			307 14 15.7	127 17 56.9	Yerba Buena I	11083.6	4.044682
			321 33 12.8	141 34 49.1	Alcatraz flagstaff	6190.4	3.791718
			321 37 19.7	141 37 37.5	Belvedere Point	1144.6	3.058644
			9 29 14.4	189 28 58.8	Point Cavallo 2	3763.6	3.575600
Angel I. N. W. 2	37 51 40.896	1260.8	331 29 57.9	151 30 49.6	Alcatraz flagstaff	4339.0	3.637391
1895	122 26 43.065	1052.7	41 52 21.4	221 51 21.2	Point Cavallo 2	3593.8	3.555551
			97 23 39.2	277 23 12.4	Belvedere Point	1076.1	3.031871
			120 13 55.2	300 13 10.6	Peninsula Hill 2	2057.4	3.313325
			267 29 31.4	87 30 05.1	Angel I. Peak 2	1343.7	3.128317
Tiburon Gate Tower	37 52 25.572	788.4	309 05 35.3	129 06 16.0	Angel I. Peak 2	2091.0	3.320356
1895	122 26 54.537	1332.9	348 29 32.8	168 29 39.8	Angel I. N. W. 2	1405.7	3.147880
			27 35 24.7	207 34 31.5	Point Cavallo 2	4573.6	3.660260
			32 25 01.7	212 24 41.9	Belvedere Point	1467.6	3.166622
			77 08 58.7	257 08 21.1	Peninsula Hill 2	1535.7	3.186300
Ridge Rock	37 52 33.059	1019.2	311 18 53.9	131 19 38.1	Angel I. Peak 2	2346.8	3.370478
1895	122 27 00.256	6.3	328 48 18.0	148 48 21.5	Tiburon Gate Tower	269.9	2.431126
			345 21 23.3	165 21 33.8	Angel I. N. W. 2	1662.2	3.220690
			23 45 30.6	203 45 14.3	Belvedere Point	1605.9	3.205715
			67 08 09.0	247 07 34.9	Peninsula Hill 2	1473.2	3.168258
Under Cavallo	37 50 16.828	518.8	189 28 20.7	9 28 35.9	Peninsula Hill 2	3677.8	3.565587
1895	122 28 20.558	502.7	205 43 54.6	25 44 27.6	Belvedere Point	3031.0	3.481586
			222 35 37.2	42 36 37.0	Angel I. N. W. 2	3521.3	3.546699
			234 33 40.6	54 35 14.1	Angel I. Peak 2	4572.8	3.660179
			285 19 11.1	105 21 02.6	Alcatraz flagstaff	4618.8	3.664532
			9 56 29.4	189 56 29.0	Point Cavallo 2	85.77	1.933317
Halfway	37 50 40.871	1260.1	212 39 29.0	32 40 15.5	Peninsula Hill 2	3428.6	3.535117
1895	122 29 11.492	281.0	243 26 08.1	63 30 58.7	Brooks I.	12949.5	4.112254
			248 58 19.4	69 00 24.2	Angel I. Peak 2	5325.3	3.726341
			289 40 50.5	109 45 18.2	Yerba Buena I.	11338.0	4.054537
			303 51 29.8	123 52 00.7	Point Cavallo 2	1482.0	3.170837
			49 24 12.6	229 22 39.4	Bonita Point L. H.	4898 8	3.690093
Richardson East	37 51 05.878	181.2	233 12 26.3	53 13 37.4	Peninsula Hill 2	3532.8	3.548114
1895	122 29 51.544	1260.2	248 12 35.8	68 17 51.0	Brooks I.	13527.6	4.131221
			251 00 04.9	71 01 33.8	Belvedere Point	3743.9	3.573327
			256 47 47.3	76 49 43.0	Angel I. N. W. 2	4732.4	3.675077
			259 08 55.7	79 11 25.1	Angel I. Peak 2	6058.0	3.782328
			291 29 11.8	111 34 04.1	Yerba Buena I.	12526.0	4.097811
			308 12 41.1	128 13 05.7	Halfway	1246.3	3.095628
Strawberry Hill 2	37 52 46.598	1436.5	288 13 25.2	108 15 55.0	Angel I. Peak 2	6282.7	3.798149
1895	122 29 52.278	1277.6	289 09 50.1	109 11 01.6	Peninsula Hill 2	3014.0	3.479149
			345 34 21.2	165 34 46.2	Halfway	4002.4	3.602325
			359 40 07.5	179 40 07.9	Richardson East	3105.3	3.492108
Oakland Point	37 48 30.031	925.8	92 26 10.4	272 24 06.7	Yerba Buena I.	4941.7	3.693879
1881	122 18 33.219	812.6	157 47 36.6	337 45 55.9	Rocky I.	10608.2	4.025641
			182 48 02.8	2 48 14.7	Highland	9650.1	3.984534
Alameda Wharf	37 46 27.502	847.8	126 31 07.6	306 28 52.7	Yerba Buena I.	6701.5	3.826174
1881	122 18 14.884	364.2	173 13 45.1	353 13 33.9	Oakland Point	3804.2	3.580262
Yerba Buena I. 2	37 48 36.778	1133.8	9 12 07.7	189 11 06.9	Sierra Point	15245.9	4.183152
1895	122 21 55.019	1345.8	11 04 07.8	191 03 26.9	Stony Hill	8524.9	3.930689
			65 48 14.7	245 45 05.2	Lone Mt. Cross	8279.4	3.917998
			78 22 02.2	258 18 25.7	Presidio Hill	8022.6	3.945598
			92 35 04.8	272 29 04.0	Bonita Point L. H.	14410.2	4.158671
North Twin *	37 45 13.212	407.3	161 50 33.1	341 49 56.0	Presidio Hill	4728.1	3.674689
1895	122 26 47.990	1174.8	172 25 49.0	352 25 39.4	Lone Mt. Cross	2904.5	3.463076
			228 46 31.7	48 49 31.0	Yerba Buena I. 2	9528.2	3.979009
			290 39 59.1	110 42 17.5	Stony Hill	5917.9	3.772165
			331 36 34.2	151 38 32.8	Sierra Point	9972.0	3.998781
Point Avisadero 2 *	37 43 33.829	1042.9	24 40 45.9	204 39 40.4	Sierra Point	6283.5	3.798201
1852	122 21 47.449	1162.0	112 37 54.0	292 34 49.9	North Twin	7971.0	3.901514
			118 07 18.2	298 06 32.6	Stony Hill	2065.9	3.315117
			127 32 44.7	307 29 30.4	Lone Mt. Cross	9758.7	3.989390
			158 35 35.6	338 35 35.5	Point Avisadero	1.83	0.26188
			178 51 50.9	358 51 46.1	Yerba Buena I. 2	9341.9	3.970434

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Visitation Knob *	37 42 55.722	1717.8	0 10 07.4	180 10 07.1	Sierra Point	4535.2	3.656592
1895	122 23 33.964	831.9	131 45 21.7	311 43 22.7	North Twin	6367.0	3.803938
			200 05 49.9	20 06 09.5	Stony Hill	2287.7	3.359406
			245 42 34.4	65 43 39.5	Point Avisadero	2861.1	3.456529
Point San Bruno 2 *	37 39 17.151	528.7	154 01 43.1	334 01 16.3	Sierra Point	2451.0	3.389347
1895	122 22 50.709	1243.0	171 03 55.3	351 03 28.7	Visitation Knob	6821.4	3.833875
			178 14 24.7	358 14 17.8	Stony Hill	8891.2	3.948959
			191 04 09.8	11 04 48.4	Point Avisadero	8065.3	3.906621
			232 07 42.9	52 12 30.9	San Leandro Pt. 2	14602.5	4.164427
Candlestick Point *	37 42 48.341	1490.3	357 00 39.3	177 00 47.9	Point San Bruno 2	6519.9	3.814238
1895	122 23 04.579	112.2	9 39 48.2	189 39 30.0	Sierra Point	4369.5	3.640434
			181 36 17.4	1 36 19.1	Stony Hill	2376.9	3.376013
			233 24 10.6	53 24 57.8	Point Avisadero 2	2352.7	3.371562
Lower Sierra Point *	37 40 31.000	955.7	344 32 26.3	164 32 42.0	Point San Bruno 2	2362.2	3.373321
1895	122 23 16.396	401.7	80 37 02.6	260 36 51.5	Sierra Point	449.9	2.653096
			149 14 16.4	329 12 06.6	North Twin	10127.2	4.005489
			174 29 30.4	354 29 19.6	Visitation Knob	4482.5	3.651521
			183 04 56.1	3 05 04.8	Stony Hill	6619.8	3.820845
			183 54 38.6	3 54 45.7	Candlestick Pt.	4244.1	3.627785
			201 07 40.2	21 08 34.7	Point Avisadero 2	6043.1	3.781262
Baden Hill *	37 39 29.150	898.6	186 39 46.1	6 39 51.5	Sierra Point	1845.9	3.266219
1895	122 23 43.249	1060.0	199 02 20.2	19 02 36.7	Lower Sierra Point	2017.2	3.304749
			286 01 23.0	106 01 55.1	Point San Bruno 2	1339.9	3.127084
			200 36 06.0	20 37 16.9	Point Avisadero 2	8059.3	3.906299
Oyster Point *	37 39 57.317	1767.0	347 08 41.7	167 08 48.8	Point San Bruno 2	1270.2	3.103859
1895	122 23 02.237	54.8	49 10 47.7	229 10 22.6	Baden Hill	1328.3	3.123309
			140 40 07.0	320 39 47.3	Sierra Point	1247.8	3.096133
			161 31 27.4	341 31 18.8	Lower Sierra Point	1094.9	3.039372
			195 20 34.0	15 21 19.8	Point Avisadero 2	6922.0	3.840230
			171 57 31.3	351 57 11.8	Visitation Knob	5554.9	3.744677
			179 22 36.9	359 22 35.4	Candlestick Point	5273.0	3.722055
			180 04 09.3	0 04 09.5	Stony Hill	7648.7	3.883585
Belair Island *	37 38 19.419	598.6	180 55 57.0	0 55 57.9	Baden Hill	2101.2	3.322459
1895	122 23 44.677	1095.3	183 34 45.4	3 34 51.7	Sierra Point	3991.1	3.601091
			216 37 10.8	36 37 43.8	San Bruno Point 2	2217.7	3.345906
Pt. San Mateo Extremity *	37 35 29.540	910.7	144 32 32.0	324 29 48.3	Sierra Point	11323.2	4.053968
1895	122 19 06.468	158.7	165 12 33.7	345 10 55.2	Point Avisadero	15444.9	4.188786
			170 21 26.5	350 19 43.2	Yerba Buena I.	24620.0	4.391288
			200 41 55.8	20 44 26.4	San Leandro Point 2	17078.0	4.232438
			282 39 32.9	102 47 43.9	Red Hill	20264.3	4.306731
Angelo 2 *	37 31 09.165	282.5	146 49 08.5	326 44 27.7	Sierra Point	20617.3	4.314231
1895	122 15 54.066	1327.7	149 32 52.6	329 30 55.3	Point San Mateo Ex.	9313.3	3.969104
			159 20 59.3	339 17 23.6	Point Avisadero	24540.8	4.389888
			183 09 37.8	3 10 11.1	San Leandro Point 2	24037.4	4.380888
			256 37 54.1	76 44 07.6	Red Hill	15468.1	4.189438
Union City Creek	37 36 03.725	114.8	320 21 43.8	140 23 37.3	Red Hill	7164.2	3.855165
1895	122 08 47.170	1157.1	49 07 12.2	229 02 52.0	Angelo 2	13865.2	4.141927
			86 05 03.6	265 58 46.0	Point San Mateo Ex.	15228.8	4.182667
			110 39 01.5	290 30 00.1	Sierra Point	23238.1	4.366201
Coyote Hill Creek	37 33 49.065	1512.6	291 04 40.8	111 06 08.8	Red Hill	3798.4	3.579601
1895	122 08 05.372	131.8	66 50 53.2	246 46 07.9	Angelo 2	12517.7	4.097527
			100 52 00.5	280 45 17.6	Point San Mateo Ex.	16514.8	4.217873
West Point *	37 30 15.777	486.4	97 50 49.5	277 45 51.8	Angelo 2	12118.8	4.083458
1895	122 07 45.190	1109.9	175 41 31.9	355 41 19.6	Coyote Hill Creek	6594.1	3.819156
			210 20 22.9	30 21 38.5	Red Hill	6035.9	3.780739
Dumbarton flumehouse chimney *	37 30 03.341	103.0	98 17 41.3	278 11 54.3	Angelo 2	14148.1	4.150699
1895	122 06 23.957	588.5	100 53 03.4	280 52 14.0	West Point	2031.8	3.307878
			118 18 43.3	298 10 58.6	Point San Mateo Ex.	21248.6	4.327329
			190 40 57.1	10 41 23.3	Red Hill	5690.8	3.755171
South Red Hill	37 32 19.483	600.6	27 46 36.8	207 45 42.0	Dumbarton flumehouse chimney	4743.4	3.676092
1895	122 04 53.961	1324.8	120 27 47.4	300 25 50.7	Coyote Hill Creek	5450.0	3.736399
			140 23 47.7	320 23 19.1	Red Hill	1810.6	3.257825

*This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Interior flumehouse chimney	37 30 56.844	1752.4	71 02 56.8	251 01 25.5	West Point	3896.1	3.590628
1895	122 05 15.164	372.4	170 52 06.2	350 51 50.5	Red Hill	3993.2	3.601321
			191 32 54.2	11 33 07.1	South Red Hill	2600.3	3.415019
Dumbarton oysterhouse flagstaff *	37 28 57.296	1766.4	104 38 03.6	284 31 36.4	Angelo 2	16149.2	4.208150
1895	122 05 17.778	436.8	123 45 40.0	303 44 10.3	West Point	4355.2	3.639004
			185 21 32.8	5 21 47.2	South Red Hill	6260.6	3.796616
			175 43 47.1	355 43 33.0	Red Hill	7649.4	3.883628
San Francisquito Creek 2*	37 27 49.252	1518.4	151 19 22.4	331 18 21.2	West Point	5149.2	3.711740
1895	122 06 04.588	112.8	183 24 34.3	3 24 48.7	Red Hill	9743.1	3.988699
			191 45 25.5	11 46 08.4	South Red Hill	8509.6	3.929911
Alviso	37 27 41.467	1278.4	92 13 17.1	272 10 42.4	San Francisquito Creek 2	6252.7	3.796069
1896	122 01 50.346	1237.3	114 39 20.9	294 37 14.7	Dumbarton oysterhouse	5607.6	3.748778
			152 15 41.8	332 13 50.0	South Red Hill	9685.2	3.986108
Mowry's oysterhouse *	37 29 33.965	1047.1	99 42 49.2	279 35 41.5	Angelo 2	17500.9	4.243060
1895	122 04 11.617	285.4	103 49 22.2	283 47 12.2	West Point	5402.2	3.732571
			116 35 42.7	296 26 37.5	Point San Mateo Ex.	24551.2	4.390072
			161 20 46.8	341 19 52.3	Red Hill	6858.3	3.836214
			168 29 06.4	348 28 40.6	South Red Hill	5207.6	3.716641
			314 57 50.5	134 59 16.5	Alviso	4906.8	3.690802
Albrae	37 28 46.126	1422.0	68 44 46.0	248 42 39.2	Alviso	5494.6	3.739936
1896	121 58 21.976	540.0	91 57 56.9	271 53 43.8	Dumbarton oysterhouse	10221.8	4.009529
			99 46 18.9	279 42 46.0	Mowry's oysterhouse	8715.6	3.940297
			124 22 30.3	304 18 31.6	South Red Hill	11659.7	4.066687
Dyke	37 27 20.420	629.9	94 56 37.5	274 53 30.8	Alviso	7568.9	3.879031
1896	121 56 43.512	1069.5	127 28 04.7	307 23 06.1	South Red Hill	15170.6	4.181002
			137 31 34.0	317 30 34.1	Albrae	3582.7	3.554216
Goucher	37 30 46.986	1448.5	68 28 05.8	248 23 53.1	Pulgas E. Base	10963.4	4.039945
1852	122 01 13.086	321.4	122 52 09.6	302 49 26.4	Red Hill	7829.3	3.893721
Punta Potrero	37 30 03.769	116.2	43 35 05.6	223 34 02.0	Pulgas E. Base	3723.7	3.570971
1852	122 06 23.662	581.2	190 38 07.2	10 38 33.2	Red Hill	5676.5	3.754077
			260 03 58.2	80 07 07.3	Goucher	7743.5	3.888938
Union Island	37 34 21.701	669.0	341 56 08.6	161 56 27.8	Red Hill	2495.9	3.397235
1852	122 06 12.513	307.1	74 36 21.8	254 26 25.8	Ridge	24914.9	4.396459
Uncle Edward	37 34 03.420	105.4	254 12 01.3	74 12 50.8	Union I.	2070.8	3.316146
1857	122 07 33.713	827.3	303 10 23.1	123 11 31.8	Red Hill	3305.9	3.519292
Union City Mills	37 35 43.598	1344.1	25 29 33.1	205 29 03.2	Union I.	2797.1	3.446701
1857	122 05 23.456	575.4	45 59 32.1	225 58 12.7	Uncle Edward	4444.4	3.647818
			119 25 44.2	299 23 29.4	Contra Costa (2)	6224.2	3.794082
Contra Costa (2)	37 37 22.737	701.0	299 23 29.4	119 25 44.3	Union City Mills	6224.2	3.794082
1852	122 09 04.516	110.8	322 53 46.0	142 55 30.9	Union I.	6996.7	3.844894
			327 51 44.4	147 53 48.5	Red Hill	9391.8	3.972749
			340 03 58.0	160 04 53.4	Uncle Edward	6536.2	3.815323
			60 36 19.2	240 32 15.7	Guano I.	11236.8	4.050641
			158 21 17.6	338 19 57.6	Contra Costa (1)	8682.4	3.938638
Point San Mateo *	37 35 27.086	835.0	165 56 57.1	345 55 23.4	Point Avisadero	15471.7	4.189537
1852	122 19 14.089	345.7	225 12 56.9	45 17 49.3	Contra Costa (1)	16528.4	4.218232
			290 42 36.1	110 44 44.5	Guano I.	5525.3	3.742355
Mowrys Creek †	37 28 22.94	707.2	92 25 18	272 21 14	Pulgas E. Base	9856.9	3.99374
1852	122 01 27.34	671.8	184 30 24	4 30 33	Goucher	4454.4	3.64879
San Antonio Point †	37 48 23.26	717.1	28 56 00	208 53 57	Point Avisadero	10192.2	4.00827
1852	122 18 26.12	639.0	94 41 11	274 39 03	Yerba Buena I.	5127.9	3.70994
Middle Point †	37 46 35.14	1083.3	47 42 01	227 39 28	Point Avisadero	8299.8	3.91907
1852	122 17 36.80	900.6	120 42 54	300 40 16	Yerba Buena I.	7348.2	3.86618
Ditch (Cutts)†	37 39 09.43	290.7	335 48 21	155 50 26	Red Hill	12324.8	4.09078
1852	122 09 06.77	166.2	51 52 13	231 44 02	Ridge	25096.3	4.39961
Union Island Rock †	37 34 21.62	666.5	342 18 09	162 18 28	Red Hill	2488	3.39589
	122 06 11.80	289.6	16 50 22	196 49 25	West Point	7918	3.89864

* This point is in the area of the 1906 earthquake disturbance.

† No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Ditch (Rodgers)	37 39 39.388	1214.3	353 38 04.3	173 38 16.0	Contra Costa (2)	4239.0	3.627267
1857	122 09 23.682	580.5	144 40 46.0	324 39 37.8	Contra Costa (1)	4727.2	3.674603
San Lorenzo	37 39 46.350	1428.9	10 17 26.0	190 17 06.0	Contra Costa (2)	4499.9	3.653203
1857	122 08 31.737	777.9	80 26 06.7	260 25 35.0	Ditch (Rodgers)	1291.1	3.110975
Thompsons Point	37 40 36.125	1113.7	306 06 57.9	126 07 50.3	San Lorenzo	2603.0	3.415477
1857	122 09 57.531	1409.8	334 37 27.5	154 37 48.2	Ditch (Rodgers)	1935.9	3.286889
			347 41 55.9	167 42 28.2	Contra Costa (2)	6102.1	3.785480
			137 54 33.5	317 53 45.8	Contra Costa (1)	2840.1	3.453336
Kerr	37 40 30.276	933.4	14 32 42.9	194 32 34.1	San Lorenzo	1399.1	3.145835
1857	122 08 17.401	426.4	46 00 08.4	225 59 27.9	Ditch	2258.3	3.353791
			94 12 41.6	274 11 40.4	Thompsons Point	2460.3	3.390994
Polite Man	37 41 23.750	732.2	334 20 51.7	154 21 11.4	Kerr	1828.8	3.262170
1857	122 08 49.708	1217.9	48 32 40.9	228 31 59.4	Thompsons Point	2217.6	3.345878
			100 10 29.0	280 08 59.8	Contra Costa (1)	3622.3	3.558983
Dumbarton Point*	37 30 04.912	151.4	98 06 54.3	278 01 07.8	Angelo 2	14115.7	4.149701
1895	122 06 25.009	614.3	99 39 31.7	279 38 42.9	West Point	1997.7	3.300534
			191 01 51.8	11 02 18.6	Red Hill	5648.0	3.751898
			208 18 50.0	28 19 45.4	South Red Hill	4712.8	3.673279
Second interior flumehouse, flagstaff†	37 31 01.95	60.1	160 48 51	340 48 18	Red Hill	4008	3.60292
1895	122 04 47.33	1162.3	176 05 59	356 05 55	South Red Hill	2396	3.37946
Ravenswood old wharf, flagstaff*†	37 28 42.29	1303.8	160 23 56	340 23 31	West Point	3060	3.48567
1895	122 07 03.40	83.5	194 02 17	14 03 07	Red Hill	8340	3.92118
West Point flumehouse, E. gable *	37 29 27.517	848.3	104 13 19	284 08 12	Angelo 2	12793	4.10697
1895	122 07 29.095	714.8	165 06 42	345 06 32	West Point	1540	3.18738
			201 36 55	21 38 02	Red Hill	7203	3.85754
South South Tree*	37 22 43.780	1349.7	169 00 22.1	348 56 30.1	Yerba Buena I.	48779.2	4.688235
1894–5	122 15 34.770	855.5	178 15 28.4	358 15 16.7	Angelo 2	15587.6	4.192779
			217 16 00.5	37 22 01.7	Red Hill	24070.5	4.381485
			219 35 55.6	39 40 41.1	West Point	18094.7	4.257551
Menlo Park floodhouse, tower*	37 28 14.449	445.4	125 36 17.8	305 33 11.2	Angelo 2	9257.6	3.966500
1894	122 10 47.556	1168.6	137 38 19.9	317 33 15.8	Pt. San Mateo Ext.	18165.3	4.259242
			220 02 59.5	40 06 06.1	Red Hill	11695.2	4.068007
			230 07 37.9	50 09 28.9	West Point	5836.4	3.766144
South Tree*	37 23 52.458	1617.2	160 58 36.4	340 54 47.3	Belair I.	28277.1	4.451435
1894–5	122 17 28.745	707.0	162 22 06.5	342 18 18.3	Baden Hill	30306.2	4.481531
			163 43 54.8	343 40 12.0	Sierra Point	31996.9	4.505108
			164 31 58.3	344 28 26.6	Lower Sierra Point	31945.9	4.504414
			164 31 39.2	344 28 23.2	Point San Bruno 2	29583.6	4.471051
			170 07 56.0	350 05 18.3	Point Avisadero	36972.0	4.567873
			171 53 54.7	351 51 12.2	Yerba Buena I.	46225.5	4.664881
			185 33 16.8	5 34 47.7	San Leandro Point 2	37641.3	4.575665
			225 32 51.4	45 40 02.0	Red Hill	24337.6	4.386278
Peak Flag	37 33 15.124	466.3	327 44 30.8	147 44 57.6	South Red Hill	2028.4	3.307154
1895	122 05 38.059	934.2	352 29 02.4	172 29 26.3	Interior flumehouse chimney	4299.9	3.633459
			10 47 44.7	190 47 16.7	Dumbarton flumehouse chimney	6019.0	3.779524
			11 07 33.7	191 07 05.1	Dumbarton Point	5976.3	3.776431
			12 37 23.5	192 37 21.7	Red Hill	328.4	2.516375
			29 27 30.2	209 26 12.8	West Point	6349.4	3.802734
			75 39 06.4	255 32 51.1	Angelo 2	15614.3	4.193523
			106 09 09.5	286 07 39.8	Coyote Hill Creek	3764.0	3.575651
			138 15 33.4	318 13 38.1	Union City Creek	6967.9	3.843100
			145 38 49.4	325 33 07.1	San Leandro Point 2	24381.6	4.387063
Ravenswood warehouse, E. gable*	37 28 35.590	1097.2	110 38 09.5	290 32 57.3	Angelo 2	13461.2	4.129085
1895	122 07 21.072	517.8	169 08 35.8	349 08 21.1	West Point	3145.0	3.497621
			196 29 36.5	16 30 37.4	Red Hill	8653.8	3.937207
			207 37 05.3	27 38 34.8	South Red Hill	7790.9	3.891588
			281 34 27.2	101 37 48.4	Alviso	8296.6	3.918899

*This point is in the area of the 1906 earthquake disturbance. † No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Red brick chimney	37 37 32.540	1003.2	342 14 22.7	162 15 09.5	Union I.	6177.7	3.790827
1857	122 07 29.305	718.6	0 57 40.8	180 57 38.1	Uncle Edward	6448.0	3.809424
			82 37 58.3	262 37 00.2	Contra Costa (2)	2354.3	3.371862
			144 22 05.3	324 20 55.5	Ditch (Rodgers)	4812.1	3.682337
Eden staff	37 37 04.472	137.9	345 20 47.0	165 21 19.6	Union I.	5186.8	3.714897
1857	122 07 05.983	146.7	6 57 04.4	186 56 47.5	Uncle Edward	5623.1	3.749973
			100 58 22.3	280 57 10.0	Contra Costa (2)	2960.9	3.471426
			144 45 22.3	324 43 58.4	Ditch (Rodgers)	5848 7	3.767062
North chimney	37 39 14.002	431.7	38 05 07.2	218 04 00.3	Contra Costa (2)	4357.6	3.639245
1857	122 07 14.908	365.4	103 56 13.2	283 54 54.5	Ditch (Rodgers)	3252.0	3.512152
			117 54 42.2	297 53 55.3	San Lorenzo	2130.9	3.328570
			122 26 20.3	302 24 40.9	Thompsons Point	4721.9	3.674114
			146 55 39.2	326 55 01.1	Kerr	2806.3	3.448140
Thompsons staff	37 40 42.849	1321.0	228 54 21.6	48 54 57.7	Polite Man	1918.6	3.282989
1857	122 09 48.724	1194.0	279 49 08.4	99 50 04.2	Kerr	2271.2	3.356255
			312 42 24.9	132 43 11.9	San Lorenzo	2567.8	3.409567
			342 34 55.4	162 35 10.7	Ditch (Rodgers)	2050.5	3.311859
High lone tree*	37 26 53.257	1641.9	165 23 17.1	345 21 00.0	Belair I.	21862.9	4.339707
1894	122 19 59.721	1468.1	166 46 13.6	346 43 57.5	Baden Hill	23941.0	4.379142
			168 10 27.4	348 08 16.8	Sierra Point	25684.0	4.409662
			169 10 39.3	349 08 39.6	Lower Sierra Point	25668.5	4.409400
			169 38 36.8	349 36 52.8	Point San Bruno 2	23314.7	4.367629
			175 06 39.3	355 05 33.8	Point Avisadero	30961.9	4.490827
			175 59 03.5	355 57 53.2	Yerba Buena I.	40287.1	4.605166
			192 57 39.9	13 00 41.0	San Leandro Pt. 2	32727.1	4.514907
			241 25 43.7	61 34 26.5	Red Hill	24001.8	4.380243
Chinahouse, E. gable*	37 31 24.657	760.2	84 44 10.2	264 42 02.1	Angelo 2	5188.3	3.715026
1894	122 12 23.679	581.5	127 24 06.2	307 20 00.7	Pt. San Mateo Ext.	12439.1	4.094789
			252 38 06.5	72 42 11.9	Red Hill	10356.8	4.015227
Redwood City Creek*	37 32 14.906	459.5	72 10 57.4	252 08 21.2	Angelo 2	6615.8	3.820584
1894	122 11 37.580	922.6	118 36 51.3	298 32 17.7	Pt. San Mateo Ext.	12544.7	4.098461
			130 56 21.1	310 49 03.7	Sierra Point	23257.6	4.366564
			260 01 03.4	80 04 40.7	Red Hill	8887.8	3.948793
Redwood little oyster-	37 32 13.411	413.4	72 33 10.9	252 30 34.8	Angelo 2	6598.2	3.819424
house, E. gable*	122 11 37.738	926.5	118 48 25.4	298 43 51.8	Pt. San Mateo Ext.	12563.5	4.099110
1894			259 43 47.7	79 47 25.1	Red Hill	8899.7	3.949373
Tree Hill*	37 31 04.956	152.8	182 39 04.1	2 39 21.8	Baden Hill	15560.8	4.192033
1894	122 24 12.611	309.7	183 04 32.7	3 04 55.9	Sierra Point	17402.6	4.240616
			184 30 49.2	4 31 23.5	Lower Sierra Point	17505.3	4.243170
			185 55 25.4	5 56 49.3	Yerba Buena I.	32602.9	4.513256
			187 32 12.5	7 33 02.4	Point San Bruno 2	15306.6	4.184880
			188 45 03.3	8 46 31.8	Point Avisadero	23362.0	4.368509
			209 16 22.4	29 21 59.9	San Leandro Point 2	27675.7	4.442098
			262 12 03.4	82 23 20.5	Red Hill	27541.2	4.439982
			273 29 38.1	93 39 39.3	West Point	24298.0	4.385570
South Belmont oyster-	37 32 40.319	1243.0	53 47 15.0	233 45 39.8	Angelo 2	4755.3	3.677173
house, red tank*	122 13 17.830	437.7	121 24 10.3	301 20 37.8	Pt. San Mateo Ext.	10020.9	4.000908
1894			133 43 10.2	313 36 53.9	Sierra Point	20909.9	4.320352
			266 07 19.9	86 11 58.3	Red Hill	11239.7	4.050755
			298 35 12.1	118 38 34.7	West Point	9304.5	3.968692
Angelo Creek*	37 33 38.244	1179.0	19 25 13.3	199 24 33.1	Angelo 2	4873.1	3.687804
1894	122 14 48.086	1180.2	118 26 37.3	298 23 59.8	Pt. San Mateo Ext.	7209.1	3.857881
			134 27 55.3	314 22 34.1	Sierra Point	18076.1	4.257104
			274 21 12.4	94 26 45.9	Red Hill	13468.3	4.129312
San Mateo oysterhouse,	37 34 28.956	892.7	1 07 48.7	181 07 45.7	Angelo 2	6160.6	3.789624
N. gable*	122 15 49.118	1205.3	111 06 38.1	291 04 37.8	Pt. San Mateo Ext.	5189.8	3.715155
1894			134 12 52.0	314 08 08.0	Sierra Point	15912.2	4.201729
			152 25 32.0	332 21 53.2	Point Avisadero	18958.2	4.277796
			279 49 04.3	99 55 15.0	Red Hill	15149.4	4.180396
Coyote warehouse, S. gable	37 33 49.771	1534.4	293 03 34.9	113 04 55.8	Red Hill	3543.6	3.549439
1894	122 07 53.809	1320.6	358 09 44.6	178 09 49.8	West Point	6600.7	3.819587
			67 15 36.9	247 10 44.3	Angelo 2	12787.6	4.106790

*This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
San Mateo, eucalyptus tree* 1894	37 35 25.904	798.6	128 52 42.5	308 49 57.2	Belair I.	8527.0	3.930795
	122 19 13.927	341.7	138 39 13.2	318 36 28.8	Baden Hill	9992.8	3.999689
			143 18 28.7	323 16 16.3	Point San Bruno 2	8893.1	3.949055
			145 37 34.0	325 34 55.0	Sierra Point	11310.3	4.053476
			146 14 06.0	326 11 46.7	Oyster Point	10067.7	4.002931
			165 58 04.3	345 56 30.6	Point Avisadero	15508.0	4.190557
			201 08 05.0	21 10 40.3	San Leandro Point 2	17248.2	4.236743
			282 14 17.6	102 22 33.3	Red Hill	20418.9	4.310032
			328 11 35.0	148 13 36.8	Angelo 2	9312.0	3.969044
Coyote oysterhouse, N. gable 1894	37 34 21.359	658.4	56 08 40.0	236 05 01.0	Angelo 2	10627.3	4.026424
	122 09 54.681	1341.9	98 52 19.5	278 46 43.0	Pt. San Mateo Ext.	13701.0	4.136751
			119 27 27.0	299 19 06.6	Sierra Point	23073.5	4.363113
			290 45 21.5	110 47 56.1	Red Hill	6659.6	3.823449
			337 12 42.0	157 14 00.9	West Point	8211.5	3.914420
Coyote house, stovepipe 1894	37 34 11.829	364.7	306 57 18.8	126 58 27.1	Red Hill	3440.1	3.536577
	122 07 32.976	809.2	2 21 38.6	182 21 31.2	West Point	7283.5	3.862338
			98 04 23.5	277 57 20.7	Pt. San Mateo Ext.	17183.8	4.235119
			116 18 30.0	296 08 43.2	Sierra Point	26285.8	4.419722
Red house cupola 1894	37 36 16.294	502.3	324 16 33.1	144 18 18.6	Red Hill	7273.3	3.861730
	122 08 33.990	833.7	48 47 51.2	228 43 22.9	Angelo 2	14363.5	4.157261
			84 44 45.9	264 38 20.0	Pt. San Mateo Ext.	15582.1	4.192625
			109 29 09.9	289 20 00.1	Sierra Point	23408.7	4.369378
Bay Farm 1894	37 43 43.240	1333.0	6 00 52.6	185 59 51.7	Angelo 2	23376.3	4.368775
	122 14 14.324	350.8	25 13 10.3	205 10 11.9	Pt. San Mateo Ext.	16820.9	4.225849
			66 25 51.9	246 20 09.4	Sierra Point	14977.2	4.175431
			88 32 59.3	268 28 22.0	Point Avisadero	11100.7	4.045351
San Leandro, eucalyptus tree 1894	37 43 59.591	1837.1	327 47 22.3	147 52 38.7	Red Hill	23850.1	4.377490
	122 14 18.896	462.6	347 28 52.6	167 28 55.3	Bay Farm	516.4	2.713031
			24 10 04.5	204 07 08.8	Pt. San Mateo Ext.	17232.2	4.236341
			55 15 57.2	235 10 44.0	Point San Bruno 2	15266.1	4.183728
			58 57 22.1	238 51 36.8	Baden Hill	16145.4	4.208050
			59 49 09.3	239 43 49.0	Oyster Point	14837.8	4.171369
			64 30 17.0	244 24 37.2	Sierra Point	15084.7	4.178538
			85 54 40.6	265 50 06.0	Point Avisadero	11013.3	4.041916
			90 50 47.8	270 45 27.7	Stony Hill	12806.7	4.107438
			97 07 06.8	276 59 28.0	North Twin	18480.1	4.266706
			127 28 24.9	307 23 45.4	Yerba Buena I.	14059.8	4.147978
Boardinghouse flagstaff 1894	37 37 47.038	1450.1	329 49 45.5	149 51 51.1	Red Hill	10065.5	4.002834
	122 09 07.072	173.4	73 57 59.2	253 51 53.4	Pt. San Mateo Ext.	15300.3	4.184700
			103 15 31.8	283 06 41.9	Sierra Point	21839.5	4.339243
Triple warehouse, NE. gable 1894	37 38 42.577	1312.6	332 33 18.4	152 35 32.8	Red Hill	11734.6	4.069469
	122 09 21.318	522.6	67 31 31.1	247 25 33.9	Pt. San Mateo Ext.	15535.5	4.191325
			98 57 28.0	278 48 46.9	Sierra Point	21166.3	4.325645
			140 24 36.3	320 21 09.4	San Leandro Point 2	13010.7	4.114300
Mulford Landing 1894	37 41 44.414	1369.2	332 57 18.1	153 00 41.4	Red Hill	17984.3	4.254893
	122 11 14.120	345.9	19 20 42.7	199 17 51.8	Angelo 2	20753.4	4.317090
			45 05 48.0	225 00 59.5	Pt. San Mateo Ext.	16360.6	4.213800
			82 43 23.6	262 35 51.0	Sierra Point	18291.2	4.262243
Roberts Landing 1894	37 40 26.904	829.4	335 36 52.8	155 39 26.1	Red Hill	14964.8	4.175070
	122 09 52.691	1291.2	27 18 17.4	207 14 36.9	Angelo 2	19345.6	4.286583
			56 01 16.0	235 55 37.6	Pt. San Mateo Ext.	16383.4	4.214405
			90 13 13.9	270 04 51.6	Sierra Point	20139.5	4.304048
			108 16 58.6	288 09 41.3	Point Avisadero	18434.9	4.265640
			132 08 52.2	312 05 44.2	San Leandro Point 2	10147.3	4.006349
Newark Catholic Church spire, cruss 1894–6	37 31 43.283	1334.3	357 53 31.9	177 53 38.7	Alviso	7460.0	3.872737
	122 02 01.511	37.0	104 46 52.1	284 45 07.1	South Red Hill	4378.6	3.641338
			115 00 19.4	294 58 05.7	Red Hill	5944.4	3.774108
			118 03 30.1	298 01 18.2	Peak Flag	6023.2	3.779824
Double Rock E. peak* 1894	37 43 15.646	482.3	06 39 25.4	186 39 11.0	Lower Sierra Point	5110.5	3.708460
	122 22 52.220	1278.8	11 22 43.5	191 22 18.1	Sierra Point	5252.6	3.720370
			19 46 37.2	199 46 30.0	Candlestick Point	894.5	2.951615
			122 08 35.6	302 06 11.5	North Twin	6816.5	3.833559
			171 15 12.4	351 15 06.5	Stony Hill	1552.2	3.190953
			250 31 49.8	70 32 29.4	Point Avisadero 2	1682.4	3.225929

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Point Avisadero hog-ranch, white tank * 1894	37 43 35.350 122 21 55.356	1089.8 1355.5	283 36 19.0 19 15 40.3 22 53 04.3 49 28 45.9	103 36 23.8 199 14 51.1 202 52 04.0 229 28 03.5	Point Avisadero 2 Lower Sierra Point Sierra Point Candlestick Point	199.3 6020.2 6248.3 2230.4	2.299417 3.779614 3.795762 3.348376
Bernal* 1903	37 44 19.537 122 24 35.128	602.3 860.0	280 47 31.0 329 53 45.6	100 48 28.0 149 54 23.0	Stony Hill Visitation Knob	2324.9 2986.8	3.366404 3.475201
Start* 1903	37 45 05.252 122 23 13.106	161.9 320.8	351 30 39.7 54 56 36.7	171 30 46.6 234 55 46.5	Stony Hill Bernal	1865.5 2453.4	3.270792 3.389762
Mile* 1903	37 44 10.954 122 22 38.368	337.6 939.5	312 31 07.6 73 26 41.3 153 04 12.3	132 31 38.8 253 26 26.9 333 03 51.0	Point Avisadero Stony Hill Start	1690.9 600.1 1877.7	3.228126 2.778223 3.273628
Army* 1903	37 44 57.883 122 23 46.229	1784.4 1131.6	254 20 44.0 326 07 00.0 45 21 52.9	74 21 04.2 146 07 27.1 225 21 23.0	Start Stony Hill Bernal	842.1 1948.7 1682.5	2.925365 3.289754 3.225966
Quarter* 1903	37 44 47.797 122 23 11.450	1473.5 280.4	349 48 50.8 110 03 55.6 175 41 24.8	169 48 56.7 290 03 34.4 355 41 23.8	Stony Hill Army Start	1327.8 906.4 539.6	3.123143 2.957352 2.732131
Half* 1903	37 44 33.044 122 23 04.347	1018.7 106.4	355 54 41.9 79 23 47.2 126 45 28.9 167 48 52.2 316 57 10.1	175 54 43.4 259 22 51.7 306 45 03.3 347 48 46.8 136 57 26.0	Stony Hill Bernal Army Start Mile	854.2 2261.4 1279.8 1015.9 931.9	2.931575 3.354373 3.107137 3.006846 2.969366
Two-Mile* 1903	37 43 27.659 122 21 44.514	852.6 1090.1	69 50 24.5 159 17 49.6	249 49 17.6 339 17 47.8	Visitation Knob Point Avisadero	2855.7 205.1	3.455706 2.312107
Hunters Point, chimney 2* 1903	37 43 45.546 122 21 28.118	1404.1 688.5	36 03 32.7 52 49 18.3 63 31 07.7 104 56 37.7 114 29 20.2 123 25 00.3 133 43 08.9	216 03 22.6 232 49 06.4 243 29 50.7 284 55 40.3 294 28 37.1 303 23 35.8 313 42 04.6	Two-Mile Point Avisadero Visitation Knob Stony Hill Mile Army Start	682.2 594.9 3443.6 2375.7 1890.2 4050.8 3556.2	2.833886 2.774498 3.537010 3.375797 3.276500 3.607540 3.550985
California sugar-refinery, chimney* 1881–1903	37 45 25.029 122 22 59.234	771.6 1449.9	49 18 38.3 53 58 10.3 86 17 49.1 126 23 54.7 159 15 31.9 194 52 10.6 228 45 07.5 332 51 03.4 1 30 00.4 5 24 13.5 14 36 10.6	229 17 39.6 233 57 41.6 266 15 29.0 306 21 38.6 339 14 43.5 14 52 50.0 48 47 50.6 152 51 47.4 181 29 58.8 185 23 52.1 194 36 03.1	Bernal Army North Twin Heights Telegraph Hill 2 Yerba Buena I. Oakland Point Point Avisadero 2 Stony Hill Sierra Point Quarter	3096.5 1422.6 5611.6 6746.9 5443.0 6117.3 8654.8 3852.6 2455.6 9179.0 1186.2	3.490872 3.153093 3.749089 3.829106 3.735837 3.786559 3.937258 3.585756 3.390158 3.962798 3.074145
Yerba Buena L. H.* 1881–1894	37 48 27.558 122 21 41.442	849.6 1013.7	269 02 06.9 306 12 00.5 13 41 33.7 51 24 36.8 77 39 50.1	89 04 02.3 126 14 07.1 193 40 44.4 231 21 29.0 257 37 54.1	Oakland Point Alameda Wharf Stony Hill North Twin Russian Hill	4605.0 6264.5 8318.5 9600.6 4730.3	3.663230 3.796884 3.920040 3.982305 3.674891
Melrose smelting-works, chimney 1894–95	37 45 20.540 122 12 08.504	633.2 208.2	29 22 41.8 45 46 19.3 61 52 58.7 112 54 29.5	209 18 26.4 225 45 02.2 241 45 59.1 292 48 30.1	Pt. San Mateo Ex. Bay Farm Sierra Point Yerba Buena I.	20902.2 4299.9 19060.6 15576.4	4.320191 3.633459 4.280137 4.192467
Moraghan's oysterhouse, E. window N. front* 1894	37 37 30.424 122 22 04.336	937.9 106.3	121 33 19.6 146 28 59.2 158 05 22.3 160 56 30.8 173 24 07.3 182 06 50.2	301 32 18.1 326 27 58.6 338 04 27.2 340 56 02.4 353 23 32.0 2 07 00.5	Belair I. Baden Hill Sierra Point Point San Bruno 2 Stony Hill Point Avisadero 2	2887.0 4390.7 5921.8 3481.2 12258.6 11211.4	3.460447 3.642537 3.772455 3.541733 4.088442 4.049661
Point Avisadero (Potrero) N. Range* 1892–1897	37 45 21.463 122 23 46.549	661.6 1139.5	118 34 14.0 133 54 21.3 163 48 07.4 165 53 56.6 165 48 45.3 170 24 35.4 181 49 19.9 204 21 43.2 208 04 23.3 264 34 24.6 318 40 26.7 334 58 56.1	298 32 13.1 313 52 34.2 343 47 38.3 345 53 32.9 345 47 30.7 350 24 21.4 1 49 22.8 24 22 51.5 28 05 40.0 84 34 53.5 138 41 39.6 154 59 23.5	Lone Mt. Cross Heights Hopkins Art Inst. Jewish Synagogue Angel I. Peak 2 St. Patricks Church Selby shot-tower Yerba Buena I. Yerba Buena L. H. Cal. sugar-refinery Point Avisadero Stony Hill	5491.4 5930.8 4157.7 3883.4 12127.3 3356.7 3652.8 6611.4 6503.1 1163.4 4415.9 2587.5	3.739687 3.773115 3.618851 3.589210 4.083764 3.525911 3.562621 3.820292 3.813119 3.065734 3.645017 3.412883

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
South Shag Rock*	37 43 07.362	226.9	22 34 07.5	202 33 17.9	Lower Sierra Point	5220.1	3.717682
1894–1903	122 21 54.642	1339.3	26 33 11.6	206 33 10.9	Sierra Point	5471.5	3.738104
			71 06 25.0	251 05 42.2	Candlestick Point	1810.5	3.257803
			118 24 06.1	298 21 06.8	North Twin	8163.8	3.911892
			192 10 55.0	12 10 59.4	Point Avisadero 2	834.7	2.921573
			201 36 15.7	21 37 22.1	Two-Mile	673.2	2.828118
San Leandro Point, McCartney's white tank	37 44 20.001	616.6	9 41 53.0	189 41 51.4	San Leandro Point 2	386.1	2.586734
1894	122 14 57.290	1402.6	60 39 45.0	240 34 28.7	Sierra Point	14539.7	4.162555
			81 58 40.3	261 54 29.3	Point Avisadero	10144.3	4.006223
			127 47 17.6	307 43 01.7	Yerba Buena I.	12931.1	4.111634
San Leandro Point, Kammer house, N. window W. front	37 44 11.872	366.0	340 22 16.0	160 22 17.3	San Leandro Point 2	138.0	2.139878
1894	122 15 01.841	45.1	55 44 10.0	235 38 51.1	Baden Hill	15464.3	4.189330
			56 20 34.2	236 15 40.4	Oyster Point	14145.2	4.150609
			61 19 03.0	241 13 49.5	Sierra Point	14320.7	4.155965
			83 18 35.5	263 14 27.3	Point Avisadero	10001.7	4.000075
			89 04 09.5	268 59 15.7	Stony Hill	11755.4	4.070238
			96 18 09.3	276 10 56.8	North Twin	17391.7	4.240341
			128 57 41.0	308 53 27.9	Yerba Buena I.	12999.3	4.113921
Roberts warehouse	37 40 37.835	1166.4	89 16 02.0	269 07 36.5	Sierra Point	20270.7	4.306869
1894	122 09 47.400	1161.5	107 09 49.8	287 02 29.4	Point Avisadero	18455.8	4.266134
			129 42 57.1	309 35 31.6	Yerba Buena I.	23139.5	4.364354
			130 13 19.9	310 10 08.7	San Leandro Point 2	10022.9	4.000994
			131 10 52.8	311 08 09.5	Bay Farm	8685.0	3.938769
Four-window barn	37 39 03.205	98.8	96 47 41.8	276 38 24.5	Sierra Point	22512.2	4.352417
1894	122 08 22.320	547.2	112 59 50.9	292 51 38.7	Point Avisadero	21419.8	4.330816
			133 58 08.5	313 54 05.5	San Leandro Point 2	13527.8	4.131227
			135 03 34.4	314 59 59.2	Bay Farm	12231.3	4.087472
Clam Point telegraph pole*	37 41 32.628	1005.9	216 17 46.8	36 18 29.6	Candlestick Point	2896.4	3.461863
1894	122 24 14.582	357.3	223 57 06.0	43 58 36.0	Point Avisadero 2	5191.4	3.715288
			333 32 32.6	153 32 57.5	Sierra Point	2204.1	3.343232
Shoe-factory smokestack†*	37 42 42.33	1305.0	339 50 44	159 51 21	Lower Sierra Point	4313	3.63478
1894	122 24 17.04	417.4	345 48 43	165 49 09	Sierra Point	4252	3.62859
Belmont, Spring Valley waterworks standpipe*	37 30 44.012	1356.8	148 53 02.2	328 48 31.3	Sierra Point	21060.5	4.323469
1894	122 16 10.392	255.2	153 51 51.8	333 50 04.6	Pt. San Mateo Ext.	9806.4	3.991509
			160 49 32.6	340 46 06.8	Point Avisadero	25133.3	4.400249
			207 20 14.3	27 20 24.2	Angelo 2	872.9	2.940947
Belmont, Swift's house, chimney†*	37 31 24.87	766.7	156 11 37	336 10 14	Pt. San Mateo Ext.	8245	3.91621
1894	122 16 50.81	1247.7	289 09 09	109 09 44	Angelo 2	1475	3.16875
Millbrae oysterhouse, main window N. front*	37 36 41.645	1283.9	135 38 38.6	315 37 25.2	Belair I.	4216.5	3.624955
1894	122 21 44.444	1090.0	150 35 01.3	330 33 48.8	Baden Hill	5929.1	3.772988
			158 55 18.8	338 54 11.7	Sierra Point	7499.8	3.875052
			161 17 01.0	341 16 20.6	Point San Bruno 2	5062.0	3.704326
			172 06 41.6	352 05 54.4	Stony Hill	13812.1	4.140259
			179 40 05.4	359 40 03.7	Point Avisadero 2	12707.8	4.104071
San Bruno oysterhouse, W. window N. front*	37 37 20.475	631.2	130 53 49.0	310 52 56.7	Belair I.	2776.0	3.443426
1894	122 22 19.090	468.1	152 31 37.9	332 30 46.5	Baden Hill	4471.5	3.650457
			162 19 38.2	342 18 52.1	Sierra Point	6088.1	3.784480
			167 50 26.0	347 50 06.6	Point San Bruno 2	3679.7	3.565808
			175 12 17.1	355 11 50.9	Stony Hill	12528.0	4.097881
			183 51 04.4	3 51 23.8	Point Avisadero 2	11536.6	4.062076
South Point*	37 42 26.821	826.9	231 38 51.6	51 39 12.5	Candlestick Point	1069.3	3.029098
1894	122 23 38.814	950.8	348 35 55.3	168 36 24.8	Point San Bruno 2	5965.2	3.775622
			348 59 36.9	168 59 59.3	Oyster Point	4695.5	3.671684
			351 15 11.8	171 15 25.5	Lower Sierra Point	3612.8	3.557838
			358 20 28.8	178 20 31.5	Sierra Point	3645.6	3.561773
Hay warehouse, S. gable*	37 42 34.625	1067.5	351 07 54	171 08 18	Point San Bruno 2	6162	3.78970
1894	122 23 29.461	721.6	352 10 00	172 10 16	Oyster Point	4896	3.68980
			355 11 54	175 12 02	Lower Sierra Point	3825	3.58260
			1 49 26	181 49 23	Sierra Point	3887	3.58958
Alvarado sugar-refinery, smokestack†	37 36 05.81	179.1	19 05 03	199 04 17	Peak Flag	5568	3.74570
1894	122 04 23.89	585.9	87 07 07	266 58 09	Pt. San Mateo Ext.	21680	4.33606

*This point is in the area of the 1906 earthquake disturbance. †No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Pinnacle Rock*	37 42 47.603	1467.6	179 48 54.1	359 48 53.9	Stony Hill	2398.7	3.379981
1894	122 23 01.544	37.8	231 50 58.4	51 51 43.7	Point Avisadero 2	2307.4	3.363123
			4 56 22.1	184 56 13.1	Lower Sierra Point	4227.2	3.626050
			10 40 37.3	190 40 17.2	Sierra Point	4360.3	3.639514
Mission Rock ventilator*	37 46 24.663	760.3	156 42 24.4	336 40 38.6	Angel I. Peak 2	10680.0	4.028570
1894–1897	122 22 55.375	1355.2	199 54 30.6	19 55 07.6	Yerba Buena I.	4332.8	3.636770
			289 54 26.0	109 59 17.2	San Leandro Point 2	12381.1	4.092760
			342 28 22.5	162 29 04.1	Point Avisadero	5521.3	3.742044
			2 07 05.6	182 07 01.7	Stony Hill	4296.2	3.633088
Union City Presbyterian Church, spire†	37 35 44.41	1369.1	13 07 53	193 07 26	Peak Flag	4726	3.67449
1894	122 04 57.32	1406.2	88 48 58	268 40 19	Pt. San Mateo Ext.	20911	4.32037
Centerville Catholic Church, spire cross	37 33 26.106	804.8	342 46 51.7	162 47 57.9	Albrae	9036.1	3.955982
1894	122 00 10.845	266.2	73 33 33.4	253 30 40.9	South Red Hill	7246.9	3.860155
			87 36 49.7	267 33 30.3	Peak Flag	8038.6	3.905179
Avisadero Bight, white barn*	37 43 41.416	1276.8	278 55 44.7	98 56 21.9	Point Avisadero 2	1506.3	3.177926
1894	122 22 48.214	1180.7	0 25 48.0	180 25 46.5	Point San Bruno 2	8147.5	3.911025
			2 50 52.4	182 50 43.8	Oyster Point	6917.5	3.839950
			6 42 34.5	186 42 17.3	Lower Sierra Point	5911.0	3.771660
			10 48 21.6	190 47 53.3	Sierra Point	6051.1	3.781836
Agnews, tall brick chimney†	37 23 41.06	1265.8	168 41 39	348 40 52	Albrae	9591.1	3.98187
1896	121 57 05.45	134.1	184 33 30	4 33 43	Dyke	6784.1	3.83149
Agnews, tall flagstaff	37 23 33.228	1024.4	139 06 53.4	319 04 09.5	Alviso	10126.0	4.005438
1896	121 57 20.653	508.0	145 33 49.0	325 29 13.2	South Red Hill	19680.1	4.294028
			171 07 21.0	351 06 43.7	Albrae	9763.4	3.989599
			187 25 32.2	7 25 54.8	Dyke	7063.3	3.849008
Agnews	37 23 38.157	1176.3	137 26 39.0	317 23 48.6	Alviso	10186.8	4.008037
1896	121 57 10.014	246.3	144 41 16.4	324 36 34.2	South Red Hill	19705.1	4.294579
			169 27 03.4	349 26 19.7	Albrae	9657.7	3.984875
			185 25 48.9	5 26 05.0	Dyke	6883.0	3.837777
Milpitas black warehouse, S. ventilator	37 27 28.838	889.0	77 57 16.3	257 56 46.2	Dyke	1243.0	3.094489
1896	121 55 54.049	1328.4	92 34 33.9	272 30 57.2	Alviso	8765.2	3.942760
			123 15 23.8	303 13 53.8	Albrae	4346.4	3.638130
			124 05 22.5	303 59 53.8	South Red Hill	16005.5	4.204268
Large red warehouse, N. gable	37 25 40.927	1261.8	129 13 14.2	309 11 21.5	Alviso	5879.0	3.769305
1896	121 58 45.019	1107.0	143 36 51.4	323 33 06.9	South Red Hill	15268.8	4.183804
			224 13 46.4	44 15 00.3	Dyke	4281.3	3.631578
Old hut, SE. gable	37 26 45.882	1414.5	144 23 26.7	324 20 24.0	South Red Hill	12654.1	4.102230
1896	121 59 53.850	1323.7	211 20 13.5	31 21 09.4	Albrae	4340.5	3.637535
			257 09 45.0	77 11 40.8	Dyke	4798.0	3.681063
Old shed, SE. gable	37 26 43.600	1344.2	144 28 43	324 25 39	South Red Hill	12726.8	4.10472
1896	121 59 52.775	1297.3	210 33 50	30 34 45	Albrae	4387.2	3.64219
			256 16 17	76 18 12	Dyke	4788.5	3.68020
Irvington wine vaults, cupola†	37 31 59.01	1819.2	17 22 10	197 21 24	Albrae	6230.2	3.79450
1896	121 57 06.28	154.2	93 11 11	273 06 27	South Red Hill	11499.5	4.06068
Tuft	37 29 42.970	1324.7	7 27 53.8	187 27 39.5	Dyke	4432.2	3.646619
1896	121 56 20.083	493.4	59 40 27.6	239 39 13.4	Albrae	3469.7	3.540288
			110 58 04.8	290 52 51.8	South Red Hill	13510.6	4.130676
Mud Creek, N. draw lantern box	37 28 10.608	327.0	79 59 06.5	259 57 00.7	Alviso	5157.1	3.712407
1896	121 58 23.699	582.4	182 12 49.8	2 12 50.8	Albrae	1095.8	3.039731
			302 08 14.7	122 09 15.6	Dyke	2907.9	3.463586
Warehouse, SE. gable	37 25 19.399	598.0	145 24 43.5	325 23 28.8	Alviso	5320.7	3.725970
1896	121 59 47.444	1166.6	149 50 50.9	329 47 44.4	South Red Hill	14981.2	4.175547
			198 14 11.0	18 15 03.0	Albrae	6710.5	3.826752
			230 27 27.8	50 29 19.6	Dyke	5862.2	3.768060
Coyote Creek, S. draw lantern box	37 27 39.077	1204.7	90 51 29.9	270 49 25.6	Alviso	5019.0	3.700616
1896	121 58 26.145	642.5	182 50 12.1	2 50 14.6	Albrae	2069.6	3.315883
			282 50 12.7	102 51 15.1	Dyke	2587.1	3.412821

* This point is in the area of the 1906 earthquake disturbance. † No check in this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Milpitas old warehouse, W. gable * 1896	37 27 22.87 121 55 56.12	705.1 1379.3	86 17 55 125 37 13	266 17 26 305 35 44	Dyke Albrae	1167.2 4408.5	3.06715 3.64429
Brick warehouse, SE. ventilator * 1896	37 26 01.25 122 04 22.00	38.5 540.9	176 09 02 230 20 02	356 08 43 50 21 35	South Red Hill Alviso	11687.2 4841.8	4.06771 3.68501
Albrae tile chimney * 1896	37 28 47.99 121 58 12.69	1479.5 311.8	320 55 29 75 50 50	140 56 23 255 50 44	Dyke Albrae	3477.3 235.2	3.54124 2.37150
Noonan water tank † 1894	37 35 47.688 122 23 42.961	1470.1 1053.9	179 29 05.9 179 56 27.1 191 13 06.4	359 29 04.8 359 56 26.9 11 13 38.3	Belair I. Baden Hill Point San Bruno 2	4678.0 6827.6 6583.5	3.670058 3.834269 3.818460
Point San Mateo Rock † 1894	37 35 30.024 122 19 06.200	925.6 152.1	127 25 37.5 137 21 41.0 141 50 33.1	307 22 47.5 317 18 51.8 321 48 16.0	Belair I. Baden Hill Point San Bruno 2	8597.6 10025.3 8907.5	3.934378 4.001096 3.949755
San Bruno house, minaret † 1894	37 37 48.249 122 24 39.054	1487.5 957.7	203 44 05.1 224 05 33.2 234 12 45.6	23 44 39.2 44 06 39.4 54 13 18.8	Baden Hill Point San Bruno 2 Belair I.	3398.3 3816.8 1643.5	3.531267 3.581696 3.215770
Red cupola † 1894	37 39 25.454 122 25 13.250	784.7 324.8	267 02 06.8 274 10 41.8 313 08 51.2	87 03 01.8 94 12 08.9 133 09 45.3	Baden Hill Point San Bruno 2 Belair I.	2209.0 3503.4 2976.5	3.344201 3.544484 3.473706
Sierra Barn, E. gable *† 1894	37 40 12.47 122 23 30.84	384.4 755.8	303 41 05 12 49 56	123 41 23 192 49 49	Oyster Point Baden Hill	842.4 1369.8	2.92550 3.13666
Guadalupe warehouse *† 1894	37 41 40.19 122 24 03.13	1239.0 76.7	214 18 51 223 28 38	34 19 27 43 30 01	Candlestick Point Point Avisadero 2	2544.1 4829.2	3.405533 3.683872
Pacific Bone Fertilizer Co., smokestack *† 1894	37 41 55.97 122 24 23.52	1725.5 576.1	230 07 51 231 42 16	50 08 40 51 43 52	Candlestick Point Point Avisadero 2	2519.2 4869.9	3.401257 3.687518
Ewell's XL Dairy, smokestack *† 1894	37 41 06.50 122 23 56.77	200.3 1390.9	202 09 04 214 52 51	22 09 36 34 54 10	Candlestick Point Point Avisadero 2	3390.2 5537.8	3.530222 3.743335
Distillery smokestack † 1894	37 43 37.886 122 23 26.113	1168.0 639.5	120 45.08.8 272 57 16.6 340 56 59.4	300 43 05.1 92 58 17.0 160 57 12.6	North Twin Point Avisadero 2 Candlestick Point	5750.6 2419.4 1616.0	3.759710 3.383709 3.208430
San Bruno Range, N. end, rocky peak *† 1899	37 42 03.09 122 27 15.54	95.3 380.7	38 37 00 64 41 09	218 35 49 244 39 44	Fog Cap Colma	4546.6 3768.6	3.65769 3.57618
San Bruno Range, S. end, low peak *† 1899	37 39 54.77 122 25 08.49	1688.5 208.1	93 53 47 109 47 43	273 51 19 289 45 01	Fog Cap Colma	5965.1 6929.3	3 77562 3.84069
South Twin (peak) † 1894–1899	37 45 07.008 122 26 49.114	216.0 1202.3	29 06 34 77 06 45 162 50 42 188 11 30 228 01 55 288 49 37 291 13 36	209 04 52 257 06 02 342 50 06 8 11 31 48 04 55 108 51 57 111 16 41	Colma Black Ridge 2 Presidio Hill North Twin Yerba Buena I. 2 Stony Hill Point Avisadero 2	8333.9 1767.7 4902.1 193.3 9675.6 5879.2 7925.6	3 92085 3.24742 3.69038 2.28614 3.98568 3.76932 3.89903
Start Pile † 1903	37 45 18.040 122 22 50.224	556.2 1229.4	352 00 36.1 13 59 45.5 29 07 55.7 54 51 46.7	172 00 43.4 193 59 36.9 209 07 42.7 234 51 32.7	Mile Half Quarter Start	2088.6 1429.7 1067.4 685.0	3.319848 3.155240 3.028330 2.835679
Quarter Pile † 1903	37 45 02.520 122 22 45.104	77.7 1104.2	354 04 35.5 27 24 15.1 54 51 58.6	174 04 39.6 207 24 03.3 234 51 42.4	Mile Half Quarter	1598.3 1023.6 788.7	3.203663 3.010130 2.896899
Mile Pile *† 1903	37 44 19.60 122 22 22.91	604.2 560.9	54 50 56 138 52 44	234 50 46 318 52 13	Mile Start	462.9 1868.5	2.66552 3.27150
Half Pile *† 1903	37 44 45.95 122 22 41.24	1416.6 1009.6	54 52 30 127 19 49	234 52 16 307 19 30	Half Start	691.8 981.2	2.83998 2.99175
Sand ‡ 1897	37 46 45.519 122 30 21.598	1403.3 528.6	172 22 34.2 239 05 25.9	352 22 32.8 59 05 41.1	Cement Cemetery	433.5 706.5	2.636981 2.849086

* No check on this position. † This point is in the area of the 1906 earthquake disturbance. ‡ See page 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Point Lobos, windmill*	37 47 09.380	289.2	89 03 02.0	269 02 52.5	Point Lobos 2	376.2	2.575404
1883	122 29 39.249	960.4	251 27 08.6	71 28 16.6	Presidio Hill	2865.5	3.457204
			328 39 06.7	148 40 01.0	Black Ridge	4173.8	3.620538
Railroad Point*	37 47 17.878	551.2	14 07 26.3	194 07 22.7	Cement	585.7	2.767662
1892	122 30 18.107	443.0	28 38 12.5	208 38 06.7	Under Cement	480.3	2.681549
			250 40 22.4	70 41 25.8	Rob 3	2680.8	3.428261
			259 57 05.7	79 58 37.6	Presidio Hill	3724.6	3.571079
			262 31 39.6	82 32 23.8	Spring Valley	1780.3	3.250497
			292 56 12.4	112 56 19.8	Point Lobos 3	322.2	2.508185
Baker Beach Life-Saving Station, weather vane*	37 47 31.181	961.3	37 45 23.4	217 45 19.9	Spring Valley	226.2	2.354415
1892–1900	122 29 00.305	7.5	62 57 44.7	242 57 11.4	Point Lobos 2	1492.1	3.173806
			71 34 04.2	251 33 24.1	Point Lobos 3	1693.9	3.228886
Fort Point Life-Saving Station, flagstaff*	37 48 17.411	536.8	155 50 01.8	335 49 12.0	Halfway	4848.1	3.685573
1895	122 27 50.316	1230.9	168 09 26.9	348 09 08.0	Point Cavallo 2	3675.5	3.565319
			178 57 02.1	358 56 58.8	Peninsula Hill 2	7310.6	3.863952
			205 14 48.8	25 16 03.8	Angel I. Peak 2	7001.7	3.845202
Point Bonita, fog-siren smokestack†	37 48 58.845	1814.1	277 35 08.6	97 37 02.1	Fort Point L. H.	4568.0	3.659722
1877	122 31 40.630	993.8	293 24 34.2	113 26 56.6	Presidio Hill	6196.6	3.792150
			296 20 26.1	116 22 20.2	Rob	5083.0	3.706124
			322 30 04.7	142 31 09.7	Point Lobos 2	4261.2	3.629537
			332 59 13.8	153 00 00.8	Cement	4131.4	3.616094
			348 40 11.7	168 41 05.6	Black Bluff	10963.6	4.039952
Bonita Bluff†	37 49 17.441	537.7	247 36 32.4	67 37 16.0	Diablo Hill	1882.1	3.274654
1887	122 31 32.754	801.1	269 23 30.1	89 24 19.7	West Diablo	1977.5	3.296110
			298 55 14.8	118 57 32.6	Presidio Hill	6276.5	3.797719
			302 51 44.3	122 53 34.0	Rob 2	5205.4	3.716453
			302 42 58.0	122 44 47.3	Rob 3	5177.3	3.714102
			313 52 54.8	133 54 24.9	Spring Valley	4983.0	3.697490
			328 43 49.9	148 44 50.2	Point Lobos 2	4626.1	3.665218
			330 04 25.3	150 05 19.8	Point Lobos	4343.4	3.637828
			338 24 25.8	158 25 08.2	Cement	4575.1	3.660399
Point Bonita, keeper's house*	37 49 17.737	546.8	287 25 46.6	107 27 43.8	Fort Point	4900.7	3.690258
1857	122 31 44.884	1097.8	297 43 56.7	117 46 21.8	Presidio Hill	6542.0	3.815713
			326 51 32.4	146 52 34.1	Point Lobos	4506.4	3.653831
North Bonita*	37 49 22.562	695.6	256 40 21.8	76 41 20.8	Diablo Hill	2425.9	3.384880
1887	122 31 58.120	1421.5	297 34 20.9	117 36 54.0	Presidio Hill	6897.8	3.838713
			300 50 52.7	120 52 57.8	Rob 2	5815.8	3.764609
			332 25 13.7	152 26 11.4	Cement	4977.3	3.696997
			273 00 48.0	93 01 53.0	West Diablo	2601.4	3.415206
High Bluff	37 49 34.100	1051.3	5 39 11.6	185 39 00.5	Point Lobos 2	4489.9	3.652235
1887	122 29 36.545	893.8	8 59 14.6	188 58 57.7	Point Lobos	4331.3	3.636618
			13 40 27.4	193 39 58.4	Cement	4906.8	3.690798
			323 15 23.1	143 16 29.6	Presidio Hill	4430.6	3.646464
			335 23 36.4	155 24 14.7	Rob 2	3589.1	3.554986
			349 19 20.6	169 19 39.2	Spring Valley	4038.4	3.606204
Alcatraz fog-bell	37 49 31.774	979.6	47 27 25.1	227 25 50.1	Presidio Hill	5144.2	3.711315
1887	122 25 13.304	325.4	56 40 33.2	236 38 29.8	Rob 3	5897.2	3.770649
Alcatraz L. H.	37 49 36.034	1110.9	15 18 56.0	195 18 00.5	North Twin	8401.0	3.924331
1857	122 25 17.344	424.0	45 38 26.5	225 36 54.0	Presidio Hill	5162.8	3.712882
			55 04 45.3	235 02 44.3	Rob 3	5889.1	3.770051
			67 04 27.9	247 02 27.5	Fort Point	5216.3	3.717361
			91 31 43.7	271 29 32.6	Lime Point Bluff	5232.9	3.718744
			290 14 44.4	110 16 48.4	Yerba Buena I. 2	5275.0	3.722225
			348 03 03.8	168 03 20.4	Russian Hill	3192.2	3.504094
Point Diablo	37 49 15.485	477.4	358 40 32.8	178 40 35.0	Point Lobos 2	3895.2	3.590529
1851	122 29 58.299	1425.9	2 13 52.8	182 13 49.2	Point Lobos	3707.1	3.569030
			2 52 05.1	182 52 00.4	Point Lobos 3	3756.2	3.574746
			8 30 42.5	188 30 26.8	Cement	4240.5	3.627422
			103 41 35.9	283 41 27.5	West Diablo	342.5	2.534657
			243 06 09.7	63 06 19.6	East Diablo	445.1	2.648426
			245 50 59.0	65 51 41.2	New Lime Point	1846.1	3.266264
			304 04 58.5	124 05 50.3	Fort Point	2497.4	3.397490
			313 04 45.4	133 06 05.1	Presidio Hill	4357.5	3.639242
			323 17 40.9	143 18 32.5	Rob 2	3449.0	3.537698
			323 15 05.6	143 15 56.8	Rob 3	3418.1	3.533781

* This point is in the area of the 1906 earthquake disturbance.

† See p. 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Lime Point foghorn, south stack	37 49 32.940	1015.5	22 35 43.9	202 34 57.7	Point Lobos 2	4800.6	3.681296
1883	122 28 39.240	959.7	298 22 54.8	118 25 15.1	Russian Hill	6365.4	3.803829
			340 26 43.2	160 27 14.5	Presidio Hill	3730.1	3.571717
Oakland Point Congregational Church, spire	37 48 32.135	990.7	91 26 50.0	271 24 25.4	Yerba Buena I.	5770.0	3.761179
1881	122 17 59.250	1449.4	153 37 09.7	333 35 08.2	Rocky I.	10891.1	4.037072
			177 51 20.9	357 51 11.9	Highland	9580.5	3.981386
Oakland Point R. R. depot, flagstaff	37 48 33.699	1038.9	91 40 32.2	271 39 09.8	Yerba Buena I.	3287.9	3.516918
1881	122 19 40.705	995.7	166 20 00.2	346 19 00.9	Rocky I.	9990.5	3.999586
			192 32 57.5	12 33 50.8	Highland	9758.9	3.989403
			273 54 48.2	93 55 29.6	Oakland Point	1654.7	3.218714
Point Blunt Rock	37 51 10.56	325.6	31 47 47	211 46 06	Presidio Hill	7675.7	3.88512
1892	122 25 02.91	71.1	39 30 12	219 28 02	Rob 3	8146.1	3.91095
			315 52 59	135 54 54	Yerba Buena I. 2	6602.4	3.81970
Point Blunt Knob	37 51 12.470	384.4	0 49 51	180 49 49	Reservoir	5699.5	3.75584
1897	122 25 05.738	140.3	132 03 19	312 02 53	Angel I. Peak 2	1396.1	3.14493
			315 48 39	135 50 37	Yerba Buena I.	6691.4	3.82552
Angel I., U. S. flagstaff	37 51 35.379	1090.7	14 40 42.4	194 39 54.5	Presidio Hill	7535.6	3.877120
1892	122 26 30.168	737.4	23 22 11.5	203 20 55.1	Rob 3	7681.7	3.885460
Quarantine Station, flagstaff *	37 51 59.12	1822.6	128 33 38	308 33 05	Ridge Rock	1678.9	3.225025
1895	122 26 06.54	159.9	147 57 01	327 56 43	Reservoir	1381.7	3.140422
Quarantine wharf, flagstaff	37 52 09.012	277.8	93 31 13.5	273 30 04.4	Peninsula Hill 2	2757.8	3.440561
1895	122 26 03.174	77.6	112 08 10.2	292 07 38.7	Tiburon Gate Tower	1355.2	3.132006
			117 59 31.4	297 58 56.4	Ridge Rock	1579.9	3.198623
			136 43 32.6	316 43 12.1	Reservoir	1189.5	3.075394
Angel I. fog-bell	37 51 23.220	715.9	15 20 57.3	195 20 09.6	Presidio Hill	7170.6	3.855555
1892	122 26 30.634	748.9	24 26 59.0	204 25 42.7	Rob 3	7334.4	3.865362
			32 30 49.3	212 28 44.1	Point Lobos 2	9286.3	3.967843
			35 04 41.0	215 02 17.9	Cement	9934.5	3.997144
Judson Chemical Works, chimney *	37 53 01.53	47.2	76 49 22	256 45 02	Angel I. Peak 2	10618.9	4.02608
1895	122 18 45.17	1103.8	154 21 25	334 21 23	Judson Point	161.2	2.20733
Contra Costa (3) *	37 53 05.98	184.4	28 57 05.9	208 55 10.7	Yerba Buena I.	9483.0	3.976945
1852	122 18 47.40	1158.3	109 43 36.3	289 42 04.2	Rocky I.	3891.2	3.590089
House flagstaff	37 53 06.994	215.6	292 23 19.8	112 25 57.9	Angel I. Peak 2	6808.7	3.833065
1895	122 30 05.691	139.1	297 00 24.9	117 01 44.7	Peninsula Hill 2	3563.4	3.551866
			354 42 29.8	174 42 38.5	Richardson East	3750.1	3.574041
Quarry hyd.	37 51 46.486	1433.1	231 38 46	51 41 02	North Brooks	6883.7	3.83782
1895	122 25 06.704	163.9	236 07 00	56 09 20	Brooks I.	6747.6	3.82915
			255 05 20	75 09 12	Judson Point	9576.1	3.98119
			44 50 41	224 50 40	Quarry	65.0	1.81280
Fence signal *	37 53 14.17	436.8	300 48 12	120 49 30	Peninsula Hill 2	3592.0	3.555331
1895	122 30 02.02	49.4	344 20 48	164 20 54	Strawberry Hill 2	882.8	2.945871
Angel	37 52 11.520	355.2	238 40 24	58 42 48	North Brooks	6731.6	3.82812
1895	122 25 21.114	516.0	243 19 55	63 22 24	Brooks I.	6662.5	3.82364
			260 00 22	80 04 23	Judson Point	9753.7	3.98917
			339 28 02	159 28 09	Quarry	873.4	2.94121
Marsh Point	37 52 54.162	1669.9	279 58 58.6	99 59 31.9	Strawberry Hill 2	1344.7	3.128639
1895	122 30 46.471	1135.6	286 19 41.8	106 21 26.6	Peninsula Hill 2	4346.9	3.638177
			338 05 16.9	158 05 50.6	Richardson East	3598.3	3.556103
Brooks I. 2	37 53 48.442	1493.4	59 40 21.2	239 37 35.0	Angel I. Peak 2	7666.3	3.884586
1905	122 21 17.440	426.1	118 39 56.3	298 37 09.7	Red Rock	7546.3	3.877734
North East X I	37 52 14.898	459.3	135 52 28.1	315 51 41.0	Bluff Point 2	2687.0	3.429275
1905	122 25 28.642	700.1	175 43 12.2	355 43 00.0	Red Rock	6519.5	3.814217
			244 48 47.8	64 51 22.1	Brooks I. 2	6782.4	3.831381
Southampton Shoal L. H.	37 52 56.057	1728.3	49 56 42.4	229 55 34.8	Angel I. Peak 2	3509.1	3.545190
1905	122 23 58.267	1423.9	60 07 45.4	240 06 49.8	NE. X I	2547.3	3.406080
			152 45 43.2	332 44 35.4	Red Rock	5885.4	3.769779
			247 38 39.1	67 40 17.9	Brooks I. 2	4248.8	3.628262

*No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Black-roof house	37 53 15.458	476.6	306 09 08.2	126 10 46.4	Angel I. Peak 2	4840.9	3.684924
1895	122 28 28.052	685.4	27 03 54.3	207 03 03.0	Richardson East	4486.1	3.651865
			66 37 42.2	246 36 50.5	Strawberry Hill 2	2242.3	3.350699
Bridge Point	37 52 35.077	1081.4	325 47 49.8	145 48 17.3	Angel I. Peak 2	1948.7	3.289747
1895	122 26 32.959	805.5	8 24 44.8	188 24 38.7	Angel I. NW. 2	1688.6	3.227530
			40 37 35.0	220 37 02.0	Belvedere Point	2018.4	3.305008
Angel I., white tank	37 52 08.090	249.4	71 18 17.0	251 16 54.7	Richardson East	5980.4	3.776728
1895	122 25 59.805	1461.8	93 59 28.4	273 58 17.2	Peninsula Hill 2	2841.8	3.453596
			111 57 01.3	291 56 27.7	Tiburon Gate Tower	1442.2	3.159027
			117 31 36.9	297 30 59.8	Ridge Rock	1666.0	3.221670
			134 53 48.2	314 53 25.7	Reservoir	1267.4	3.102905
			339 55 16.7	159 55 23.8	Angel I. Peak 2	830.2	2.919169
Isabel Pile	37 53 45.592	1405.6	324 24 50.9	144 25 12.7	Judson Point	1491.8	3.173708
1895	122 19 23.547	575.3	68 05 37.8	248 01 41.8	Angel I. Peak 2	10132.8	4.005731
			101 19 40.2	281 18 25.1	North Brooks	3044.9	3.483568
High	37 53 25.335	781.1	153 32 48.3	333 32 16.1	California Point 2	2875.2	3.458675
1903	122 27 34.054	832.1	281 30 20.4	101 30 50.4	Bluff Point 2	1218.2	3.085715
			320 40 54.2	140 41 59.6	Angel I. Peak 2	4085.7	3.611269
Bluff Point North Base	37 53 32.908	1014.5	337 40 49.6	157 40 54.5	Bluff Point 2	515.2	2.711942
1903	122 26 53.209	1300.2	76 50 08.3	256 49 43.2	High	1025.0	3.010712
Fence	37 53 18.892	582.4	105 20 19.6	285 20 01.4	High	751.0	2.875656
1903	122 27 04.413	107.8	144 07 58.5	324 07 08.0	California Point 2	3421.8	3.534259
			212 21 14.4	32 21 21.3	Bluff Point N. Base	511.5	2.708884
			275 24 22.8	95 24 34.6	Bluff Point 2	471.5	2.673490
Bluff Point South Base	37 53 23.332	719.3	74 20 02.5	254 19 50.2	Fence	506.9	2.704939
1903	122 26 44.438	1085.9	144 01 27.0	324 01 21.6	Bluff Point N. Base	364.8	2.562075
Corinthian Clubhouse,	37 52 18.967	584.7	295 38 43.8	115 39 42.1	Angel I. Peak 2	2575.7	3.410890
flagstaff	122 27 23.135	565.4	320 09 15.0	140 09 39.6	Angel I. NW. 2	1528.7	3.184332
1895			4 50 33.5	184 50 31.3	Belvedere Point	1039.1	3.016640
			80 11 27.0	260 11 07.0	Peninsula Hill 2	810.1	2.908524
Belvedere, telegraph pole	37 52 46.610	1437.0	298 03 34.8	118 05 07.4	Angel I. Peak 2	4180.6	3.621238
1895	122 28 19.070	466.0	36 03 20.5	216 02 23.7	Richardson East	3841.1	3.584460
			89 59 53.5	269 58 56.3	Strawberry Hill 2	2277.9	3.357530
North Trestle	37 52 36.712	1131.8	2 20 52.2	182 20 49.3	Richardson East	2802.9	3.447601
1895	122 29 46.847	1144.9	156 28 01.9	336 27 58.6	Strawberry Hill 2	332.4	2.521684
			284 09 28.8	104 10 37.0	Peninsula Hill 2	2799.3	3.447049
Middle Trestle	37 52 19.024	586.5	3 12 22.2	183 12 19.0	Richardson East	2258.7	3.353857
1895	122 29 46.377	1133.5	170 22 16.8	350 22 13.2	Strawberry Hill 2	862.3	2.935645
			272 57 05.2	92 58 13.1	Peninsula Hill 2	2706.4	3.432386
South Trestle	37 52 02.185	67.4	4 31 12.1	184 31 08.6	Richardson East	1741.4	3.240897
1895	122 29 45.930	1122.6	173 32 11.2	353 32 07.3	Strawberry Hill 2	1378.1	3.139268
			261 58 06.7	81 59 14.3	Peninsula Hill 2	2718.5	3.434334
Reservoir	37 52 37.103	1143.8	5 15 29.4	185 15 25.4	Angel I. NW. 2	1740.2	3.240609
1895	122 26 36.541	893.0	51 03 09.7	231 02 58.6	Tiburon Gate Tower	565.5	2.752462
			77 51 42.7	257 51 28.2	Ridge Rock	592.8	2.772938
			324 45 15.8	144 45 45.5	Angel I. Peak 2	2049.9	3.311737
Raccoon Point	37 52 50.356	1552.4	341 24 49.6	161 25 07.2	Angel I. Peak 2	2197.4	3.341906
1895	122 26 16.798	410.5	16 41 26.2	196 41 10.1	Angel I. NW. 2	2235.7	3.349407
			40 28 39.1	220 27 56.2	Belvedere Point	2633.1	3.420467
			49 44 38.1	229 44 26.0	Reservoir	632.2	2.800884
Railroad curve, telegraph	37 53 11.150	343.7	288 26 54.4	108 30 19.2	Angel I. Peak 2	8594.7	3.934229
pole.	122 31 21.688	529.9	289 06 02.4	109 06 57.3	Strawberry Hill 2	2312.3	3.364052
1895			330 17 19.5	150 18 14.8	Richardson East	4446.5	3.648017
San Pablo flagstaff	37 57 33.501	1032.8	335 51 05.7	155 52 03.7	Topog	5638.0	3.751126
1881	122 20 22.044	538.2	336 15 22.2	156 16 40.9	Highland	7774.6	3.890680
			341 09 06.8	161 09 23.1	Mound	2012.1	3.303645
			4 58 02.8	184 57 54.2	El Cerrito	3931.9	3.594601
Ellis Landing barn, inner	37 55 05.384	166.0	247 34 35.9	67 35 15.5	El Cerrito	1703.2	3.231268
gable	122 21 40.447	987.9	277 47 07.7	97 48 53.9	Topog	4261.0	3.629511
1881			296 47 59.2	116 50 06.1	Highland	5653.3	3.752305
			346 39 57.7	166 40 12.4	Brooks I.	2438.0	3.387030

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Ellis Landing, window 1895	37 55 09.801 122 21 43.045	302.2 1051.3	311 40 59 345 59 38 348 03 46	131 42 46 165 59 53 168 03 55	Judson Point Brooks I. North Brooks	5726.8 2585.4 2042.9	3.75791 3.41252 3.31025
Bill 1900	37 55 14.278 122 29 09.317	440.2 227.6	306 52 09 186 55 28 198 12 22 226 17 18 242 44 15 258 46 56	126 52 35 6 55 36 18 13 03 46 19 29 62 46 40 78 49 00	California Point 2 Point San Quentin Marin I. E. Point San Pablo 2 Molate Point 2 Red Rock	1307.7 2637.6 5151.0 7177.3 6477.8 4998.3	3.11652 3.42121 3.71189 3.85596 3.81143 3.69882
San Pablo Road flagstaff* 1881	37 55 30.33 122 18 59.11	935.1 1443.7	47 06 20.6 341 36 02.3	227 04 55.7 161 36 30.1	Rocky I. Highland	4609.1 3498.4	3.663613 3.543805
Mt. Tamalpais, wireless tower 1905	37 55 44.840 122 35 12.466	1382.4 304.4	269 49 58.6 279 54 25.5 294 21 29.8 298 22 29.5	89 55 45.2 100 02 58.6 114 27 28.5 118 28 16.4	Red Rock Brooks I. 2 NE. X I Angel I. Peak 2	13771.6 20710.8 15663.6 15678.0	4.138984 4.316196 4.194892 4.195290
San Quentin wharfhouse, SE. gable 1897	37 56 34.984 122 28 34.578	1078.6 844.3	197 34 04.8 290 30 25.4 356 32 42.6	17 34 24.0 110 32 07.5 176 32 47.5	Marin I. East Red Rock California Point 2	2522.3 4328.7 3279.0	3.401798 3.636354 3.515737
Wells Fargo wharfhouse, chimney 1899	37 56 36.234 122 28 36.708	1117.1 896.3	100 50 06.0 198 58 11.1 212 13 16.3 241 01 14.7 252 01 24.4	280 49 54.0 18 58 31.6 32 14 36.0 61 03 05.3 72 03 40.6	Point San Quentin Marin I. East East Sister Point San Pablo 2 San Pablo Ridge	486.9 2502.0 5928.7 5020.5 5682.7	2.687457 3.398292 3.772960 3.700745 3.754558
Molate E. Reef 1899	37 55 59.039 122 24 56.446	1820.3 1378.5	72 10 57 101 57 32 127 36 00 165 18 18	252 10 25 281 55 04 307 34 05 345 18 07	Red Rock Point San Quentin Marin I. East Molate Point 2	1336.9 5986.3 5759.7 1638.9	3.12611 3.77716 3.76240 3.21455
Molate W. Reef 1899	37 55 59.663 122 25 00.926	1839.5 22.6	101 59 43.0 168 55 45.1 128 07 12.0	281 57 18.2 348 55 37.4 308 05 19.8	Point San Quentin Molate Point 2 Marin I. East	5875.3 1595.7 5661.4	3.769029 3.202949 3.752925
Prison searchlight 1897	37 56 19.654 122 29 18.072	605.9 441.3	221 25 09.7 281 31 25.4 326 22 25.1 335 46 25.7	41 25 23.1 101 33 34.2 146 23 59.1 155 46 57.4	Point San Quentin Red Rock Bluff Point 2 California Point 2	803.7 5221.8 6745.4 3070.7	2.905115 3.717822 3.829008 3.487236
Gray house, chimney* 1897	37 56 49.14 122 29 28.17	1515.1 687.8	226 26 05 291 29 14	46 26 57 111 29 34	Marin I. East Point San Quentin	2856.1 836.5	3.45578 2.92245
San Rafael Court-house flagstaff* 1897	37 58 26.29 122 31 36.65	810.6 894.5	300 11 08 310 07 54	120 14 42 130 09 32	Red Rock Point San Quentin	9834.4 5121.1	3.99275 3.70936
San Rafael Rock 1897	37 57 39.850 122 29 26.319	1228.6 642.5	258 41 15.3 303 28 04.9 338 35 29.0	78 42 06.3 123 30 18.8 158 35 47.5	Marin I. East Red Rock Point San Quentin	2064.5 6375.0 2008.4	3.314806 3.804480 3.302856
San Rafael Creek* 1852	37 58 18.31 122 29 12.86	564.6 313.9	240 33 27 352 27 28	60 34 47 172 27 38	Point San Pedro Point San Quentin	3648.6 3082.4	3.56213 3.48889
Brickworks, tall chimney 1899	37 56 42.478 122 30 17.402	1309.6 424.9	322 17 07 328 33 05 337 46 08	142 18 14 148 33 46 157 46 36	California Point 2 Bill Large Boulder	4428.8 3187.4 2977.5	3.64629 3.50343 3.47385
Point San Pedro house, SE. gable 1897	37 59 10.600 122 26 50.718	326.8 1237.7	248 05 51.7 246 00 44.1 316 51 27.4 331 12 35.8 346 29 05.8 33 18 12.2 36 32 55.7	68 08 52.0 66 00 58.6 136 52 38.4 151 13 35.8 166 29 44.1 213 16 55.0 216 32 11.0	Point Pinole 3 East Sister San Pablo Ridge Molate Point 2 Red Rock Point San Quentin Marin I. East	7696.0 629.0 4120.8 4929.9 6495.0 5584.4 2978.8	3.886266 2.798681 3.614984 3.692841 3.812581 3.746973 3.474046
Point San Pablo Hydrographic 1897	37 57 56.065 122 25 40.166	1728.4 980.4	2 55 23.1 10 28 54.5 35 08 29.9 62 57 29.0 88 27 08.1 155 48 54.4 226 21 47.4	182 55 17.9 190 28 14.5 215 06 47.5 242 57 18.0 268 25 40.0 335 48 25.5 46 24 04.2	Red Rock Bluff Point 2 California Point 2 E. Brother I. L. H. Marin I. East East Sister Point Pinole 3	4022.5 8735.6 7058.4 487.5 3497.4 2799.5 7488.2	3.604497 3.941295 3.848705 2.688003 3.543744 3.447087 3.874379

*No check on this position.

San Franscisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Red house, chimney	37 57 33.260	1025.4	308 55 50.7	128 56 49.8	Mound	3018.0	3.479716
1881	122 21 31.570	770.7	322 03 25.2	142 05 06.0	Topog	6513.3	3.813800
			325 48 31.4	145 50 32.9	Highland	8503.5	3.934172
			340 50 59.7	160 51 33.9	El Cerrito	4138.6	3.616852
Cove*	37 58 57.52	1773.5	252 37 55	72 38 42	Point San Pedro	1955.1	3.29162
1852	122 28 19.20	468.5	11 59 25	191 59 02	Point San Quentin	4359.6	3.63945
Point Cavallo tip	37 49 56.52	1742.5	5 16 40	185 16 30	Rob 3	4021.2	3.60436
1892	122 28 19.60	479.2	13 41 08	193 40 37	Spring Valley	4795.9	3.68087
			24 15 41	204 14 42	Point Lobos 2	5659.0	3.75274
			29 08 18	209 07 00	Cement	6249.3	3.79583
			30 30 33	210 29 13	Under Cement	6165.5	3.78997
Grayback double end	37 49 11.77	362.9	300 27 49	120 29 41	Rob 3	5174.0	3.71383
1892	122 31 37.00	905.0	336 20 11	156 20 56	Cement	4453.5	3.64870
			336 37 13	156 37 56	Under Cement	4284.8	3.63193
Flat Rock	37 47 19.57	603.4	253 11 18	73 12 27	Rob 3	2887.6	3.46054
1892	122 30 27.69	677.6	264 52 20	84 53 10	Spring Valley	2007.8	3.30271
			288 29 32	108 29 46	Point Lobos 3	560.2	2.74837
			351 35 37	171 35 40	Cement	626.8	2.79715
			359 28 27	179 28 27	Under Cement	473.7	2.67553
West Diablo Under Rock*	37 49 16.38	505.0	318 55 50	138 56 50	Rob 3	3669.2	3.56457
1892	122 30 13.24	323.8					
Bight Shore Rock*	37 49 21.72	669.6	326 40 33	146 41 22	Rob 3	3508.0	3.54506
1892	122 29 53.48	1308.0					
Bonita Bight*	37 49 32.65	1006.6	242 55 39	62 55 52	Diablo Hill	544.6	2.73610
1887	122 30 41.42	1013.0	301 49 42	121 50 00	West Diablo	849.7	2.92928
End of wharf-fence,	37 49 21.28	656.0	304 03 09	124 04 57	Rob 3	5208.5	3.71671
Bonita Point L. H.†*	122 31 31.10	760.6	315 10 19	135 11 48	Spring Valley	5037.1	3.70218
1892							
Rock Point	37 53 39.507	1218.0	318 55 51.0	138 56 48.4	Peninsula Hill 2	3476.3	3.541118
1895	122 29 29.236	714.3	6 34 05.8	186 33 52.1	Richardson, East	4767.8	3.678318
			19 02 42.8	199 02 28.7	Strawberry Hill 2	1725.7	3.236962
Carson, telegraph pole	37 53 25.654	790.9	329 07 58.5	149 08 31.4	Peninsula Hill 2	2556.0	3.407558
1895	122 28 49.447	1208.2	19 24 24.4	199 23 46.3	Richardson, East	4568.9	3.659808
			51 53 57.8	231 53 19.2	Strawberry Hill 2	1951.2	3.290309
Alcatraz, sentry-box*	37 49 44.59	1374.7	142 31 02	322 29 33	Peninsula Hill 2	5825.1	3.765306
1895	122 25 30.76	752.2	153 45 53	333 45 08	Angel I. NW. 2	3998.0	3.601842
Black Point wharfhouse,	37 48 31.537	972.3	153 08 40.6	333 07 13.2	Peninsula Hill 2	7705.6	3.886805
W. gable	122 25 33.375	816.5	155 07 45.5	335 06 36.0	Belvedere Point	6588.0	3.818751
1895			176 29 45.4	356 29 36.4	Angel I. Peak 2	5907.8	3.771427
Red Bluff	37 53 38.488	1186.6	312 40 17.5	132 41 28.9	Peninsula Hill 2	3865.6	3.587219
1895	122 29 52.081	1272.6	359 50 27.6	179 50 27.9	Richardson East	4736.0	3.675408
			0 10 08.4	180 10 08.3	Strawberry Hill 2	1630.7	3.212368
Richardson Schoolhouse,	37 51 35.644	1098.9	158 14 33.0	338 14 11.1	Strawberry Hill 2	2355.4	3.372071
tower	122 29 16.551	404.6	238 44 46.3	58 45 35.9	Peninsula Hill 2	2308.9	3.363399
1895			263 36 24.1	83 37 31.5	Belvedere Point	2701.4	3.431592
Railroad tank	37 52 17.035	525.2	214 49 35.4	34 49 51.3	Strawberry Hill 2	1110.4	3.045467
1895	122 30 18.226	445.5	271 16 44.2	91 18 11.6	Peninsula Hill 2	3482.1	3.541838
			343 26 25.3	163 26 41.7	Richardson East	2288.7	3.359593
Railroad telegraph pole	37 52 17.281	532.8	203 34 18.1	23 34 28.0	Strawberry Hill 2	986.2	2.993945
1895	122 30 08.415	205.7	271 30 34.3	91 31 55.7	Peninsula Hill 2	3242.5	3.510886
			349 23 16.7	169 23 27.0	Richardson East	2239.7	3.350193
Marin Island*	37 57 53.72	1656.1	293 26 01	113 28 24	High Hill	6197.4	3.792211
1852	122 27 58.61	1430.7	31 30 52	211 30 16	Point San Quentin	2694.7	3.430517
Castro Slough warehouse,	37 57 23.88	736.2	50 00 18	229 59 31	High Hill	2405.9	3.381277
W. gable*	122 22 50.24	1226.5	95 18 40	275 17 23	San Pablo Ridge	3065.7	3.486533
1897							

* No check on this position.

† This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Three gable warehouse, middle W. gable 1897	37 58 30.587 122 22 06.850	943.0 167.4	38 51 27.9 66 40 47.3 82 26 26.8 103 12 59.0	218 50 14.8 246 39 03.7 262 22 47.4 283 10 18.8	High Hill San Pablo Ridge Marin I. East East Sister	4626.7 4477.7 8779.5 6525.1	3.665270 3.651055 3.943468 3.814589
Shanty on end small wharf 1899	37 56 33.137 122 24 38.806	1021.6 947.6	49 23 50.6 59 58 31.4 91 43 31.5	229 23 07.7 239 56 11.4 271 40 53.2	Red Rock California Point 2 Point San Quentin	2243.9 6423.6 6289.9	3.350996 3.807779 3.798647
Large Boulder 1900	37 55 13.080 122 29 31.282	403.2 764.0	197 50 05 244 29 01 259 29 06 266 03 55	17 50 26 64 31 39 79 31 23 86 04 08	Point San Quentin Molate Point 2 Red Rock Bill	2789.3 6974.9 5532.1 537.7	3.44550 3.84354 3.74289 2.73057
Outer gable small whitewashed house 1900	37 56 02.381 122 24 15.409	73.4 376.3	15 48 52 35 45 05 69 43 34 77 19 05	195 47 56 215 43 33 249 41 00 257 18 08	Angel I. Peak 2 Bluff Point 2 California Point 2 Red Rock	8317.6 6264.6 6538.2 2332.0	3.92000 3.79689 3.81546 3.36772
Stump near H. W. M. 1899	37 55 56.926 122 24 00.658	1754.8 16.1	18 32 23 39 16 51 72 06 11 82 34 23	198 31 17 219 15 10 252 03 27 262 33 16	Angel I. Peak 2 Bluff Point 2 California Point 2 Red Rock	8263.4 6350.5 6823.5 2657.5	3.91716 3.80281 3.83401 3.42448
Whitewashed rock on point 1900	37 55 48.216 122 23 58.337	1486.6 1424.7	19 32 00 41 15 49 74 24 12 88 24 10	199 30 52 221 14 05 254 21 27 268 23 02	Angel I. Peak 2 Bluff Point 2 California Point 2 Red Rock	8028.0 6182.4 6800.6 2693.1	3.90461 3.79116 3.83255 3.43025
Red Rock southernmost rock 1899	37 55 40.653 122 25 45.977	1253.2 1123.0	0 24 52 18 08 57 111 14 35 183 05 54 200 14 28	180 24 50 198 08 20 291 12 38 3 05 59 20 14 48	Angel I. Peak 2 Bluff Point 2 Point San Quentin Point San Pablo 2 Molate Point 2	7333.5 4646.1 4985.7 4151.0 2293.8	3.86531 3.66709 3.69773 3.61815 3.36055
Angel I. E. Point 1895	37 52 18.112 122 25 51.670	558.4 1262.8	66 32 02.3 69 13 23.5 87 54 08.4 98 31 07.3 105 22 39.6 118 06 06.4	246 31 03.9 249 10 56.2 267 52 52.2 278 30 28.7 285 21 57.5 298 05 38.8	Belvedere Point Richardson East Peninsula Hill 2 Tiburon Gate Tower Ridge Rock Reservoir	2533.0 6272.2 3035.8 1553.6 1738.5 1243.2	3.403634 3.797423 3.482276 3.191352 3.240166 3.094533
Angel I. Middle Point 1895	37 52 07.463 122 26 16.690	230.1 407.9	41 03 08.2 68 19 19.0 70 08 32.5 95 07 08.5 121 07 01.6 126 32 50.1 152 02 14.2	221 01 51.8 248 18 36.0 250 06 20.6 275 06 07.7 301 06 38.4 306 32 23.4 332 02 02.0	Point Cavallo 2 Belvedere Point Richardson East Peninsula Hill 2 Tiburon Gate Tower Ridge Rock Reservoir	4634.5 1842.2 5584.7 2431.9 1080.5 1325.3 1034.6	3.666002 3.265335 3.747002 3.385954 3.033606 3.122326 3.014786
Alcatraz Rock 1895	37 49 41.046 122 25 32.989	1265.5 806.7	143 35 05 144 03 10 174 21 47	323 33 38 324 02 01 354 21 38	Peninsula Hill 2 Belvedere Point Angel I. Peak 2	5879.6 4735.9 3772.0	3.76935 3.67540 3.57657
Lime Pt. fog-station 1892	37 49 33.120 122 28 39.274	1021.1 960.5	9 24 55.6 22 33 39.0 28 24 00.3 29 58 58.0 358 03 08.7	189 24 39.2 202 32 52.8 208 22 56.2 209 57 51.7 178 03 11.5	Spring Valley Point Lobos 2 Cement Under Cement Rob 3	3992.1 4805.4 5385.3 5300.0 3284.7	3.601197 3.681732 3.731213 3.724280 3.516493
Needles (Lime Rocks) 1892	37 49 46.505 122 28 38.646	1433.7 945.1	206 41 12.0 342 34 55.6 358 15 56.8 358 30 29.2	26 41 22.7 162 35 26.5 178 15 59.6 178 30 31.6	Point Cavallo 2 Presidio Hill Rob 2 Rob 3	951.8 4122.2 3723.5 3696.7	2.978541 3.615127 3.570956 3.567815
Yellow Bluff tip 1892	37 50 12.71 122 28 15.44	391.9 377.4	352 00 11 5 58 42	172 00 27 185 58 30	Presidio Hill Rob 3	4787.7 4528.0	3.68013 3.65591
Richmond Rock 1897	37 54 35.827 122 23 24.398	1104.5 596.0	25 48 20.7 33 22 33.2 63 47 43.2 93 08 03.6 115 10 03.1 121 29 38.9 164 28 54.3 295 12 41.4	205 47 16.7 213 21 05.1 243 45 39.5 273 04 57.6 295 06 38.8 301 28 10.1 344 28 28.7 115 13 59.4	Quarry Angel I. Peak 2 Bluff Point 2 California Point 2 Point San Quentin Red Rock High Hill Brooks I.	5850.0 6387.3 5468.9 7390.3 8954.0 4129.1 3772.2 3428.6	3.767159 3.805316 3.737898 3.868661 3.952015 3.615855 3.576594 3.535120

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Point Richmond tip	37 54 35.48	1093.8	26 11 30	206 10 18	Angel I. SE., 2	6521.5	3.81435
1895	122 23 24.61	601.2	25 48 24	205 47 20	Quarry	5838.1	3.76627
			33 23 23	213 21 55	Angel I. Peak 2	6375.4	3.80451
			287 56 17	107 57 30	North Brooks	3052.2	3.48462
			295 00 46	115 02 03	Brooks I.	3428.8	3.53514
			348 47 44	168 48 38	Yerba Buena I.	11273.0	4.05204
Projection S. Pt. Richmond	37 54 35.500	1094.4	296 24 06	116 25 19	Brooks I.	3261.9	3.51347
	122 23 17.024	415.8	34 45 28	214 43 55	Angel I. Peak 2	6479.9	3.81157
1899			64 41 58	244 39 49	Bluff Point 2	5626.9	3.75027
End of wharf	37 54 41.083	1266.6	307 16 01	127 16 54	Brooks I.	2679.9	3.42812
1899	122 22 44.722	1092.4	39 12 38	219 10 45	Angel I. Peak 2	7092.5	3.85080
			66 19 34	246 17 06	Bluff Point 2	6416.2	3.80728
Brooks Rock	37 53 45.988	1417.8	55 00 45.0	234 58 31.2	Quarry	6502.8	3.813101
1895	122 21 30.629	748.4	58 54 40.0	238 52 02.0	Angel I. Peak 2	7350.6	3.866323
			83 29 49.8	263 26 36.3	Bluff Point 2	7736.6	3.888549
			120 23 50.1	300 21 11.5	Red Rock	7303.2	3.863514
			191 30 36.2	11 30 39.2	North Brooks	597.4	2.776230
			256 48 15.9	76 48 24.0	Brooks I.	331.1	2.519956
			287 07 37.3	107 09 17.2	Judson Point	4157.9	3.618876
Brooks I. S. tip	37 53 39.775	1226.2	7 58 08	187 57 36	Yerba Buena I.	9432.1	3.97461
1895	122 21 01.604	39.2	57 02 42	237 00 03	Angel I. SE. 2	7596.8	3.88063
			59 38 17	239 35 46	Quarry	6996.6	3.84489
			62 46 34	242 43 39	Angel I. Peak 2	7877.0	3.89636
Fort Rock	37 48 41.50	1279.4	31 09 49	211 09 00	Cemetery	3754.7	3.57457
1892	122 28 37.43	915.6	41 55 40	221 54 33	Under Cement	4031.6	3.60548
Blackhead Rock *	37 47 22.553	695.3	0 56 33.0	180 56 32.6	Cement	712.2	2.852625
1892	122 30 23.470	574.3	9 55 34.2	189 55 31.7	Under Cement	574.3	2.759170
			254 23 47.2	74 24 53.8	Rob 3	2762.7	3.441332
			267 21 41.8	87 22 29.2	Spring Valley	1898.4	3.278386
Fort Pt. Rock	37 48 30.20	931.0	16 56 34	196 56 19	Spring Valley	2089.0	3.31993
1887	122 28 41.08	1004.9	35 46 08	215 45 23	Point Lobos 2	3078.4	3.48833
			41 24 52	221 24 00	Point Lobos 3	3140.3	3.49697
			44 29 34	224 28 29	Under Cement	3717.1	3.57020
			123 37 54	303 36 57	West Diablo	2667.8	3.42615
			136 58 11	316 57 34	East Diablo	2185.7	3.33960
			174 35 22	354 35 17	New Lime Point	2161.0	3.33466
			188 38 51	8 39 03	Point Cavallo 2	3239.8	3.51052
Spring Valley Rock	37 47 23.40	721.5	61 47 35	241 47 14	Point Lobos 2	928	2.96746
1892	122 29 21.21	518.9	76 42 12	256 41 45	Point Lobos	1081	3.03380
			172 03 23	352 03 10	East Diablo	3692	3.56730
			190 27 38	10 27 57	New Lime Point	4282	3.63164
			237 47 27	57 47 56	Rob 3	1344	3.12853
			239 06 53	59 07 22	Rob 2	1345	3.12861
			260 42 29	80 42 39	Spring Valley	378	2.57734
Cone Rock (Sail Rock)	37 51 51.790	1596.6	60 42 32	240 41 28	Richardson East	2892.3	3.46125
1895	122 28 08.359	204.3	123 38 42	303 37 38	Strawberry Hill 2	3050.6	3.48439
			203 41 32	23 41 40	Peninsula Hill 2	764.3	2.88325
			274 36 40	94 38 06	Angel I. Peak 2	3438.6	3.53638
			280 58 24	100 58 49	Belvedere Point	1036.8	3.01569
Shore Cone	37 49 29.812	919.1	296 33 50	116 34 09	West Diablo	806.4	2.90654
1887	122 30 41.395	1012.4	315 49 17	135 50 35	Rob 2	4471.1	3.65041
			347 37 04	167 37 28	Point Lobos	4244.6	3.62784
			348 19 24	168 19 46	Point Lobos 3	4291.5	3.63261
			354 44 17	174 44 28	Cement	4655.2	3.66794
Tick Rock †	37 49 17.34	534.6	356 31 54	176 32 00	Point Lobos 2	3958.7	3.59755
1892	122 30 04.41	107.8	7 50 36	187 50 22	Under Cement	4143.5	3.61737
Bonita Wash Rock †*	37 48 57.12	1761.0	319 40 02	139 41 13	Point Lobos 2	4365.0	3.63998
1892	122 31 50.08	1225.0	329 52 15	149 53 06	Under Cement	4024.7	3.60473
South Seal Rock *	37 46 43.608	1344.4	188 57 34	8 57 56	Diablo Hill	5527.0	3.74249
1877	122 30 56.790	1389.8	192 58 40	12 59 08	West Diablo	4888.5	3.68918
			200 30 52	20 31 38	East Diablo	5214.7	3.71723
			238 42 03	58 42 23	Cement	940.5	2.97338
			304 14 04	124 15 47	Black Ridge	4922.4	3.69218
			307 50 23	127 52 12	Black Ridge 2	5495.9	3.74004
			350 40 40	170 41 07	Black Bluff	6668.7	3.82404

* This point is in the area of the 1906 earthquake disturbance. † No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
North Seal Rock *	37 46 50.722	1563.8	190 13 27	10 13 50	Diablo Hill	5324.8	3.72630
1887	122 31 00.240	5.9	194 34 57	14 35 26	West Diablo	4695.5	3.67168
			202 17 12	22 18 00	East Diablo	5041.3	3.70254
Helmet Rock	37 48 07.58	233.7	14 38 39	194 38 32	Spring Valley	1344.6	3.12860
1887	122 28 52.07	1273.8	40 22 04	220 21 26	Point Lobos 2	2303.0	3.37347
			47 29 26	227 28 41	Point Lobos 3	2453.2	3.38974
			47 37 07	227 36 23	Point Lobos	2389.2	3.37825
			151 57 01	331 56 31	East Diablo	2600.5	3.41505
			181 18 20	1 18 22	New Lime Point	2849.6	3.45478
			190 57 57	10 58 17	Point Cavallo 2	3973.0	3.59912
Pescada Landing fish-house, flagstaff	37 52 11.578	356.9	5 03 37.9	185 03 29.8	Point Cavallo 2	3636.5	3.560685
1895	122 28 08.045	196.6	29 01 05.9	209 00 26.9	Halfway	3197.9	3.504864
			51 19 36.1	231 18 32.5	Richardson East	3241.0	3.510676
			112 58 38.4	292 57 34.4	Strawberry Hill 2	2766.8	3.441979
Benjamin's yellow house, flagstaff	37 51 53.852	1660.2	341 37 41.3	161 37 43.5	Belvedere Point	275.0	2.439367
1895	122 27 30.270	739.9	22 01 44.5	202 01 13.3	Point Cavallo 2	3318.0	3.520870
			66 49 39.4	246 48 12.7	Richardson East	3756.9	3.574829
			135 34 00.4	315 33 44.8	Peninsula Hill 2	891.1	2.949938
Belvedere Rock	37 51 43.94	1354.6	275 00 09	95 00 36	Angel I. NW. 2	1073.7	3.03087
1895	122 27 26.82	655.6	25 37 43	205 37 10	Point Cavallo 2	3072.2	3.48745
			71 39 52	251 38 23	Richardson East	3727.4	3.57141
			118 31 57	298 30 28	Strawberry Hill 2	4046.2	3.60705
			183 00 03	3 00 03	Belvedere Point	44.8	1.65123
			270 49 23	90 50 24	Angel I. Peak 2	2412.2	3.38242
Angel I. wharfhouse, W. gable	37 51 35.088	1081.7	122 19 39.5	302 18 51.4	Peninsula Hill 2	2272.2	3.356434
1895	122 26 37.241	910.4	45 30 12.8	225 29 09.1	Point Cavallo 2	3562.6	3.551767
			79 16 53.2	259 14 54.0	Richardson East	4834.6	3.684360
			104 42 45.6	284 42 15.2	Belvedere Point	1250.6	3.097108
Tiburon Rock	37 52 20.49	631.7	27 10 18	207 09 27	Point Cavallo 2	4380.4	3.64151
1895	122 26 59.36	1450.8	31 42 56	211 42 39	Belvedere Point	1272.3	3.10460
			61 21 20	241 19 34	Richardson East	4796.6	3.68093
			82 21 50	262 21 14	Peninsula Hill 2	1391.6	3.14353
			303 43 17	123 44 00	Angel I. Peak 2	2093.0	3.32076
Lobos Rock *	37 47 15.22	469.2	198 18 22	18 18 55	East Diablo	4117.7	3.61465
1887	122 30 34.95	855.2	251 45 47	71 47 02	Rob 3	3097.3	3.49099
			252 19 14	72 20 28	Rob 2	3104.8	3.49204
			269 43 28	89 43 47	Point Lobos	752.5	2.87652
			273 31 18	93 31 37	Point Lobos 3	710.2	2.85141
			331 00 49	151 00 56	Cement	555.6	2.74479
			331 49 10	151 49 15	Under Cement	385.3	2.58583
Pyramid Rock *	37 47 23.43	722.3	194 39 25	14 39 48	East Diablo	3779.1	3.57739
1887	122 30 21.17	518.0	208 03 19	28 04 14	New Lime Point	4770.8	3.67859
			254 37 38	74 38 44	Rob 3	2701.2	3.43155
			255 15 23	75 16 27	Rob 2	2710.3	3.43301
			268 07 15	88 08 01	Spring Valley	1841.0	3.26506
			300 59 58	120 00 08	Point Lobos	484.4	2.68522
			308 36 29	128 36 38	Point Lobos 3	475.6	2.67721
			5 15 40	185 15 38	Cement	742.3	2.87056
			14 41 10	194 41 06	Under Cement	607.2	2.78330
Mile Rock *	37 47 35.21	1085.5	201 16 46	21 17 18	East Diablo	3533.9	3.54826
1887	122 30 34.51	844.3	263 07 54	83 09 08	Rob 3	2952.1	3.47013
			277 57 13	97 58 08	Spring Valley	2187.6	3.33996
			309 33 18	129 33 36	Point Lobos	962.0	2.98318
			313 23 16	133 23 34	Point Lobos 3	960.6	2.98255
			346 48 16	166 48 23	Cement	1132.2	3.05392
			349 50 55	169 51 00	Under Cement	971.1	2.98727
Little Mile Rock *	37 47 34.43	1061.4	200 29 11	20 29 42	East Diablo	3541.0	3.54912
1887	122 30 32.74	801.0	213 08 05	33 09 07	New Lime Point	4622.7	3.66490
			262 33 43	82 34 55	Rob 3	2912.3	3.46423
			263 06 58	83 08 10	Rob 2	2925.2	3.46616
			277 28 44	97 29 37	Spring Valley	2141.5	3.33072
			310 07 32	130 07 48	Point Lobos	913.4	2.96067
			314 09 43	134 09 59	Point Lobos 3	912.8	2.96037
			348 42 59	168 43 04	Cement	1099.6	3.04123
			352 11 17	172 11 20	Under Cement	940.7	2.97344
Double White	37 49 31.65	975.7	338 05 00	158 05 45	Point Lobos 2	4734.6	3.67528
1892	122 31 06.84	167.3	340 41 18	160 41 56	Point Lobos 3	4503.2	3.65352
			347 23 28	167 23 55	Cement	4808.2	3.68198

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Bonita Rock*	37 48 53.29	1642.9	232 17 10	52 17 56	Diablo Hill	2389.4	3.37829
1887–92	122 31 38.88	951.0	250 12 17	70 13 10	West Diablo	2260.9	3.35428
			250 50 01	70 51 44	New Lime Point	4387.6	3.64223
			294 29 59	114 31 52	Rob 3	5067.1	3.70476
			305 54 32	125 56 06	Spring Valley	4619.4	3.66459
			321 31 04	141 32 08	Point Lobos 2	4099.9	3.61277
			322 30 07	142 31 04	Point Lobos	3806.0	3.58047
			323 27 10	143 28 06	Point Lobos 3	3817.4	3.58177
			332 24 44	152 25 30	Cement	3959.5	3.59764
			332 33 27	152 34 11	Under Cement	3789.3	3.57856
Bonita Bluff 2†	37 49 23.53	725.4	275 15 30	95 16 15	West Diablo	1818.7	3.25975
1887	122 31 25.95	634.7	301 10 27	121 12 40	Presidio Hill	6226.4	3.79424
			305 28 40	125 30 25	Rob 3	5144.8	3.71137
			305 36 35	125 38 20	Rob 2	5173.4	3.71378
			316 45 22	136 46 47	Spring Valley	4999.5	3.69893
			331 38 58	151 39 54	Point Lobos 2	4706.3	3.67268
			333 09 07	153 09 57	Point Lobos	4429.5	3.64635
			341 08 24	161 09 02	Cement	4693.6	3.67151
Shore Cone Rock	37 49 28.70	884.8	315 17 19	135 18 36	Rob 3	4426.7	3.64608
1887	122 30 42.01	1027.3	328 16 43	148 17 42	Spring Valley	4469.3	3.65024
			344 54 51	164 55 20	Point Lobos 2	4455.0	3.64885
			354 30 54	174 31 04	Cement	4622.4	3.66487
			355 26 58	175 27 06	Under Cement	4469.0	3.65021
White Top Rock	37 49 26.97	831.5	305 28 50	125 29 00	West Diablo	470.6	2.67262
1887	122 30 27.57	674.3	318 14 27	138 15 36	Rob 3	4146.0	3.61763
			331 57 22	151 58 12	Spring Valley	4247.1	3.62809
			349 15 12	169 15 33	Point Lobos 2	4324.1	3.63590
			351 58 42	171 58 56	Point Lobos	4098.5	3.61262
			352 40 02	172 40 15	Point Lobos 3	4139.4	3.61694
			358 52 59	178 53 02	Cement	4548.9	3.65791
			359 58 55	179 58 55	Under Cement	4401.7	3.64362
Grayback white tip	37 49 22.70	699.8	305 43 20	125 45 03	Rob 3	5070.5	3.70505
1892	122 31 22.97	561.7	332 17 32	152 18 27	Point Lobos 2	4649.3	3.66739
			334 38 09	154 38 56	Point Lobos 3	4397.5	3.64321
			341 53 27	161 54 03	Cement	4646 3	3.66711
			342 22 13	162 22 47	Under Cement	4480.3	3.65131
Point Diablo tip	37 49 13.30	410.0	228 21 28	48 21 36	East Diablo	404.4	2.60677
1887	122 29 54.42	1331.0	242 38 32	62 39 11	New Lime Point	1790.1	3.25287
			0 04 17	180 04 16	Point Lobos 2	3826.7	3.58283
			3 45 41	183.45 35	Point Lobos	3644.8	3.56167
			4 23 19	184 23 11	Point Lobos 3	3694.9	3.56760
			9 55 49	189 55 31	Cement	4189.3	3.62214
			11 29 58	191 29 38	Under Cement	4061.6	3.60870
Under Rock	37 49 30.82	950.2	338 20 44	158 21 17	Rob 2	3483.9	3.54207
1887	122 29 26.59	650.2	338 26 16	158 26 48	Rob 3	3453.4	3.53825
			352 34 00	172 34 13	Spring Valley	3900.0	3.59107
			8 55 38	188 55 21	Point Lobos 2	4420.4	3.64546
			12 51 15	192 50 52	Point Lobos 3	4332.8	3.63677
			12 25 32	192 25 10	Point Lobos	4277.1	3.63115
			16 44 28	196 43 53	Cement	4873.0	3.68780
			18 15 19	198 14 42	Under Cement	4759.6	3.67757
			54 22 22	234 22 13	East Diablo	465.9	2.66830
Bird Point*	37 49 26.46	815.7	321 31 07	141 32 32	Point Lobos 2	5405.9	3.73287
1892	122 32 12.09	295.7	322 57 39	142 58 56	Point Lobos 3	5122.8	3.70951
			329 43 02	149 44 09	Cement	5247.8	3.71998
			329 44 07	149 45 12	Under Cement	5077.4	3.70564
Whale Point	37 49 33.93	1046.0	354 44 50	174 44 57	Rob 2	3348.1	3.52480
1887	122 28 46.57	1138.9	354 59 14	174 59 20	Rob 3	3320.3	3.52118
			6 49 43	186 49 31	Spring Valley	3991.4	3.60113
			20 27 46	200 27 05	Point Lobos 2	4763.1	3.67789
			24 13 08	204 12 20	Point Lobos 3	4736.7	3.67548
			23 58 08	203 57 20	Point Lobos	4675.8	3.66986
			26 34 59	206 33 59	Cement	5325.0	3.72632
			28 09 16	208 08 13	Under Cement	5235.2	3.71893
			74 51 53	254 51 18	East Diablo	1406.2	3.14805

* This point is in the area of the 1906 earthquake disturbance. † See p. 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Grayback	37 49 29.77	917.8	309 35 07	129 36 43	Rob 3	4988.2	3.69794
1892	122 31 11.84	289.5	336 26 47	156 27 35	Point Lobos 2	4728.2	3.67470
			338 58 17	158 58 57	Point Lobos 3	4490.9	3.65233
			345 48 33	165 49 02	Cement	4780.0	3.67943
			346 24 52	166 25 18	Under Cement	4617.0	3.66436
Cluster Rock	37 49 25.22	777.5	333 29 52	153 30 38	Spring Valley	4128.3	3.61577
1892	122 30 21.25	519.7	354 43 46	174 43 55	Point Lobos 3	4068.8	3.60947
			351 10 03	171 10 19	Point Lobos 2	4244.6	3.62784
			0 50 24	180 50 23	Cement	4494.6	3.65269
			2 01 04	182 01 01	Under Cement	4350.4	3.63853
Diablo Diamond	37 49 13.87	427.6	322 44 27	142 45 18	Rob 3	3378.7	3.52875
1892	122 29 58.32	1426.4	339 02 40	159 03 13	Spring Valley	3581.7	3.55409
			358 39 07	178 39 10	Point Lobos 2	3845.6	3.58496
			2 53 57	182 53 52	Point Lobos 3	3706.6	3.56897
			8 36 21	188 36 05	Cement	4191.4	3.62236
			10 07 57	190 07 39	Under Cement	4061.1	3.60864
E. Diablo E. tip	37 49 23.09	711.8	332 10 42	152 11 20	Rob 3	3362.0	3.52660
1892	122 29 38.85	950.2	347 30 00	167 30 20	Spring Valley	3717.1	3.57020
			9 27 25	189 27 08	Point Lobos 3	4040.8	3.60647
			13 59 41	193 59 14	Cement	4263.7	3.65932
			15 32 35	195 32 06	Under Cement	4444.4	3.64781
E. Diablo, W. tip	37 49 20.54	633.2	329 57 19	149 58 01	Rob 3	3344.1	3.52428
1892	122 29 43.15	1055.3	345 37 41	165 38 05	Spring Valley	3665.1	3.56409
			3 57 57	183 57 50	Point Lobos 2	4059.8	3.60850
			8 08 14	188 08 01	Point Lobos 3	3947.1	3.59628
			12 55 40	192 55 15	Cement	4462.8	3.64961
			14 28 58	194 28 31	Under Cement	4341.3	3.63762
Second Under Rock	37 49 28.10	866.3	336 16 15	156 16 51	Rob 3	3417.0	3.53364
1892	122 29 30.91	756.0	350 50 07	170 50 23	Spring Valley	3832.7	3.58350
			7 42 48	187 42 35	Point Lobos 2	4322.4	3.63572
			11 42 29	191 42 09	Point Lobos 3	4228.5	3.62619
			15 48 41	195 48 09	Cement	4763.1	3.67789
			17 20 20	197 19 46	Under Cement	4647.6	3.66723
Third Under Rock	37 49 24.92	768.3	333 44 26	153 45 04	Rob 3	3378.5	3.52872
1892	122 29 35.81	875.8	348 47 37	168 47 55	Spring Valley	3757.0	3.57484
			6 16 39	186 16 29	Point Lobos 2	4210.2	3.62430
			10 21 03	190 20 46	Point Lobos 3	4109.1	3.61375
			14 43 06	194 42 37	Cement	4636.8	3.66622
			16 15 38	196 15 07	Under Cement	4519.0	3.65504
Andrew Rock	37 49 36.13	1113.9	344 23 54	164 24 18	Rob 3	3504.8	3.54466
1892	122 29 13.24	323.8	357 28 19	177 28 25	Spring Valley	4035.2	3.60586
			12 35 54	192 35 29	Point Lobos 2	4642.5	3.66675
			16 23 18	196 22 46	Point Lobos 3	4573.9	3.66029
			19 42 29	199 41 46	Cement	5130.9	3.71019
			21 12 29	201 11 44	Under Cement	5024.2	3.70107
Under High tip	37 49 33.98	1047.6	339 05 03	159 05 35	Rob 3	3542.7	3.54934
1892	122 29 26.41	645.9	352 48 38	172 48 52	Spring Valley	3996.4	3.60167
			8 47 27	188 47 10	Point Lobos 2	4517.5	3.65490
			12 37 43	192 37 20	Point Lobos 3	4428.9	3.64630
			16 27 56	196 27 21	Cement	4967.8	3.69616
			17 56 37	197 56 00	Under Cement	4853.8	3.68608
Point 3	37 49 36.04	1111.1	346 59 37	166 59 56	Rob 3	3461.5	3.53927
1892	122 29 06.55	160.2	359 47 42	179 47 42	Spring Valley	4028.3	3.60512
			14 33 42	194 33 12	Point Lobos 2	4678.0	3.67006
			18 20 44	198 20 07	Point Lobos 3	4619.9	3.66463
			21 25 16	201 24 28	Cement	5185.6	3.71480
			22 56 23	202 55 33	Under Cement	5082.8	3.70610
Bird Lime Pt.	37 49 37.17	1145.9	347 58 58	167 59 16	Rob 3	3484.0	3.54208
1892	122 29 04.36	106.6	0 33 14	180 33 13	Spring Valley	4063.3	3.60888
			15 05 08	195 04 37	Point Lobos 2	4725.5	3.67445
			18 50 11	198 49 33	Point Lobos 3	4670.0	3.66932
			21 49 43	201 48 54	Cement	5237.8	3.71915
			23 20 23	203 19 32	Under Cement	5136.2	3.71064
North Pt. Rock*	37 50 02.68	82.6	320 42 12	140 44 01	Point Lobos 2	6911.0	3.83954
1892	122 32 53.49	1308.0	321 47 00	141 48 42	Point Lobos 3	6625.7	3.82123
			327 00 24	147 01 53	Under Cement	6559.8	3.81689
			327 03 41	147 05 12	Cement	6730.2	3.82803

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*metets*	
Point 2	37 49 34.16	1053.1	351 06 52	171 07 05	Rob 3	3355.0	3.52569
1892	122 28 55.89	1367.0	3 33 08	183 33 02	Spring Valley	3977.9	3.59965
			17 49 23	197 48 47	Point Lobos 2	4695.0	3.67164
			21 37 16	201 36 33	Point Lobos 3	4654.5	3.66787
			24 18 49	204 17 55	Cement	5233.5	3.71879
			25 52 22	205 51 26	Under Cement	5137.8	3.71078
H	37 49 36.06	1111.7	353 23 33	173 23 43	Rob 3	3396.1	3.53098
1892	122 28 50.68	1239.5	5 18 07	185 17 58	Spring Valley	4046.3	3.60706
			19 03 33	199 02 53	Point Lobos 2	4791.2	3.68044
			22 47 14	202 46 27	Point Lobos 3	4757.0	3.67733
			25 18 02	205 17 04	Cement	5340.2	3.72756
			26 50 43	206 49 43	Under Cement	5247.1	3.71992
Lime Pt. Rock (Cross)	37 49 32.99	1017.1	356 43 32	176 43 36	Rob 3	3284.2	3.51643
1892	122 28 42.38	1036.5	8 20 42	188 20 27	Spring Valley	3976.5	3.59950
			21 44 13	201 43 28	Point Lobos 2	4773.2	3.67881
			25 29 18	205 28 26	Point Lobos 3	4753.7	3.67703
			27 42 14	207 41 11	Cement	5346.3	3.72805
			29 17 14	209 16 09	Under Cement	5259.1	3.72091
Bonita Outer Rock *	37 48 53.85	1660.1	305 05 30	125 07 08	Spring Valley	4743.1	3.67606
1892	122 31 44.58	1090.4	320 10 39	140 11 47	Point Lobos 2	4201.4	3.62339
			321 57 58	141 58 58	Point Lobos 3	3915.8	3.59282
			330 46 31	150 47 21	Cement	4041.0	3.60649
			330 50 44	150 51 31	Under Cement	3870.7	3.58779
Shag rock	37 50 05.876	181.1	24 17 31.6	204 16 40.4	Presidio Hill	4970.3	3.696380
1851–95	122 26 24.641	602.6	36 14 44.2	216 13 24.9	Rob 2	5354.6	3.728726
			36 33 17.2	216 31 57.5	Rob 3	5343.1	3.727793
			77 18 12.1	257 16 43.4	New Lime Point	3629.3	3.559828
			95 05 16.6	275 04 05.2	Point Cavallo 2	2860.5	3.456448
			134 19 43.6	314 17 36.3	Strawberry Hill 2	7093.5	3.850863
			150 40 20.6	330 39 24.8	Peninsula Hill 2	4548.6	3.657876
San Francisco:							
Ladies Pavilion, flagstaff †*	37 46 11.80	363.8	191 59 57	12 00 05	Cement	1502	3.17673
1892	122 30 36.71	898.5	214 49 49	34 50 14	Cemetery	1709	3.23268
McLain watertank tower*	37 47 35.862	1105.6	322 06 50.6	142 08 57.0	Stony Hill	8219.2	3.914828
1894	122 26 27.989	684.8	6 21 08.5	186 20 56.3	North Twin	4425.1	3.645926
			92 45 56.0	272 45 06.8	Presidio Hill	1965.1	3.293376
Hopkins Art Institute tower, flagstaff *	37 47 30.963	954.5	37 41 40.5	217 40 18.4	North Twin	5366.3	3.729677
1877–97	122 24 33.952	830.6	51 25 38.1	231 23 25.4	Black Ridge	6781.9	3.831354
			83 33 30.4	263 29 55.8	Cement	8618.9	3.935452
			85 08 03.7	265 04 47.1	Point Lobos 2	7874.9	3.896247
			92 58 28.9	272 56 29.7	Presidio Hill	4759.3	3.677543
			197 52 48.8	17 52 58.6	Telegraph Hill 2	1268.7	3.103352
			242 24 55.5	62 26 32.9	Yerba Buena I.	4385.2	3.641989
			330 50 49.5	150 52 31.6	Point Avisadero 2	8370.2	3.922738
			340 24 44.9	160 25 41.4	Stony Hill	6726.3	3.827776
Selby shot-tower *	37 47 19.881	612.9	338 05 26.6	158 06 36.6	Point Avisadero 2	7510.4	3.875666
1881–97	122 23 41.802	1022.8	350 44 07.5	170 44 32.0	Stony Hill	6074.9	3.783540
			49 26 05.5	229 23 11.6	North Twin	6001.3	3.778246
			122 39 44.0	302 39 02.1	Russian Hill	1991.4	3.299168
			150 13 32.7	330 13 10.3	Telegraph Hill 2	1784.7	3.251564
			159 08 40.9	339 07 23.2	Angel I. Peak 2	8674.9	3.938265
			227 44 59.9	47 46 05.3	Yerba Buena I.	3527.4	3.547461
Selby smelting-works, chimney *	37 48 27.790	856.7	125 07 52.3	305 05 55.5	Point Cavallo 2	5697.4	3.755677
1895	122 25 10.609	259.5	149 59 27.6	329 57 46.3	Peninsula Hill 2	8072.5	3.907008
			151 21 40.9	331 20 17.4	Belvedere Point	6942.0	3.841486
			171 19 22.2	351 18 59.4	Angel I. Peak 2	6082.0	3.784045
			180 28 02.1	0 28 03.3	Quarry	6080.1	3.783912
			266 39 40.4	86 41 40.3	Yerba Buena I.	4791.5	3.680473
Telegraph Hill, U. S. time-ball flagstaff *	37 48 11.878	366.2	169 27 00.9	349 26 30.2	Quarry	6683.5	3.825006
1894–5	122 24 18.520	453.0	203 05 25.4	23 07 16.5	Brooks I.	11281.4	4.052364
			257 39 09.0	77 40 36.9	Yerba Buena I. 2	3593.3	3.555494
			336 39 16.0	156 40 48.8	Point Avisadero 2	9335.9	3.970154
			346 07 26.3	166 08 13.5	Stony Hill	7827.0	3.893596
			355 40 53.3	175 41 20.7	Sierra Point	14323.0	4.156033
			33 35 55.0	213 34 23.6	North Twin	6612.3	3.820350
			161 22 54.5	341 21 59.7	Angel I. Peak 2	6862.3	3.836468

* This point is in the area of the 1906 earthquake disturbance. † No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
San Francisco—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Butchertown smokestack * 1894	37 44 44.192 122 23 08.925	1362.4 218.5	317 23 24.6 351 46 06.7 99 29 22.8	137 24 14.5 171 46 11.0 279 27 08.6	Point Avisadero 2 Stony Hill North Twin	2947.2 1208.2 5437.1	3.469412 3.082141 3.735369
California Pressed Brick Co., stack * 1895	37 48 18.268 122 26 39.618	563.2 969.2	145 11 20.3 169 46 42.0 191 17 01.1	325 10 18.0 349 46 13.1 11 17 32.7	Point Cavallo 2 Belvedere Point Angel I. Peak 2	4349.6 6488.7 6430.3	3.638448 3.812157 3.808229
Fort Point wharf * 1895	37 48 32.081 122 28 06.924	989.0 169.4	158 19 08.0 173 40 56.2 182 16 18.8 189 21 45.6 209 58 43.6 269 03 10.2	338 18 28.4 353 40 47.5 2 16 25.7 9 22 10.4 30 00 08.8 89 06 58.2	Halfway Point Cavallo 2 Peninsula Hill 2 Belvedere Point Angel I. Peak 2 Yerba Buena I.	4273.1 3164.2 6862.4 6040.3 6789.0 9097.5	3.630748 3.500260 3.836478 3.781056 3.831806 3.958924
Engineers warehouse * 1895	37 48 54.763 122 21 31.720	1688.3 775.9	106 15 42.6 108 20 35.9 121 14 46.8 123 17 10.8 129 35 13.6 129 32 19.4 134 43 24.2 182 12 27.0 207 17 16.3	286 11 00.7 288 15 29.4 301 11 09.2 303 13 15.4 309 32 36.4 309 29 58.2 314 41 11.2 2 12 35.8 27 18 56.7	Halfway Richardson East Belvedere Point Peninsula Hill 2 Angel I. Peak 2 Angel I. SE. 2 Quarry Brooks I. Judson Point	11709.9 12873.6 10150.0 11229.6 8133.5 7310.9 7460.7 9061.0 8725.2	4.068552 4.109701 4.006468 4.050365 3.910278 3.863972 3.872781 3.957178 3.940778
Ocean House, flagstaff † 1877–1892	37 44 21.818 122 30 20.400	672.4 499.5	178 58 36.7 186 51 43.8 243 15 24.4 253 50 26.0 355 06 36.4	358 58 34.5 6 51 58.1 63 16 43.9 73 51 52.3 175 06 41.1	Cement Cemetery Black Ridge Black Ridge 2 Black Bluff	4860.8 4827.9 3559.6 3591.3 2217.3	3.686711 3.683757 3.551399 3.555257 3.345829
Sutro's stable, red spire † 1892	37 46 38.016 122 30 28.742	1172.0 703.4	190 03 53.4 217 05 02.0 232 43 58.6	10 03 56.3 37 05 06.3 52 44 18.1	Cement Sand Cemetery	671.3 290.0 981.3	2.826919 2.462331 2.991812
Sutro's Observatory, tower † 1892	37 46 41.629 122 30 40.507	1283.4 991.3	216 24 02.1 245 41 18.2 255 28 11.2	36 24 12.2 65 41 44.9 75 28 22.8	Cement Cemetery Sand	682.8 1172.9 478.0	2.834303 3.069243 2.679450
Baker Beach, windmill * 1892	37 47 47.364 122 28 51.812	1460.2 1267.6	27 03 50.9 60 18 56.8	207 03 42.2 240 18 11.4	Spring Valley Point Lobos 3	761.1 2088.9	2.881440 3.319927
Golden Gate Park, N. base * 1889	37 46 13.609 122 27 21.103	419.6 516.5	2 24 35.0 33 15 40.1	182 24 33.6 213 15 09.8	Blue Mountain Black Ridge	1319.6 2206.8	3.120445 3.343777
Children's playhouse * 1889	37 46 07.352 122 27 27.168	226.6 664.9	32 43 33.9 217 34 24.4 355 16 40.7	212 43 07.3 37 34 28.1 175 16 43.0	Black Ridge Golden Gate Park, N. Base Blue Mountain	1964.2 243.4 1129.4	3.293192 2.386350 3.052829
Azimuth Mark, Golden Gate Park * 1889	37 45 30.799 122 27 23.427	949.5 573.4	182 28 04.6 224 45 32.0	2 28 06.0 44 45 32.0	Golden Gate Park, N. Base Blue Mountain	1321.1 2.0	3.120933 0.302354
California Glueworks, flagstaff 1903	37 44 42.092 122 23 31.549	1297.6 772.4	65 56 02.9 143 33 59.3 212 18 20.7 250 19 49.9	245 55 24.0 323 33 50.3 32 18 32.0 70 20 02.2	Bernal Army Start Quarter	1704.9 605.1 844.8 522.6	3.231702 2.781844 2.926760 2.718152
Conservatory, Golden Gate Park * 1889	37 46 22.703 122 27 34.104	699.9 834.7	350 40 03.2 22 46 00.3 171 38 40.2	170 40 09.8 202 45 38.0 351 38 31.6	Blue Mountain Black Ridge Presidio Hill	1620.2 2305.3 2375.3	3.209579 3.362736 3.375726
Prayer Book Cross * 1894–1899	37 46 19.543 122 28 39.268	602.5 961.0	115 39 57.2 121 31 10.2 129 41 38.8 207 02 15.9	295 38 53.1 301 30 22.7 309 40 52.6 27 02 47.2	Cement Cemetery Point Lobos 2 Presidio Hill	2842.0 2226.4 2396.3 2748.0	3.453619 3.347611 3.379532 3.439012
Cogswell Monument * 1892–1900	37 47 09.460 122 29 51.694	291.6 1264.9	18 30 39.1 83 03 18.2 110 58 00.7 238 40 06.3 246 18 35.1 253 15 09.4	198 30 35.9 263 03 16.3 290 57 51.9 58 40 53.4 66 19 03.1 73 16 25.0	Cemetery Point Lobos 2 Point Lobos 3 Rob 3 Spring Valley Presidio Hill	395.7 72.1 374.3 2205.0 1221.9 3155.0	2.597372 1.858036 2.573258 3.343412 3.087027 3.499003

* This point is in the area of the 1906 earthquake disturbance.

† See p. 291.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
San Francisco—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Broderick Monument *	37 47 04.505	138.9	88 18 05.3	268 15 55.3	Cement	5197.3	3.715778
1877	122 26 51.648	1263.8	91 51 29.6	271 49 37.5	Point Lobos 2	4479.5	3.651234
			116 46 24.2	296 45 21.3	Rob	2816.9	3.449777
			127 29 16.1	307 28 41.5	Presidio Hill	1744.1	3.241572
Crocker's house, flagstaff *	37 47 31.948	984.9	83 09 04.3	263 05 36.4	Cement	8365.6	3.922497
1877	122 24 44.519	1089.3	84 44 24.3	264 41 14.3	Point Lobos 2	7620.0	3.881957
			92 45 26.9	272 43 34.4	Presidio Hill	4499.5	3.653169
Parker Monument *	37 46 45.822	1412.6	26 51 43.9	206 51 08.0	Black Ridge	3181.8	3.502668
1877	122 27 11.819	289.2	100 15 32.7	280 13 53.0	Point Lobos 2	4048.4	3.607279
			132 23 02.1	312 22 11.6	Rob	2736.7	3.437230
			151 27 45.6	331 27 23.4	Presidio Hill	1863.8	3.270409
Tetlow's SE. chimney †	37 46 41.276	1272.5	214 34 40.3	34 34 50.0	Cement	680.8	2.832991
1877	122 30 39.736	972.4	306 27 02.4	126 28 33.8	Black Ridge	4540.4	3.657093
			354 11 15.5	174 11 32.1	Black Bluff	6542.4	3.815740
Edison Light and Power Co., dynamo stack *	37 46 49.301	1519.9	351 49 00.3	171 49 18.5	Stony Hill	5104.9	3.707983
1894	122 23 31.535	771.7	58 22 44.2	238 20 44.0	North Twin	5647.7	3.751871
			215 28 00.6	35 28 59.7	Yerba Buena I. 2	4068.9	3.609475
Chronicle tower, flagstaff *	37 47 18.603	573.5	45 13 20.7	225 11 43.2	North Twin	5487.2	3.739349
1894	122 24 08.878	217.2	233 38 11.4	53 39 33.4	Yerba Buena I. 2	4066.1	3.609183
			333 26 31.8	153 27 58.4	Point Avisadero 2	7746.5	3.889105
			344 35 46.4	164 36 27.4	Stony Hill	6178.0	3.790851
Union St. powerhouse, stack *	37 47 58.548	1805.0	26 58 43.5	206 57 34.4	North Twin	5719.4	3.757354
1894	122 25 02.004	49.0	73 14 23.0	253 13 22.1	Heights	2534.5	3.403899
			81 33 14.3	261 31 32.2	Presidio Hill	4111.1	3.613961
			148 07 15.8	328 07 11.3	Reservoir	329.4	2.517752
			251 38 27.0	71 38 54.0	Telegraph Hill 2	1133.5	3.054412
Pier No. 27, outer gable *	37 48 21.273	655.8	53 02 09.3	233 01 57.9	Telegraph Hill 2	571.6	2.757064
1897	122 23 59.362	1452.2	156 49 53.3	336 48 46.6	Angel I. Peak 2	6758.7	3.829865
			261 02 41.2	81 03 57.4	Yerba Buena I.	3078.1	3.488286
Gas tank *	37 48 14.930	460.3	135 32 58.3	315 31 27.9	Point Cavallo 2	5147.4	3.711592
1894	122 25 53.746	1314.8	160 41 49.3	340 40 52.3	Belvedere Point	6875.4	3.837296
			181 13 25.3	1 13 28.8	Angel I. Peak 2	6410.3	3.806878
			263 23 36.3	83 26 02.6	Yerba Buena I.	5877.6	3.769202
Sailors' Home, flagstaff *‡	37 47 21.25	655.1	137 44 39	317 44 05	Telegraph Hill 2	2036	3.30876
1897	122 23 22.07	540.0	222 25 07	42 26 00	Yerba Buena I.	3155	3.49903
U. S. barge office, flagstaff *	37 48 33.750	1040.5	24 07 35.9	204 07 27.0	Reservoir	882.7	2.945801
1897	122 24 54.368	1330.0	55 12 23.9	235 11 18.4	Heights	3182.7	3.502801
			167 17 25.9	347 16 52.9	Angel I. Peak 2	5839.1	3.766344
			268 45 28.2	88 47 18.1	Yerba Buena I.	4387.2	3.642183
			309 19 38.4	129 20 00.8	Telegraph Hill 2	1149.2	3.060401
Pier No. 12, outer gable *	37 47 32.213	993.1	111 07 18.0	291 06 07.2	Reservoir	3030.7	3.481543
1897	122 23 13.555	331.6	126 32 35.8	306 31 56.3	Telegraph Hill 2	1963.3	3.292980
			223 57 23.0	43 58 11.1	Yerba Buena I.	2766.3	3.441894
Pier No. 2, outer gable *‡	37 47 42.80	1319.5	122 13 26	302 12 53	Telegraph Hill 2	1580	3.19862
1897	122 23 23.40	572.5	232 23 09	52 24 03	Yerba Buena I.	2728	3.43582
Mariners' Church, spire *	37 47 42.208	1301.2	103 32 40.0	283 31 59.8	Russian Hill	1649.8	3.217437
1881	122 23 44.770	1095.4	136 36 37.5	316 36 17.1	Telegraph Hill 2	1184.4	3.073515
			237 54 02.3	57 55 09.5	Yerba Buena I.	3168.0	3.500779
Pier No. 3, outer gable *‡	37 47 53.92	1662.4	114 44 13	294 43 46	Telegraph Hill 2	1194	3.07694
1897	122 23 33.71	824.6	241 16 53	61 17 53	Yerba Buena I.	2752	3.43957
Pier No. 5, outer gable *	37 47 56.560	1743.7	112 11 52.4	292 11 26.7	Telegraph Hill 2	1107.1	3.044192
1897	122 23 36.129	883.8	155 10 27.5	335 09 06.5	Angel I. Peak 2	7686.0	3.885703
			243 20 50.6	63 21 52.5	Yerba Buena I.	2766.2	3.441886
St. Marys Hospital, tank *	37 47 07.376	227.4	339 09 23.4	159 10 26.1	Point Avisadero	7042.6	3.847730
1897	122 23 29.802	729.2	353 02 48.9	173 03 06.1	Stony Hill	5651.7	3.752180
			148 37 24.9	328 36 55.4	Telegraph Hill 2	2266.0	3.355268
			158 17 12.8	338 15 48.0	Angel I. Peak 2	9140.8	3.960983
			220 02 53.8	40 03 51.9	Yerba Buena I.	3601.8	3.556522

* This point is in the area of the 1906 earthquake disturbance. † See p. 291. ‡ No check on this position.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
San Francisco—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
St. Brendans Church, cross * 1897	37 47 14.475 122 23 28.973	446.3 709.0	339 55 22.3 353 30 08.7 145 01 46.5 157 38 51.9 222 08 44.8	159 56 24.5 173 30 25.4 325 01 16.5 337 37 26.6 42 09 42.4	Point Avisadero Stony Hill Telegraph Hill 2 Angel I. Peak 2 Yerba Buena I.	7240.5 5866.7 2093.9 8945.5 3423.5	3.859770 3.768393 3.320951 3.951605 3.534474
Ferry tower, flagstaff * 1897	37 47 44.895 122 23 34.249	1384.2 837.9	106 48 23.1 125 59 32.1 155 57 14.6 236 35 21.3 341 19 48.1 353 18 56.0	286 47 25.0 305 59 05.3 335 55 52.5 56 36 22.1 161 20 53.5 173 19 15.9	Reservior Telegraph Hill 2 Angel I. Peak 2 Yerba Buena I. Point Avisadero Stony Hill	2424.4 1323.7 8032.5 2966.6 8168.2 6813.2	3.384599 3.121805 3.904852 3.463392 3.912125 3.833349
Pacific Mail dock, outer gable * 1897	37 46 54.345 122 23 09.718	1675.4 237.8	210 02 02.9 341 56 58.5 357 53 03.7	30 02 48.6 161 57 48.8 177 53 08.5	Yerba Buena I. Point Avisadero Stony Hill	3648.7 6499.9 5212.0	3.562144 3.812909 3.717002
Pier No. 24, outer gable* 1897	37 47 13.834 122 23 07.675	426.5 187.8	343 50 49.0 358 35 45.1 135 14 27.7 214 46 36.5	163 51 38.1 178 35 48.7 315 13 44.6 34 47 21.0	Point Avisadero Stony Hill Telegraph Hill 2 Yerba Buena I.	7059.6 5811.0 2444.3 3114.2	3.848781 3.764252 3.388160 3.493350
Blue Mountain * 1889	37 45 30.845 122 27 23.370	950.9 572.0	65 28 32.0 171 15 00.6	245 28 03.1 351 14 45.4	Black Ridge Presidio Hill	1269.4 3995.4	3.103600 3.601565
Sutro's Olympus * 1889	37 45 49.240 122 26 41.208	1518.0 1008.6	61 12 51.3 154 08 19.9 300 06 31.5 300 46 54.4 8 30 04.0	241 12 22.4 334 07 38.7 120 09 31.4 120 49 08.8 188 29 59.8	Blue Mountain Presidio Hill Point Avisadero 2 Stony Hill North Twin	1177.6 3758.3 8315.9 6251.7 1123.1	3.070993 3.574996 3.919908 3.795998 3.050415
Market St. powerhouse, stack * 1894	37 46 20.897 122 25 16.925	644.2 414.2	229 41 04.7 321 37 33.0 46 53 41.4	49 43 08.4 141 38 55.7 226 52 45.6	Yerba Buena I. 2 Stony Hill North Twin	6477.3 5327.4 3053.4	3.811392 3.726516 3.484778
Grace Church, cross * 1894	37 47 33.017 122 24 23.282	1017.9 569.6	241 31 52.0 332 38 07.6 342 41 54.4	61 33 22.9 152 39 43.1 162 42 44.3	Yerba Buena I. 2 Point Avisadero 2 Stony Hill	4125.6 8302.4 6703.8	3.615485 3.919204 3.826319
Edison Light and Power Co., electric stack * 1894	37 47 09.900 122 24 11.335	305.2 277.4	231 13 07.7 343 20 55.0 46 50 10.6	51 14 31.2 163 21 37.5 226 48 34.5	Yerba Buena I. 2 Stony Hill North Twin	4277.5 5936.8 5257.6	3.631185 3.773549 3.720789
First Baptist Mission, cupola * 1881	37 43 51.238 122 22 31.496	1579.6 771.3	161 55 03.3 185 46 51.2 214 08 09.4	341 53 58.1 5 47 13.5 34 10 35.3	Telegraph Hill 2 Yerba Buena I. Oakland Point	8396.7 8848.9 10387.0	3.924108 3.946890 4.016488
Potrero Presbyterian Church, spire * 1881	37 45 32.833 122 23 18.255	1012.2 446.8	163 13 11.9 199 44 16.3 231 54 20.1	343 12 35.3 19 45 07.3 51 57 14.7	Telegraph Hill 2 Yerba Buena I. Oakland Point	5065.2 6026.0 8859.7	3.704596 3.780027 3.947417
Tannery ventilator, flagstaff * 1894	37 43 22.678 122 23 35.047	699.2 858.3	211 40 05.2 262 33 28.6 324 49 04.7	31 40 25.5 82 34 34.4 144 49 23.3	Stony Hill Point Avisadero 2 Candlestick Point	1547.9 2657.4 1295.2	3.189729 3.424452 3.112338
Powder house, windmill * 1894	37 43 13.316 122 23 05.150	410.5 126.1	182 52 15.8 251 36 32.3 358 57 35.3	2 52 17.8 71 37 19.8 178 57 35.7	Stony Hill Point Avisadero 2 Candlestick Point	1608.0 2005.2 770.1	3.206292 3.302165 2.886550
Catholic Orphan Asylum, flagstaff * 1894	37 44 01.784 122 23 39.983	55.0 979.0	112 04 11.8 115 34 59.0 174 56 50.6 196 50 52.2 263 10 24.1 287 21 28.5 339 02 38.1	292 03 38.1 295 33 03.8 354 56 46.8 16 51 56.4 83 10 47.5 107 22 37.4 159 02 59.8	Bernal North Twin Army Yerba Buena I. 2 Stony Hill Point Avisadero 2 Candlestick Point	1457.0 5102.7 1736.3 8858.8 940.2 2887.4 2424.6	3.163455 3.707796 3.239628 3.947375 2.973197 3.460500 3.384642
City Hall, dome* 1897	37 46 47.737 122 24 54.256	1471.7 1327.7	119 01 59.4 171 45 38.2 199 14 00.1 232 29 59.0 322 33 58.2 331 11 27.7	299 00 53.6 351 45 05.0 19 14 22.2 52 31 48.7 142 35 52.5 151 12 36.5	Heights Angel I. Peak 2 Telegraph Hill 2 Yerba Buena I. Point Avisadero Stony Hill	2992.5 9192.0 2690.3 5525.1 7525.0 5711.1	3.476033 3.963410 3.429796 3.742344 3.876507 3.756719
Spreckels Building, dome* 1897	37 47 15.163 122 24 10.217	467.5 250.0	163 49 22.3 173 33 52.2 232 42 44.2 332 52 02.3 344 02 00.4	343 48 22.3 353 33 47.5 52 44 07.1 152 53 29.8 164 02 42.4	Angel I. Peak 2 Telegraph Hill 2 Yerba Buena I. Point Avisadero Stony Hill	8592.0 1705.3 4155.5 7664.9 6084.8	3.934094 3.231792 3.618623 3.884504 3.784247

* This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
San Francisco—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Jewish Synagogue, E. spire *	37 47 23.624	728.2	165 41 51.3	345 41 00.2	Angel I. Peak	8244.3	3.916155
1881	122 24 25.217	617.0	186 59 30.9	6 59 35.3	Telegraph Hill 2	1444.4	3.159681
			238 25 59.5	58 27 31.5	Yerba Buena I.	4310.9	3.634572
St. 'Patrick's Church, spire *	37 47 08.817	271.8	163 59 25.6	343 58 24.8	Angel I. Peak	8786.2	3.943801
1881	122 24 09.404	230.0	173 37 46.8	353 37 41.5	Telegraph Hill 2	1901.9	3.279194
			230 27 24.7	50 28 47.0	Yerba Buena I.	4261.5	3.629562
Marine Hospital, flagstaff *	37 47 21.224	654.3	81 06 20.9	261 05 21.5	Point Lobos 2	2400.0	3.380212
1892	122 28 17.717	433.5	85 04 26.0	265 03 19.7	Point Lobos 3	2658.9	3.424701
			152 11 50.2	332 11 40.2	Rob 2	856.2	2.932559
			232 54 08.7	52 54 26.8	Presidio Hill	905.1	2.956685
Pier No. 7, outer gable *	37 47 58.760	1811.5	109 50 03	289 49 39	Telegraph Hill 2	1033	3.014043
1897	122 23 38.314	937.3	155 19 30	335 18 11	Angel I. Peak 2	7602	3.880933
			245 05 16	65 06 19	Yerba Buena I.	2785	3.444805
Pier No. 9, outer gable *	37 48 01.109	34.2	106 46 23.7	286 46 00.6	Telegraph Hill 2	963.4	2.983805
1897	122 23 40.325	986.6	155 26 05.9	335 24 47.5	Angel I. Peak 2	7515.7	3.875972
			246 51 20.1	66 52 24.6	Yerba Buena I.	2800.3	3.447205
Washington Square *	37 48 04.721	145.6	56 13 40.4	236 13 28.9	Russian Hill	553.8	2.743326
1869–1887	122 24 31.515	771.0	95 33 16.8	275 32 53.8	Reservoir	924.2	2.965770
			246 11 06.4	66 11 14.7	Telegraph Hill	361.7	2.558333
Union street *	37 48 02.548	78.6	179 57 14.9	359 57 14.9	Washington Square	67.0	1.825965
1869	122 24 31.513	770.9	237 13 21.1	57 13 29.4	Telegraph Hill	393.5	2.594932
Engine house *	37 48 10.071	310.5	273 16 11.1	93 16 19.4	Telegraph Hill	331.6	2.520566
1869	122 24 31.519	771.0	359 57 14.9	179 57 14.9	Union street	231.9	2.365372
			359 57 14.9	179 57 14.9	Washington Square	165.0	2.217366
Presidio:							
Longitude Station *	37 47 51.386	1584.2	157 07 12.8	337 06 26.4	Point Cavallo 2	4775.5	3.679019
1896–1903	122 27 05.233	128.0	194 47 38.6	14 48 26.0	Angel I. Peak 2	7379.5	3.868026
			259 59 53.5	80 01 04.7	Reservoir	2884.5	3.460072
			310 57 18.6	130 57 33.3	Heights	778.8	2.891410
Magnetic Station *	37 47 39.163	1207.3	89 31 03.3	269 30 42.1	Presidio Hill	848.0	2.928391
1852	122 27 13.554	331.6	160 54 32.4	340 53 51.0	Point Cavallo 2	5054.6	3.703689
			195 31 55.9	15 32 48.4	Angel I. Peak 2	7796.5	3.891902
Flagstaff *	37 47 57.727	1779.8	199 14 33.3	19 15 34.0	Angel I. Peak 2	7350.2	3.866298
1897	122 27 27.245	666.6	264 49 48.8	84 51 13.4	Reservoir	3393.0	3.530579
			302 03 58.6	122 04 26.8	Heights	1329.5	3.123704
Wharf, NE. corner *	37 48 25.780	794.8	152 47 51.5	332 47 08.4	Point Cavallo 2	3754.7	3.574573
1895	122 27 10.971	268.3	171 10 07.6	351 09 40.1	Peninsula Hill 2	7136.0	3.853455
			198 25 57.9	18 26 48.7	Angel I. Peak 2	6403.1	3.806587
Wharfhouse *	37 48 25.392	782.8	141 50 25.8	321 48 48.2	Richardson East	6293.8	3.798914
1895	122 27 12.483	305.3	145 08 27.8	325 07 14.8	Halfway	5090.9	3.706797
			153 23 01.4	333 22 19.3	Point Cavallo 2	3748.6	3.573867
			171 28 35.3	351 28 08.8	Peninsula Hill 2	7142.2	3.853832
			176 46 07.7	356 45 59.0	Belvedere Point	6175.8	3.790693
			198 42 42.4	18 43 34.2	Angel I. Peak 2	6426.1	3.807950
South San Francisco:							
Artesian well tower *	37 39 09.805	302.3	26 42 45.5	206 42 26.0	Belair I.	1739.0	3.240283
1894	122 23 12.795	313.6	128 37 34.6	308 37 16.0	Baden Hill	955.5	2.980239
			167 38 51.1	347 38 37.9	Sierra Point	2487.5	3.395766
			181 40 57.8	1 41 04.5	Stony Hill	9117.4	3.959871
			194 23 59.7	14 24 52.0	Point Avisadero 2	8404.2	3.924495
Packinghouse, smokestack *	37 39 04.531	139.7	26 40 57.5	206 40 40.1	Belair I.	1556.5	3.192155
1894	122 23 16.169	396.4	138 49 51.0	318 49 34.5	Baden Hill	1008.3	3.003610
			170 09 52.6	350 09 41.5	Sierra Point	2631.2	3.420152
Linden House, cupola *	37 39 17.295	533.2	213 39 19.2	33 39 55.8	Sierra Point	2641.9	3.421920
1894	122 24 34.255	839.6	241 18 37.2	61 19 33.5	Oyster Point	2570.9	3.410080
			253 42 00.6	73 42 31.8	Baden Hill	1302.6	3.114811
			270 05 30.4	90 06 33.7	Point San Bruno 2	2538.2	3.404522
			325 44 02.5	145 44 32.8	Belair I.	2158.9	3.334242
Armour Hotel, flagstaff *	37 39 24.544	756.7	210 56 21.4	30 56 51.0	Sierra Point	2303.3	3.362355
1894	122 24 22.833	559.6	242 54 12.9	62 55 02.2	Oyster Point	2218.8	3.346121
			261 40 06.8	81 40 31.0	Baden Hill	980.6	2.991488
			275 45 20.9	95 46 17.2	Point San Bruno 2	2269.6	3.355950
			335 01 01.7	155 01 25.0	Belair I.	2215.0	3.345370

*This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
South San Francisco—Con.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Merriam Block E. cupola * 1894	37 39 18.586	573.0	210 15 32.2	30 16 03.7	Sierra Point.	2499.9	3.397920
	122 24 25.914	635.2	252 41 48.1	72 42 14.2	Baden Hill	1095.3	3.039550
			271 04 39.9	91 05 38.2	Point San Bruno 2	2334.1	3.368121
			331 00 03.5	151 00 28.7	Belair I.	2085.5	3.319210
Merriam Block W. cupola * 1894	37 39 18.981	585.2	211 15 20.0	31 15 52.5	Sierra Point	2511.6	3.399954
	122 24 27.687	678.7	253 56 22.1	73 56 49.2	Baden Hill	1133.5	3.054410
			271 21 07.4	91 22 06.6	Point San Bruno 2	2377.8	3.376179
			330 07 56.1	150 08 22.3	Belair I.	2117.5	3.325822
Depot, chimney * 1894	37 39 08.146	251.1	210 40 49.2	30 41 25.9	Sierra Point	2885.0	3.460144
	122 24 34.578	847.6	242 45 43.8	62 46 15.1	Baden Hill	1415.1	3.150777
			320 50 16.6	140 50 47.0	Belair I.	1937.4	3.287213
Berkeley:							
California University building 1881	37 52 21.238	654.8	54 08 01.0	234 04 01.1	Yerba Buena I.	11801.0	4.071918
	122 15 24.100	589.0	107 21 08.3	287 17 31.4	Rocky I.	9041.5	3.956239
			121 11 04.1	301 09 19.8	Highland	4850.1	3.685747
Shellmound, flagstaff 1881	37 50 09.518	293.4	27 35 18.0	207 34 37.9	Oakland Point	3460.6	3.539150
	122 17 27.703	677.4	66 24 29.2	246 21 45.3	Yerba Buena I.	7136.3	3.853474
			103 16 13.2	283 11 06.3	Angel I. Peak 2	12568.5	4.099284
			140 15 39.3	320 13 18.3	Brooks I.	8780.0	3.943493
			140 17 25.2	320 15 04.4	Rocky I.	8780.8	3.943535
			160 11 25.0	340 10 35.8	Judson Point	5791.5	3.762791
Powder wharf 1895	37 53 02.567	79.1	27 30 40.7	207 28 53.7	Yerba Buena I.	9237.4	3.965550
	122 19 00.620	15.2	72 16 33.5	252 12 39.2	Angel I. SE. 2	9796.9	3.991088
			75 08 18.1	255 04 32.0	Quarry	9305.7	3.968749
			76 09 54.3	256 05 44.2	Angel I. Peak 2	10259.3	4.011116
			112 56 34.4	292 55 10.2	Brooks I.	3629.9	3.559893
			249 47 49.3	69 47 56.9	Judson Point	328.0	2.515932
Corder tannery, chimney 1895	37 50 54.746	1687.8	97 04 46.4	276 59 45.3	Angel I. Peak 2	12092.1	4.082501
	122 17 37.238	910.5	98 01 50.3	277 57 13.3	Quarry	11141.9	4.046959
			134 52 36.0	314 50 20.8	Brooks I.	7592.2	3.880366
			156 53 41.6	336 52 58.3	Judson Point	4407.9	3.644231
University Ave. wharf 1895	37 51 58.784	1812.4	87 34 02	267 29 55	Quarry	9878.0	3.99467
	122 18 24.838	607.2	128 43 42	308 41 56	Brooks I.	5405.6	3.73284
			164 45 48	344 45 34	Judson Point	2155.6	3.33356
California University, flagstaff 1894–5	37 52 20.846	642.7	357 37 35.7	177 37 51.4	San Leandro Point 2	15218.4	4.182368
	122 15 25.685	627.8	29 55 40.6	209 51 46.5	Point Avisadero	18740.2	4.272774
			54 04 13.8	234 00 14.9	Yerba Buena I.	11762.5	4.070501
			83 23 48.0	263 17 41.9	Angel I. SE. 2	14683.5	4.166831
			85 38 40.1	265 32 18.0	Angel I. Peak 2	15259.6	4.183544
			105 49 15.2	285 47 10.8	Judson Point	5139.1	3.710888
			107 28 18.8	287 24 42.6	Brooks I.	9009.9	3.954718
Pipeworks, chimney 1895	37 51 59.039	1820.1	87 39 10.6	267 34 49.3	Quarry	10413.9	4.017614
	122 18 02.906	71.0	87 31 07.8	267 26 22.3	Angel I. Peak 2	11383.1	4.056261
			125 22 22.5	305 20 23.0	Brooks I.	5828.9	3.765585
			151 58 58.5	331 58 30.8	Judson Point	2347.1	3.370523
Reduction works, chimney 1895	37 50 20.289	625.4	101 53 47.1	281 48 42.9	Angel I. Peak 2	12383.7	4.092851
	122 17 32.416	792.6	103 13 04.9	283 08 25.0	Quarry	11454.0	4.058954
			139 25 17.6	319 22 59.5	Brooks I.	8451.8	3.926951
			160 08 45.8	340 07 59.4	Judson Point	5440.0	3.735599
State Deaf and Dumb Asylum, flagstaff 1895	37 51 52.425	1616.2	88 59 48.7	268 53 05.7	Angel I. Peak 2	16054.1	4.205586
	122 14 51.482	1258.4	110 48 03.5	290 44 06.5	Brooks I.	10087.4	4.003779
			111 30 30.0	291 28 04.8	Judson Point	6212.9	3.793293
Lumber wharf 1895	37 52 02.986	92.0	38 47 26.6	218 45 18.5	Yerba Buena I.	8153.8	3.911362
	122 18 26.232	641.2	83 34 49.4	263 30 34.3	Angel I. SE. 2	10236.8	4.010161
			86 44 24.6	266 39 53.6	Angel I. Peak 2	10819.8	4.034217
			86 48 20.6	266 44 13.6	Quarry	9850.3	3.993450
			127 51 56.0	307 50 10.8	Brooks I.	5298.6	3.724157
Capworks, wharf 1895	37 54 31.739	978.5	325 16 48.5	145 17 34.4	Judson Point	3206.8	3.506072
	122 20 02.766	67.6	53 48 30.7	233 47 44.8	Brooks I.	2260.5	3.354210
			58 20 56.0	238 17 24.1	Angel I. Peak 2	9917.7	3.996411
			67 51 26.0	247 50 35.0	North Brooks	2188.8	3.340209
West Berkeley:							
Episcopal Church spire, cross 1881	37 52 13.795	425.3	43 12 03.8	223 09 26.3	Yerba Buena I.	9174.6	3.962586
	122 17 38.304	936.2	118 38 51.8	298 36 37.2	Rocky I.	6097.5	3.785149
			162 22 44.6	342 22 22.7	Highland	2874.7	3.458590

*This point is in the area of the 1906 earthquake disturbance.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
West Berkeley—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Presbyterian Church spire, vane	37 52 12.098	373.0	42 59 43.9	222 57 08.8	Yerba Buena I.	9072.4	3.957722
1881	122 17 42.136	1029.9	119 30 30.2	299 28 18.1	Rocky I.	6041.1	3.781113
			164 27 23.6	344 27 04.1	Highland	2898.1	3.462116
Standard Soap Co., flagstaff	37 52 55.661	1716.0	43 17 03.1	223 14 38.4	Yerba Buena I.	8419.6	3.925291
1881	122 17 59.069	1443.6	125 42 41.8	305 40 40.1	Rocky I.	5965.4	3.775640
			173 43 22.3	353 43 13.2	Highland	3318.8	3.520976
Boot and shoe factory, cupola	37 52 48.538	1496.4	36 28 29.2	216 26 05.3	Yerba Buena I.	9649.6	3.984508
1881	122 18 00.550	13.4	111 03 57.2	291 01 56.4	Rocky I.	5151.8	3.711959
			168 55 24.3	348 55 16.1	Highland	1700.3	3.230522
"Butchertown" windmill	37 50 52.060	1605.0	19 45 57.3	199 45 17.8	Oakland Point	4652.9	3.667720
1881	122 17 28.895	706.5	57 22 31.5	237 19 48.2	Yerba Buena I.	7730.4	3.888202
			134 17 06.8	314 14 46.6	Rocky I.	7796.0	3.891870
Oakland:							
Oakland Harbor L. H.†	37 48 01.367	42.2	19 06 56.4	199 05 44.9	Point Avisadero 2	8729.2	3.940972
1894	122 19 50.719	1240.8	32 45 37.8	212 43 40.6	Stony Hill	8649.2	3.936974
			109 45 37.4	289 44 21.2	Yerba Buena I. 2	3230.8	3.509308
Methodist Church, spire	37 48 19.602	604.4	93 45 04.6	273 41 40.6	Yerba Buena I.	8164.1	3.911907
1881	122 16 22.020	538.7	144 34 50.4	324 31 49.2	Rocky I.	12449.0	4.095133
			164 39 02.9	344 37 54.3	Highland	10329.0	4.014060
Presbyterian Church, spire	37 48 15.419	475.4	94 28 03.4	274 24 30.6	Yerba Buena I.	8517.5	3.930310
1881	122 16 07.916	193.7	143 39 20.8	323 36 10.9	Rocky I.	12755.7	4.105705
			163 01 52.5	343 00 35.2	Highland	10548.9	4.023209
Catholic Church, spire	37 48 41.150	1268.6	113 43 10.2	293 37 45.9	Quarry	14115.7	4.149701
1895	122 16 19.892	486.6	142 30 32.2	322 27 29.6	Brooks I.	11944.3	4.077162
			156 06 49.0	336 05 18.2	Judson Point	8939.4	3.951310
Congregational Church, spire	37 48 16.262	501.3	94 31 19.5	274 27 57.7	Yerba Buena I.	8079.8	3.907398
1881	122 16 25.780	630.7	145 11 53.5	325 08 54.6	Rocky I.	12480.3	4.096225
			165 17 19.8	345 16 13.4	Highland	10404.6	4.017226
County Court-house dome, flagstaff	37 47 53.960	1663.5	99 27 14.1	279 23 54.8	Yerba Buena I.	8063.9	3.906543
1881	122 16 29.878	731.0	147 17 27.8	327 14 31.4	Rocky I.	12996.4	4.113822
			166 41 48.5	346 40 44.7	Highland	11047.6	4.043266
Landing N. tower	37 48 33.769	1041.1	17 38 30.5	197 37 17.0	Point Avisadero 2	9703.1	3.986911
1895	122 19 47.367	1158.7	29 55 44.2	209 53 45.1	Stony Hill	9545.3	3.979788
			91 42 43.8	271 41 25.6	Yerba Buena I. 2	3123.9	3.494700
Mole outer switch-house	37 48 33.777	1041.3	122 14 17.5	302 10 25.4	Angel I. Peak 2	10934.6	4.038801
1895	122 19 29.780	728.5	125 27 52.3	305 24 24.4	Quarry	10168.1	4.007238
			164 49 50.9	344 48 44.8	Brooks I.	10052.0	4.002252
			186 55 32.9	6 55 58.5	Judson Point	8462.1	3.927479
Mole inner switch-house*	37 48 29.06	896.0	119 09 37	299 05 08	Angel I. Peak 2	12273.0	4.08895
1895	122 18 29.70	726.5	177 00 03	356 59 52	Judson Point	8557.4	3.93234
Nev. Smith wharfhouse gable	37 49 34.010	1048.5	111 01 22.0	290 56 57.8	Quarry	11275.7	4.052143
1895	122 17 57.998	1418.4	109 05 46.2	289 00 57.8	Angel I. Peak 2	12161.6	4.084992
			148 09 23.9	328 07 21.5	Brooks I.	9235.8	3.965474
			169 25 04.7	349 24 34.2	Judson Point	6656.6	3.823251
Nailworks stack	37 49 49.420	1523.6	107 35 50.6	287 31 08.0	Quarry	11811.4	4.072303
1895	122 17 27.988	684.5	142 44 44.3	322 42 23.5	Brooks I.	9260.7	3.966644
			162 08 11.4	342 07 22.4	Judson Point	6375.8	3.804535
Sausalito:							
Crag Hazel boathouse, flagstaff	37 50 50.212	1548.0	225 27 44.9	45 28 28.3	Belvedere Point	2425.6	3.384815
1895	122 28 37.454	915.7	248 35 39.7	68 37 23.6	Angel I. Peak 2	4445.2	3.647893
			338 07 48.7	158 07 59.1	Under Cavallo	1109.1	3.044961
S. Dock-light	37 51 22.876	705.2	144 23 45.7	324 22 59.3	Strawberry Hill 2	3175.0	3.501739
1895	122 28 36.643	896.0	212 06 12.4	32 06 37.5	Peninsula Hill 2	1878.6	3.273841
			247 53 39.2	67 54 22.1	Belvedere Point	1844.7	3.265929
			261 30 11.7	81 31 55.1	Angel I. Peak 2	4164.5	3.619561
			349 04 05.3	169 04 15.2	Under Cavallo	2073.9	3.316796
N. Dock-light	37 51 24.538	756.5	72 38 54.5	252 38 08.3	Richardson East	1928.3	3.285169
1895	122 28 36.259	886.4	143 42 44.6	323 41 57.9	Strawberry Hill 2	3139.0	3.496790
			212 42 24.8	32 42 49.6	Peninsula Hill 2	1830.3	3.262533
			249 16 48.4	69 17 31.0	Belvedere Point	1817.3	3.259419
			262 11 03.6	82 12 46.7	Angel I. Peak 2	4147.9	3.617832
			349 34 45.6	169 34 55.2	Under Cavallo	2122.6	3.326859

*No check on this position.

†Rebuilt in 1903.

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Sausalito—Continued.							
Baron wharf	37 51 36.388	1121.8	55 08 27.7	235 07 53.8	Richardson East	1645.5	3.216303
1895	122 28 56.313	1376.6	147 42 56.0	327 42 21.7	Strawberry Hill 2	2560.6	3.408345
			231 32 25.8	51 33 03.0	Peninsula Hill 2	1889.0	3.276225
			267 31 22.3	87 33 17.8	Angel I. Peak 2	4603.9	3.663126
Railroad depot, inner flagstaff	37 51 24.886	767.2	146 22 33.4	326 21 51.3	Strawberry Hill 2	3025.7	3.480819
1895	122 28 43.720	1068.8	217 26 54.8	37 27 24.2	Peninsula Hill 2	1926.5	3.284760
			251 25 52.1	71 26 39.3	Belvedere Point	1985.5	3.297863
			262 39 08.1	82 40 55.8	Angel I. Peak 2	4327.3	3.636218
			344 53 40.2	164 53 54.4	Under Cavillo	2173.4	3.337131
Railroad depot, outer flagstaff	37 51 24.296	749.0	72 01 27.0	252 00 43.0	Richardson East	1839.3	3.264660
1895	122 28 39.980	977.3	145 09 08.0	325 08 23.6	Strawberry Hill 2	3092.1	3.490258
			214 54 31.2	34 54 58.3	Peninsula Hill 2	1887.2	3.275807
			250 02 16.5	70 03 01.4	Belvedere Point	1905.1	3.279928
			262 15 04.3	82 16 49.7	Angel I. Peak 2	4239.1	3.627269
			347 08 22.0	167 08 33.9	Under Cavallo	2133.6	3.329117
Tide Station, wharf	37 50 38.060	1173.4	197 10 17.7	17 10 40.8	Peninsula Hill 2	3111.8	3.493009
1895	122 28 33.382	816.2	218 07 45.2	38 08 26.1	Belvedere Point	2639.0	3.421438
			243 41 29.4	63 43 10.8	Angel I. Peak 2	4505.8	3.653770
			334 24 13.6	154 24 21.5	Under Cavallo	725.8	2.860836
Tiburon:							
Freight wharf, SE. corner	37 52 20.122	620.3	299 56 40.5	119 57 30.5	Angel I. Peak 2	2304.8	3.362624
1895	122 27 09.846	240.6	331 34 22.0	151 34 38.3	Angel I. NW. 2	1375.2	3.138355
			21 04 07.5	201 03 57.0	Belvedere Point	1147.7	3.059814
Dock-bell	37 52 19.226	592.7	300 36 20.5	120 37 08.2	Angel I. Peak 2	2205.4	3.343494
1895	122 27 05.800	141.8	334 48 48.0	154 49 02.0	Angel I. NW. 2	1305.9	3.115909
			26 06 54.2	206 06 41.4	Belvedere Point	1161.9	3.065183
			83 11 19.7	263 10 49.1	Peninsula Hill 2	1230.6	3.090118
Ferry-slip, E. end	37 52 18 783	579.1	301 00 03.1	121 00 49.4	Angel I. Peak 2	2153.5	3.333150
1895	122 27 03.662	89.5	336 40 57.3	156 41 09.9	Angel I. NW. 2	1271.9	3.104468
			28 42 04.3	208 41 50.1	Belvedere Point	1173.9	3.069614
			84 04 28.4	264 03 56.4	Peninsula Hill 2	1281.0	3.107565
Depot flagstaff	37 52 21.256	655.3	302 31 48.8	122 32 35.5	Angel I. Peak 2	2204.4	3.343293
1895	122 27 04.179	102.1	25 38 55.3	205 38 08.1	Point Cavallo 2	4349.0	3.638391
			26 29 19.4	206 29 05.6	Belvedere Point	1235.6	3.091870
			80 36 57.2	260 36 25.6	Peninsula Hill 2	1278.7	3.106761
Catholic Church	37 52 44.304	1365.8	5 33 56.9	185 33 52.4	Belvedere Point	1825.1	3.261289
1895	122 27 19.482	476.1	43 59 48.4	223 59 26.1	Peninsula Hill 2	1277.7	3.106432
			50 47 01.0	230 45 27.7	Richardson East	4798.3	3.681087
			91 05 52.7	271 04 18.9	Strawberry Hill 2	3734.8	3.572264
Bluff Point:							
S. Range E.	37 52 54.192	1670.7	341 07 08.4	161 07 27.7	Angel I. Peak 2	2326.2	3.366651
1897	122 26 18.942	462.9	187 58 59.5	7 59 18.2	Red Rock	5341.7	3.727677
			205 39 58.7	25 41 20.6	High Hill	7509.8	3.875627
			233 40 39.4	53 42 26.8	Richmond Rock	5292.1	3.723629
			233 51 33.3	53 53 21.8	Point Richmond 2	5337.2	3.727317
			257 11 02.3	77 14 07.5	Brooks I.	7554.8	3.878225
S. Range W.	37 52 42.338	1305.2	322 25 23.1	142 25 58.8	Angel I. Peak 2	2315.9	3.364726
1897	122 26 45.923	1122.3	234 35 04.7	54 37 08.6	Richmond Rock	6040.6	3.781082
			234 44 13.8	54 46 18.8	Point Richmond 2	6086.0	3.784334
			240 59 49.2	61 00 05.7	S. Range E.	753.9	2.877318
			255 43 32.1	75 46 53.8	Brooks I.	8281.5	3.918110
N. Range E.	37 53 40.054	1234.8	139 05 22.6	319 04 36.4	California Point 2	2805.9	3.448072
1897	122 27 11.264	275.2	155 05 44.9	335 04 40.3	Point San Quentin	6090.1	3.784621
			207 31 19.0	27 32 09.8	Red Rock	4370.8	3.640556
			220 13 43.6	40 15 37.7	High Hill	7014.6	3.846001
			252 44 39.8	72 46 59.4	Richmond Rock	5803.2	3.763666
			252 45 23.1	72 47 43.8	Point Richmond 2	5851.4	3.767257
N. Range W.	37 53 34.084	1050.8	146 50 31.2	326 49 53.3	California Point 2	2752.7	3.439765
1897	122 27 24.852	607.2	210 04 38.6	30 05 37.7	Red Rock	4692.1	3.671364
			240 59 48.0	60 59 56.3	N. Range E.	379.6	2.579329
			252 01 30.4	72 03 58.3	Richmond Rock	6175.3	3.790660
			252 02 31.1	72 05 00.1	Point Richmond 2	6223.5	3.794033
Alameda:							
Borax-works, round brick stack	37 46 44.508	1372.1	37 02 28.1	216 58 50.2	Sierra Point	14512.7	4.161748
1895	122 17 37.768	924.3	46 08 13.1	226 05 40.2	Point Avisadero 2	8480.5	3.928422
			58 17 58.0	238 14 39.6	Stony Hill	9327.4	3.969758
			78 14 29.5	258 08 52.7	North Twin	13758.1	4.138559
			118 49 46.6	298 47 09.3	Yerba Buena I. 2	7183.0	3.856308

San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Alameda—Continued.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Pacific Oilworks, stack 1895	37 46 31.360	966.8	320 57 52.2	140 58 55.0	San Leandro Pt. 2	5703.4	3.756132
	122 17 26.666	652.6	34 06 51.9	214 02 59.5	Oyster Point	14667.2	4.166346
			38 52 25.7	218 49 13.6	Sierra Point	14360.2	4.157160
			49 25 20.2	229 22 13.4	Point Avisadero 2	8409.2	3.924756
			61 17 45.6	241 13 53.2	Stony Hill	9358.2	3.971192
			80 06 32.0	260 00 20.9	North Twin	13948.8	4.144537
			120 31 29.8	300 28 18.0	Yerba Buena I. 2	7619.8	3.881942
Pipeworks, stack 1895	37 46 42.172	1300.1	39 42 12.0	219 38 13.4	Sierra Point	14961.9	4.174987
	122 17 04.486	109.8	50 03 07.5	230 00 14.2	Point Avisadero 2	9038.9	3.956115
			61 06 39.1	241 03 00.3	Stony Hill	9994.5	3.999759
			79 10 44.0	259 04 46.4	North Twin	14542.7	4.162646
			116 27 18.9	296 24 20.7	Yerba Buena I. 2	7938.1	3.899716
St. Joseph's spire, cross 1895	37 45 58.351	1798.9	354 00 45.6	174 00 54.6	San Leandro Pt. 2	3431.5	3.535481
	122 15 14.564	356.4	16 21 25.9	196 19 04.3	Pt. San Mateo Ext.	20202.0	4.305393
			50 20 29.0	230 15 23.2	Sierra Point	15914.1	4.201782
			65 11 18.4	245 07 17.9	Point Avisadero	10600.5	4.025327
			116 31 47.2	296 27 41.8	Yerba Buena I.	10949.6	4.039397
Narrow gauge landing, N. tower 1895	37 47 48.708	1501.6	18 59 43.9	198 58 36.3	Point Avisadero 2	8310.1	3.919607
	122 19 56.995	1394.4	33 19 48.8	213 17 55.6	Stony Hill	8238.3	3.915836
			117 10 51.8	297 09 39.6	Yerba Buena I. 2	3245.4	3.511271
Cupola 1881	37 46 15.608	481.2	118 46 45.6	298 43 26.9	Yerba Buena I.	9049.4	3.956620
	122 16 30.807	754.0	126 31 25.4	306 25 43.4	Angel I. Peak	16965.0	4.229555
			169 38 29.3	349 37 26.0	Highland	14011.7	4.146491
Cupola flagstaff 1881	37 46 43.902	1353.5	118 57 34.3	298 54 56.6	Yerba Buena I.	7193.5	3.856938
	122 17 37.755	923.9	157 28 44.7	337 28 10.7	Oakland Point	3542.3	3.549281
			157 43 18.7	337 41 04.0	Rocky I.	14150.4	4.150768
Warmsprings:							
Red warehouse, W. gable 1896	37 28 48.559	1497.0	354 31 25.1	174 31 31.6	Dyke	2729.7	3.436111
	121 56 54.111	1329.6	74 09 46.5	254 06 46.3	Alviso	7567.5	3.878951
			88 01 04.5	268 00 11.1	Albrae	2160.1	3.334480
			118 55 43.4	298 50 51.3	South Red Hill	13460.1	4.129048
Schoolhouse flagstaff 1896	37 28 58.847	1814.2	32 04 14.3	212 03 27.2	Dyke	3580.6	3.553957
	121 55 26.158	642.7	84 49 38.5	264 47 51.5	Albrae	4337.5	3.637240
			113 58 04.8	293 52 19.0	South Red Hill	15255.3	4.183420
Depot chimney * 1896	37 29 07.41	228.4	22 22 27	202 21 53	Dyke	3566.7	3.55227
	121 55 48.27	1186.0	80 09 27	260 07 53	Albrae	3832.9	3.58353
Hip-roof house, flagstaff* 1896	37 30 00.21	6.5	23 29 59	203 29 06	Dyke	5371.6	3.73010
	121 55 16.36	401.8	63 24 33	243 22 40	Albrae	5099.9	3.70756
Alviso:							
Church spire 1896	37 25 44.476	1371.2	124 36 34.7	304 34 25.3	Alviso	6352.9	3.802971
	121 58 17.590	432.4	178 53 50.7	358 53 48.0	Albrae	5601.1	3.748273
			218 00 45.5	38 01 42.7	Dyke	3754.6	3.574564
Factory, SE. gable 1896	37 25 39.755	1225.6	126 17 25.7	306 15 19.2	Alviso	6342.1	3.802236
	121 58 22.339	549.3	142 03 04.7	321 59 06.3	South Red Hill	15634.5	4.194084
			180 05 20.3	0 05 20.5	Albrae	5745.6	3.759336
			218 02 47.8	38 03 47.9	Dyke	3941.2	3.595626
Warehouse gable * 1896	37 25 40.91	1261.2	205 23 26	25 24 10	Alviso	4114.1	3.61428
	122 03 02.13	52.4	167 24 17	347 23 09	South Red Hill	12591.0	4.10006
Mill chimney * 1854	37 25 46.00	1418.1	295 03 57	115 18 48	Masters Hill	23803.6	4.376642
	121 58 49.15	1208.4	50 27 40	230 21 35	Black Mountain	19165.7	4.282525
Redwood City:							
Waterworks tank 1894	37 28 57.000	1757.3	136 29 03.3	316 27 27.4	Angelo 2	5619.8	3.749724
	122 13 16.490	405.2	144 39 17.4	324 35 44.2	Pt. San Mateo Ext.	14841.8	4.171486
			235 38 19.1	55 42 56.5	Red Hill	13544.7	4.131770
High-school tower 1894	37 29 11.393	351.7	138 38 21.2	318 37 02.0	Angelo 2	4838.2	3.684688
	122 13 43.874	1078.0	145 50 15.3	325 46 58.8	Pt. San Mateo Ext.	14093.6	4.149024
			238 43 02.3	58 47 56.4	Red Hill	13869.7	4.142068
			257 16 27.4	77 20 05.8	West Point	9031.8	3.955773
Frank's tannery stack 1894	37 29 32.764	1010.1	129 19 55.5	309 18 25.6	Angelo 2	4690.2	3.671197
	122 13 26.334	647.0	142 49 29.5	322 46 02.3	Pt. San Mateo Ext.	13809.6	4.140180
			240 11 50.2	60 16 33.6	Red Hill	13163.7	4.119379
			260 58 44.1	81 02 11.8	West Point	8484.0	3.928602

*No check on this position.

San Pablo Bay.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Point Pinole	38 00 43.627	1345.2	22 00 21.6	201 59 03.1	High Hill	8310.0	3.919602
1852	122 21 58.206	1419.9	70 08 10.3	250 05 02.9	Point San Pedro	7899.4	3.897592
East Sister	37 59 18.894	582.5	325 29 36.2	145 30 32.7	San Pablo Ridge	3959.3	3.597615
1897	122 26 27.166	662.9	325 51 13.9	145 52 40.8	High Hill	6152.7	3.789063
			338 32 15.2	158 33 00.7	Molate Point 2	4917.4	3.691734
			351 50 08.4	171 50 32.2	Red Rock	6638.2	3.822053
			2 15 53.5	182 15 42.3	Bluff Point 2	11152.5	4.047371
			19 17 37.0	199 16 23.6	California Point 2	8821.5	3.945543
			36 29 23.2	216 27 51.5	Point San Quentin	6123.1	3.786970
			41 34 01.0	221 33 01.8	Marin I. E	3540.1	3.549012
Marsh Island	37 57 36.669	1130.5	8 07 49.2	188 07 42.2	High Hill	1960.7	3.292406
1852	122 23 54.373	1327.4	123 49 09.1	303 47 13.2	Point San Pedro	5530.4	3.742753
			206 10 40.8	26 11 52.2	Point Pinole	6423.6	3.807778
Petaluma Creek	38 06 13.466	415.2	313 09 40.8	133 14 14.6	Point Pinole	14856.1	4.171905
1852	122 29 22.425	546.4	341 29 56.4	161 31 44.5	East Sister	13477.5	4.129610
			345 08 31.6	165 09 57.7	Point San Pedro	13301.1	4.123886
			357 56 10.3	177 56 26.4	Point San Quentin	17717.1	4.248392
Long Pond	38 07 41.070	1266.4	15 11 11.2	195 09 42.9	Point Pinole	13335.6	4.125011
1852	122 19 35.002	852.5	35 05 12.6	215 00 36.6	Point San Pedro	19004.2	4.278849
			79 21 40.4	259 15 37.8	Petaluma Creek	14562.3	4.163231
Long Point 2	38 02 48.268	1488.3	194 01 38.9	14 02 18.9	Petaluma Creek	6521.3	3.814335
1886	122 30 27.302	665.7	317 45 33.2	137 48 01.3	East Sister	8716.8	3.940358
			322 35 16.2	142 37 22.2	Point San Pedro	8219.7	3.914857
Point Pinole 2	38 00 43.599	1344.4	53 35 46.2	233 31 28.9	Point San Quentin	12685.9	4.103322
1886	122 21 58.130	1418.0	70 08 48.7	250 05 41.2	Point San Pedro	7900.8	3.897671
			107 14 32.8	287 09 19.2	Long Point 2	12999.3	4.113921
			133 14 06.0	313 09 32.1	Petaluma Creek	14858.1	4.171962
Tolay Creek 2	38 07 55.787	1720.2	341 43 55.1	161 45 46.3	Point Pinole 2	14031.2	4.147096
1886	122 24 58.428	1423.0	63 53 28.5	243 50 45.5	Petaluma Creek	7163.0	3.855093
			10 43 16.7	190 42 00.0	Point San Pedro	16295.7	4.212073
Sears Point	38 08 24.275	748.5	289 15 03.9	109 16 07.6	Tolay Creek 2	2662.8	3.425341
1886	122 26 41.649	1014.2	334 01 55.4	154 04 50.2	Point Pinole 2	15795.4	4.198530
			1 44 18.6	181 44 05.8	Point San Pedro	16898.0	4.227834
			44 10 15.7	224 08 36.4	Petaluma Creek	5621.6	3.749863
Point Pinole 3	38 00 43.612	1344.8	22 02 18.3	202 00 59.7	High Hill	8311.4	3.919674
1897	122 21 58.007	1415.0	36 22 57.0	216 21 08.1	San Pablo Ridge	7296.0	3.863085
			45 47 45.0	225 45 30.3	Point San Pablo 2	7449.7	3.872140
			47 24 13.7	227 21 46.1	E. Brother I. L. H.	7956.7	3.900732
			53 36 10.1	233 31 52.7	Point San Quentin	12688.5	4.103412
			68 20 00.0	248 17 14.3	East Sister	7067.4	3.849262
			82 47 05.4	262 47 05.3	Point Pinole 2	2.997	0.476716
			133 13 34.1	313 09 00.1	Petaluma Creek	14860.0	4.172018
			59 29 19.8	239 25 34.8	Marin I. E.	10352.6	4.015048
Island Hydrographic	38 00 17.449	538.0	264 27 27.4	84 30 58.3	Point Pinole 3	8396.0	3.924072
1896	122 27 40.574	989.9	315 13 13.8	135 13 59.1	East Sister	2543.1	3.405364
			321 28 15.0	141 29 56.9	San Pablo Ridge	6477.6	3.811412
			322 44 25.6	142 46 37.8	High Hill	8664.9	3.937762
			333 47 57.2	153 48 20.4	Point San Pedro	2095.6	3.321308
			167 15 41.9	347 14 39.0	Petaluma Creek	11254.1	4.051310
			138 50 40.8	318 48 57.9	Long Point 2	6177.3	3.790801
Lone Tree Point	38 02 19.816	611.0	70 18 38.7	250 15 09.7	Point Pinole	8789.9	3.943983
1852	122 16 18.950	462.1	110 44 05.1	290 36 02.2	Petaluma Creek	20410.7	4.309857
			154 15 54.2	334 13 53.3	Long Pond	10997.1	4.041278
			70 18 04.7	250 14 35.8	Point Pinole 2	8788.4	3.943912
Vallejo (3)	38 04 12.827	395.5	50 58 37.8	230 56 49.2	Lone Tree Point	5532.1	3.742893
1852	122 13 22.704	553.5	62 52 53.0	242 47 35.5	Point Pinole	14128.7	4.150101
			125 19 20.8	305 15 31.1	Long Pond	11113.6	4.045854
Sonoma Creek	38 08 27.160	837.5	323 42 12.7	143 45 43.2	Lone Tree Point	14047.5	4.147599
1852	122 21 59.955	1460.0	359 49 44.4	179 49 45.5	Point Pinole	14291.8	4.155086
			69 06 27.7	249 01 54.6	Petaluma Creek	11539.0	4.062170
Wilson	38 00 43.994	1356.5	89 52 11.6	269 50 19.3	Point Pinole	4448.7	3.648230
1852	122 18 55.842	1302.2	175 45 29.6	355 45 05.5	Long Pond	12894.7	4.110410
			232 18 59.4	52 20 36.1	Lone Tree Point	4834.4	3.684340
Mare Island SE.	38 04 37.424	1153.9	285 25 12.7	105 26 22.2	Vallejo (3)	2850.4	3.454911
1852	122 15 15.434	376.2	20 03 22.7	200 02 43.5	Lone Tree Point	4516.5	3.654798

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Vallejo (1)	38 05 18.453	569.0	315 32 46.1	135 33 36.3	Vallejo (3)	2834.3	3.452441
1852	122 14 44.136	1075.5	31 05 29.0	211 05 09.7	Mare I. SE.	1477.2	3.169430
Mare Island NW.	38 05 22.275	686.8	273 31 33.4	93 32 21.7	Vallejo (1)	1912.4	3.281568
1852	122 16 02.462	60.0	298 47 38.2	118 49 16.7	Vallejo (3)	4443.5	3.647731
			320 20 36.4	140 21 05.4	Mare I. SE.	1796.1	3.254319
			4 05 17.5	184 05 07.4	Lone Tree Point	5639.9	3.751269
			129 35 25.9	309 33 14.8	Long Pond	6717.5	3.827207
Lone Tree Point, Iron Rod (U. S. E.)*	38 02 20.12	620.4	281 17 27	101 17 28	Lone Tree Point	46.94	1.67154
1903–1906	122 16 20.84	508.3					
Abbot	38 03 13.585	418.8	158 23 55.2	338 23 29.3	Mare I. SE.	2780.3	3.444085
1851	122 14 33.438	815.1	223 20 45.3	43 21 28.9	Vallejo (3)	2511.9	3.400006
Bush Hill	38 03 00.970	29.9	96 47 42.4	276 46 19.8	Abbot	3292.5	3.517529
1851	122 12 19.340	471.5	145 07 12.1	325 06 33.1	Vallejo (3)	2700.8	3.431492
North Bay	38 04 00.224	6.9	50 12 41.2	230 11 45.7	Bush Hill	2854.4	3.455510
1851–52	122 10 49.382	1203.8	95 56 51.7	275 55 17.2	Vallejo (3)	3757.4	3.574891
Vallejo Hill 2	38 07 01.471	45.2	332 32 13.8	152 32 55.6	Vallejo (1)	3579.5	3.553818
1887	122 15 51.876	1263.7	4 49 17.2	184 49 10.7	Mare I. NW.	3069.3	3.487037
Brush*	38 07 32.62	1005.8	281 35 00	101 36 58	Vallejo Hill 2	4777.3	3.67918
1887	122 19 04.00	97.4	312 14 46	132 16 38	Mare I. NW.	5976.0	3.77641
Slaughterhouse Point 2*	38 09 17.94	553.2	348 13 39	168 14 18	Mare I. NW.	7422.0	3.87052
1887	122 17 04.60	112.0	41 51 10	221 49 57	Brush	4358.5	3.63934
Red Marsh*	38 08 34.80	1073.0	251 02 18	71 03 56	Slaughterhouse Pt.2	4095.7	3.61233
1887	122 19 43.70	1064.2	317 44 42	137 46 59	Mare I. NW.	8017.5	3.90404
Black Marsh*	38 09 09.41	290.2	267 34 15	87 36 53	Slaughterhouse Pt.2	6259.9	3.79657
1887	122 21 21.48	523.0	311 59 52	132 03 09	Mare I. NW.	10460.7	4.01956
Marsh Pole*	38 07 20.01	617.0	281 09 17	101 10 30	Vallejo Hill 2	2951.5	3.47005
1887	122 17 50.75	1236.2	323 58 50	143 59 57	Mare I. NW.	4487.5	3.65200
Grove Point 2	38 00 48.802	1504.7	155 26 21.2	335 25 38.7	Long Point 2	4049.9	3.607449
1887–99	122 29 18.263	445.5	179 25 10.6	359 25 08.0	Petaluma Creek	10010.6	4.000458
			246 26 39.7	66 34 48.8	Mare I. NW.	21155.6	4.325426
			270 48 58.7	90 53 29.9	Point Pinole 3	10740.9	4.031039
			292 04 17.9	112 05 18.1	Island Hydrographic	2571.7	3.410223
Point Pinole 2 ⊙	38 00 43.609	1344.6	46 23 36.3	226 21 19.6	Point San Pablo Hydrographic	7487.1	3.874313
1896	122 21 58.069	1416.5	68 19 45.1	248 16 59.5	E. Sister	7066.0	3.849174
			84 30 56.1	264 27 25.4	Island Hydrographic	8394.5	3.923994
			90 53 31.2	270 49 00.1	Grove Point 2	10739.4	4.030978
			133 13 49.1	313 09 15.2	Petaluma Creek.	14858.9	4.171987
Observatory	38 06 02.414	74.4	301 15 51.2	121 16 47.7	Vallejo (1)	2611.1	3.416819
1877	122 16 15.723	383.0	330 43 00.0	150 43 37.2	Mare I. SE.	3004.2	3.477726
			345 21 55.2	165 22 03.4	Mare I. NW.	1279.1	3.106896
Vallejo (2) '96	38 04 16.996	524.0	42 42 01.8	222 40 37.5	Lone Tree Point	4915.2	3.691537
1896	122 14 02.259	55.1	109 27 24.2	289 26 39.1	Mare I. SE.	1891.5	3.276801
			134 42 47.3	314 41 29.1	Navy-yard, tall chimney	4341.6	3.637651
			137 22 14.2	317 20 47.4	Navy-yard, foundry chimney	5058.8	3.704051
			152 11 17.4	332 10 28.1	PresbyterianChurch, spire	4170.3	3.620167
			277 35 23.9	97 35 48.2	Vallejo (3)	972.7	2.987986
Wilson 2	38 00 43.960	1355.5	199 54 33.6	19 56 07.9	Navy-yard, foundry chimney	10944.6	4.039198
1896	122 18 55.857	1362.6	206 12 49.1	26 14 36.0	Mare I. NW.	9565.8	3.980723
			231 34 04.8	51 37 30.2	Vallejo (3)	10366.7	4.015639
			232 18 32.3	52 20 09.0	Lone Tree Point	4835.3	3.684424
			216 43 45.4	36 46 01.2	Mare I. SE.	8983.4	3.953439
Point Pinole 2 '96	38 00 43.612	1344.8	225 14 12.0	45 17 51.1	Mare I. NW.	12207.5	4.086626
1896	122 21 58.145	1418.4	250 14 47.5	70 18 16.4	Lone Tree Point	8788.6	3.943922
			269 50 46.4	89 52 38.6	Wilson 2	4446.8	3.648052

*No check on this position.

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Lone Tree Point 2	38 02 19.897	613.5	52 07 26.8	232 05 50.6	Wilson 2	4816.2	3.682701
1896	122 16 20.018	488.2	184 21 02.9	4 21 13.7	Mare I. NW.	5639.4	3.751231
			231 08 09.1	51 09 58.4	Vallejo (3)	5550.8	3.744358
Ferris	38 04 45.994	1418.2	219 42 59.7	39 43 56.4	Petaluma Creek	3506.5	3.544875
1887	122 30 54.389	1325.6	349 41 14.5	169 41 31.2	Long Point 2	3689.3	3.566945
Novato Bend	38 05 13.454	414.8	241 04 47.2	61 06 12.0	Petaluma Creek	3827.6	3.582931
1887	122 31 39.935	973.2	307 19 48.8	127 20 17.0	Ferris	1396.0	3.144890
			338 24 49.6	158 25 34.4	Long Point 2	4813.8	3.682488
Pacheco	38 04 05.076	156.5	174 06 33.9	354 06 28.4	Novato Bend	2119.4	3.326213
1887	122 31 31.009	755.9	215 16 36.3	35 16 58.9	Ferris	1545.4	3.189042
Ferris chimney *	38 04 47.06	1451.1	271 55 44	91 56 09	Ferris	975.7	2.989320
1887	122 31 34.40	838.4	356 20 47	176 20 49	Pacheco	1297.1	3.112978
North Grass	38 04 23.478	723.9	35 15 41.2	215 14 48.7	Long Point 2	3594.8	3.555674
1887	122 29 02.190	53.4	171 43 42.1	351 43 29.6	Petaluma Creek	3426.9	3.534896
			204 44 47.9	24 46 14.7	Sears Point	8175.9	3.912533
South Grass	38 03 34.467	1062.8	46 44 43.8	226 44 05.5	Long Point 2	2078.5	3.317754
1887	122 29 25.217	614.8	180 47 42.5	0 47 44.2	Petaluma Creek	4902.7	3.690439
			204 01 26.7	24 03 07.7	Sears Point	10365.1	4.015573
Novato Pole *	38 04 39.89	1230.0	211 47 15	31 48 00	Petaluma Creek	3394.5	3.53078
1887	122 30 35.82	873.0	356 32 53	176 32 58	Long Point 2	3447.9	3.53755
Sonoma Landing, flagstaff	38 06 39.524	1218.7	60 33 16.4	240 32 40.4	Petaluma Creek	1634.1	3.213275
1887	122 28 24.019	585.1	169 21 09.4	349 20 52.8	Swift 2	3539.7	3.548970
			217 39 37.4	37 40 40.6	Sears Point	4080.2	3.610681
Austin's windmill *	38 07 45.13	1391.6	244 30 34	64 31 38	Sears Point	2805.0	3.44794
1887	122 28 25.62	624.0	26 05 24	206 04 48	Petaluma Creek	3146.9	3.49788
Story's windmill	38 07 39.573	1220.2	202 14 51	22 15 06	Sears Point	1489.1	3.17293
1887–99	122 27 04.801	116.9	260 45 48	80 47 07	Tolay Creek 2	3118.2	3.49390
			51 38 10	231 36 45	Petaluma Creek	4276.4	3.63108
Old barn, SW. gable *	38 08 52.21	1609.9	285 14 14	105 15 34	Sears Point	3275.1	3.51522
1887	122 28 51.41	1251.8	8 46 37	188 46 17	Petaluma Creek	4952.4	3.69482
Tubb's windmill *	38 09 38.96	1201.3	352 02 09	172 02 21	Tolay Creek 2	3212.0	3.50677
1887	122 25 16.70	406.5	41 56 23	221 55 31	Sears Point	3095.2	3.49069
Sonoma Pole	38 09 08.879	273.8	37 10 30.8	217 09 47.4	Tolay Creek 2	2828.1	3.451497
1887	122 23 48.260	1175.0	56 25 27.3	236 22 01.0	Petaluma Creek	9772.0	3.989985
			71 58 21.6	251 56 34.5	Sears Point	4440.3	3.647417
Midshipman Point *	38 06 57.44	1771.1	68 13 36	248 12 10	Petaluma Creek	3653.1	3.562660
1887	122 27 03.18	77.5	191 04 56	11 05 09	Sears Point	2728.2	3.435880
Sonoma Creek 2	38 08 34.817	1073.6	323 45 35.9	143 49 10.2	Lone Tree Point	14329.8	4.156241
1887	122 22 06.340	154.4	359 12 36.7	179 12 41.8	Point Pinole 2	14530.0	4.162266
			67 43 45.3	247 39 17.1	Petaluma Creek	11481.3	4.059992
			87 14 53.1	267 12 04.2	Sears Point	6712.2	3.826862
House in tules, S. gable	38 08 19.182	591.5	307 40 01.3	127 44 10.0	Vallejo (3)	12420.3	4.094133
1896	122 20 06.049	147.2	333 26 22.3	153 28 42.3	Lone Tree Point	12385.2	4.092904
			353 02 39.4	173 03 22.7	Wilson 2	14139.3	4.150428
			11 01 01.2	190 59 52.3	Point Pinole 2 '96	14309.4	4.155621
Chinahouse, E. gable	38 03 26.896	829.3	297 52 33.7	117 56 33.8	Point Pinole 3	10755.6	4.031634
1899	122 28 27.748	676.5	338 57 03.7	158 58 18.0	E. Sister	8192.5	3.913418
			348 51 10.7	168 51 39.7	Island Hydrographic	5952.8	3.774756
			14 11 15.1	194 10 44.0	Grove Point 2	5027.6	3.701360
			67 47 08.4	247 45 54.7	Long Point 2	3148.8	3.498145
			165 27 32.1	345 26 58.2	Petaluma Creek	5305.8	3.724747
San (1896)	38 03 22.018	678.9	249 06 42	69 10 48	Mare I. NW.	10415.0	4.01766
1896	122 22 41.769	1018.2	281 34 40	101 38 36	Lone Tree Point	9529.3	3.97906
			311 28 28	131 30 46	Wilson 2	7355.3	3.86660
South windmill	38 03 28.890	890.8	335 00 59.9	155 02 09.5	Island Hyrdographic	6511.3	3.813670
1899	122 29 33.297	811.8	46 26 14.0	226 25 40.7	Long Point 2	1817.2	3.259413
			182 59 17.5	2 59 24.2	Petaluma Creek	5081.1	3.705958

* No check on this position.

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Middle windmill 1896	38 03 51.545	1589.4	359 48 57.4	179 48 57.8	Grove Point 2	5634.3	3.750842
	122 29 19.005	463.3	40 29 09.0	220 28 26.9	Long Point 2	2564.9	3.409073
			178 54 32.8	358 54 30.5	Petaluma Creek	4376.5	3.641126
			298 16 55.6	118 21 27.1	Point Pinole 2 ⊙	12214.5	4.086876
			333 29 10.1	153 30 55.8	E. Sister	9393.3	3.972817
			334 00 44.1	154 02 58.8	Point San Pablo Hydrographic	12191.1	4.086043
			340 00 28.0	160 01 28.6	Island Hydrographic	7024.0	3.846583
McNears Landing wharfhouse, front gable 1896	37 59 29.255	902.0	144 04 47.8	324 04 20.6	Island Hydrographic	1834.9	3.263617
	122 26 56.450	1377.4	294 04 58.8	114 05 16.8	E. Sister	782.7	2.893618
			327 03 02.6	147 03 49.5	Point San Pablo Hydrographic	3423.7	3.534490
North windmill 1899	38 04 22.791	702.7	337 55 21.3	157 56 57.5	E. Sister	10110.2	4.004758
	122 29 02.890	70.4	345 07 52.0	165 08 43.0	Island Hydrographic	7826.2	3.893552
			35 14 02.1	215 13 10.1	Long Point 2	3567.6	3.552380
			172 03 34.1	352 03 22.1	Petaluma Creek	3445.4	3.537238
Novato windmill 1899	38 05 27.276	841.0	202 10 29	22 10 44	Petaluma Creek	1537.9	3.18692
	122 29 46.248	1127.0	342 12 14	162 13 32	Island Hydrographic	10032.1	4.00139
			11 32 25	191 32 00	Long Point 2	5003.6	3.69928
Chinahouse, E. gable 1899	38 00 16.548	510.2	115 35 25	295 34 32	Grove 2	2303.0	3.36229
	122 27 53.114	1295.8	141 12 58	321 11 23	Long Point 2	6002.1	3.77830
			168 48 55	348 48 00	Petaluma Creek	11217.9	4.04991
			264 28 06	84 31 45	Point Pinole 3	8703.2	3.93968
			264 49 20	84 49 27	Island Hydrographic	307.2	2.48748
Pinole Landing, outside end 1896	38 00 54.382	1676.7	86 39 36	266 37 13	Point Pinole 2 '96	5664.6	3.75317
	122 18 06.334	154.5	200 04 27	20 05 44	Mare I. NW.	8794.5	3.94421
			224 30 47	44 31 52	Lone Tree Point 2	3698.0	3.56797
			228 28 39	48 31 34	Vallejo (3)	9234.2	3.96540
Mill 1877	38 04 50.906	1569.5	62 36 53.3	242 36 33.0	Mare I. SE.	903.6	2.955988
	122 14 42.514	1036.1	116 24 23.0	296 23 33.7	Mare I. NW.	2175.2	3.337499
			134 09 18.5	314 08 21.0	Observatory	3165.4	3.500434
			177 20 04.4	357 20 03.4	Vallejo (1)	850.2	2.929542
Stockyard wharf, outer W. corner 1896	38 02 29.468	908.6	49 23 37	229 22 01	Wilson 2	4996.3	3.69865
	122 16 20.358	496.5	68 25 06	248 21 38	Point Pinole 2 '96	8861.4	3.94750
			184 49 47	4 40 58	Mare I. NW.	5345.8	3.72801
			233 38 22	53 40 12	Vallejo (3)	5377.2	3.73056
			353 24 31	173 24 32	Lone Tree Point	299.4	2.74624
Oil wharf, outer W. corner 1896	38 03 09.895	305.1	34 13 16	214 12 49	Lone Tree Point	1872.2	3.27120
	122 15 35.888	875.0	64 12 53	244 08 58	Point Pinole 2 '96	10356.0	4.01519
			190 27 57	10 28 10	Mare I. SE.	2744.4	3.43844
			239 07 32	59 08 54	Vallejo (3)	3782.4	3.57777
Oilworks, E. chimney 1896	38 03 00.662	20.4	40 53 10	220 52 43	Lone Tree Point	1665.7	3.221602
	122 15 34.240	834.9	49 24 54	229 22 50	Wilson 2	6476.3	3.811325
			65 44 34	245 40 37	Point Pinole 2 '96	10272.1	4.011659
Oilworks, W. chimney 1896	38 03 00.567	17.5	40 48 41	220 48 14	Lone Tree Point	1660.0	3.22011
	122 15 34.460	840.2	49 24 12	229 22 08	Wilson 2	6337.7	3.80193
			65 44 42	245 40 46	Point Pinole 2 '96	10266.0	4.01140
			188 49 34	8 49 46	Mare I. SE.	3022.0	3.48030
California Powderworks, large stack 1896	38 01 10.523	324.4	72 29 06.2	252 28 00.7	Wilson 2	2719.8	3.434535
	122 17 09.534	232.6	83 18 12.6	263 15 14.8	Point Pinole 2 '96	7088.9	3.850578
			191 53 27.4	11 54 08.7	Mare I. NW.	7932.4	3.899403
			209 26 44.2	29 27 14.8	Lone Tree Point 2	2456.2	3.390266
California Powderworks, outside lower stack 1896	38 01 14.183	437.3	68 41 38	248 40 38	Wilson 2	2563.4	3.40882
	122 17 17.957	438.0	82 10 21	262 07 28	Point Pinole 2 '96	6899.2	3.83880
			214 53 20	34 53 56	Lone Tree Point 2	2470.1	3.39272
Refugio wharf-end 1896	38 01 23.200	715.4	60 06 50.1	240 05 56.9	Wilson 2	2427.2	3.385107
	122 17 29.590	721.8	196 04 04.3	16 04 58.0	Mare I. NW.	7671.1	3.884860
			224 08 23.6	44 09 06.6	Lone Tree Point 2	2436.1	3.386695
			228 59 42.7	49 02 14.9	Vallejo (3)	7974.4	3.901696
Lone Tree Point Plasterworks, chimney 1896	38 02 17.591	542.4	52 48 17.8	232 46 41.7	Wilson 2	4773.8	3.678864
	122 16 19.972	487.0	70 40 22.1	250 36 53.8	Point Pinole 2 '96	8742.2	3.941623
			184 17 08.0	4 17 18.8	Mare I. NW.	5710.1	3.756647
			199 57 27.7	19 57 28.4	Lone Tree Point	73.0	1.863395
			230 33 42.7	50 35 32.0	Vallejo (3)	5594.8	3.747788

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Lone Tree Point Plasterworks, NW. gable 1896	38 02 18.179 122 16 21.131	560.5 515.4	52 25 31.6 70 29 55.3 184 34 57.4 226 28 59.7 230 53 17.9	232 23 56.2 250 26 27.7 4 35 08.9 46 29 01.1 50 55 07.9	Wilson 2 Point Pinole 2 '96 Mare I. NW. Lone Tree Point Vallejo (3)	4762.4 8721.6 5694.3 73.3 5605.2	3.677822 3.940596 3.755437 1.865364 3.748595
Dock, SW. corner * 1896	38 03 09.15 122 14 57.10	282.1 1392.2	170 40 28 212 34 40	350 40 17 32 35 14	Mare I. SE. Vallejo (2) '96	2758.0 2482.4	3.44059 3.39487
Vallejo Junction, E. end ferry-slip 1896	38 03 29.792 122 14 11.512	918.6 280.7	143 14 11.7 188 48 26.3 221 52 43.0	323 13 32.3 8 48 32.1 41 53 13.1	Mare I. SE. Vallejo (2) '96 Vallejo (3)	2603.1 1472.8 1782.2	3.415490 3.168129 3.250949
Vallejo Junction, W. end ferry-slip 1896	38 03 30.276 122 14 17.322	933.6 422.3	145 37 29.3 194 17 57.2 225 25 06.8	325 36 53.5 14 18 06.6 45 25 40.5	Mare I. SE. Vallejo (2) '96 Vallejo (3)	2508.5 1486.5 1869.2	3.399419 3.172173 3.271658
Telegraph 1877	38 05 22.248 122 14 47.108	686.0 1148.0	26 32 41.4 90 01 54.6 119 50 33.8 328 14 55.9	206 32 23.9 270 01 08.1 299 49 39.1 148 14 57.7	Mare I. SE. Mare I. NW. Observatory Vallejo (1)	1544.8 1836.3 2489.2 137.6	3.188884 3.263941 3.396061 2.138670
Commission Rock Beacon 1877	38 05 26.348 122 15 16.480	812.4 401.6	83 36 29.2 127 36 43.5 287 09 39.9 359 01 53.7	263 36 00.8 307 36 06.9 107 09 59.8 179 01 54.3	Mare I. NW. Observatory Vallejo (1) Mare I. SE.	1127.5 1822.2 824.9 1508.7	3.052130 3.260594 2.916411 3.178589
Starr's mill, chimney 1896	38 03 27.392 122 13 04.521	844.6 110.2	124 05 41.4 137 22 53.4 162 26 37.6	304 04 20.7 317 22 17.9 342 26 26.4	Mare I. SE. Vallejo (2) '96 Vallejo (3)	3853.0 2078.5 1469.3	3.585802 3.317749 3.167115
NW. Straits 1852	38 05 13.519 122 15 22.690	416.8 553.0	260 48 00.3 350 58 15.0	80 48 24.1 170 58 19.5	Vallejo (1) Mare I. SE.	951.8 1126.9	2.978527 3.051866
Mare Island: Navy-yard, tall chimney 1877–96	38 05 56.048 122 16 08.885	1728.2 216.5	299 17 52.6 308 08 48.6 331 44 40.9 351 27 04.7 2 06 30.2	119 18 44.9 128 10 31.1 151 45 13.9 171 27 08.7 182 06 24.1	Vallejo (1) Vallejo (3) Mare I. SE. Mare I. NW. Lone Tree Point	2368.2 5150.8 2751.9 1053.0 6671.4	3.374416 3.711871 3.439639 3.022429 3.824214
Naval Observatory transit 1877	38 06 02.64 122 16 15.72	81.4 383.0	0 09	180 09	Observatory	7.1	0.8512
Craven's transit pier 1877	38 06 02.42 122 16 15.79	74.6 384.7	270 58	90 58	Observatory	1.6	0.2169
Navy-yard, foundry chimney 1877–96	38 06 17.692 122 16 22.884	545.5 557.6	307 11 35.9 311 13 41.7 331 59 45.5 343 45 40.2 359 15 02.5	127 12 36.8 131 15 32.8 152 00 27.1 163 45 52.8 179 15 05.0	Vallejo (1) Vallejo (3) Mare I. SE. Mare I. NW. Lone Tree Point	3020.8 5839.6 3501.2 1779.6 7334.8	3.480126 3.766386 3.544223 3.250326 3.865389
Mare I. L. H. 1874–1896	38 04 25.866 122 15 15.424	797.6 376.0	278 18 52.7 278 42 43.6 21 43 59.4 38 10 22.8 55 07 58.2	98 20 02.2 98 43 28.7 201 43 20.2 218 08 06.9 235 03 50.2	Vallejo (3) Vallejo (2) '96 Lone Tree Point Wilson 2 Point Pinole	2776.8 1804.2 4183.6 8700.7 11975.5	3.443543 3.256286 3.621548 3.939552 4.078293
Smokestack back of Marine barracks 1896	38 05 28.518 122 16 14.273	879.3 347.8	303 46 33 1 07 23 24 11 46 43 41 41	123 46 40 181 07 20 204 10 05 223 38 08	Mare I. NW. Lone Tree Point Wilson 2 Point Pinole 2 '96	346.3 5819.2 9617.5 12143.1	2.53941 3.76486 3.98306 4.08433
Lighthouse wharf, SW. corner * 1896	38 04 23.39 122 15 16.93	721.2 412.7	276 10 36 21 38 59	96 11 22 201 38 21	Vallejo (2) '96 Lone Tree Point	1830.8 4099.1	3.26265 3.61269
Petaluma Creek: Swift * 1857	38 08 32.23 122 28 50.88	993.8 1239.0	279 32 40 10 10 50	99 35 09 190 10 31	Tolay Creek Petaluma Creek	5967.2 4347.1	3.77577 3.63820
Novato * 1857	38 08 22.34 122 32 21.74	688.8 529.4	266 34 51 312 16 45	86 37 01 132 18 36	Swift Petaluma Creek	5143.6 5904.9	3.71127 3.77121
Sears * 1857	38 10 19.78 122 31 25.78	609.9 627.6	311 18 51 20 37 27	131 20 27 200 36 53	Swift Novato	5021.6 3869.0	3.70084 3.58760

* No check on this position.

San Pablo Bay—Continued

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Petaluma Creek—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
San Antonio *	38 09 55.79	1720.2	259 16 24	79 18 03	Sears	3979.6	3.59984
1857	122 34 06.41	156.0	318 29 57	138 31 02	Novato	3846.7	3.58509
Lakeville *	38 12 14.62	450.8	328 00 54	148 01 50	Sears	4174.4	3.62059
1857	122 32 56.62	1377.6	21 38 57	201 38 14	San Antonio	4605.4	3.66327
Haydon *	38 12 26.02	802.3	275 09 14	95 10 53	Lakeville	3901.8	3.59126
1857	122 35 36.33	883.9	334 42 18	154 43 14	San Antonio	5123.1	3.70953
Bodwell *	38 13 55.18	1701.4	325 24 40	145 25 35	Lakeville	3765.9	3.57587
1857	122 34 24.48	595.5	32 27 07	212 26 23	Haydon	3257.7	3.51291
Italian *	38 13 36.81	1135.0	260 50 05	80 51 34	Bodwell	3561.9	3.55168
1857	122 36 49.06	1193.4	320 57 48	140 58 33	Haydon	2809.6	3.44865
Flat *	38 14 55.70	1717.5	303 06 54	123 08 06	Bodwell	3414.6	3.53334
1857	122 36 22,07	536.8	346 26 33	166 27 01	Haydon	4747.3	3.67645
			15 06 13	195 05 56	Italian	2519.6	3.40133
Petaluma Baptist Church, spire *	38 14 13.00	400.9	247 24 22	67 25 43	Flat	3429.0	3.53517
1857	122 38 32.27	784.8	293 57 27	113 58 31	Italian	2746.9	3.43885
Swift 2	38 08 32.352	997.6	274 30 49.6	94 32 09.4	Sears Point	3156.7	3.499240
1887–99	122 28 50.877	1239.0	10 10 34.8	190 10 15.3	Petaluma Creek	4350.6	3.638547
Dyke 2	38 07 52.897	1631.0	249 41 46.0	69 43 09.4	Swift 2	3507.6	3.545015
1899	122 31 05.970	145.4	261 25 48.9	81 28 32.1	Sears Point	6509.4	3.813543
			320 32 42.9	140 33 46.8	Petaluma Creek	3969.9	3.598785
Green Point	38 06 54.810	1689.9	216 39 21.9	36 40 18.6	Swift 2	3749.2	3.573942
1887	122 30 22.795	555.3	242 51 47.6	62 54 04.1	Sears Point	6051.5	3.781864
Brown	38 10 19.445	599.6	311 07 02.1	131 08 38.0	Swift 2	5019.9	3.700693
1899	122 31 26.179	637.3	338 19 04.1	158 20 20.5	Petaluma Creek	8161.0	3.911743
			353 47 00.7	173 47 13.2	Dyke 2	4545.1	3.657547
San	38 09 30.686	946.2	229 26 08.9	49 26 53.5	Brown	2312.1	3.364009
1899	122 32 38.338	933.4	283 14 07.7	103 17 48.0	Sears Point	8923.1	3.950516
			287 58 18.0	108 00 38.5	Swift 2	5823.1	3.765153
			321 51 45.4	141 53 46.4	Petaluma Creek	7729.3	3.888141
			323 16 11.0	143 17 08.1	Dyke 2	3761.6	3.575370
Slaten's windmill	38 08 41.453	1278.2	172 04 02.3	352 03 51.6	Brown	3050.5	3.484377
1887–99	122 31 08.883	216.3	274 37 48.9	94 40 33.9	Sears Point	6529.0	3.814847
			274 45 41.2	94 47 06.4	Swift 2	3372.3	3.527921
			330 22 53.4	150 23 59.1	Petaluma Creek	5248.1	3.720005
White House, S. gable *	38 07 30.09	927.8	248 08 28	68 10 14	Sears Point	4490.0	3.65225
1887	122 29 32.77	798.2	353 54 33	173 54 39	Petaluma Creek	2375.9	3.37582
Red Hyd	38 08 26.461	815.9	16 38 50.9	196 38 19.8	Petaluma Creek	4279.8	3.631426
1899	122 28 32.102	781.7	108 17 54.9	288 15 22.8	San	6314.1	3.800313
			111 40 11.9	291 40 00.3	Swift 2	492.0	2.691937
			129 26 01.3	309 24 13.8	Brown	5486.2	3.739268
			271 25 32.7	91 26 40.9	Sears Point	2690.6	3.429846
Boathouse, E. gable	38 09 28.000	863.4	235 56 43.5	55 57 43.1	Brown	2833.2	3.452274
1899	122 33 02.611	63.6	262 01 12.7	82 01 27.7	San	596.7	2.775781
			315 54 10.1	135 55 22.2	Dyke 2	4082.3	3.610904
			318 10 54.3	138 13 10.3	Petaluma Creek	8045.7	3.905564
Barn, W. gable	38 07 49.021	1511.5	94 29 58.1	274 29 19.6	Dyke 2	1525.3	3.183359
1899	122 30 03.534	86.1	156 33 09.9	336 32 18.9	Brown	5055.7	3.703779
			232 56 22.7	52 57 07.6	Swift 2	2217.2	3.345801
			257 30 58.9	77 33 03.6	Sears Point	5035.4	3.702032
			341 13 24.6	161 13 50.0	Petaluma Creek	3111.7	3.493000
Barn, SE. gable	38 08 00.076	2.3	15 17 09.7	195 16 46.9	Petaluma Creek	3407.5	3.532438
1886	122 28 45.553	1109.4	86 18 32.6	266 17 05.9	Dyke 2	3426.9	3.534907
			137 42 28.6	317 40 49.4	Brown	5810.3	3.764202
			172 34 42.1	352 34 38.8	Swift 2	1003.6	3.001547
			256 06 02.1	76 07 18.6	Sears Point	3108.3	3.492528

* No check on this position.

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Petaluma Creek—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
San Antonio 2	38 09 56.093	1729.6	259 30 40.1	79 32 19.0	Brown	3960.3	3.597727
1899	122 34 06.157	149.9	284 37 14.2	104 41 48.7	Sears Point	11186.9	4.048711
			288 33 48.6	108 37 03.0	Swift 2	8098.9	3.908424
			290 06 56.5	110 07 50.8	San	2276.9	3.357353
			310 52 08.3	130 53 59.6	Dyke 2	5803.2	3.763670
			314 47 05.8	134 50 01.0	Petaluma Creek	9739.8	3.988550
Clubhouse, flagstaff	38 09 23.380	720.9	255 00 48.9	75 01 10.3	San	871.3	2.940146
1899	122 33 12.907	314.2	236 21 15.5	56 22 21.5	Brown	3120.7	3.494253
			280 47 43.9	100 51 45.6	Sears Point	9699.6	3.986753
			283 49 48.2	103 52 30.1	Swift 2	6571.3	3.817651
			312 03 25.5	132 04 44.0	Dyke 2	4163.8	3.619491
			316 11 21.1	136 13 43.5	Petaluma Creek	8111.6	3.909106
Warehouse, W. gable	38 08 31.388	967.8	356 00 44.7	176 00 46.8	Dyke 2	1189.6	3.075414
1899	122 31 09.367	228.1	130 10 15.4	310 09 20.4	San	2834.7	3.452510
			172 59 51.7	352 59 41.3	Brown	3356.7	3.525917
			269 28 59.2	89 30 24.7	Swift 2	3372.6	3.527959
			271 54 13.6	91 56 58.9	Sears Point	6523.1	3.814453
			328 30 04.0	148 31 10.0	Petaluma Creek	4986.9	3.697826
Barn, NW. gable	38 08 06.297	194.2	74 40 41.5	254 40 03.3	Dyke 2	1563.0	3.193970
1899	122 30 04.074	99.2	154 02 36.2	334 01 45.5	Brown	4566.1	3.659548
			245 44 02.9	65 44 48.1	Swift 2	1955.2	3.291186
			263 34 02.0	83 36 07.0	Sears Point	4960.7	3.695542
			343 44 18.9	163 44 44.6	Petaluma Creek	3623.8	3.559159
Double barn, NW. gable	38 07 30.402	937.4	107 38 11.8	287 37 16.5	Dyke 2	2290.2	3.359865
1899	122 29 36.357	885.5	152 50 56.4	332 49 48.6	Brown	5858.0	3.767746
			210 06 19.8	30 06 47.9	Swift 2	2208.0	3.343996
			248 39 38.2	68 41 26.1	Sears Point	4567.7	3.659694
			351 51 23.2	171 51 31.8	Petaluma Creek	2396.3	3.379536
Building, S. gable	38 09 17.669	544.8	125 26 24.7	305 26 10.5	San	692.2	2.840214
1899	122 32 15.175	369.5	212 03 05.6	32 03 35.9	Brown	2247.4	3.351674
			281 25 50.6	101 29 16.6	Sears Point	8286.4	3.918364
			285 40 17.5	105 42 23.7	Swift 2	5167.0	3.713238
			323 27 12.3	143 28 59.0	Petaluma Creek	7068.1	3.849303
			327 10 55.7	147 11 38.6	Dyke 2	3109.9	3.492744
Lone Tree	38 11 29.403	906.6	339 53 49.8	159 55 20.1	Petaluma Creek	10372.2	4.015871
1899	122 31 48.748	1186.3	345 42 40.6	165 42 54.5	Brown	2225.8	3.347495
			351 07 45.6	171 08 12.0	Dyke 2	6756.2	3.829700
Don	38 11 09.988	308.0	317 04 06.0	137 04 42.8	Brown	2128.3	3.328028
1899	122 32 25.733	626.3	333 57 41.3	153 59 34.5	Petaluma Creek	10173.9	4.007489
			342 16 17.8	162 17 07.1	Dyke 2	6379.6	3.804790
			5 43 25.8	185 43 18.0	San	3077.1	3.488140
Green Point	38 06 54.885	1692.2	145 29 58.6	325 28 34.8	San	5829.7	3.765645
1899	122 30 22.709	553.2	149 30 00.7	329 29 34.0	Dyke 2	2076.0	3.317217
			166 14 11.7	346 13 32.5	Brown	6493.7	3.812491
			216 39 06.0	36 40 02.7	Swift 2	3746.1	3.573581
			242 52 25.5	62 54 42.0	Sears Point	6048.6	3.781653
Chickenhouse, E. gable	38 07 04.577	141.1	172 30 22.2	352 30 17.2	Dyke 2	1502.7	3.176859
1899	122 30 57.924	1411.0	173 28 11.3	353 27 53.8	Brown	6047.6	3.781580
			228 48 56.1	48 50 14.5	Swift 2	4110.8	3.613925
			248 29 21.9	68 32 00.1	Sears Point	6708.0	3.826594
Haré farmhouse cupola, flagstaff	38 07 29.313	903.8	152 23 15.9	332 22 26.2	San	4223.5	3.625673
1899	122 31 17.933	436.8	177 48 31.6	357 48 26.5	Brown	5249.5	3.720114
			201 50 02.9	21 50 10.3	Dyke 2	783.4	2.893963
			241 29 55.1	61 31 25.9	Swift 2	4074.8	3.610111
			255 50 26.2	75 53 16.8	Sears Point	6938.9	3.841288
Barn, SW. gable	38 09 32.646	1006.6	326 37 01.0	146 37 32.0	Swift 2	2226.2	3.347568
1899	122 29 41.180	1002.5	355 44 41.1	175 44 52.6	Petaluma Creek	6158.1	3.789450
			33 52 55.0	213 52 02.6	Dyke 2	3704.3	3.568701
			89 12 44.6	269 10 55.1	San	4313.5	3.634828
Burdell red R. R. tank	38 09 21.042	648.8	242 40 46.9	62 42 15.4	Brown	3925.1	3.593846
1899	122 33 49.442	1203.7	260 14 51.8	80 15 35.7	San	1756.5	3.244646
			279 30 05.6	99 34 29.8	Sears Point	10562.6	4.023769
			281 38 31.7	101 41 36.1	Swift 2	7254.2	3.860590
			304 18 30.0	124 20 11.0	Dyke 2	4819.9	3.683041
			311 37 25.8	131 40 10.7	Petaluma Creek	8702.9	3.939666

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Petaluma Creek—Cont'd.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
White tank	38 09 07.624	235.1	336 10 43.4	156 10 55.6	Swift 2	1188.8	3.075103
1899	122 29 10.594	258.0	3 04 22.5	183 04 15.2	Petaluma Creek	5377.4	3.730575
			50 39 22.7	230 38 11.5	Dyke 2	3633.5	3.560324
			98 01 12.3	277 59 04.0	San	5107.7	3.708223
Red barn cupola, weather vane	38 08 18.929	583.7	223 33 36.2	43 34 29.5	San	3053.5	3.484795
1899	122 34 04.766	116.1	226 05 07.0	46 06 44.9	Brown	5358.7	3.729058
			266 52 26.3	86 55 40.1	Swift 2	7655.0	3.883946
			280 25 43.2	100 27 33.6	Dyke 2	4427.7	3.646179
White barn, SE. gable	38 08 15.759	485.9	220 33 26.0	40 34 16.1	San	3041.0	3.483013
1899	122 33 59.554	1450.3	224 23 05.5	44 24 40.2	Brown	5337.4	3.727328
			266 04 48.5	86 07 59.1	Swift 2	7534.3	3.877043
			268 33 07.8	88 37 38.2	Sears Point	10667.2	4.028052
Napa Creek:							
Vallejo Hill	38 07 01.368	42.2	332 28 58.2	152 29 39.8	Vallejo (1)	3577.7	3.553601
1858	122 15 51.965	1265.9	4 47 08.5	184 47 02.0	Mare I. NW.	3066.0	3.486567
			102 43 01.7	282 40 44.0	Long Pond	5568.9	3.745769
Slaughterhouse	38 09 17.872	551.1	337 12 38.7	157 13 23.6	Vallejo Hill	4564.9	3.659432
1858	122 17 04.552	110.8	348 14 01.0	168 14 39.3	Mare I. NW.	7419.8	3.870392
			50 50 41.2	230 49 08.3	Long Pond	4725.5	3.674450
Napa Branch	38 11 11.901	367.0	314 27 15.0	134 28 45.9	Slaughterhouse	5019.1	3.700622
1858	122 19 31.702	771.5	0 42 30.3	180 42 28.3	Long Pond	6501.0	3.812977
Navy-Yard Slough	38 09 27.229	839.6	10 11 09.4	190 10 54.5	Long Pond	3325.5	3.521863
1858	122 19 10.856	264.3	171 03 59.5	351 03 46.6	Napa Branch	3267.0	3.514143
			275 20 57.4	95 22 15.4	Slaughterhouse	3088.6	3.489758
Green Hill	38 12 07.173	221.2	356 07 18.4	176 07 27.4	Slaughterhouse	5232.0	3.718667
1858	122 17 19.087	464.4	62 10 23.3	242 09 01.3	Napa Branch	3649.4	3.562221
Good Luck Point	38 11 02.395	73.8	98 24 49.2	278 23 58.8	Napa Branch	2004.8	3.302070
1858	122 18 10.211	248.5	211 54 48.7	31 55 20.3	Green Hill	2353.0	3.371631
			333 36 57.4	153 37 38.0	Slaughterhouse	3597.3	3.555974
Flys Hill	38 13 12.506	385.6	296 52 42.1	116 54 23.1	Green Hill	4453.5	3.648705
1858	122 20 02.350	57.2	348 39 29.7	168 39 48.7	Napa Branch	3792.6	3.578940
Suscol Hill	38 14 36.748	1133.1	14 08 07.0	194 07 37.5	Green Hill	4755.7	3.677214
1858	122 16 31.355	762.5	63 10 19.8	243 08 09.3	Flys Hill	5751.6	3.759788
Green Island	38 12 48.855	1506.4	27 42 30.1	207 41 50.2	Napa Branch	3376.4	3.528451
1858	122 18 27.193	661.6	107 29 39.2	287 28 40.3	Flys Hill	2427.0	3.385065
			220 15 11.2	40 16 22.9	Suscol Hill	4359.4	3.639430
			307 47 29.1	127 48 11.2	Green Hill	2097.0	3.321591
Home Hill	38 14 26.497	817.0	260 08 11.0	80 08 57.2	Suscol Hill	1846.1	3.266255
1858	122 17 46.149	1122.3	351 17 08.0	171 17 24.7	Green Hill	4345.9	3.638079
			55 27 27.6	235 26 03.3	Flys Hill	4022.2	3.604467
Stony Hill	38 16 00.594	18.3	317 43 42.7	137 44 42.5	Suscol Hill	3493.3	3.543231
1858	122 18 07.981	194.0	349 37 46.6	169 38 00.1	Home Hill	2949.4	3.469739
			28 13 45.9	208 12 35.1	Flys Hill	5881.7	3.769503
Napa Hill	38 18 06.707	206.8	8 06 14.0	188 05 50.5	Suscol Hill	6539.0	3.815508
1858	122 15 53.450	1298.8	21 58 58.8	201 57 49.0	Home Hill	7321.6	3.864605
			40 04 15.3	220 02 52.0	Stony Hill	5080.4	3.705902
Green's house, chimney	38 17 27.585	850.6	253 31 03.0	73 32 47.1	Napa Hill	4255.2	3.628924
1858	122 18 41.379	1005.6	329 01 19.3	149 02 39.9	Suscol Hill	6143.0	3.788381
			343 09 32.7	163 09 53.5	Stony Hill	2802.3	3.447519
Fly's house, chimney	38 13 49.152	1515.6	247 54 22.2	67 55 53.2	Suscol Hill	3903.7	3.591477
1858	122 19 00.096	2.3	321 59 03.9	142 00 05.4	Green Hill	3990.6	3.601034
			53 16 33.1	233 15 53.6	Flys Hill	1889.3	3.276306
Ferry-house, chimney	38 14 37.978	1171.0	5 06 44.3	185 06 33.7	Green Hill	4668.3	3.669158
1858	122 17 01.991	48.4	59 01 09.6	238 59 18.0	Flys Hill	5117.3	3.709044
			71 45 32.7	251 45 05.4	Home Hill	1130.7	3.053339
			147 47 59.7	327 47 18.9	Stony Hill	3010.5	3.478636
Napa Creek	38 15 39.456	1216.6	334 57 02.6	154 57 25.6	Suscol Hill	2134.2	3.329230
1858	122 17 08.513	207.0	22 08 23.4	202 08 00.1	Home Hill	2428.5	3.385346
			114 16 17.2	294 15 40.4	Stony Hill	1585.8	3.200257

San Pablo Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Napa Creek—Continued.							
Napa City Court-house, spire	38 17 52.935	1633.2	256 25 15.2	76 26 00.0	Napa Hill	1809.4	3.257526
1858	122 17 05.833	141.7	8 45 24.2	188 44 59.2	Home Hill	6440.1	3.808893
			23 33 59.0	203 33 20.5	Stony Hill	3778.9	3.577361
Point Pinole:							
E. stack	38 00 31.394	968.0	145 41 41.5	325 41 35.1	Point Pinole 2 '96	456.1	2.659028
1896	122 21 47.608	1161.4	233 08 54.8	43 12 27.5	Mare I. NW.	12298.4	4.089850
			240 56 54.2	61 02 05.3	Vallejo (3)	14078.5	4.148557
			247 20 06.0	67 23 28.6	Lone Tree Point	8685.3	3.938784
			264 42 07.0	84 43 52.8	Wilson 2	4207.8	3.624051
West tall brick chimney	38 00 35.349	1090.0	23 42 57.4	203 41 34.8	High Hill	8136.4	3.910432
1896	122 21 51.708	1261.4	38 34 30.0	218 32 37.0	San Pablo Ridge	7187.3	3.856566
			70 41 46.0	250 38 56.4	E. Sister	7122.2	3.852617
			92 13 08.5	272 08 33.5	Grove Point 2	10901.4	4.037482
			148 54 12.4	328 54 08.5	Point Pinole 3	297.5	2.473505
			223 52 41.0	43 56 15.0	Mare I. NW.	12278.9	4.089161
			241 34 42.0	61 39 54.4	Vallejo (3)	14107.6	4.149452
			248 19 34.0	68 22 57.9	Lone Tree Point	8731.9	3.941110
			266 26 37.8	86 28 24.9	Wilson 2	4298.1	3.633281
Outer tank	38 00 43.084	1328.5	112 01 08.0	292 01 06.9	Point Pinole 2 '96	43.5	1.638290
1896	122 21 56.492	1378.0	225 02 56.9	45 06 35.1	Mare I. NW.	12190.4	4.086018
			242 39 18.8	62 44 35.4	Vallejo (3)	14099.2	4.149194
			250 03 26.4	70 06 54.3	Lone Tree Point	8756.3	3.942319
			269 37 59.4	89 39 50.5	Wilson 2	4406.6	3.644104
First tank	38 00 09.542	294.2	169 03 15.5	349 03 10.4	Point Pinole 2 '96	1069.9	3.029350
1896	122 21 49.817	1215.4	243 30 44.6	63 34 08.4	Lone Tree Point	9014.7	3.954950
			255 56 47.4	75 58 34.6	Wilson 2	4374.6	3.640939
High tank	38 00 32.984	1017.0	149 12 11.6	329 12 06.7	Point Pinole 2 '96	381.5	2.581514
1896	122 21 50.138	1223.1	223 30 49.8	43 34 24.1	Mare I. NW.	12305.1	4.090086
			247 47 16.1	67 50 40.1	Lone Tree Point	8723.6	3.940696
			265 26 01.4	85 27 48.7	Wilson 2	4265.0	3.629922
Vallejo:							
Catholic Church, NW. pinnacle	38 06 20.922	645.1	330 42 45.1	150 43 12.4	Vallejo (1)	2208.2	3.344047
	122 15 28.465	693.5	24 36 58.9	204 36 37.9	Mare I. NW.	1988.9	3.298619
1877			63 38 29.4	243 38 00.1	Observatory	1285.1	3.108924
School cupola	38 06 16.873	520.2	1 31 47.4	181 31 45.3	Mare I. SE.	3067.3	3.486758
1877	122 15 12.074	294.1	36 06 33.2	216 06 02.1	Mare I. NW.	2083.6	3.318805
			73 58 01.6	253 57 22.3	Observatory	1613.6	3.207792
Orphan Asylum cupola, flagstaff	38 07 06.378	196.7	8 15 28.4	188 15 16.2	Vallejo (1)	3362.4	3.526653
	122 14 24.318	592.4	15 10 39.7	195 10 08.2	Mare I. SE.	4758.5	3.677467
1877			36 41 36.5	216 40 36.0	Mare I. NW.	4002.5	3.602334
Presbyterian Church, spire	38 06 16.623	512.6	322 39 58.3	142 41 11.9	Vallejo (3)	4799.7	3.681218
	122 15 22.123	539.0	332 41 58.7	152 42 22.1	Vallejo (1)	2018.2	3.304973
1877–1896			356 56 57.2	176 57 01.3	Mare I. SE.	3062.8	3.486122
			30 23 57.9	210 23 33.0	Mare I. NW.	1942.7	3.288401
			71 27 41.5	251 27 08.4	Observatory	1377.5	3.139087

Suisun Bay.

Carquinez Point	38 02 36.570	1127.6	108 29 35.5	288 28 38.6	Bush Hill	2372.6	3.375222
1851–2	122 10 47.054	1147.4	178 44 24.0	358 44 22.6	North Bay	2579.8	3.411594
Monument Hill	38 03 35.428	1092.4	48 10 59.9	228 10 08.6	Carquinez Point	2721.3	3.434783
1851–2	122 09 23.877	582.2	110 08 59.0	290 08 06.3	North Bay	2220.1	3.346380
Martinez	38 01 09.936	306.4	131 04 26.2	311 03 08.8	Carquinez Point	4066.2	3.609189
1851–2	122 08 41.341	1008.4	166 59 02.4	346 58 36.2	Monument Hill	4604.1	3.663146
Army Point	38 03 03.399	104.8	20 31 08.8	200 30 35.7	Martinez	3735.2	3.572309
1851–2	122 07 47.667	1162.2	112 50 18.7	292 49 19.4	Monument Hill	2545.0	3.405688
Island	38 01 50.849	1567.9	69 04 34.7	249 03 11.4	Martinez	3530.3	3.547812
1851–2	122 06 26.153	637.9	138 22 57.8	318 22 07.6	Army Point	2992.4	3.476019
Goodyear	38 06 22.892	705.9	2 13 01.6	182 12 53 4	Island	8393.9	3.923966
1864	122 06 12.839	312.8	20 36 07.0	200 35 08.5	Army Point	6570.7	3.817611

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Martinez East	38 01 13.600	419.3	192 12 47.9	12 13 40.2	Goodyear	9757.2	3.989324
1878	122 07 37.562	916.2	236 35 37.4	56 36 21.5	Island	2086.2	3.319359
			309 12 34.9	129 20 28.0	Mount Diablo	24259.9	4.384889
Benecia B. M.	38 02 40.289	1242.3	303 45 02.9	123 46 00.6	Island	2743.1	3.438248
1878	122 07 59.673	1455.1	348 35 28.7	168 35 42.3	Martinez East	2726.6	3.435628
Naylor	38 02 04.628	142.7	331 46 57.6	151 50 46.2	Mount Diablo	19208.7	4.283498
1880	122 01 00.005	0.1	80 49 03.7	260 44 58.8	Martinez East	9823.0	3.992242
			86 58 13.9	266 54 52.9	Island	7965.3	3.901203
			96 10 05.7	276 05 47.1	Benecia B. M.	10292.7	4.012528
			136 16 01.4	316 12 48.5	Goodyear	11025.1	4.042381
Clayton, Mount Diablo Azimuth Mark	37 58 56.356	1737.4	350 16 47.7	170 17 35.6	Mount Diablo	11288.1	4.052619
	121 56 06.344	154.8	104 08 40.4	284 01 34.8	Martinez East	17387.1	4.240228
1876–80			129 02 29.1	308 59 28.3	Naylor	9220.6	3.964759
Hewston 2	38 08 21.016	648.0	0 25 45.7	180 25 43.5	Naylor	11605.2	4.064652
1886	122 00 56.439	1374.5	33 46 09.1	213 42 45.7	Island	14466.4	4.160362
			64 43 58.5	244 40 43.1	Goodyear	8524.0	3.930644
Middle	38 05 41.549	1281.2	30 12 39.6	210 11 01.2	Naylor	7738.2	3.888641
1886	121 58 20.342	495.7	59 03 08.3	238 58 08.8	Island	13814.9	4.140347
			96 21 31.3	276 16 39.8	Goodyear	11582.8	4.063814
			142 17 43.4	322 16 07.2	Hewston 2	6215.6	3.793481
Collinsville	38 05 33.618	1036.6	66 20 27.2	246 14 16.2	Naylor	16024.1	4.204774
1866–1867	121 50 58.159	1417.4	91 20 17.0	271 15 44.2	Middle	10777.6	4.032522
			109 33 08.0	289 26 58.9	Hewston 2	15461.1	4.189240
Diamond	38 02 26.678	822.6	86 35 17.6	266 30 32.8	Naylor	11293.2	4.052817
1886	121 53 17.745	432.8	129 11 26.7	309 08 20.1	Middle	9513.5	3.978339
			210 32 36.1	30 34 02.1	Collinsville	6693.1	3.825630
Meins	38 08 21.542	664.2	318 08 29.3	138 10 26.8	Collinsville	6949.8	3.841970
1886	121 54 08.476	206.4	353 32 57.9	173 33 29.2	Diamond	11010.8	4.041820
			51 13 18.9	231 10 43.5	Middle	7872.5	3.896115
			89 56 29.4	269 52 17.6	Hewston 2	9934.9	3.997165
Anderson	38 04 31.487	970.9	58 50 58.7	238 48 17.9	Diamond	7434.2	3.871235
1886	121 48 56.836	1385.3	122 56 56.0	302 55 41.2	Collinsville	3523.1	3.546923
Sand	38 00 52.283	1612.1	96 21 40.0	276 13 09.0	Naylor	20358.1	4.308737
1886	121 47 10.356	252.6	108 01 31.0	287 57 44.7	Diamond	9421.2	3.974108
			147 23 15.8	327 20 55.4	Collinsville	10299.9	4.012832
			158 59 37.4	338 58 31.7	Anderson	7240.0	3.859740
Buckler 2	38 05 51.870	1599.4	357 37 32.0	177 37 39.4	Naylor	7012.4	3.845864
1886	122 01 11.919	290.4	45 53 46.4	225 50 32.7	Island	10672.4	4.028262
			97 27 30.7	277 24 25.0	Goodyear	7393.9	3.868876
			184 41 10.1	4 41 19.8	Hewston 2	4614.0	3.664073
Coon 2	38 08 35.818	1104.4	277 13 58.2	97 15 29.2	Hewston 2	3618.7	3.558548
1886	122 03 23.853	580.9	327 32 30.9	147 33 52.3	Buckler 2	5990.0	3.777427
			45 08 13.3	225 06 29.1	Goodyear	5808.5	3.764061
Hastings	38 12 02.336	72.0	316 30 41.0	136 33 24.8	Meins	9379.7	3.972189
1888	121 58 33.549	816.4	27 01 15.8	206 59 47.5	Hewston 2	7659.2	3.884184
			48 00 11.5	227 57 12.1	Coon 2	9512.0	3.978274
Suisun Hill	38 12 54.086	1667.6	292 51 26.7	112 53 02.9	Hastings	4105.5	3.613361
1888	122 01 09.027	219.6	357 54 53.7	177 55 01.5	Hewston 2	8425.0	3.925572
			22 24 28.3	202 23 05.0	Coon 2	8612.7	3.935141
			31 32 36.6	211 29 29.0	Goodyear	14148.7	4.150716
Pierce	38 09 38.867	1198.3	236 16 51.3	56 20 40.7	Suisun Hill	10851.9	4.035507
1888	122 07 20.065	488.5	288 39 18.0	108 41 44.0	Coon 2	6071.0	3.783258
Bridgeport	38 13 03.312	102.1	271 54 51.1	91 58 24.3	Suisun Hill	8386.5	3.923583
1888	122 06 53.574	1303.3	315 00 25.8	135 04 06.6	Hewston 2	12301.1	4.089944
			5 50 29.7	185 50 13.4	Pierce	6336.5	3.801847
Marsh	38 10 33.941	1046.5	23 13 10.2	203 11 46.2	Goodyear	8421.9	3.925411
1888	122 03 56.550	1376.5	71 05 51.9	251 03 46.1	Pierce	5237.0	3.719082
			136 55 47.8	316 53 58.4	Bridgeport	6306.0	3.799755
			223 19 02.2	43 20 45.8	Suisun Hill	5940.5	3.773821
			250 50 58.1	70 54 18.0	Hastings	8319.7	3.920107

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Edith	38 03 14.410	444.3	51 53 50.3	231 52 27.3	Island	4174.1	3.620558
1864	122 04 11.476	279.9	53 28 25.5	233 26 18.4	Martinez East	6255.5	3.796262
			86 20 00.0	266 17 46.8	Army Point	5281.9	3.722791
			153 02 06.2	333 00 51.3	Goodyear	6520.8	3.814299
			294 43 31.6	114 45 29.6	Naylor	5140.6	3.711017
Garnett	38 05 18.893	582.6	35 31 37.1	215 30 27.8	Edith	4715.4	3.673522
1864	122 02 19.088	465.3	43 13 09.4	223 10 37.1	Island	8799.0	3.944435
			62 28 54.8	242 25 32.2	Army Point	9033.2	3.955844
			109 07 43.0	289 05 18.7	Goodyear	6027.8	3.780156
Seal Bluff	38 03 19.798	610.4	65 27 45.1	245 25 13.4	Island	6598.5	3.819444
1864	122 02 20.030	488.4	86 30 38.9	266 29 30.2	Edith	7722.2	3.434916
			134 52 27.5	314 50 03.9	Goodyear	8003.9	3.903301
			180 21 28.5	0 21 29.1	Garnett	3672.0	3.564906
			319 53 56.2	139 54 45.4	Naylor	3029.6	3.481392
Simmons	38 05 17.189	530.0	55 44 56.6	235 42 42.2	Seal Bluff	6427.8	3.808063
1866	121 58 42.102	1026.0	90 35 16.2	270 33 02.4	Garnett	5288.0	3.723295
			267 23 41.2	87 28 27.6	Collinsville	11316.9	4.053726
Hill	38 01 55.756	1719.1	128 01 00.5	307 59 36.7	Seal Bluff	4208.3	3.624104
1866	122 00 04.042	98.6	152 16 57.7	332 15 34.5	Garnett	7075.7	3.849770
			197 49 22.0	17 50 12.5	Simmons	6523.9	3.814510
			243 10 11.9	63 15 48.7	Collinsville	14906.5	4.173377
Mallard	38 02 29.777	918.0	80 01 19.8	259 58 49.5	Hill	6041.3	3.781129
1866	121 56 00.071	1.7	142 35 23.4	322 33 43.5	Simmons	6499.5	3.812882
			232 22 13.9	52 25 20.4	Collinsville	9289.2	3.967977
McDuff	38 05 34.346	1059.0	270 13 02.8	90 15 20.9	Collinsville	5442.3	3.735784
1866	121 54 41.504	1011.3	18 36 25.7	198 35 37.2	Mallard	6004.3	3.778462
			84 51 54.1	264 49 25.7	Simmons	5886.8	3.769881
New York	38 02 24.350	750.8	92 22 00.2	272 20 17.3	Mallard	4076.3	3.610262
1866	121 53 13.049	318.3	159 47 59.3	339 47 04.8	McDuff	6242.2	3.795338
			209 23 14.8	29 24 38.3	Collinsville	6698.1	3.825949
Pittsburg	38 01 37.978	1170.9	113 18 37.9	293 17 14.0	New York	3614.8	3.558081
1867	121 50 56.912	1388.0	179 45 33.8	359 45 33.0	Collinsville	7265.3	3.861254
Marshal	38 04 31.460	970.0	28 42 07.2	208 40 53.2	Pittsburg	6097.5	3.785150
1867	121 48 56.846	1385.6	57 54 57.1	237 52 19.2	New York	7373.7	3.867687
			122 57 41.4	302 56 26.6	Collinsville	3523.4	3.546959
Antioch	38 01 00.595	18.3	104 32 28.5	284 30 36.1	Pittsburg	4595.3	3.662316
1867	121 47 54.533	1330.2	108 24 54.0	288 21 37.5	New York	8186.2	3.913085
			152 00 34.6	331 58 41.4	Collinsville	9534.3	3.979289
			166 51 04.2	346 50 25.8	Marshal	6676.5	3.824552
Grant	38 04 29.508	909.8	7 29 56.6	187 29 35.2	Antioch	6496.7	3.812693
1867	121 47 19.773	482.0	45 02 55.2	225 00 41.4	Pittsburg	7483.2	3.874085
			65 53 44.2	245 50 06.4	New York	9437.6	3.974862
			91 27 55.3	271 26 55.5	Marshal	2366.8	3.374157
Hammond	38 01 08.172	252.0	85 35 51.1	265 34 34.7	Antioch	3035.9	3.482283
1867	121 45 50.443	1230.4	97 02 05.6	276 58 56.8	Pittsburg	7531.3	3.876870
			102 18 47.2	282 14 14.4	New York	11047.1	4.043249
			137 30 56.7	317 27 47.3	Collinsville	11102.5	4.045419
			144 04 06.3	324 02 11.5	Marshal	7742.2	3.888866
			160 40 21.3	340 39 26.3	Grant	6578.6	3.818136
Foley	38 07 58.197	1794.3	166 31 03.6	346 30 44.6	Pierce	3191.9	3.504050
1888	122 06 49.496	1205.5	179 23 45.5	359 23 42.8	Bridgeport	9408.0	3.973498
			221 13 55.6	41 15 42.4	Marsh	6386.6	3.805273
			256 56 29.1	76 58 36.0	Coon 2	5140.6	3.711012
			343 05 34.9	163 05 57.6	Goodyear	3071.1	3.487300
Delta 2	38 07 36.143	1114.4	45 58 08.6	225 57 09.4	Goodyear	3248.9	3.511737
1886	122 04 36.962	900.3	101 54 25.0	281 53 03.2	Foley	2298.8	3.518356
			133 37 36.0	313 35 55.1	Pierce	5485.6	3.739228
			224 03 10.0	44 03 55.1	Coon 2	2560.4	3.408301
			302 44 55.1	122 47 01.6	Buckler 2	5940.3	3.773809
Army Point 2	38 03 03.151	97.2	200 17 02.3	20 17 59.9	Goodyear	6565.9	3.817297
1886	122 07 46.268	1128.1	225 30 10.3	45 34 23.2	Hewston 2	13992.0	4.145879
			241 32 37.7	61 36 40.8	Buckler 2	10929.2	4.038588
			250 27 18.8	70 33 07.7	Middle	14633.1	4.165336
			266 11 21.1	86 13 33.5	Edith	5248.4	3.720026
			280 17 16.8	100 21 27.2	Naylor	10069.4	4.003004
			318 45 48.1	138 46 37.5	Island	2964.1	3.471893
			356 24 10.4	176 24 15.6	Martinez East	3384.3	3.529469

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Suisun Point 2	38 02 06.870	211.8	29 26 37.8	209 26 14.2	Martinez East	1885.9	3.275525
1886	122 06 59.555	1452.4	146 43 20.5	326 42 51.7	Army Point 2	2075.7	3.317164
			188 12 16.8	8 12 45.6	Goodyear	7975.4	3.901754
			230 39 55.4	50 43 29.8	Buckler 2	10951.5	4.039475
			243 03 02.8	63 04 46.4	Edith	4597.1	3.662485
			270 25 15.4	90 28 57.0	Naylor	8768.6	3.942929
			301 13 48.2	121 14 08.8	Island	952.7	2.978936
Stake	38 03 04.710	145.2	72 34 03.1	252 31 34.1	Naylor	6176.3	3.790728
1886	121 56 58.378	1423.4	157 33 34.8	337 32 44.2	Middle	5232.1	3.718678
			242 21 51.0	62 25 33.1	Collinsville	9908.1	3.995990
			282 16 37.5	102 18 53.5	Diamond	5506.0	3.740840
Bark	38 02 09.674	298.3	85 19 16.9	265 18 28.9	Naylor	1904.7	3.279829
1886	121 59 42.164	1028.3	196 58 18.7	16 59 09.1	Middle	6830.3	3.834437
			246 57 59.6	66 59 40.5	Stake	4339.3	3.637419
			266 45 57.9	86 49 54.7	Diamond	9389.0	3.972619
Upham	38 05 39.368	1213.8	153 24 36.5	333 23 33.0	Meins	5592.0	3.747569
1887	121 52 25.691	626.1	274 44 38.2	94 45 32.2	Collinsville	2140.3	3.330471
Birds Landing warehouse,	38 07 23.000	709.2	339 41 54.7	159 42 24.6	Upham	3406.7	3.532339
S. gable	121 53 14.199	345.9	143 47 16.3	323 46 42.7	Meins	2237.3	3.349715
1887			315 29 13.1	135 30 37.0	Collinsville	4728.4	3.674717
Mass	38 03 34.536	1064.9	74 11 43.2	254 10 47.7	Edith	2277.3	3.357412
1864	122 02 41.602	1014.3	82 41 42.3	262 38 33.6	Army Point	7523.4	3.876415
			135 15 17.9	315 13 07.6	Goodyear	7310.7	3.863960
Preston	38 04 16.558	510.5	50 10 42.5	230 08 26.2	Island	7012.4	3.845864
1864	122 02 45.320	1104.7	73 00 37.7	252 57 31.3	Army Point	7708.1	3.886949
			127 37 22.2	307 35 14.2	Goodyear	6383.3	3.805045
Marked tree *	38 01 57.58	1775.3	132 48 47	312 47 52	Army Point	2986.4	3.47515
1864	122 06 17.81	434.4	180 50 56	0 50 59	Goodyear	8180.9	3.91280
King *	38 05 25.72	793.0	43 53 12	223 50 31	Island	9188.8	3.96326
1864	122 02 04.96	120.9	62 18 57	242 15 26	Army Point	9435.8	3.97478
Ryer's house, cupola	38 04 36.660	1130.3	13 56 47.7	193 56 18.3	Naylor	4829.7	3.683923
1886	122 00 12.275	299.2	60 44 48.1	240 40 57.6	Island	10451.1	4.019164
			65 05 28.6	245 01 17.5	Suisun Point 2	10951.0	4.039453
			75 26 15.0	255 21 35.1	Army Point 2	11436.5	4.058294
			110 28 32.2	290 24 49.7	Goodyear	9377.0	3.972062
			147 55 29.7	327 54 53.0	Buckler 2	2736.8	3.437242
			231 55 58.5	51 59 43.0	Meins	11253.0	4.051268
			300 56 17.8	120 58 17.3	Stake	5511.7	3.741285
			350 47 46.5	170 48 05.1	Bark	4590.9	3.661901
			291 35 45.2	111 40 00.6	Diamond	10871.5	4.036288
Big barn, S. gable *	38 05 43.38	1337.5	349 23 34	169 23 57	Stake	4977.1	3.696980
1886	121 57 35.95	876.1	36 25 36	216 23 30	Naylor	8380.5	3.923270
Dutton's tank	38 04 34.068	1050.4	25 14 08.5	205 13 15.5	Bark	4921.3	3.692084
1886	121 58 16.126	393.1	40 56 40.6	220 54 59.6	Naylor	6098.6	3.785230
			106 09 05.4	286 04 11.4	Goodyear	12091.6	4.082484
			220 40 58.7	40 43 31.5	Meins	9251.7	3.966220
			260 12 06.6	80 16 36.7	Collinsville	10830.3	4.034639
			325 28 05.7	145 28 53.6	Stake	3344.0	3.524271
			298 20 26.8	118 23 30.8	Diamond	8266.9	3.917342
Dutton's flagstaff	38 04 27.000	832.5	25 11 44.9	205 10 54.6	Bark	4679.0	3.670149
1886	121 58 20.484	499.3	41 33 17.8	221 31 39.5	Naylor	5864.7	3.768247
			67 54 56.3	247 49 57.0	Island	12782.5	4.106616
			79 25 56.2	259 20 07.4	Army Point 2	14032.8	4.147144
			107 17 10.4	287 12 19.1	Goodyear	12052.5	4.081077
			122 04 28.8	302 02 43.1	Buckler 2	4929.7	3.692821
			220 18 39.2	40 21 14.7	Meins	9486.3	3.977096
			259 10 28.1	79 15 00.9	Collinsville	10973.7	4.040354
			321 43 24.1	141 44 14.7	Stake	3231.6	3.509424
			296 39 35.4	116 42 42.0	Diamond	8260.5	3.917006
Red brick chimney	38 02 43.722	1348.0	300 54 47.8	120 55 35.7	Suisun Point 2	2211.2	3.344619
1886	122 08 17.345	422.9	301 00 16.8	121 01 25.3	Island	3163.8	3.500210
			340 44 55.5	160 45 19.8	Martinez East	2943.1	3.468804

* No check on this position.

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Army flagstaff	38 03 20.188	622.4	317 24 31.0	137 25 35.0	Island	3741.0	3.572986
1886	122 08 09.964	242.9	322 46 41.5	142 47 24.9	Suisun Point 2	2838.6	3.453099
			348 33 08.6	168 33 28.4	Martinez East	3982.1	3.600113
Arsenal flagstaff	38 02 51.116	1576.0	224 22 48.9	44 22 58.1	Army Point 2	519.2	2.715326
1886	122 08 01.162	28.3	308 43 21.1	128 44 19.7	Island	2969.9	3.472744
			312 14 13.5	132 14 51.5	Suisun Point 2	2029.2	3.307331
			349 09 42.3	169 09 56.7	Martinez East	3061.2	3.485886
Arsenal clocktower	38 02 47.309	1458.6	199 35 25.3	19 35 29.7	Army Point 2	518.5	2.714722
1886	122 07 53.398	1302.0	309 16 59.4	129 17 53.2	Island	2748.9	3.439161
			313 30 54.1	133 31 27.3	Suisun Point 2	1810.6	3.257826
			352 23 07.8	172 23 17.4	Martinez East	2914.9	3.464621
Ventilator	38 04 21.586	665.6	343 17 30.8	163 18 06.1	Island	4852.3	3.685945
1886	122 07 23.354	569.3	352 02 44.6	172 09 59.3	Suisun Point 2	4193.9	3.622617
			3 25 19.6	183 25 10.7	Martinez East	5806.3	3.763899
			13 00 30.9	193 00 16.8	Army Point 2	2482.0	3.394800
Windmill	38 04 55.536	1712.3	354 32 47.6	174 33 01.3	Island	5720.1	3.757406
1886	122 06 48.444	1180.6	2 58 58.0	182 58 51.1	Suisun Point 2	5207.3	3.716616
			9 55 53.0	189 55 22.5	Martinez East	6946.7	3.841779
			22 08 27.0	202 07 51.3	Army Point 2	3740.8	3.572960
Goodyear R. R. station, tank	38 05 42.804	1319.7	3 14 39.5	183 14 29.3	Island	7163.1	3.855102
1886	122 06 09.531	232.2	10 23 00.8	190 22 30.0	Suisun Point 2	6768.4	3.830488
			14 30 17.7	194 29 23.3	Martinez East	8573.0	3.933135
			25 36 11.1	205 35 11.5	Army Point 2	5458.0	3.737032
			311 41 28.4	131 44 39.3	Naylor	10108.5	4.004686
Montezuma Hill	38 10 04.107	126.6	333 58 19.6	153 58 58.8	Meins	3519.1	3.546432
1887	121 55 11.885	289.3	69 16 41.8	249 13 08.9	Hewston 2	8971.0	3.952843
			126 37 10.6	306 35 06.0	Hastings	6113.6	3.786300
White house, S. gable	38 05 02.592	79.9	302 32 01.7	122 35 38.9	Naylor	10194.2	4.008355
1886	122 06 52.426	1277.7	353 48 50.3	173 49 06.5	Island	5946.4	3.774254
			1 50 15.9	181 50 11.5	Suisun Point 2	5420.6	3.734048
			19 37 12.4	199 36 39.2	Army Point 2	3909.5	3.592117
Bull 2	38 02 08.488	261.7	78 29 30.7	258 28 23.3	Island	2723.7	3.435167
1886	122 04 36.716	895.3	110 03 00.0	290 01 03.2	Army Point 2	4919.7	3.691942
			163 22 37.9	343 21 38.6	Goodyear	8186.3	3.913087
			271 16 16.9	91 18 30.5	Naylor	5286.2	3.723146
Bay 2	38 04 07.300	225.1	292 21 37.7	112 25 29.7	Naylor	9928.3	3.996877
1886	122 07 16.510	402.5	343 43 34.2	163 44 05.2	Island	4382.6	3.641726
			353 38 45.0	173 38 55.4	Suisun Point 2	3736.0	3.572410
			5 28 37.2	185 28 24.0	Martinez East	5380.0	3.730785
			20 08 41.5	200 08 23.1	Army Point 2	2106.7	3.323600
Schoolhouse, E. gable	38 05 37.832	1166.4	1 40 06.6	181 40 01.4	Island	7001.3	3.845180
1886	122 06 17.795	433.6	8 53 55.4	188 53 29.7	Suisun Point 2	6583.6	3.818461
			13 25 57.2	193 25 07.9	Martinez East	8375.7	3.923019
			24 20 20.1	204 19 25.6	Army Point 2	5234.0	3.718836
			184 58 02.5	4 58 05.5	Goodyear	1394.6	3.144437
			266 39 00.9	86 42 09.6	Buckler 2	7465.8	3.873074
			310 17 19.9	130 20 35.9	Naylor	10159.9	4.006891
Seal Bluff W. warehouse, N. gable	38 03 16.066	495.4	65 29 12.8	245 26 47.3	Island	6327.7	3.801248
1886	122 02 30.081	733.4	72 02 06.2	251 59 20.0	Suisun Point 2	6908.4	3.839379
			87 04 12.6	267 00 57.6	Army Point 2	7719.2	3.887573
			136 42 53.7	316 40 36.2	Goodyear	7915.5	3.898477
			201 37 33.0	21 38 21.1	Buckler 2	5167.7	3.713301
			272 27 02.6	92 30 27.0	Stake	8094.9	3.908210
			296 32 52.8	116 34 36.3	Bark	4577.7	3.660643
			315 04 22.0	135 05 17.5	Naylor	3110.5	3.492837
Baypoint R. R. warehouse, W. gable	38 02 45.325	1397.4	320 29 28.5	140 29 54.7	Naylor	1626.3	3.211191
1886	122 01 42.431	1034.6	76 22 44.8	256 19 50.0	Island	7119.8	3.852465
			81 18 37.5	261 15 22.0	Suisun Point 2	7823.5	3.893399
			135 31 43.2	315 28 56.5	Goodyear	9404.0	3.973313
Seal Bluff E. warehouse, N. gable	38 03 20.576	634.4	273 33 16.6	93 36 34.2	Stake	7829.9	3.893755
1886	122 02 18.898	460.7	299 45 22.2	119 46 58.8	Bark	4402.8	3.643727
			320 35 22.2	140 36 10.8	Naylor	3030.5	3.481510
			65 22 23.3	245 19 50.9	Island	6633.5	3.821743
			71 39 15.0	251 36 22.0	Suisun Point 2	7210.8	3.857985
			134 36 49.7	314 34 25.3	Goodyear	8006.6	3.903447

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Green 2	38 04 14.829	457.2	327 25 51.7	147 26 56.5	Naylor	4762.9	3.677876
1886	122 02 45.141	1100.3	50 32 13.2	230 29 57.0	Island	6981.7	3.843959
			51 56 27.2	231 53 26.7	Martinez East	9058.7	3.957068
			57 33 50.3	237 31 13.4	Suisun Point 2	7351.2	3.866358
			73 16 17.6	253 13 11.9	Army Point 2	7666.4	3.884590
			127 58 34.7	307 56 26.5	Goodyear	6419.4	3.807491
Garnett 2	38 05 18.976	585.1	43 06 25.4	223 03 53.6	Island	8786.4	3.943812
1886	122 02 19.956	486.3	49 02 02.0	228 59 09.6	Suisun Point 2	9030.0	3.955687
			62 15 40.0	242 12 18.8	Army Point 2	8989.0	3.953713
			109 10 17.8	289 07 54.1	Goodyear	6006.9	3.778650
			238 32 21.2	58 33 03.1	Buckler 2	1943.5	3.288589
			341 58 30.5	161 59 19.8	Naylor	6301.2	3.799420
Hastings warehouse, W. gable	38 01 58.624	1807.5	80 28 02.6	260 24 34.2	Martinez East	8356.9	3.922045
1886	122 01 59.682	1455.4	87 54 37.2	267 51 53.0	Island	6503.1	3.813123
			103 16 34.5	283 13 00.9	Army Point 2	8682.4	3.938639
			142 53 00.3	322 50 24.0	Goodyear	10220.9	4.009491
Tormey's windmill*	38 01 36.85	1136.2	116 18 40	296 16 24	Army Point 2	6007.2	3.77867
1886	122 04 05.41	132.0	97 10 47	277 09 20	Island	3459.6	3.53903
Tormey's new barn, N. gable*	38 01 18.63	574.4	105 49 20	285 47 49	Island	3646.5	3.561880
1886	122 04 02.30	56.1	120 33 42	300 31 24	Army Point 2	6341.8	3.802210
Drawbridge flagstaff	38 09 09.729	300.0	13 56 07.4	193 55 35.0	Goodyear	5299.9	3.724264
1888	122 05 20.449	497.9	44 31 18.0	224 30 23.0	Foley	3092.9	3.490372
			107 09 17.0	287 08 02.9	Pierce	3047.6	3.483964
			218 10 55.4	38 11 47.0	Marsh	3303.5	3.518973
			290 12 27.3	110 13 39.1	Coon 2	3025.5	3.480794
			339 50 32.1	159 50 58.9	Delta 2	3073.7	3.487661
Suisun schoolhouse, cupola	38 14 13.999	431.6	320 41 11.4	140 42 02.7	Suisun Hill	3184.3	3.503017
1888	122 02 31.957	777.2	16 52 54.9	196 52 02.6	Marsh	7090.3	3.850664
			20 19 51.2	200 17 34.9	Goodyear	15488.5	4.190010
			39 35 41.8	219 32 43.6	Pierce	11004.9	4.041586
			71 06 57.0	251 04 15.0	Bridgeport	6726.2	3.827771
Upper 2	38 06 47.374	1460.7	336 24 57.1	156 25 19.5	Middle	2214.5	3.345272
1886	121 58 56.700	1381.3	62 33 38.1	242 32 14.6	Buckler 2	3712.4	3.569652
			85 58 25.0	265 53 55.8	Goodyear	10652.0	4.027432
			134 43 16.3	314 42 02.4	Hewston 2	4103.8	3.613187
Sun	38 05 44.982	1386.9	347 39 40.9	167 40 06.6	Edith	4752.2	3.676891
1864	122 04 53.126	1294.6	17 26 52.6	197 25 55.3	Island	7566.6	3.878902
			40 14 21.9	220 12 35.1	Army Point 2	6535.0	3.815243
			121 02 51.9	301 02 02.6	Goodyear	2266.8	3.355412
Suisun, flagstaff	38 14 16.723	515.6	324 46 21.4	144 47 07.2	Suisun Hill	3118.9	3.494003
1888	122 02 22.980	558.9	18 20 40.8	198 19 42.9	Marsh	7236.4	3.859524
			40 10 58.2	220 07 54.4	Pierce	11209.4	4.049581
			71 02 41.5	250 59 53.9	Bridgeport	6960.0	3.842608
Honker	38 04 53.676	1654.9	28 07 53.1	208 07 07.6	Stake	3809.5	3.580866
1866	121 55 44.708	1089.6	48 53 01.3	228 50 34.9	Bark	7686.3	3.885718
			49 04 31.6	229 01 51.6	Hill	8370.4	3.922748
			55 53 14.0	235 49 59.6	Naylor	9287.2	3.967883
			99 32 06.1	279 30 16.5	Simmons	4383.4	3.641812
			111 16 43.7	291 15 07.7	Middle	4069.7	3.609567
			259 58 26.0	80 01 22.7	Collinsville	7090.9	3.850700
			321 39 39.2	141 41 09.8	Diamond	5777.3	3.761723
Freeman	38 04 40.860	1259.8	309 41 54.5	129 43 24.8	Stake	4639.9	3.666509
1864	121 59 24.801	604.5	5 11 25.1	185 11 14.4	Bark	4680.5	3.670296
			25 44 09.0	205 43 10.3	Naylor	5347.0	3.728111
			59 40 55.8	239 39 07.8	Seal Bluff	4948.9	3.694509
			63 00 09.8	242 55 50.1	Island	11532.8	4.061936
Stephenson	38 03 18.168	560.2	7 33 40.6	187 33 33.5	Bark	2130.3	3.328445
1864	121 59 30.669	747.7	43 51 39.0	223 50 43.9	Naylor	3144.3	3.497519
			75 09 14.8	255 04 58.7	Island	10482.9	4.020482
			90 42 42.5	270 40 58.1	Seal Bluff	4129.3	3.615881
			183 12 38.4	3 12 42.0	Freeman	2553.6	3.407148
			276 21 48.9	96 23 22.8	Stake	3736.1	3.572420

* No check on this position.

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Greek Jo's house, E. gable	38 04 19.850	612.0	53 16 13.3	233 14 15.1	Diamond	5832.4	3.765844
1886	121 50 06.052	147.5	150 49 38.8	330 49 06.7	Collinsville	2604.9	3.415796
			257 59 19.1	78 00 01.7	Anderson	1724.8	3.236746
			386 11 04.8	146 12 53.0	Sand	7701.4	3.886567
Bigelow, flagstaff	38 04 01.814	55.9	353 41 31.8	173 41 46.7	Hammond	5386.3	3.731292
1867	121 46 14.705	358.5	23 33 00.4	203 31 58.9	Antioch	6094.6	3.784944
			118 18 06.7	298 17 26.6	Grant	1801.3	3.255581
Sherman I. house	38 03 01.323	40.7	28 08 20	208 07 33	Hammond	3956.0	3.59726
1867	121 44 33.958	828.0	52 44 49	232 42 46	Antioch	6146.7	3.78864
			123 56 24	303 54 41	Grant	4871.6	3.68767
Sherman I. house	38 02 02.226	68.6	56 05 21	236 04 18	Hammond	2986.6	3.47518
1867	121 44 08.830	215.3	70 58 32	250 56 13	Antioch	5823.6	3.76519
			123 15 35	303 12 37	Marshal	8395.0	3.92402
			134 18 16	314 16 18	Grant	6503.2	3.81313
New barn, SE. gable*	38 07 16.48	508.1	327 53 31	147 54 21	Collinsville	3743.8	3.57331
1887	121 52 19.82	482.8	127 10 26	307 09 19	Meins	3320.8	3.52124
Kohler's house, stovepipe	38 03 58.206	1794.6	15 02 00.9	195 01 23.7	Antioch	5670.0	3.753584
1867	121 46 54.240	1322.2	108 56 46.1	288 55 30.5	Marshal	3159.5	3.499619
			147 11 05.3	327 10 49.5	Grant	1148.4	3.060084
			343 28 01.0	163 28 40.2	Hammond	5468.4	3.737861
Farthest house on creek	38 02 42.698	1316.5	359 17 50	179 17 51	Hammond	2914.7	3.46459
1867	121 45 51.910	1265.8	43 32 27	223 31 12	Antioch	4342.0	3.63769
			146 57 57	326 57 02	Grant	3928.4	3.59422
Woods' house	38 02 01.400	43.2	350 58 13	170 58 20	Hammond	1661.7	3.22056
1867	121 46 01.136	27.7	55 52 45	235 51 35	Antioch	3341.3	3.52391
			137 13 05	317 11 16	Marshal	6305.4	3.79971
			157 13 54	337 13 05	Grant	4952.6	3.69483
Fish flagstaff	38 03 36.964	1139.7	40 35 03.5	220 33 44.1	Pittsburg	4829.8	3.683925
1867	121 48 48.081	1172.2	138 36 53.7	318 35 33.5	Collinsville	4794.6	3.680752
			172 45 18.9	352 45 13.5	Marshal	1693.8	3.228855
			233 01 39.0	53 02 33.4	Grant	2694.2	3.430422
			316 37 37.5	136 39 26.7	Hammond	6309.5	3.799996
			344 50 23.8	164 50 56.8	Antioch	4994.8	3.698522
Brown's house	38 03 28.552	880.3	39 34 51	219 33 41	Pittsburg	4422.6	3.64568
1867	121 49 01.369	33.4	143 34 26	323 33 15	Collinsville	4792.9	3.68060
			183 15 12	3 15 15	Marshal	1942.8	3.28842
			312 53 39	132 55 38	Hammond	6357.0	3.80325
			340 19 58	160 20 39	Antioch	4844.2	3.68522
House E. of Brown's*	38 03 18.05	556.5	138 52 12	318 50 40	Collinsville	5550.5	3.74433
1867	121 48 28.34	691.0	162 56 02	342 55 44	Marshal	2367.8	3.37434
Cornwall R. R. tankhouse	38 01 31.654	976.0	97 36 50.9	277 33 08.5	Bark	8882.8	3.948549
1886	121 53 41.127	1003.1	198 34 34.3	18 34 48.7	Diamond	1789.8	3.252802
			208 01 25.1	28 03 05.5	Collinsville	8452.1	3.926963
Sacramento Packing Co.,	38 03 04.055	125.0	78 54 23.7	258 50 48.3	Bark	8690.9	3.939064
cannery smokestack	121 53 52.445	1278.7	90 16 16.2	270 14 21.6	Stake	4533.4	3.656426
1886			177 42 58.2	357 42 48.3	Meins	9796.6	3.991076
			222 38 13.9	42 40 01.4	Collinsville	6269.8	3.797256
			249 27 53.0	69 30 55.2	Anderson	7693.9	3.886148
			292 28 13.2	112 32 21.0	Sand	10614.3	4.025892
			323 42 42.6	143 43 04.1	Diamond	1429.6	3.155216
Cornwall R. R. depot, N.	38 01 27.555	849.6	97 45 37.3	277 41 35.0	Bark	9681.8	3.985955
chimney	121 53 08.788	214.3	173 10 42.1	353 10 36.6	Diamond	1839.0	3.264581
1886			277 02 22.6	97 06 03.4	Sand	8809.9	3.944973
Cupola on house *	38 01 37.62	1159.9	101 25 17	281 23 13	Bark	4998.7	3.69886
1886	121 56 21.25	518.3	251 18 30	71 20 23	Diamond	4723.9	3.67430
Hewston	38 08 20.453	630.6	329 59 24.5	150 00 47.1	Simmons	6524.5	3.814546
1864	122 00 56.009	1364.0	19 53 02.7	199 52 11.4	Garnett	5955.3	3.774902
			64 52 07.1	244 48 51.6	Goodyear	8526.1	3.930752
Cupola	38 07 05.838	180.0	318 51 45.2	138 52 47.4	McDuff	3745.1	3.573459
1866	121 56 22.611	550.8	45 25 31.4	225 24 05.3	Simmons	4772.0	3.678702
			109 04 59.0	289 02 10.2	Hewston	7045.0	3.847883

* No check on this position.

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ″	° ′ ″		*meters*	
Large gray house, chimney * 1886	38 07 08.27 121 54 39.02	255.0 950.6	198 13 15 298 27 18	18 13 34 118 29 34	Meins Collinsville	2378.4 6121.2	3.376290 3.786840
Coalhouse 1867	38 01 38.528 121 50 54.517	1187.9 1329.6	112 42 22 179 17 51 208 16 26 224 47 10 277 09 58 284 54 06	292 40 57 359 17 49 28 17 39 44 49 23 97 13 05 104 55 57	New York Collinsville Marshal Grant Hammond Antioch	3661.8 7248.9 6054.8 7430.0 7475.5 4543.2	3.56370 3.86027 3.78210 3.87099 3.87364 3.65736
White house, E. gable 1867	38 02 09.600 121 52 54.834	296.0 1337.2	135 40 23.8 204 19 09.2 232 58 09.5 280 19 58.4 286 10 18.9 288 43 04.0	315 40 12.6 24 20 21.1 53 00 36.2 100 24 19.9 106 13 24.1 108 44 16.7	New York Collinsville Marshal Hammond Antioch Pittsburg	635.7 6903.3 7266.0 10522.4 7627.0 3036.6	2.803274 3.839059 3.861295 4.022115 3.882351 3.482389
Bowman, N. gable 1867	38 03 39.937 121 47 02.810	1231.3 68.5	14 24 11.9 119 45 24.7 164 51 45.7 339 19 50.8	194 23 40.0 299 44 14.4 344 51 35.2 159 20 35.3	Antioch Marshal Grant Hammond	5072.1 3201.6 1583.3 5000.9	3.705191 3.505370 3.199569 3.699050
End house, N. gable 1866	38 03 40.028 121 49 20.746	1234.1 505.8	31 56 10.3 67 37 48.6 145 52 23.9 200 10 20.2 312 22 37.2 336 50 10.0	211 55 11.0 247 35 25.3 325 51 23.8 20 10 34.9 132 24 46.7 156 51 03.1	Pittsburg New York Collinsville Marshal Hammond Antioch	4433.8 6125.6 4231.2 1689.4 6944.1 5346.3	3.646777 3.787152 3.626461 3.227737 3.841618 3.728056
Barn 1867	38 04 31.608 121 45 15.519	974.5 378.3	7 44 05 30 48 25 88 47 08	187 43 43 210 46 47 268 45 50	Hammond Antioch Grant	6329.9 7573.6 3029.3	3.80140 3.87939 3.48134
Collinsville Pt., E. house 1867	38 04 35.708 121 50 39.504	1100.8 962.8	4 25 48 42 45 30 165 42 49 272 59 19 328 44 56	184 25 37 222 43 56 345 42 38 93 00 22 148 46 38	Pittsburg New York Collinsville Marshal Antioch	5496.2 5515.1 1842.4 2505.6 7756.9	3.74006 3.74155 3.26539 3.39891 3.88969
Collinsville depot, flagstaff 1864	38 04 28.560 121 50 58.614	880.6 1429.0	40 34 07.2 42 04 58.0 110 29 42.2 180 18 48.1 268 14 54.4 268 15 50.3 309 24 06.3 320 07 47.2 324 59 28.8 359 32 51.7	220 32 44.4 222 03 32.5 290 27 24.6 0 18 48.4 88 16 09.6 88 17 05.4 129 27 16.2 140 10 08.0 145 01 22.3 179 32 52.8	New York Diamond McDuff Collinsville Anderson Marshal Hammond Sand Antioch Pittsburg	5040.6 5062.4 5798.3 2005.9 2969.5 2969.3 9728.0 8685.8 7826.9 5259.5	3.702482 3.704353 3.763302 3.302307 3.472679 3.472650 3.988023 3.938809 3.893588 3.720948
Dark house, ventilator 1886	38 05 16.311 121 52 52.776	502.9 1286.2	6 38 27.7 162 06 39.8 259 10 25.6 283 29 39.2 314 14 49.6	186 38 12.3 342 05 53.1 79 11 36.3 103 32 04.6 134 18 20.6	Diamond Meins Collinsville Anderson Sand	5265.4 6001.4 2843.5 5913.9 11660.6	3.721433 3.778256 3.453851 3.771874 4.066719
Collinsville schoolhouse, chimney 1886	38 04 58.448 121 50 55.707	1802.0 1357.7	36 30 47.2 176 50 34.9 285 59 56.5 324 04 40.0	216 29 19.8 356 50 33.4 106 01 09.8 144 06 58.9	Diamond Collinsville Anderson Sand	5821.2 1086.0 3014.0 9369.8	3.765011 3.035845 3.479148 3.971732
Robinson's large windmill 1886	38 01 37.464 121 50 53.502	1155.1 1304.9	179 06 24.0 207 55 12.6 284 20 10.2	359 06 21.1 27 56 24.5 104 22 27.7	Collinsville Anderson Sand	7282.0 6072.8 5618.4	3.862250 3.783392 3.749609
Black Diamond engine house, flagstaff 1886	38 02 09.690 121 52 53.842	298.8 1313.0	131 56 42.6 204 08 48.3 285 52 16.7	311 56 27.9 24 09 59.6 105 55 48.3	Diamond Collinsville Sand	783.7 6891.0 8711.0	2.894129 3.838280 3.940069
Black Diamond Catholic Church, cross 1886	38 02 08.740 121 53 07.780	269.2 189.7	156 16 42.3 206 33 49.6 234 14 53.6 285 06 02.1	336 16 36.4 26 35 09.6 54 17 28.3 105 09 42.3	Diamond Collinsville Anderson Sand	604.1 7063.0 7536.6 9030.8	2.781112 3.848989 3.877176 3.955724
Soldati milkhouse, cupola * 1887	38 06 39.06 121 55 51.86	1204.3 1263.4	218 32 29 285 43 14	38 33 33 105 46 15	Meins Collinsville	4040.5 7434.8	3.60643 3.87127

* No check on this position.

Suisun Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Ferry, flagstaff *	38 06 19.66	606.2	162 43 55	342 43 25	Meins	3935.5	3.59500
1887	121 53 20.50	499.4	292 14 44	112 16 12	Collinsville	3747.5	3.57374
Schoolhouse chimney *	38 08 14.22	438.4	266 53 20	86 55 06	Meins	4176.8	3.62084
1886	121 56 59.74	1454.8	299 18 48	119 22 31	Collinsville	10104.6	4.00452
Millerick milkhouse, cupola *	38 08 57.16	1762.3	284 41 20	104 43 06	Meins	4327.0	3.63619
1887	121 57 00.35	8.5	305 23 41	125 27 25	Collinsville	10826.8	4.03450
White shanty, W. gable	38 03 48.750	1503.1	58 08 38.2	238 06 55.4	Diamond	4792.5	3.680560
1886	121 50 30.815	751.2	168 21 18.4	348 21 01.5	Collinsville	3301.3	3.518684
			240 05 03.1	60 06 01.0	Anderson	2642.7	3.422053
Montezuma House	38 04 35.708	1100.9	17 21 36.5	197 20 53.2	Pittsburg	5741.1	3.758996
1867	121 49 46.675	1137.6	51 11 02.5	231 08 55.2	New York	6458.8	3.810149
			135 42 32.5	315 41 48.4	Collinsville	2494.6	3.397004
			276 09 03.1	96 09 33.8	Marshal	1221.6	3.086915
			317 59 13.4	138 01 38.9	Hammond	8609.4	3.934972
			337 35 06.1	157 36 15.2	Antioch	7173.9	3.855755
Island house, red chimney	38 01 55.531	1712.1	102 19 01.9	282 17 10.6	Diamond	4507.3	3.653921
1886	121 50 17.166	418.7	171 32 55.1	351 32 29.8	Collinsville	6797.9	3.832377
			202 09 11.0	22 10 00.4	Anderson	5191.9	3.715329
			293 09 14.6	113 11 09.6	Sand	4956.1	3.695139
White house stovepipe	38 05 36.493	1125.2	165 28 24.0	345 27 50.6	Meins	5257.0	3.720738
1886	121 53 14.329	349.1	271 31 06.2	91 32 30.2	Collinsville	3319.2	3.521038
			287 41 28.2	107 44 06.9	Anderson	6587.5	3.818720
			0 48 58.1	180 48 56.0	Diamond	5853.0	3.767375
Black house, chimney	38 03 34.577	1066.1	49 01 26.4	229 00 28.3	Mallard	3046.3	3.483770
1866	121 54 25.754	627.9	69 45 21.6	249 41 52.6	Hill	8793.3	3.944151
			116 52 38.3	296 49 59.7	Simmons	7003.5	3.845318
			174 04 00.2	354 03 50.0	McDuff	3712.7	3.569685
			320 41 10.7	140 41 55.0	New York	2798.3	3.446899
Black shanty, N. gable	38 04 15.946	491.7	208 22 29.5	28 23 02.2	Collinsville	2721.9	3.434874
1886	121 51 51.245	1249.0	263 33 15.0	83 35 02.5	Anderson	4278.0	3.631242
			312 29 23.2	132 32 16.3	Sand	9292.1	3.968113
Brant	38 08 59.287	1828.0	344 14 06.1	164 14 55.0	Simmons	7115.2	3.852189
1866	122 00 01.429	34.8	26 16 35.4	206 15 10.4	Garnett	7577.6	3.879530
			47 59 19.3	227 58 45.6	Hewston	1788.8	3.252573
Antioch:							
Distillery, large smokestack	38 00 57.468	1771.8	110 44 12.3	290 41 08.5	Diamond	7777.3	3.890829
1886	121 48 19.470	474.9	155 34 33.6	335 32 55.8	Collinsville	9352.1	3.970907
			172 08 30.1	352 08 07.0	Anderson	6661.2	3.823552
			275 24 37.7	95 25 20.2	Sand	1693.5	3.228792
Congregational Church, spire	38 00 51.532	1588.8	31 25 20.1	211 21 34.7	Mount Diablo	17194.0	4.235377
1886	121 48 41.549	1013.5	159 03 24.2	339 02 00.1	Collinsville	9313.2	3.969100
			176 51 17.9	356 51 08.5	Anderson	6791.9	3.831989
			269 23 43.3	89 24 39.5	Sand	2224.7	3.347767
Tall chimney	38 01 01.787	55.1	107 48 43.0	287 47 15.2	Pittsburg	3650.2	3.562318
1866	121 48 34.423	839.7	110 33 36.1	290 30 44.4	New York	7256.5	3.860730
			157 19 14.3	337 17 45.8	Collinsville	9084.3	3.958290
			175 10 03.2	355 09 49.4	Marshal	6487.7	3.812092
			195 51 32.7	15 52 18.8	Grant	6658.1	3.823350
			267 10 05.4	87 11 46.3	Hammond	4004.7	3.602571
			272 09 29.4	92 09 54.1	Antioch	973.7	2.988432

Monterey Bay to San Francisco Bay.

Santa Cruz Point †	36 57 05.560	171.4	138 36 14.0	318 35 10.3	Santa Cruz	3964.5	3.598188
1852	122 01 32.700	809.1	222 23 21.8	42 29 57.1	Loma Prieta	24034.9	4.380842
Moore	36 56 54.994	1695.2	194 51 48.0	14 52 09.3	Santa Cruz	3473.6	3.533209
1852	122 03 54.097	1313.8	264 40 08.6	84 41 33.6	Santa Cruz Point	3513.6	3.545755
St. Johns Hill †	36 58 38.069	1173.5	267 51 46.6	87 53 06.4	Santa Cruz	3285.5	3.516605
1852	122 05 31.441	777.6	322 50 03.1	142 51 01.6	Moore	3986.9	3.600630

* No check on this position.

† See p. 291.

Monterey Bay to San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Balcraft 1 *	36 57 18.355	565.8	179 13 31.6	359 13 30.8	St. Johns Hill	2457.5	3.390497
1852	122 05 30.098	744.7	286 51 30.6	106 52 28.3	Moore	2482.0	3.394799
Parsons *	36 57 48.261	1487.7	236 37 50.4	56 38 47.1	St. Johns Hill	2792.0	3.445921
1864	122 07 05.716	141.4	291 17 02.7	111 18 00.2	Balcraft 1	2538.8	3.404632
Rice *	36 58 49.491	1525.5	280 27 45.3	100 28 31.6	St. Johns Hill	1937.8	3.287316
1864	122 06 48.487	1199.2	325 22 46.9	145 23 34.1	Balcraft 1	3413.6	3.533215
			12 43 27.8	192 43 17.4	Parsons	1935.0	3.286684
Lagoon *	36 58 36.797	1134.3	263 28 19.2	83 29 42.5	Rice	3448.2	3.537597
1864	122 09 07.005	173.3	296 29 42.3	116 30 55.2	Parsons	3352.5	3.525374
Butler *	36 59 30.769	948.5	298 36 30.4	118 37 27.2	Rice	2656.8	3.424354
1864	122 08 22.793	563.6	328 53 28.7	148 54 15.1	Parsons	3690.5	3.567080
			33 18 58.3	213 18 31.7	Lagoon	1990.9	3.299050
Glassell *	36 59 58.152	1792.6	282 31 28.7	102 33 01.1	Butler	3888.6	3.589790
1864	122 10 56.300	1392.4	312 50 53.2	132 51 59.0	Lagoon	3687.1	3.566690
Redwood *	37 02 07.445	229.5	333 53 02.0	153 53 59.6	Butler	5378.6	3.730667
1864	122 09 58.536	1446.7	19 42 57.9	199 42 23.1	Glassell	4233.7	3.626723
Point *	37 01 31.639	975.3	257 28 35.1	77 30 36.4	Redwood	5097.0	3.707313
1864	122 13 19.862	491.0	309 03 51.2	129 05 17.6	Glassell	4571.8	3.660091
Manzanita *	37 02 44.214	1363.0	287 20 22.4	107 21 50.8	Redwood	3800.6	3.579847
1864	122 12 25.325	625.8	31 04 19.4	211 03 46.6	Point	2611.9	3.416956
Cook *	37 03 48.979	1509.9	304 37 32.4	124 38 42.9	Manzanita	3512.8	3.545650
1864	122 14 22.300	550.9	339 58 16.2	159 58 53.8	Point	4506.1	3.653804
Pine *	37 05 30.709	946.7	348 39 02.2	168 39 27.3	Manzanita	5234.8	3.718901
1864	122 13 07.013	173.2	2 28 03.6	182 27 55.8	Point	7376.6	3.867857
			30 40 27.2	210 39 41.8	Cook	3645.9	3.561809
Tranta *	37 05 47.034	1449.9	276 33 39.3	96 35 25.9	Pine	4394.6	3.642915
1864	122 16 03.791	93.6	325 25 51.2	145 26 52.4	Cook	4419.1	3.645335
Steele *	37 08 13.028	401.6	311 42 23.7	131 44 40.8	Pine	7518.2	3.876112
1864	122 16 54.285	1339.9	335 14 02.7	155 15 34.4	Cook	8963.4	3.952472
			344 30 49.6	164 31 20.1	Tranta	4670.0	3.669320
Point Ano Nuevo *	37 06 52.060	1604.9	239 45 07.8	59 46 52.5	Steele	4957.1	3.695229
1864	122 19 47.783	1179.7	289 54 13.0	109 56 28.1	Tranta	5882.9	3.769588
			305 02 42.7	125 05 59.1	Cook	9821.9	3.992197
Masters Hill	37 20 17.976	554.2	86 48 52.95	266 33 57.80	Black Mountain	36403.7	4.5611457
1854	121 44 13.228	325.6	126 51 32.81	306 38 29.86	Red Hill	39506.6	4.5966696
			20 35 27.74	200 31 35.93	Loma Prieta	26901.4	4.4297748
Murphy	37 06 44.043	1357.7	0 09 15.85	180 09 13.27	Gavilan	39554.1	4.5971910
1854	121 31 07.053	174.1	89 54 23.33	269 42 37.76	Loma Prieta	28871.7	4.4604720
			142 22 56.75	322 15 01.14	Masters Hill	31705.4	4.5011327
Johnston *	37 26 19.985	616.1	215 17 07.1	35 19 30.9	Ridge	10050.9	4.002204
1854	122 26 27.011	664.0	253 14 58.0	73 18 31.5	Pise Hill	9010.6	3.954752
Halfmoon Bay *	37 29 19.364	597.0	290 36 09.9	110 39 23.1	Pise Hill	8337.8	3.921051
1854	122 25 53.493	1314.2	8 28 28.5	188 28 08.1	Johnston	5591.0	3.747493
Summit †	37 25 39.820	1227.6	100 26 15.6	280 23 29.0	Johnston	6849.9	3.835684
1863	122 21 52.979	1302.6	138 53 16.9	318 50 50.6	Halfmoon Bay	8986.1	3.953573
			206 18 11.3	26 18 58.2	Pise Hill	4273.4	3.630771
Sellick †	37 24 03.987	122.9	143 09 39.9	323 08 22.3	Johnston	5239.4	3.719279
1865	122 24 19.226	473.0	218 57 32.6	38 59 48.5	Pise Hill	8728.0	3.940914
			230 35 06.4	50 36 35.3	Summit	4654.3	3.667850
Wetner 2 †	37 20 36.347	1120.5	156 17 00.8	336 15 06.7	Johnston	11572.4	4.063423
1864	122 23 17.672	435.0	166 41 37.6	346 41 00.2	Sellick	6577.9	3.818089
			192 32 52.0	12 33 43.4	Summit	9584.8	3.981581
Hamilton †	37 20 31.753	978.9	92 21 56.3	272 26 31.4	Wetner 2	3448.0	3.537573
1865	122 20 57.709	1420.5	171 51 25.3	351 50 51.7	Summit	9594.0	3.982001
Peak †	37 17 46.990	1448.7	154 05 47.6	334 04 45.1	Wetner 2	5804.5	3.763764
1865	122 21 34.654	853.5	190 09 01.9	10 09 24.3	Hamilton	5160.1	3.712662

*See p. 291–292.

† This point is in the area of the 1906 earthquake disturbance.

Monterey Bay to San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Pescadero*	37 16 31.891	983.2	190 00 39.5	10 01 12.3	Wetner 2	7652.7	3.883814
1865	122 24 11.718	288.7	239 05 28.3	59 07 03.5	Peak	4508.8	3.654057
Beutro*	37 13 38.803	1196.3	134 44 37.8	314 42 25.4	Pescadero	7582.6	3.879816
1865	122 20 33.116	816.4	168 47 42.4	348 47 05.1	Peak	7799.9	3.892088
Young*	37 12 24.721	762.1	167 21 12.8	347 20 30.8	Pescadero	7809.3	3.892612
1865	122 23 02.320	57.2	192 15 41.4	12 16 34.4	Peak	10167.0	4.007193
			238 09 19.8	58 10 50.0	Beutro	4330.0	3.636483
Gushee†	37 09 47.883	1476.2	315 36 10.3	135 37 20.3	Steele	4091.8	3.611910
1864	122 18 50.270	1240.4	14 40 49.5	194 40 14.8	Point Ano Nuevo	5602.9	3.748412
			127 53 33.4	307 51 01.1	Young	7875.8	3.896295
			160 23 49.3	340 22 47.1	Beutro	7557.0	3.878351
Pigeon Point (center L. H. site)*	37 10 55.570	1713.2	196 38 20.8	16 38 41.0	Young	2868.4	3.457647
1865	122 23 35.629	878.9	286 29 09.0	106 32 01.4	Gushee	7342.6	3.865847
Middle Point†	37 09 00.723	22.3	139 51 37.4	319 50 24.3	Pigeon Point	4631.8	3.665754
1864	122 21 34.580	853.3	250 15 34.1	70 17 13.3	Gushee	4307.2	3.634190
			281 58 32.5	102 01 21.7	Steele	7072.1	3.849546
			326 22 55.3	146 23 59.8	Point Ano Nuevo	4762.4	3.677825
Seal*	37 23 36.137	1114.1	161 39 38.3	341 38 56.9	Johnston	5321.7	3.726049
1865	122 25 18.897	464.8	233 00 16.3	53 02 21.3	Summit	6339.0	3.802021
			239 40 01.8	59 40 38.0	Sellick	1700.4	3.230558
			331 42 06.4	151 43 20.0	Wetner 2	6294.3	3.798946
Gilbert*	37 21 35.234	1086.2	6 57 01.2	186 56 40.1	Peak	7088.4	3.850547
1865	122 20 59.828	1472.4	61 51 35.6	241 50 12.0	Wetner 2	3847.8	3.585208
			170 10 03.1	350 09 30.8	Summit	7652.7	3.883813
Tunitas*	37 21 28.843	889.2	266 38 53.7	86 40 16.9	Gilbert	3381.4	3.529100
1865	122 23 16.999	418.3	0 35 11.7	180 35 11.3	Wetner 2	1618.5	3.209105
Ranch*	37 11 15.513	478.2	72 15 41.7	252 14 54.6	Pigeon Point	2017.1	3.304731
1865	122 22 17.743	437.6	152 44 32.7	332 44 05.8	Young	2400.1	3.380231
			210 16 43.9	30 17 47.2	Beutro	5115.5	3.708889
			297 48 27.5	117 50 32.9	Gushee	5787.3	3.762478
			345 37 18.8	165 37 45.0	Middle Point	4289.5	3.632403
Bolsa*	37 11 46.668	1438.7	235 55 33.2	55 56 15.7	Young	2094.1	3.320996
1865	122 24 12.662	312.3	288 42 35.5	108 43 45.0	Ranch	2992.7	3.476058
			329 53 19.8	149 58 42.2	Pigeon Point	1820.9	3.260287
Last*	37 21 44.192	1362.4	273 23 31.1	93 25 25.4	Gilbert	4645.5	3.667032
1865	122 24 08.269	203.5	290 33 08.6	110 33 39.7	Tunitas	1347.5	3.129535
			329 13 36.9	149 14 07.6	Wetner 2	2434.2	3.386354
Cutts No. 2†	36 58 07.475	230.4	118 28 59.6	298 28 19.2	Lagoon	1895.7	3.277761
1864	122 07 59.639	1475.2	167 25 44.6	347 25 30.7	Butler	2630.7	3.420078
			255 33 33.6	75 35 02.8	St. Johns Hill	3785.0	3.578068
			293 56 17.6	113 56 50.0	Parsons	1459.5	3.164196
Topog No. 2†	37 00 52.649	1623.0	128 15 25.9	308 14 48.8	Point	1941.4	3.288105
1864	122 12 18.190	449.7	177 03 53.2	357 03 49.0	Manzanita	3443.7	3.537025
			236 14 51.2	56 16 15.3	Redwood	4151.2	3.618171
			309 40 39.2	129 41 28.7	Glassell	2630.8	3.420093
Topog No. 3†	37 02 00.200	6.2	161 00 45.6	341 00 17.5	Cook	3546.3	3.549777
1864	122 13 35.597	879.8	186 12 29.4	6 12 46.7	Pine	6527.6	3.814754
			231 59 41.0	52 00 23.3	Manzanita	2203.8	3.343174
			336 10 03.8	156 10 13.4	Point	962.5	2.983414
Topog No. 1†	36 59 20.648	636.5	132 28 48.4	312 28 17.7	Glassell	1712.0	3.233516
1864	122 10 05.235	129.5	262 58 14.0	82 59 15.6	Butler	2552.4	3.406957
			313 10 58.4	133 11 33.5	Lagoon	1975.2	3.295603
Purcell's flagstaff†	37 24 15.768	486.1	12 26 17.7	192 26 11.1	Seal	1251.2	3.097317
1864–5	122 25 07.941	195.3	153 05 22.4	333 04 34.4	Johnston	4294.7	3.632932
			173 10 54.5	353 10 26.9	Halfmoon Bay	9426.2	3.974336
			286 51 32.1	106 52 01.7	Sellick	1252.0	3.097604
			338 08 08.0	158 09 15.0	Wetner 2	7288.2	3.862620
Topog No. 5†	37 04 21.725	669.7	159 08 38.3	339 08 13.8	Tranta	2814.2	3.449362
1864	122 15 23.219	573.6	237 41 28.6	57 42 50.7	Pine	3980.0	3.599878
			303 50 49.2	123 51 25.9	Cook	1812.1	3.258194

* This point is in the area of the 1906 earthquake disturbance.

† See p. 292.

Monterey Bay to San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Hilltop with single tree *	37 08 58.505	1803.5	90 41 02.6	270 38 38.2	Middle Point	5900.7	3.770906
1865	122 17 35.480	875.5	112 08 02.4	292 04 24.8	Pigeon Point	9590.6	3.981844
			121 15 38.3	301 12 47.8	Ranch	8144.5	3.910864
Topog No. 7 †	37 08 25.664	791.1	125 11 29.0	305 10 51.5	Middle Point	1875.6	3.273129
1864	122 20 32.468	801.3	224 50 52.5	44 51 54.2	Gushee	3575.5	3.553335
			274 07 07.8	94 09 19.4	Steele	5399.1	3.732318
Jack *	37 15 31.337	966.1	204 48 26.9	24 48 48.1	Pescadero	2056.6	3.313140
1865	122 24 46.742	1151.8	228 31 01.2	48 32 57.5	Peak	6315.3	3.800391
			299 00 27.3	119 03 00.9	Beutro	7149.3	3.854262
High Top *	37 19 59.635	1838.5	68 50 52	248 46 32	Peak	11313.7	4.053606
1865	122 14 26.251	646.3	94 59 22	274 54 00	Wetner 2	13130.4	4.118277
			106 57 16	286 53 17	Gilbert	10125.7	4.005424
Green Top *	37 22 11.515	355.0	33 52 54	213 50 39	Peak	9820.6	3.992140
1865	122 17 52.371	1288.7	69 54 03	249 50 46	Wetner 2	8526.4	3.930764
			76 23 11	256 21 17	Gilbert	4746.5	3.676375
Topog No. 8 * ‡	37 10 19.54	602.4	281 56 16	101 58 09	Gushee	4711.5	3.67316
1864	122 21 57.10	1408.7	347 07 08	167 07 22	Middle Point	2492.4	3.39661
Topog No. 6 * ‡	37 06 50.22	1548.1	91 16 28	271 15 25	Point Ano Nuevo	2574.1	3.41062
1864	122 18 03.55	87.6	168 06 51	348 06 23	Gushee	5597.1	3.74796
Gushee's house chimney*‡	37 09 00.52	16.0	284 34 04	104 36 22	Steele	5812.9	3.76439
1864	122 20 42.23	1042.1	341 14 56	161 15 29	Point Ano Nuevo	4181.8	3.62136
Topog No. 4 †	37 03 21.829	672.9	195 49 53.8	15 49 59.6	Cook	870.0	2.939498
1864	122 14 31.907	788.4	331 03 11.4	151 03 45.3	Topog No. 3	2875.5	3.458706
			332 19 58.3	152 20 41.6	Point	3835.1	3.583780
Cutts No. 1 * ‡	36 59 00.39	12.0	291 38 26	111 39 08	St. Johns Hill	1865.5	3.27080
1864	122 06 41.55	1027.6	27 03 05	207 03 01	Rice	377.3	2.57669
Dunlop's house chimney*‡	36 58 23.25	716.7	320 06 48	140 07 10	Parsons	1405.6	3.14785
1864	122 07 42.15	1042.6	101 15 36	281 14 45	Lagoon	2139.8	3.33038
N. gable barn No. 2 * ‡	36 58 15.85	488.6	40 42 59	220 42 41	Parsons	1122.0	3.04998
1864	122 06 36.13	893.7	163 34 53	343 34 46	Rice	1081.2	3.03390
Rice's house chimney * ‡	36 58 10.69	329.5	19 11 53	199 11 47	Parsons	732.3	2.86466
1864	122 06 55.98	1384.7	188 48 38	8 48 43	Rice	1210.2	3.08286
N. gable, old house * ‡	36 57 32.20	992.6	132 06 23	312 05 19	Rice	3554.2	3.55074
1864	122 05 01.87	46.3	160 11 37	340 11 19	St. Johns Hill	2158.3	3.33411
Balcraft's Ldg. flagstaff	36 57 13.188	406.5	107 34 33.3	287 34 21.2	Balcraft 1	527.5	2.722230
1864	122 05 09.772	241.8	110 39 44.7	290 38 35.0	Parsons	3065.4	3.486488
			140 34 08.9	320 33 09.5	Rice	3843.9	3.584777
			168 25 26.8	348 25 13.8	St. Johns Hill	2670.9	3.426660
West gable barn * ‡	36 57 41.13	1267.9	327 21 05	147 21 16	Balcraft 1	833.9	2.92113
1864	122 05 48.28	1194.4	96 32 59	276 32 12	Parsons	1928.1	3.28514
Waddell's wharf, E. pier*‡	37 06 59.23	1825.9	230 05 12	50 06 19	Steele	3546.5	3.54980
1864	122 18 44.50	1098.6	299 16 19	119 17 56	Tranta	4549.6	3.65797
San Jose Catholic Institute spire	37 20 07.208	222.2	268 35 08.9	88 40 51.8	Masters Hill	13919.9	4.143635
1854	121 53 38.534	948.6	349 44 45.3	169 46 35.5	Loma Prieta	25258.3	4.402405
			85 33 53.0	265 24 40.8	Black Mountain	22495.8	4.352102
Santa Clara Catholic Church, spire	37 20 58.760	1811.6	273 55 40.1	94 03 04.4	Masters Hill	18070.7	4.256975
1854	121 56 25.605	630.3	341 56 27.4	161 59 58.7	Loma Prieta	27811.0	4.444217
			79 40 05.1	259 32 34.1	Black Mountain	18616.6	4.269901
Gilroy Pres. Ch., white sp.‡	37 00 27.99	862.9	115 29 05.2	295 19 14.7	Loma Prieta	26798.3	4.428108
1884–85	121 34 16.64	411.4	290 32 43.9	110 44 56.7	Santa Ana	32225.6	4.508201
Two Tree Hill * ‡	36 29 33.86	1043.7	184 34 00.3	4 26 08.5	Loma Prieta	68854.4	4.837932
1854	121 54 10.37	258.1	229 27 22.1	49 41 04.7	Gavilan	45014.1	4.653349
Calaveras Point	37 27 59.072	1821.2	27 47 41.0	207 44 08.9	Black Mountain	18439.6	4.265752
1854	122 03 00.220	5.4	100 14 57.5	280 03 05.2	Ridge	29209.6	4.465526
			157 16 46.8	337 15 09.0	Red Hill	10216.9	4.009321

* This point is in the area of the 1906 earthquake disturbance. † See page 292. ‡ No check on this position.

Monterey Bay to San Francisco Bay—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Whites Landing * † 1854	36 54 25.58	788.5	112 55 22	292 47 47	Santa Cruz	20349.1	4.308545
	121 50 40.92	1013.0	180 16 50	0 16 53	Loma Prieta	22668.0	4.355414
Santa Cruz warehouse, flagstaff * † 1854	36 57 40.14	1237.4	5 18 50	185 18 48	Santa Cruz Point	1070.6	3.02964
	122 01 28.69	709.8	125 02 29	305 01 23	Santa Cruz	3323.0	3.52153
Wetner † 1863	37 22 10.950	337.6	156 09 29.9	336 08 06.0	Johnston	8394.4	3.923990
	122 24 08.985	221.0	207 26 27.8	27 27 50.4	Summit	7256.2	3.860712
			149 29 00.8	329 25 32.1	Pillar Point	16604.7	4.220231
San Jose Mission Church * 1854	37 32 03.19	98.4	40 18 00	220 09 41	Black Mountain	31229.8	4.494569
	121 55 09.09	223.2	86 45 44	266 29 04	Ridge	40378.6	4.606151

Astronomic stations, mountain peaks, and miscellaneous points.

Mt. Lola Latitude Station 1879	39 26 00.28	8.6	44 25	224 25	Mount Lola	9.53	0.97887
	120 21 51.32	1227.4					
Round Top Latitude Station 1879	38 39 50.30	1551.0	268 06	88 06	Round Top	10.70	1.02945
	120 00 01.57	38.0					
Yolo SE. Base Latitude Station 1880	38 31 42.63	1314.5	73 36	253 36	Yolo SE. Base	48.71	1.68762
	121 47 56.59	1370.7					
Yolo NW. Base Latitude Station 1880	38 40 44.94	1385.7	311 45	131 45	Yolo NW. Base	5.95	0.77460
	121 51 28.74	694.7					
Monticello Latitude Station 1880	38 39 50.96	1571.3	15 38	195 38	Monticello	9.96	0.99818
	122 11 22.22	537.2					
Vaca Latitude Station 1880	38 22 33.44	1031.1	121 18	301 18	Vaca	21.95	1.34135
	122 05 01.22	29.6					
Mt. Tamalpais Latitude Station ‡ 1882	37 55 27.55	849.3	283 13	103 13	Mount Tamalpais	5.60	0.74789
	122 35 45.46	1110.3					
Mocho Latitude Station 1887	37 28 39.70	1223.9	90	270	Mocho	1.60	0.20418
	121 33 18.72	460.0					
Mt. Diablo Latitude Station 1876	37 52 55.45	1709.6	269 02	89 02	Mount Diablo	51.15	1.70886
	121 54 50.45	1232.7					
Presidio Latitude Station † 1852	37 47 39.17	1207.6					
	122 27 13.62	333.2					
Presidio Latitude Station, E. pier † 1896	37 47 51.39	1584.2					
	122 27 05.17	126.5					
Lafayette Park Latitude Station † 1888–1895	37 47 31.93	984.4					
	122 25 37.16	909.2					
Ross Mt. Latitude Station 1859–60	38 30 20.58	634.6	89 50	269 50	Ross Mountain	9.68	0.98576
	123 07 08.82	213.7					
Mount Helena: Helena Eccentric 1876	38 40 10.511	324.1	246 54 21	66 54 22	Mount Helena	44.77	1.65096
	122 37 59.520	1439.0					
Helena Flank 1876	38 39 21.930	676.2	69 19 42	249 00 51	Ross Mountain	46945.1	4.67159
	122 36 56.499	1366.2	134 31 15	314 30 36	Helena Eccentric	2136.8	3.32977
			135 38 22	315 37 44	Mount Helena	2120.0	3.32633
			268 29 58	88 45 57	Monticello	37103.9	4.56942

* No check on this position. † This point is in the area of the 1906 earthquake disturbance. ‡ See p. 292.

Astronomic stations, mountain peaks, and miscellaneous points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Mount Helena—Con.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Vertical Circle Station	38 40 10.329	318.5	315 39 16	135 39 53	Helena Flank	2086.7	3.31946
1876	122 37 56.826	1373.8	94 54 58	274 54 56	Helena Eccentric	65.36	1.81533
			134 02 55	314 02 54	Mount Helena	33.31	1.52260
Spur green tree	38 39 38.888	1199.1	138 11 28	318 11 05	Vertical Circle Sta.	1300.8	3.11421
1876	122 37 20.955	506.6	311 29 18	131 29 33	Helena Flank	789.4	2.89730
A	38 39 59.618	1838.3	338 57 50	158 57 57	Spur green tree	684.8	2.83559
1876	122 37 31.123	752.4	117 59 48	297 59 32	Vertical Circle Sta.	703.7	2.84740
S. Flat	38 39 26.247	809.3	121 24 07	301 23 51	Spur green tree	748.2	2.87400
1876	122 36 54.543	1318.8	132 04 42	312 04 04	Vertical Circle Sta.	2028.6	3.30720
			132 06 37	312 05 58	Mount Helena	2061.7	3.31423
			139 19 30	319 19 07	A	1356.8	3.13253
Latitude Station	38 40 10.58	326.2	150 10 24	330 10 24	Mount Helena	17.74	1.24900
1876	122 37 57.45	1388.8	297 11 49	117 11 50	Vertical Circle Sta.	17.00	1.23040
East summit	38 39 57.77	1781.3	356 22 30	176 22 31	South Flat	974.0	2.98855
1876	122 36 57.09	1380.3	93 57 45	273 57 24	A	824.7	2.91631
			105 01 00	285 00 23	Vertical Circle Sta.	1495.1	3.17468
Mount Conness:							
W. Base	37 57 57.317	1767.2	114 24 14	294 24 05	Mount Conness	393.5	2.59495
1890	119 18 59.546	1453.5					
E. Base	37 57 54.867	1691.6	114 25 22	294 25 09	Mount Conness	575.9	2.76036
1890	119 18 52.744	1287.5	114 27 42	294 27 37	W. Base	182.4	2.26099
Lower Jagged	37 57 47.549	1466.0	162 59 27	342 59 23	Mount Conness	484.9	2.68568
1890	119 19 08.415	205.4	215 42 39	35 42 44	W. Base	370.9	2.56926
			239 27 46	59 27 56	E. Base	444.1	2.64749
Slope	37 57 46.109	1421.6	96 02 05	276 01 55	Lower Jagged	422.6	2.62593
1890	119 18 51.199	1249.8	132 06 53	312 06 39	Mount Conness	757.7	2.87952
			149 28 32	329 28 27	W. Base	401.2	2.60332
			172 02 46	352 02 46	E. Base	272.7	2.43563
Vertical Circle Station	37 57 58.988	1818.7	283 47 08	103 47 13	W. Base	216.2	2.33480
1890	119 19 08.147	198.9	288 40 07	108 40 17	E. Base	396.8	2.59862
			313 49 26	133 49 36	Slope	573.4	2.75848
Magnetic Station	37 57 59.812	1844.1	118 20 05	298 20 01	Mount Conness	180.4	2.25634
1890	119 19 07.720	188.4	291 05 07	111 05 12	W. Base	213.9	2.33012
			292 38 17	112 38 26	E. Base	396.1	2.59778
			316 19 52	136 20 02	Slope	584.1	2.76648
Latitude Station	37 57 59.249	1826.8	121 59 06	301 59 02	Mount Conness	194.5	2.28890
1890	119 19 07.469	182.3	160 29 45	340 29 45	Magnetic Station	18.4	1.26580
			287 07 00	107 07 05	W. Base	202.4	2.30611
			290 35 49	110 35 59	E. Base	384.0	2.58429
			315 34 04	135 34 14	Slope	567.3	2.75384
Marysville:							
Court-house flagstaff	39 08 29.645	914.2	109 47 26.0	289 38 39.1	Marysville Butte	21271.1	4.327790
1898	121 35 17.366	417.0					
Stone	39 11 58.397	1800.9	297 30 03.5	117 35 28.2	Court-house flagstaff	13920.0	4.143640
1898	121 43 51.495	1235.6	95 31 29.4	275 28 07.1	Marysville Butte	7714.8	3.887327
Walton	39 09 40.433	1246.9	113 41 10.8	293 36 10.5	Marysville Butte	12450.7	4.095195
1898	121 41 16.333	392.1	138 48 57.8	318 47 19.8	Stone	5654.3	3.752378
			284 10 48.5	104 14 35.1	Court-house flagstaff	8891.8	3.948989
Roll	39 10 43.885	1353.4	116 44 38.2	296 41 59.3	Marysville Butte	6753.6	3.829533
1898	121 45 00.176	4.2	215 38 50.0	35 39 33.4	Stone	2827.9	3.451458
			286 25 45.7	106 31 53.7	Court-house flagstaff	14592.3	4.164125
			289 59 20.5	110 01 41.9	Walton	5718.7	3.757298
Fields	39 10 57.614	1776.8	0 00 08.7	180 00 08.7	Walton	2380.1	3.376595
1898	121 41 16.329	392.0	85 30 50.8	265 28 29.4	Roll	5389.5	3.731546
			116 43 58.4	296 42 20.4	Stone	4168.9	3.620025
Elmer	39 09 10.549	325.3	110 31 39.1	290 30 34.3	Walton	2629.2	3.419826
1898	121 39 33.776	811.1	143 17 54.1	323 16 49.3	Fields	4118.5	3.614740
N. Base	39 11 23.305	718.7	357 21 48.8	177 21 53.8	Elmer	4098.2	3.612598
1898	121 39 41.627	999.1	35 38 01.8	215 37 02.0	Walton	3902.8	3.591375
			70 47 29.0	250 46 29.2	Fields	2407.0	3.381474
			80 59 37.0	260 56 15.8	Roll	7741.5	3.888826
			97 38 07.2	277 32 07.1	Marysville Butte	13796.5	4.139770
			100 15 08.8	280 12 31.0	Stone	6093.1	3.784835

Astronomic stations, mountain peaks, and miscellaneous points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Marysville—Continued.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
S. Base	39 10 44.505	1372.5	49 02 34.2	229 01 34.3	Walton	3013.8	3.479109
1898	121 39 41.535	997.0	100 05 00.1	280 04 00.2	Fields	2310.9	3.363780
			179 53 38.3	359 53 38.2	N. Base	1196.5	3.077918
			356 19 15.8	176 19 20.7	Elmer	2903.4	3.462904
South Meridian	39 08 20.069	618.9	111 01 57.0	290 53 23.8	Marysville Butte	20886.3	4.319862
1898	121 35 39.036	937.5	240 25 33.8	60 25 47.4	Court-house flagstaff	598.4	2.776991
North Meridian	39 08 29.127	898.3	268 14 15.6	88 14 29.3	Court-house flagstaff	520.7	2.716559
1898	121 35 39.036	937.5	0 00 14.6	180 00 14.6	South Meridian	279.3	2.446110
Middle Meridian	39 08 25.602	789.6	0 00 14.6	180 00 14.6	South Meridian	170.6	2.232106
1898	121 35 39.037	937.5	180 00 14.6	0 00 14.6	North Meridian	108.7	2.036150
			256 31 34.8	76 31 48.5	Court-house flagstaff	535.2	2.728481
Presbyterian Church	39 08 25.847	797.1	71 40 37.1	251 40 23.0	South Meridian	567.3	2.753848
1898	121 35 16.584	398.3	89 10 46.7	269 10 32.6	Middle Meridian	538.6	2.731284
			102 36 16.7	282 33 34.3	Elmer	6328.1	3.801276
			104 56 28.4	284 52 41.3	Walton	8939.4	3.951308
			100 37 07.1	280 36 53.0	North Meridian	547.9	2.738720
			123 55 52.5	303 53 05.2	S. Base	7664.8	3.884502
			130 43 11.6	310 40 24.2	N. Base	8392.6	3.923896
Catholic Church	39 08 35.689	1100.6	99 48 47.9	279 46 04.1	Elmer	6321.7	3.800836
1898	121 35 14.289	343.1	116 46 21.1	296 40 54.5	Stone	13899.2	4.142991
			121 47 29.5	301 44 40.8	S. Base	7545.2	3.877668
			128 52 37.6	308 49 48.7	N. Base	8239.5	3.915900
North Butte, summit, pole	39 14 11.587	357.4	311 47 15.4	131 49 16.4	Stone	6161.7	3.789702
1898	121 47 02.958	70.9	315 07 17.8	135 10 56.8	Walton	11794.2	4.071670
			335 17 24.8	155 18 42.4	Roll	7050.1	3.848196
Latitude Station	39 08 19.59	604.2	180 00	0 00	South Meridian	14.71	1.16761
1898	121 35 39.04	937.6					
Longitude Station	39 08 29.19	900.2					
1889	121 35 10.32	247.8					
Sacramento, ball on capitol dome	38 34 37.331	1151.1	265 17 18.5	86 13 12.4	Round Top	130346.2	5.1150983
1876–1880	121 29 34.498	835.1	25 38 47.8	205 23 10.9	Mount Diablo	85476.1	4.9318447
			66 47 26.3	246 25 22.5	Vaca	56188.5	4.7496471
			99 15 55.2	278 49 49.9	Monticello	61432.4	4.7883974
Sacramento Longitude Station	38 34 34.80	1073.0					
1888–89	121 29 30.47	737.6					
Mount Hamilton:							
N. Base	37 20 31.793	980.1	69 01 50	249 01 49	Lick Obs., N. dome	24.28	1.38525
1888	121 38 30.786	757.8					
Astronomic Eccentric	37 20 34.946	1077.4	75 57 04	255 56 53	Lick Obs., N. dome	436.2	2.63971
1888	121 38 14.515	357.3	76 21 27	256 21 17	N. Base	412.1	2.61504
Tycho	37 20 35.610	1097.8	295 42 19	115 42 20	Astron. Eccentric	47.1	1.67346
1888	121 38 16.241	399.8	71 38 24	251 38 14	Lick Obs., N. dome	401.1	2.60325
			71 48 27	251 48 18	N. Base	376.9	2.57617
S. Base	37 20 29.000	894.0	194 14 13	14 14 13	N. Base	88.8	1.94861
1888	121 38 31.674	779.6	241 47 16	61 47 24	Tycho	431.1	2.63455
			246 32 06	66 32 16	Astron. Eccentric	460.4	2.66316
Longitude Station	37 20 34.81	1073.2	67	247	S. Base	458.8	2.6616
1888	121 38 14.52	357.4	77	257	N. Base	411.1	2.6140
			120	300	Tycho	49.2	1.6917
			180	0	Astron. Eccentric	4.29	0.6325
Magnetic Station	37 20 36.810	1134.8	47 12 54	227 12 52	Astron. Eccentric	84.6	1.92723
1888	121 38 11.993	295.2	70 30 49	250 30 46	Tycho	110.9	2.04494
Residence, flagstaff	37 20 31.485	970.6	45 13 57	225 13 56	S. Base	108.8	2.03660
1888	121 38 28.535	702.4	99 43 49	279 43 47	N. Base	56.2	1.74972
			247 12 25	67 12 32	Tycho	328.3	2.51621
			252 49 00	72 49 08	Astron. Eccentric	361.2	2.55778
Latitude Station	37 20 34.81	1073.2	90	270	Longitude Station	2.02	0.3054
1888	121 38 14.43	355.2					

Astronomic stations, mountain peaks, and miscellaneous points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Calistoga, mark on depot 1876	38 34 49.288 122 34 40.894	1519.8 990.0	154 08 23 154 22 21 154 25 58 158 41 38	334 06 19 334 20 18 334 23 55 338 40 12	Helena Eccentric Mount Helena Vertical Circle Sta. Helena Flank	11008.8 11006.8 10976.0 9025.3	4.04174 4.04166 4.04045 3.95546
Calistoga Church, N. corner 1876	38 34 49.573 122 34 52.660	1528.6 1274.6	155 42 11 160 22 36 271 45 36	335 40 15 340 21 17 91 45 43	Mount Helena Helena Flank Calistoga, mk. on dp.	10878.5 8917.2 284.9	4.03657 3.95023 2.45475
Downieville Butte, N. highest peak 1876–79	39 35 38.23 120 38 45.81	1179.0 1093.1	257 07 21 306 15 41 30 30 25 59 46 51	77 52 17 126 26 26 209 42 49 238 31 37	Pah Rah Mount Lola Mount Diablo Mount Helena	103018.7 30082.1 219664.0 200083.8	5.012916 4.478308 5.341759 5.301212
Santa Rosa Court-house, dome * 1891	38 26 25.60 122 42 46.60	789.4 1130.3	101 40 33.90 195 20 10.75	281 25 23.94 15 23 10.74	Ross Mt. Mount Helena	36188.0 26396.4	4.5585643 4.4215449
Pyramid Peak 1876–79	38 50 43.35 120 09 25.70	1336.7 619.8	55 41 11 85 35 55 164 43 08 283 57 41 325 51 15	234 35 47 264 02 56 344 35 16 104 48 57 145 57 08	Mount Diablo Mount Helena Mount Lola Mount Grant Round Top	187063.1 216061.8 67688.5 122703.8 24317.6	5.271990 5.334578 4.830515 5.088858 4.385920
Jackson Butte † 1879–98	38 20 24.950 120 43 13.780	769.3 334.7	150 57 13.6 240 00 27.5	330 47 09.9 60 27 21.5	Pine Hill Round Top	48224.5 72373.2	4.6832680 4.8595778
Castle Peak, summit 1876–79	39 21 55.95 120 20 56.93	1725.5 1362.8	69 23 16 170 08 52 237 21 55	247 57 00 350 08 18 57 55 24	Mount Helena Mount Lola Pah Rah	212314.6 7641.0 89057.4	5.326980 3.883152 4.949670
Needle Peak, summit 1876–79	39 12 03.95 120 18 01.34	121.8 32.2	44 21 02 74 28 26 167 56 45	223 20 45 253 00 30 347 54 21	Mount Diablo Mount Helena Mount Lola	203009.3 210651.2 26368.5	5.307516 5.323564 4.421085
Dicks Peak or Red Peak 1876–79	38 54 03.08 120 09 00.87	95.0 21.0	83 59 46 162 41 17 256 54 42 333 35 51	262 26 27 342 33 10 77 20 15 153 41 29	Mount Helena Mount Lola Mount Como Round Top	217216.1 61943.5 60193.8 29345.8	5.336892 4.791996 4.779552 4.467546
Carys Peak, cairn 1878–79	38 44 20.000 119 52 18.243	616.7 440.7	53 24 38.0 196 12 46.4 227 38 26.4 280 53 08.4	233 19 48.6 16 27 54.0 47 53 26.9 101 33 39.3	Round Top Pah Rah Mount Como Mount Grant	13937.8 122162.7 46704.5 95934.2	4.1441941 5.0869385 4.6693585 4.9819735
Silver Mt. N. Peak, cairn 1879–80	38 34 03.322 119 45 25.781	102.4 624.1	116 52 49.6 205 59 10.2 261 13 57.4 269 27 55.8	296 43 43.3 26 09 50.6 82 44 10.9 90 04 05.1	Round Top Mount Como Toiyabe Dome Mount Grant	23726.7 56120.6 211255.3 84227.1	4.3752376 4.7491221 5.3248077 4.9254520
Silver Mt. S. Peak or Highland Peak, cairn 1876–80	38 32 38.604 119 45 17.417	1190.3 421.8	94 04 58.5 204 41 09.3 260 31 35.3 267 41 08.6	272 17 13.0 24 51 44.3 82 01 42.0 88 17 12.0	Mount Helena Mount Como Toiyabe Dome Mount Grant	251058.6 58395.0 211469.6 84089.6	5.3997751 4.7663759 5.3252480 4.9247424
Jobs Sister, summit 1879–80	38 51 45.94 119 53 01.51	1416.6 36.4	24 41 47 146 53 32 243 30 16 270 04 02 288 29 26	204 37 24 326 35 20 63 45 45 91 39 18 109 10 27	Round Top Mount Lola Mount Como Toiyabe Dome Mount Grant	24281.3 75752.9 39724.6 219774.3 10044.1	4.385272 4.879399 4.599059 5.341977 4.001910
Sweetwater Mt., summit 1879–80	38 26 14.21 119 18 15.64	438.2 379.3	140 35 57 167 17 51 251 33 06 254 54 02	319 55 59 347 11 31 71 52 17 76 07 10	Mount Lola Mount Como Mount Grant Toiyabe Dome	143783.1 66515.1 47187.0 175540.4	5.157708 4.822920 4.673822 5.244377
Hulls Mt., summit 1878–79	39 31 20.86 122 56 09.82	643.3 234.6	316 21 02 37 11 04 42 32 30	136 28 50 216 56 46 222 10 14	Snow Mt. W. Paxton Cold Spring	22239.0 53784.2 75095.0	4.347116 4.730655 4.875611
Buck Peak, summit 1875–79	38 57 21.65 123 27 55.78	667.6 1343.1	146 20 18 152 52 55 213 35 29 328 49 42	326 18 09 332 43 17 33 41 18 149 02 43	Cold Spring Great Caspar Paxton Ross Mt.	8883.4 48118.7 23985.2 58354.6	3.948578 4.682314 4.379944 4.766075
Sherwood Mt., highest knoll 1878–79	39 30 46.52 123 30 38.56	1434.7 921.1	337 40 34 1 03 40 43 29 48	157 48 07 281 03 12 223 21 49	Paxton Cold Spring Great Caspar	45229.1 54443.8 26202.2	4.655418 4.735948 4.418338

*No check on this position.

† Checked by vertical angles only.

Astronomic stations, mountain peaks, and miscellaneous points—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Round Valley Mt., summit 1878–79	39 35 44.22 123 14 23.32	1363.7 556.4	6 58 27 21 03 00 55 49 39	186 55 42 200 52 15 235 31 20	Paxton Cold Spring Great Caspar	51417.3 68123.3 50026.8	4.711109 4.833296 4.699203
Sanel Mt. 1859–78	38 56 55.800 123 13 00.314	1720.7 7.6	350 11 13.94 107 16 54.64 158 22 07.64	170 14 53.59 287 05 22.50 338 18 31.62	Ross Mt. Cold Spring Paxton	49915.1 27716.4 22343.5	4.6982323 4 4427362 4.3491519
Walalla * 1859–78	38 51 24.724 123 29 50.322	762.4 1213.3	173 16 40.72 207 20 14.36 247 09 16.63 319 43 02.60	353 15 44.08 27 27 14.13 67 19 50.92 139 57 13.28	Cold Spring Paxton Sanel Mt. Ross Mt.	18526.2 34887.5 26392.1 51007.9	4.2677874 4.5426701 4.4214741 4.7076375
Sulphur Peak 1859	38 45 54.278 122 50 40.221	1673.8 971.0	39 48 25.72 100 23 31.63 122 22 52.06 299 48 48.58 334 15 28.67 7 50 57.83	219 38 08.22 279 58 58.67 302 08 51.30 119 56 45.45 154 25 34.53 187 47 09.78	Ross Mt. Walalla Sanel Mt. Mount Helena Sonoma Mt. Tomales Bay	37431.0 57610.0 38212.4 21242.6 54380.9 65322.4	4.5732317 4.7604979 4.5822042 4.3272075 4.7354468 4.8150621
Sulphur Peak, Latitude Station 1859	38 45 54.27 122 50 39.99	1673.5 965.4	91 21 28	271 21 28	Sulphur Peak	5.537	0.7433
King Peak 1881	40 09 26.187 124 07 24.332	807.7 575.9	308 38 02.37 318 05 40.32 338 58 17.57	129 17 33.19 138 26 38.93 159 13 46.46	Mount Sanhedrin Cahto Great Caspar	113170.88 69971.27 96948.52	5.0537347 4.8449108 4.9865412
Mount Lassic 1881	40 20 03.791 123 33 12.978	116.9 306.4	336 31 32.60 1 42 41.94 68 06 22.97	156 49 11.23 181 41 43.98 247 44 17.66	Mount Sanhedrin Cahto King Peak	98917.89 71916.70 52321.96	4.9952748 4.8568297 4.7186840
Bear Ridge † 1869	40 29 52.68 124 17 37.81	1624.9 890.3	285 53 05.9 338 59 46.7	106 21 53.6 159 06 23.7	Mount Lassic King Peak	65400.3 40507.7	4.8155796 4.6075371
Mad River † 1881	40 42 11.45 123 46 31.32	353.2 735.3	335 16 36.1 26 05 24.7	155 25 14.8 205 51 52.1	Mount Lassic King Peak	45058.3 67430.4	4.6537747 4.8288560

Golden Gate to Point Arena.

Point Reyes Head * 1859	37 59 48.260 123 00 50.766	1487.8 1238.6	196 06 03.11 282 12 44.86 234 21 19.75	16 08 33.63 102 28 10.94 54 26 46.28	Tomales Bay Mount Tamalpais Point Reyes Hill	21413.4 37621.9 15893.2	4.3306866 4.5754407 4.2012108
Redwood * 1860	38 24 12.028 123 01 16.324	370.9 396.1	336 36 15.0 350 40 35.1 18 55 25.8 143 03 06.8	156 39 25.5 170 41 20.1 198 53 53.3 322 59 27.3	Smith Bodega Bodega Head Ross Mountain	18826.6 10883.8 11171.4 14225.3	4.274772 4.036781 4.048106 4.153061
Bodega Hill * 1860	38 22 13.361 123 03 21.665	412.0 526.0	159 50 54.0 219 43 43.1 325 48 56.2 4 46 46.3	339 48 32.4 39 45 00.9 145 50 58.8 184 46 31.6	Ross Mountain Redwood Bodega Bodega Head	16004.6 4758.3 8558.4 6933.5	4.204246 3.677455 3.932395 3.840953
Table Mount ‡ 1876	38 35 43.700 123 12 31.745	1347.5 768.2	321 52 47.6 354 39 25.4 27 19 32.6	141 56 08.6 174 39 48.6 207 18 20.4	Ross Mountain Dixon Henry Hill	12659.4 9692.2 6107.2	4.102412 3.986421 3.785839
Lucky Tree ‡ 1876	38 36 59.983 123 21 10.809	1849.5 261.5	261 59 27.1 315 11 03.0 342 17 56.3 55 10 53.3	82 00 58.4 135 12 57.3 162 18 41.8 235 10 16.7	Lancaster Funcke Salt Point Horseshoe Point	3579.9 6301.5 5815.6 1728.6	3.553874 3.799447 3.764592 3.237704
Smith ‡ 1870	38 54 43.278 123 42 36.697	1334.5 884.2	127 09 39.1 207 17 48.5 216 50 53.3	307 09 01.5 27 20 16.9 36 53 51.1	Arena Dunn Clark	1820.0 12380.4 11350.9	3.260081 4.092735 4.055030
Adams * 1870	38 59 38.894 123 37 57.914	1199.3 1393.8	28 46 24.2 36 23 33.0 45 32 43.5 65 05 05.6 108 11 10.5	208 43 56.1 216 20 37.7 225 29 10.5 245 01 02.8 288 08 53.5	High Bluff Smith Arena Point Arena L. H. Lane	11784.1 11320.9 11440.6 10247.4 5513.0	4.071296 4.053880 4.058449 4.010615 3.741390

*See pp. 292–3. † No check on this position. ‡ This point is in the area of the 1906 earthquake disturbance.

Golden Gate to Point Arena—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Point Arena NW. Base*	38 57 09.973	307.5	211 09 01.0	51 10 40.7	Lane	7375.6	3.867795
1870	123 44 14.173	341.3	243 04 53.5	63 08 50.1	Adams	10155.1	4.006686
			345 18 36.4	165 18 59.9	Arena	3540.0	3.548998
Hall*	38 56 19.376	597.4	20 23 22.0	200 23 04.0	Arena	1988.6	3.298553
1870	123 43 08.149	196.3	134 27 52.9	314 27 11.4	Pt. Arena NW. Base	2227.6	3.347847
			135 06 09.5	315 05 21.8	Point Arena L. H.	2583.7	3.412249
			195 47 41.0	15 48 39.2	Lane	8180.6	3.912786
Sand†	38 57 21.249	655.2	0 31 08.9	180 31 08.4	Hall	1908.0	3.280587
1870	123 43 07.431	178.9	77 47 49.5	257 47 07.5	Pt. Arena NW. Base	1644.3	3.215973
			87 34 59.2	267 34 11.0	Point Arena L. H.	1842.6	3.265437
Point Arena SE. Base†	38 56 41.989	1294.7	144 59 42.6	324 59 21.9	Point Arena L. H.	1383.0	3.140808
1870	123 43 50.941	1226.8	147 02 48.0	327 02 33.4	Pt. Arena NW. Base	1028.4	3.012173
			204 24 39.6	24 26 04.7	Lane	7879.2	3.896480
			220 52 10.8	40 52 38.2	Sand	1601.1	3.204412
Knox†	38 53 38.346	1182.4	98 57 42.7	278 55 32.4	High Bluff	5061.7	3.704300
1879	123 38 25.812	622.1	108 20 48.6	288 18 11.0	Smith	6368.4	3.804028
			128 15 48.9	308 12 03.9	Point Arena L. H.	10981.0	4.040643
Anderson Tree†	38 51 26.687	822.9	124 05 00.6	304 01 53.9	High Bluff	8654.7	3.937250
1879	123 36 55.842	1346.4	126 27 11.2	306 23 37.2	Smith	10210.0	4.009025
			151 53 49.0	331 52 52.5	Knox	4602.9	3.663028
Marr†	38 54 18.767	578.7	9 33 46.2	189 33 44.2	High Bluff	466.0	2.668360
1891	123 41 50.092	1207.0	123 56 54.3	303 56 25.0	Smith	1353.6	3.131488
			132 34 12.9	312 33 54.7	Sinclair	948.9	2.977198
Point Arena Long. Sta.†	38 54 36.160	1115.0	49 03 38.4	229 03 22.3	Marr	818.5	2.913009
1889	123 41 24.432	588.7	94 35 07.6	274 34 33.3	Sinclair	1321.2	3.120982
Iversen Point†	38 50 47.229	1456.3	142 33 46.2	322 31 21.0	Smith	9169.6	3.962350
1879	123 38 45.342	1093.5	143 14 48.9	323 17 51.0	High Bluff	7569.5	3.879067
			245 15 00.8	65 16 09.5	Anderson Tree	2907.3	3.463490
Havens Neck†	38 48 32.509	1002.4	136 54 04.3	316 52 22.8	Iversen Point	5690.6	3.755160
1878	123 36 04.108	99.1	166 55 33.2	346 55 00.3	Anderson Tree	5514.0	3.741463
Triplet Hill†	38 49 32.638	1006.4	10 19 46.9	190 19 38.5	Havens Neck	1884.6	3.275224
1878	123 35 50.105	1208.7	118 34 14.3	298 32 24.4	Iversen Point	4811.9	3.682315
			133 43 00.0	313 39 12.2	High Bluff	12109.1	4.083112
			155 44 23.7	335 43 42.5	Anderson Tree	3857.7	3.586325
Rocky Peak†	38 49 20.910	644.8	47 19 26.3	227 18 44.3	Havens Neck	2201.6	3.342731
1878	123 34 57.024	1375.6	105 46 28.6	285 45 54.9	Triplet Hill	1330.5	3.123999
Sandstone†	38 44 33.089	1020.3	134 01 16.3	313 57 57.9	Havens Neck	10629.0	4.026494
1878	123 30 47.332	1143.1	145 50 34.1	325 47 57.7	Rocky Peak	10728.1	4.030522
Robinson Point†	38 46 24.788	764.3	326 58 25.3	146 59 23.3	Sandstone	4107.7	3.613600
1878	123 32 20.035	483.6	126 05 05.3	306 02 44.9	Havens Neck	6689.9	3.825421
			145 06 54.7	325 05 16.3	Rocky Peak	6621.7	3.820970
Rutherford Tree†	38 45 00.586	18.1	53 54 08.2	233 53 38.1	Sandstone	1439.0	3.158055
1878	123 29 59.188	1429.3	126 36 10.2	306 32 21.7	Havens Neck	10967.8	4.040118
			127 22 28.7	307 21 00.5	Robinson Point	4278.5	3.631291
			138 10 52.9	318 07 46.4	Rocky Peak	10775.6	4.032440
Knipp†	38 43 20.365	627.9	322 13 43.5	142 15 19.1	Bihler Point	6031.3	3.780412
1878	123 28 25.540	617.0	123 13 42.1	303 12 13.4	Sandstone	4093.6	3.612110
			143 48 30.4	323 47 31.8	Rutherford Tree	3829.6	3.583156
Stengel†	38 42 04.637	143.0	334 15 01.5	154 15 31.9	Bihler Point	2701.4	3.431593
1878	123 26 41.260	997.0	127 37 12.0	307 34 38.1	Sandstone	7502.7	3.875218
			132 50 02.1	312 48 57.0	Knipp	3435.2	3.535954
			138 37 46.4	318 35 42.6	Rutherford Tree	7231.5	3.859230
Helmke Ridge†	38 36 59.236	1826.5	338 39 20.0	158 40 15.5	Salt Point	5923.4	3.772572
1876	123 21 26.825	648.9	46 56 22.2	226 55 55.6	Horseshoe Point	1412.0	3.149825
Rocky Point†	38 37 49.157	1515.7	145 40 21.3	325 38 45.1	Bihler Point	6593.8	3.819136
1876	123 23 18.874	456.6	299 34 57.6	119 36 07.5	Helmke Ridge	3117.1	3.493755
			326 08 29.5	146 09 12.8	Horseshoe Point	3014.5	3.479210

* This point is in the area of the 1906 earthquake disturbance. † See p. 293.

Golden Gate to Point Arena—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Harbeck*	38 38 35.796	1103.7	337 09 45.0	157 10 27.8	Horseshoe Point	4276.6	3.631102
1876	123 23 18.063	436.8	0 46 56.6	180 46 56.1	Rocky Point	1438.3	3.157837
Bihler Point*	38 40 45.725	1409.9	316 57 50.2	136 59 26.8	Harbeck	5480.0	3.738782
1876	123 25 52.707	1274.0	325 47 34.8	145 49 54.2	Horseshoe Point	9608.2	3.982642
			134 35 21.9	314 32 17.7	Sandstone	9991.2	3.999618
Stewart Point*	38 39 18.301	564.3	136 51 33.7	316 47 38.0	Sandstone	13309.7	4.124168
1876	123 24 30.482	737.1	143 36 06.2	323 35 14.7	Bihler Point	3349.4	3.524966
			306 48 18.8	126 49 04.0	Harbeck	2187.4	3.339921
			326 59 12.1	147 00 40.1	Horseshoe Point	6262.6	3.796755
			327 46 56.6	147 47 41.3	Rocky Point	3248.8	3.511722
Lark*	38 42 37.457	1154.9	348 43 24.0	168 43 41.8	Bihler Point	3513.1	3.545690
1878	123 26 21.128	510.5	25 40 24.6	205 40 12.0	Stengel	1122.9	3.050333
			113 46 09.2	293 44 51.4	Knipp	3284.0	3.516408
			119 01 51.4	298 59 04.9	Sandstone	7352.7	3.866449
Ross Tree*	38 40 59.071	1821.4	330 35 45.8	150 36 50.1	Harbeck	5070.7	3.705068
1878	123 25 01.005	24.3	346 38 18.5	166 38 37.6	Stewart Point	3193.7	3.504289
			71 46 38.2	251 46 05.8	Bihler Point	1315.7	3.119160
			129 51 04.5	309 50 01.8	Stengel	3155.6	3.499082
			131 24 53.8	311 22 45.9	Knipp	6588.6	3.818791
			147 27 35.6	327 26 45.5	Lark	3599.0	3.556181
Sandy Point*	38 38 41.863	1290.8	144 02 40.1	324 01 28.5	Bihler Point	4718.8	3.673835
1876	123 23 58.081	1404.6	145 06 49.1	325 06 28.9	Stewart Point	1369.8	3.136649
			280 56 10.6	100 56 35.6	Harbeck	985.7	2.993745
			327 31 05.0	147 32 12.8	Horseshoe Point	4893.8	3.689644
			329 44 04.5	149 44 29.0	Rocky Point	1881.6	3.274526
Fisk Tree*	38 39 41.917	1292.5	2 09 07.1	182 09 05.3	Sandy Point	1853.1	3.267893
1876	123 23 55.204	1334.6	49 30 55.0	229 30 33.0	Stewart Point	1121.5	3.049813
			124 43 06.1	304 41 52.7	Bihler Point	3455.5	3.538505
Bourns Landing*	38 47 05.877	181.2	127 14 35.8	307 13 04.5	Havens Neck	4415.3	3.644961
1878	123 33 38.431	927.6	155 31 10.5	335 30 21.2	Rocky Peak	4575.4	3.660430
			303 47 53.4	123 48 42.6	Robinson Point	2277.3	3.357426
			306 06 27.1	126 08 44.4	Rutherford Tree	6553.0	3.816438
Island*	38 45 05.468	168.6	135 05 45.2	315 03 00.0	Havens Neck	9017.2	3.955074
1878	123 31 40.287	972.8	142 28 45.6	322 27 31.6	Bourns Landing	4682.0	3.670431
			148 56 03.2	328 53 59.9	Rocky Peak	9197.4	3.963664
			158 34 49.8	338 34 25.0	Robinson Point	2627.4	3.419524
			273 31 12.9	93 32 16.2	Rutherford Tree	2446.0	3.388448
			304 33 05.0	124 35 06.9	Knipp	5712.0	3.756788
			307 58 36.5	127 59 09.6	Sandstone	1622.4	3.210159
False Ford*	38 45 10.808	333.3	133 27 22.4	313 24 31.8	Havens Neck	9046.7	3.956492
1878	123 31 31.933	771.1	139 17 37.9	319 16 18.5	Bourns Landing	4681.4	3.670380
			147 19 26.6	327 17 17.9	Rocky Peak	9164.0	3.962084
			153 01 27.2	333 00 56.9	Robinson Point	2559.8	3.408210
			278 00 11.6	98 01 09.6	Rutherford Tree	2261.6	3.354422
			307 05 28.9	127 07 25.5	Knipp	5644.8	3.751647
			309 14 39.4	129 17 41.2	Stengel	9069.4	3.957580
			317 11 43.6	137 12 11.5	Sandstone	1585.2	3.200078
Walalla Tree*	38 46 37.070	1143.0	337 22 59.7	157 23 41.1	Sandstone	4141.3	3.617139
1878	123 31 53.278	1286.0	349 02 01.7	169 02 15.1	False Ford	2709.4	3.432872
			353 39 43.2	173 39 51.3	Island	2842.0	3.453623
			59 37 01.5	239 36 44.8	Robinson Point	748.7	2.874330
			109 17 55.6	289 16 49.7	Bourns Landing	2689.1	3.429604
			120 28 46.1	300 26 08.9	Havens Neck	7022.5	3.846490
			138 44 39.7	318 42 44.5	Rocky Peak	6722.0	3.827498
Knipp & Stengel's ranch chimney*	38 43 03.517	108.4	338 18 49	158 19 32	Bihler Point	5916.1	3.772033
1876–8	123 27 02.607	63.0	344 08 21	164 08 34	Stengel	1887.4	3.275874
			104 32 39	284 31 47	Knipp	2069.8	3.315922
Peter Tree*	38 43 52.817	1628.6	334 20 51.2	154 22 02.8	Bihler Point	6399.3	3.806132
1878	123 27 47.317	1142.8	334 25 36.8	154 26 18.1	Stengel	3697.9	3.567953
			42 42 04.1	222 41 40.2	Knipp	1361.6	3.134034
			113 55 44.4	293 53 23.9	False Ford	5933.8	3.773330

*See p. 293–4.

Golden Gate to Point Arena—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Junction †	38 52 54.402	1677.4	140 53 32.8	320 52 47.4	High Bluff	2760.7	3.441023
1879	123 40 41.040	989.2	197 28 08.8	17 29 51.3	Adams	13077.3	4.116518
			197 55 31.4	17 57 16.5	Clark	13073.4	4.116387
			247 24 41.6	67 26 06.5	Knox	3529.7	3.547732
			296 27 48.9	116 30 10.3	Anderson Tree	6065.4	3.782862
			324 33 56.2	144 35 08.9	Iversen Point	4812.4	3.682359
Morse †	38 50 31.223	962.7	343 37 42.1	163 37 55.8	Triplet Hill	1882.9	3.274821
1879	123 36 12.106	291.9	356 59 00.3	176 59 05.6	Havens Neck	3665.7	3.564158
			97 37 14.9	277 35 38.8	Iversen Point	3728.3	3.571511
			128 35 28.6	308 31 54.5	High Bluff	10519.1	4.021978
			136 43 12.4	316 38 03.6	Point Arena L. H.	17272.6	4.237358
			148 20 36.2	328 20 08.8	Anderson Tree	2009.3	3.303051
Saunders Hill †	38 51 45.331	1397.8	131 30 03.4	311 29 00.7	Junction	3214.9	3.507164
1879	123 39 01.146	27.6	135 50 49.4	315 49 01.3	High Bluff	5955.6	3.774924
			193 43 49.8	13 44 12.1	Knox	3587.6	3.554802
Black †	39 00 54.899	1693.1	354 31 23.8	174 31 31.4	Spur	3046.7	3.483836
1870	123 40 26.076	627.4	8 00 01.9	187 59 41.9	Shoemake	5495.4	3.739997
			38 22 56.8	218 20 33.4	Pt. Arena NW. base	8845.9	3.946741
			69 31 22.4	249 30 38.6	Lane	1785.6	3.251795
Spur Mountain †	38 34 24.704	761.7	330 40 46.3	150 42 34.9	Ross Mountain	8632.1	3.936115
1876	123 10 03.676	89.0	20 24 56.6	200 23 47.5	Dixon	7697.4	3.886342
			64 56 14.5	244 53 30.0	Henry Hill	7053.3	3.848390
Russian River †	38 27 52.052	1605.0	133 50 41.2	313 49 17.2	Chaparral	4537.3	3.650801
1860	123 08 41.184	998.4	205 56 36.0	25 57 33.4	Ross Mountain	5093.4	3.707010
			302 07 18.8	122 11 55.4	Redwood	12745.3	4.105349
			323 23 16.1	143 26 34.8	Bodega Hill	13005.6	4.114129
			327 15 12.2	147 16 12.4	Peaked Hill	4337.5	3.637242
Benitz †	38 30 00.400	12.3	188 04 30.5	8 05 00.5	Spur Mountain	8231.4	3.915472
1860	123 10 51.442	1246.5	263 23 17.4	83 25 35.8	Ross Mountain	5420.5	3.734039
			307 33 21.5	127 39 19.1	Redwood	17602.9	4.245584
			321 24 25.0	141 25 46.0	Russian River	5062.6	3.704372
			322 48 59.7	142 53 39.6	Bodega Hill	18066.0	4.256863
			324 05 38.7	144 08 00.1	Peaked Hill	9388.1	3.972576
Dry Creek †	38 28 31.916	984.1	135 43 14.8	315 42 26.9	Chaparral	2672.6	3.426930
1860	123 09 39.223	950.8	227 19 13.6	47 20 47.0	Ross Mountain	4943.9	3.694072
			303 15 45.2	123 20 57.7	Redwood	14593.4	4.164155
			311 08 11.2	131 08 47.2	Russian River	1868.3	3.271441
			321 50 52.5	141 54 47.1	Bodega Hill	14836.6	4.171335
			322 24 44.6	142 26 20.9	Peaked Hill	6154.3	3.789181
Silvers Tree *	38 32 47.884	1476.5	121 50 08.6	301 47 51.6	Funcke	6263.1	3.796792
1876	123 14 27.506	666.1	143 06 11.6	323 03 31.5	Lancaster	10345.8	4.014766
			207 19 32.8	27 20 45.0	Table Mount	6102.6	3.785518
			244 55 40.6	64 58 25.1	Spur Mountain	7051.0	3.848251
			318 45 17.4	138 46 52.7	Dixon	5623.2	3.749986
			16 14 19.7	196 13 51.6	Fort Ross	3911.6	3.592358
Allston Tree flag *	38 32 40.234	1240.6	328 44 26.6	148 45 21.5	Fort Ross	4117.2	3.614600
1876	123 16 40.837	988.9	354 08 09.2	174 08 12.5	Timber Cove	1260.9	3.100665
			117 23 23.6	297 21 20.8	Salt Point	5369.6	3.729942
Fox †	38 49 55.358	1706.9	130 27 35.8	310 26 47.0	Iversen Point	2465.2	3.391854
1879	123 37 27.562	664.8	286 35 14.3	106 36 15.4	Triplet Hill	2453.0	3.389700
			321 45 10.8	141 46 03.1	Havens Neck	3252.6	3.512235
Sail Rock †	38 49 52.874	1630.3	148 39 21.8	328 38 55.2	Iversen Point	1962.6	3.292826
1878	123 38 03.008	72.6	246 08 26.3	66 09 35.9	Morse	2924.6	3.466063
			264 52 39.8	84 53 02.0	Fox	858.4	2.933690
			281 00 12.7	101 01 36.0	Triplet Hill	3266.0	3.514019
			282 22 28.6	102 24 25.7	Rocky Peak	4593.3	3.662121
			310 48 54.2	130 50 08.7	Havens Neck	3790.6	3.578706
Richards †	38 04 03.074	94.8	28 05 39.9	208 03 54.0	Point Reyes Head	8904.5	3.949610
1859	122 57 58.904	1435.8	187 51 43.6	7 52 28.0	Tomales Bay	12835.8	4.108424
			260 53 12.5	80 56 53.3	Point Reyes Hill	8838.5	3.946381
Steele †	38 02 11.397	351.4	66 18 44.9	246 14 31.3	Point Reyes Head	10969.5	4.040188
1859	122 53 59.064	1440.4	120 30 40.2	300 28 12.4	Richards	6786.0	3.831616
			210 46 26.0	30 47 39.1	Point Reyes Hill	5632.0	3.750662

* This point is in the area of the 1906 earthquake disturbance. † See p. 294.

Golden Gate to Point Arena—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Number 1*	38 01 41.304	1273.6	74 07 28.8	254 02 20.3	Point Reyes Head	12707.8	4.104070
1859	122 52 29.810	727.1	118 36 25.0	298 33 02.2	Richards	9137.5	3.960828
			186 59 00.6	6 59 18.6	Point Reyes Hill	5809.4	3.764134
Point Reyes, East*	37 59 26.750	824.7	98 45 44.0	278 43 55.3	Point Reyes Head	4360.8	3.639570
1859	122 57 54.125	1320.7	220 57 35.2	41 01 12.9	Point Reyes Hill	13135.2	4.118437
Number 2*	38 01 08.343	257.2	73 15 00.9	253 10 38.8	Point Reyes East	10845.8	4.035263
1859	122 50 48.511	1183.3	80 30 43.1	260 24 32.3	Point Reyes Head	14898.5	4.173144
			165 25 59.5	345 25 14.9	Point Reyes Hill	7008.0	3.845591
Estero*	38 02 11.794	363.6	54 26 39.7	234 24 03.5	Point Reyes Head	7606.4	3.881178
1859	122 56 37.148	905.9	149 51 05.5	329 50 15.1	Richards	3968.0	3.598572
			234 21 25.7	54 24 16.1	Point Reyes Hill	8286.8	3.918389
Preston†	38 12 14.985	462.0	40 33 34.6	220 32 41.3	Tomales Bay	3226.9	3.508785
1857	122 55 20.550	500.1	102 38 47.8	282 37 00.2	Tomales Point	4336.5	3.637140
Reynolds†	38 08 59.057	1821.0	50 37 41.2	230 36 57.7	Foster	2218.1	3.345974
1857	122 53 12.894	314.0	124 36 00.3	304 33 48.2	Tomales Bay	6323.6	3.800963
			160 09 17.2	340 08 44.4	Mershon	3810.5	3.580984
Mike†	38 07 30.605	943.7	170 30 45.2	350 30 33.6	Reynolds	2765.0	3.441698
1857	122 52 54.176	1319.6	235 51 21.0	55 51 53.2	Hans	1532.3	3.185353
Frink†	38 07 00.935	28.8	108 24 17.0	288 23 07.3	Mike	2898.9	3.462239
1857	122 51 01 245	30.3	114 26 23.7	294 24 18.9	Foster	5405.0	3.732799
			138 39 08.4	318 37 47.0	Reynolds	4852.2	3.685939
			140 08 09.0	320 07 31.4	Hans	2312.4	3.364060
Agnew†	38 06 41.003	1264.3	155 38 23.8	335 37 34.9	Reynolds	4672.8	3.669576
1857	122 51 53.737	1309.1	175 07 32.6	355 07 27.4	Hans	2398.0	3.379850
			244 19 37.3	64 20 09.7	Frink	1418.8	3.151906
Young†	38 06 04.405	135.8	139 29 23.7	319 28 59.3	Agnew	1484.3	3.171509
1857	122 51 14.161	345.0	190 13 55.8	10 14 03.8	Frink	1771.1	3.248252
Sigvart†	38 06 07.987	246.3	86 19 15.9	266 18 32.5	Young	1718.7	3.235193
1857	122 50 03.767	91.8	110 48 48.3	290 47 40.6	Agnew	2866.1	3.457288
			139 23 00.7	319 22 25.2	Frink	2150.8	3.332597
Willow Point†	38 05 27.105	835.8	136 23 50.1	316 23 22.4	Young	1588.3	3.200920
1857	122 50 29.205	711.7	206 10 56.5	26 11 12.2	Sigvart	1404.6	3.147568
Creek†	38 04 25.616	789.8	143 28 35.0	323 27 59.5	Willow Point	2359.3	3.372785
1857	122 49 31.583	769.8	166 02 53.1	346 02 33.3	Sigvart	3252.3	3.512196
			246 30 09.9	66 30 44.8	Hammond	1503.0	3.176970
Teton†	38 15 13.602	419.4	329 35 03	149 36 25	Preston	6385.5	3.805192
1860	122 57 33.419	812.6	351 52 50	171 53 18	Tomales Bay	8039.6	3.905237
			12 21 31	192 21 06	Tomales Point	4667.0	3.669042
			123 44 40	303 40 50	Bodega Head	10870.1	4.036233
			148 04 26	328 02 53	Bodega	6907.0	3.839288
Sugarloaf Hill†	38 14 30.028	925.9	322 38 06	142 39 28	Preston	5238.1	3.719177
1860	122 57 31.204	758.8	350 42 52	170 43 20	Tomales Bay	6703.4	3.826293
			18 07 45	198 07 18	Tomales Point	3383.3	3.529346
			152 46 47.6	332 45 13.8	Bodega	8103.0	3.908647
Ocean Beach*	38 19 57.233	1764.7	190 40 10.5	10 40 30.9	Bodega Hill	4271.2	3.630552
1860	123 03 54.242	1317.4	297 13 54.1	117 16 17.0	Bodega	6298.2	3.799216
			355 29 35.8	175 29 41.3	Bodega Head	2720.5	3.434648
Bay Beach*	38 18 49.552	1527.9	67 45 21.3	247 44 42.3	Bodega Head	1651.3	3.217836
1860	123 02 42.534	1033.3	140 09 17.1	320 08 32.6	Ocean Beach	2718.2	3.434289
			171 24 15.1	351 23 51.0	Bodega Hill	6355.6	3.803157
			281 39 39.6	101 41 18.0	Bodega	3939.2	3.595406
Bodega Latitude Station*	38 18 29.842	920.2	178 47 02.0	358 46 58.4	Bodega Hill	6893.5	3.838437
1853	123 03 15.639	380.0	232 55 17.2	52 55 37.7	Bay Beach	1008.1	3.003490
			272 18 34.4	92 20 33.3	Bodega	4666.0	3.668944
Bodega Rock*	38 17 47.132	1453.3	159 20 01.9	339 19 23.2	Ocean Beach	4287.5	3.632201
1860	123 02 51.942	1262.2	174 58 35.7	354 58 17.4	Bodega Hill	8240.5	3.915951
			186 46 19.1	6 46 24.9	Bay Beach	1938.1	3.287386
			254 33 41.8	74 35 26.0	Bodega	4239.4	3.627306

* See p. 294. † This point is in the area of the 1906 earthquake disturbance.

Golden Gate to Point Arena—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Lagoon †	38 18 42.104	1298.2	83 21 04.4	263 19 38.0	Bodega Head	3410.9	3.532869
1860	123 01 25.998	631.6	156 40 56.5	336 39 44.8	Bodega Hill	7093.6	3.850869
			285 50 49.0	105 51 40.0	Bodega	2077.2	3.317488
Rocky Point †	38 23 39.577	1220.3	170 10 15.5	350 09 20.4	Ross Mountain	12549.1	4.098614
1860	123 05 40.809	990.3	308 11 45.8	128 13 12.2	Bodega Hill	4297.9	3.633261
			343 40 15.6	163 41 27.2	Bodega Head	9969.4	3.998670
Pigott's (Dr.) house SW. gable †	38 19 23.533	725.6	36 55 04.8	216 54 44.7	Bay Beach	1310.5	3.117427
	123 02 10.133	246.2	54 09 29.2	234 08 30.1	Bodega Head	2856.6	3.455851
1860			112 20 48.6	292 19 44.0	Ocean Beach	2733.9	3.436783
Cheney's house flagstaff †	38 19 02.803	86.4	28 25 39	208 25 24	Bodega Head	1175.6	3.070249
1860	123 03 22.409	544.4	155 15 58	335 15 38	Ocean Beach	1847.8	3.266655
			180 10 34	0 10 35	Bodega Hill	5875.6	3.769054
			284 00 32	104 02 36	Bodega	4974.7	3.696765
			292 51 54	112 52 19	Bay Beach	1051.4	3.021750
Bodega Head highest part, rock *	38 18 41.787	1288.5	179 53 35	359 53 35	Ocean Beach	2326.3	3.366658
	123 03 54.064	1313.5	262 08 55	82 09 40	Bay Beach	1754.2	3.244075
1860			275 40 18	95 42 41	Bodega	5623.3	3.749992
Preston's house, stovepipe †	38 12 46.255	1426.2	318 04 36.1	138 04 58.1	Preston	1295.8	3.112529
	122 55 56.133	1365.6	321 55 41.0	141 56 52.1	Mershon	4345.0	3.637985
1857			19 50 10.4	199 49 39.1	Tomales Bay	3631.4	3.560069
			89 44 32.4	269 43 06.8	Tomales Point	3365.7	3.527073
Lone house, south gable †	38 12 28.106	866.6	338 01 04.2	158 01 08.4	Preston	436.3	2.639744
1857	122 55 27.262	663.3	34 06 56.5	214 06 07.4	Tomales Bay	3449.8	3.537800
			97 37 39.8	277 35 56.4	Tomales Point	4104.3	3.613242
Tom Point *	38 13 10.483	323.2	303 09 22	123 10 28	Preston	3128.0	3.495262
1857	122 57 08.179	199.0	313 13 43	133 15 35	Mershon	6083.7	3.784171
			352 51 49	172 52 02	Tomales Bay	4195.5	3.622783
			64 41 33	244 40 52	Tomales Point	1784.2	3.251433
Point Reyes Beach *	38 07 30.599	943.5	171 31 49	351 31 12	Tomales Point	9821.7	3.992186
1857	122 57 15.000	365.3	186 12 34	6 12 51	Tomales Bay	6353.8	3.803034
			252 27 52	72 29 38	Foster	4385.1	3.641983
			9 29 46	189 29 18	Richards	6487.3	3.812065
Hog Island *	38 11 51.914	1600.7	117 48 10	297 46 50	Tomales Point	3559.6	3.551396
1857	122 56 05.052	122.9	236 41 37	56 42 04	Preston	1295.6	3.112465
			301 04 03	121 05 16	Mershon	3381.4	3.529102
Frost's house, east chimney †	38 54 14.309	441.2	127 36 51	307 36 20	Smith	1463.8	3.165470
	123 41 48.572	1170.4	136 39 43	316 39 24	Sinclair	1071.6	3.030021
1891			165 04 26	345 04 25	Marr	142.3	2.153135
			220 47 52	40 48 07	Pt. Arena Long. Sta.	890.1	2.949450
Point Arena Methodist Church, S. gable †	38 54 44.554	1373.8	321 07 04	141 07 09	Pt. Arena Long. Sta.	332.5	2.521787
	123 41 33.095	797.4	27 15 04	207 14 53	Marr	894.4	2.951550
1891			82 07 42	262 07 13	Sinclair	1118.8	3.048769
Derrick *	38 57 19.222	592.7	322 20 45	142 21 22	Hall	2330.8	3.367504
1870	123 44 07.270	175.0	341 05 39	161 05 49	Pt. Arena SE. Base	1213.6	3.084077
			30 13 59	210 13 54	Pt. Arena NW. Base	330.1	2.518679
Bald Top 1, lone tree *	39 00 39.669	1223.3	36 27 47.0	216 24 36.3	Arena Latitude Sta.	12294.0	4.089692
1870	123 38 33.614	808.8	39 29 23.4	219 26 30.8	Hall	10397.1	4.016913
			46 12 38.0	226 09 18.4	Pt. Arena SE. Base	10586.0	4.024732
			51 45 40.8	231 42 06.6	Pt. Arena NW. Base	10440.6	4.018727
Bald Top 2, highest bush of three *	38 59 43.749	1349.0	44 57 40.7	224 54 08.0	Arena Latitude Sta.	11535.1	4.062021
	123 37 58.548	1408.9	49 48 40.4	229 45 25.7	Hall	9760.7	3.989483
1870			62 21 32.0	242 17 35.7	Pt. Arena NW. Base	10210.1	4.009030
Number 3 ‡*	38 00 09.42	290.5	87 48 33	267 41 34	Point Reyes Head	16629.1	4.220870
1859	122 49 29.73	725.4	120 09 49	300 04 35	Richards	14355.6	4.157020
Wildcat ‡*	37 59 00.52	16.0	94 26 44	274 18 39	Point Reyes Head	19277.5	4.285050
1859	122 47 43.07	1051.1	121 53 41	301 47 22	Richards	17681.1	4.247510
Joyce ‡*	37 56 38.29	1180.4	104 19 29	284 09 47	Point Reyes Head	23804.6	4.376660
1859	122 45 05.48	133.8	126 04 29	305 56 33	Richards	23326.0	4.36784

* This point is in the area of the 1906 earthquake disturbance. † See p. 295. ‡ No check on this position.

Golden Gate to Point Arena—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Perrot *†	37 57 00.40	12.3	104 06 32	283 57 50	Point Reyes Head	21338.3	4.32916
1859	122 46 42.62	1040.6	128 21 43	308 14 47	Richards	21024.2	4.32272
Shepherd's chimney ‡	38 56 58.608	1807.1	73 53 20	253 52 34	Pt. Arena SE. Base	1846.0	3.266238
1870	123 42 37.956	914.0	98 33 09	278 32 08	Pt. Arena NW. Base	2359.0	3.372725
			103 35 42	283 34 35	Pt. Arena L. H.	2640.6	3.421699
Point Reyes Lat. Sta.*†	37 59 44.28	1365.1	225 38 12	45 42 14	Point Reyes Hill	13414.1	4.12756
1853	122 58 34.31	837.2	257 06 56	77 11 43	Number 2	11655.5	4.06653
North Farallon N. Islet *†	37 46 20.35	627.4	211 35 14	31 44 04	Point Reyes Hill	40133.8	4.60351
1859	123 06 23.36	571.7	249 16 14	69 35 02	Mount Tamalpais	48001.0	4.68125
North Farallon Middle Islet *†	37 46 02.36	72.8	210 25 46	30 34 21	Point Reyes Hill	40290.3	4.60520
1859	123 05 58.11	1422.3	248 23 16	68 41 48	Mount Tamalpais	47625.5	4.67784
North Farallon S. Islet *†	37 45 52.36	1614.2	210 01 17	30 09 48	Point Reyes Hill	40479.0	4.60723
1859	123 05 51.81	1268.1	247 58 30	68 16 58	Mount Tamalpais	47597.0	4.67758
North Farallon S. Rock *†	37 45 54.19	1670.6	209 41 23	29 49 46	Point Reyes Hill	40279.1	4.60508
1859	123 05 39.39	964.1	247 54 10	68 12 31	Mount Tamalpais	47294.4	4.67481
Point Reyes L. H. site *†	37 59 48.62	1498.9	210 54 09	30 56 08	Richards	9144.7	3.96117
1859	123 01 11.57	282.3	235 25 26	55 31 05	Point Reyes Hill	16302.0	4.21224
Middle Farallon *†	37 43 41.06	1265.8	200 16 21	20 22 25	Point Reyes Hill	41664.9	4.61977
1859	123 01 53.17	1302.0	240 16 18	60 32 20	Mount Tamalpais	44098.1	4.64442
Grasier *†	38 03 45.99	1418.1	134 23 49	314 23 17	Creek	1746.5	3.24217
1857	122 48 40.39	984.6	184 06 09	4 06 12	Hammond	1825.6	3.26141
Tomales Bay Mag. Sta.*†	38 11 13.93	429.5	225 08 52	45 09 40	Preston	2669.5	3.42643
1857	122 56 38.33	932.8	278 47 47	98 49 21	Mershon	3750.5	3.57409
Blake's (T) house, SE. gable *†	38 11 39.21	1209.0	61 59 27	241 58 23	Tomales Bay	2871.3	3.45808
1857	122 55 02.60	63.3	113 44 17	293 42 18	Tomales Point	5099.3	3.70751
Estero *†	38 17 16.16	498.3	110 21 03	290 18 28	Bodega Head	6488.4	3.81214
1860	122 59 35.06	852.0	161 29 21	341 29 03	Bodega	2195.9	3.34162
Inlet *†	38 16 29.20	900.4	118 27 00	298 24 06	Bodega Head	7777.3	3.89083
1860	122 59 04.00	97.2	157 38 47	337 38 10	Bodega	3817.2	3.58175
Tomales Bluff *†	38 14 24.63	759.4	141 29 58	321 27 25	Bodega Head	9641.4	3.98414
1860	122 59 38.41	934.1	175 13 29	355 13 13	Bodega	7397.1	3.86906
Sandhill *†	38 20 10.78	332.4	302 32 44	122 34 56	Bodega	6134.4	3.78777
1860	123 03 36.58	888.4	3 56 05	183 56 00	Bodega Head	3137.3	3.49656
Salmon Creek *†	38 21 22.94	707.3	314 08 05	134 10 30	Bodega	7933.6	3.89947
1860	123 03 58.10	1410.7	356 42 43	176 42 51	Bodega Head	5363.5	3.72945
Dougherty's house, SW. gable *†	38 20 04.86	149.8	305 45 01	125 46 52	Bodega	5336.4	3.72725
1860	123 03 02.01	48.8	19 42 19	199 41 52	Bodega Head	3130.4	3.49560
Stillwater dead tree *†	38 32 35.60	1097.7	316 39 39	136 40 06	Timber Cove	1527.8	3.18408
1876	123 17 18.82	455.8	117 09 20	297 08 47	Stockhoff	1443.8	3.15951
Fork Tree *†	38 38 41.90	1292.0	339 15 44	159 16 24	Horseshoe Point	4415.8	3.64501
1876	123 23 14.08	340.5	4 04 27	184 04 24	Rocky Point	1630.5	3.21233
Arm Tree *†	38 39 56.43	1740.0	354 35 29	174 35 35	Sandy Point	2309.5	3.36352
	123 24 07.08	171.2	25 42 06	205 41 51	Stewart Point	1304.7	3.11550
Bald Top 3 dead tree †	38 58 51.444	1586.2	60 56 09.7	240 52 29.6	Hall	9643.8	3.984247
1870	123 37 18.152	436.9	71 43 39.6	251 40 00.0	Sand	8856.7	3.947270
Bushy top tree †	38 55 12.544	386.8	101 21 04	281 20 39	Arena Latitude Sta.	1000.3	3.000126
1870	123 42 56.197	1353.8	151 30 53	331 29 58	Point Arena L. H.	4427.2	3.646126

*No check on this position. † This point is in the area of the 1906 earthquake disturbance. ‡ See p. 295.

Point Arena to Shelter Cove.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Round*	39 01 45.181	1393.4	348 11 35.2	168 11 43.6	Black	1584.0	3.199768
1871	123 40 39.548	951.3	352 21 26.2	172 21 42.3	Spur	4624.4	3.665058
			31 47 55.8	211 47 20.5	Lane	2559.4	3.408146
Cuffey Cove *	39 08 30.971	955.1	346 11 46.3	166 13 20.8	Lane	15125.0	4.179694
1871	123 44 05.591	134.3	1 13 02.8	181 12 51.3	Point Arena L. H.	20735.0	4.316704
Peak *	39 04 23.720	731.5	356 37 43.6	176 37 51.2	Round	4897.4	3.689967
1871	123 40 51.521	1238.5	8 32 18.1	188 31 50.3	Lane	7143.4	3.853908
			148 34 06.8	328 32 04.4	Cuffey Cove	8937.4	3.951212
Red Bluff *	39 04 50.610	1560.8	158 18 28.1	338 17 17.1	Cuffey Cove	7313.8	3.864144
1871	123 42 13.024	313.1	292 55 59.0	112 56 50.3	Peak	2127.4	3.327844
			338 32 00.9	158 32 59.8	Round	6144.0	3.788452
			353 29 33.2	173 29 56.8	Lane	7944.7	3.900076
Elk Creek *	39 06 33.196	1023.8	151 58 58.7	331 58 07.9	Cuffey Cove	4114.3	3.614296
1871	123 42 45.116	1084.6	325 37 40.3	145 38 51.8	Peak	4836.8	3.684558
			346 17 47.6	166 18 07.8	Red Bluff	3256.2	3.512706
Greenwood *	39 07 29.421	907.3	36 23 35.9	216 23 02.3	Elk Creek	2153.8	3.333210
1871	123 41 51.928	1247.4	120 36 16.3	300 34 51.9	Cuffey Cove	3729.5	3.571646
Cavanagh *	39 09 13.739	423.7	323 49 48.7	143 50 50.5	Greenwood	3984.5	3.600374
1871	123 43 29.824	716.1	347 45 28.9	167 45 57.1	Elk Creek	5065.9	3.704657
			33 04 33.2	213 04 10.6	Cuffey Cove	1573.9	3.196973
Navarro Head	39 11 48.933	1509.1	324 05 03.6	144 06 34.8	Cavanagh	5908.4	3.771468
1871	123 45 54.165	1299.7	336 52 12.8	156 53 21.4	Cuffey Cove	6637.9	3.822028
Saddle Point	39 10 36.611	1129.1	152 03 21.4	332 02 50.2	Navarro Head	2524.7	3.402216
1871	123 45 04.862	116.7	318 13 59.9	138 14 59.9	Cavanagh	3425.9	3.534774
			339 49 36.5	159 50 13.9	Cuffey Cove	4127.5	3.615091
Tichenor	39 11 26.992	832.4	349 48 52.5	169 48 59.8	Saddle Point	1578.5	3.198250
1871	123 45 16.491	395.8	126 48 52.3	306 48 28.5	Navarro Head	1129.3	3.052792
Navarro Ridge West Base	39 12 04.270	131.7	328 17 06.8	148 17 25.5	Tichenor	1351.3	3.130762
1871	123 45 46.092	1106.0	22 16 32.5	202 16 27.4	Navarro Head	511.1	2.708498
Navarro Ridge East Base	39 12 11.016	339.7	14 12 41.3	194 12 32.3	Tichenor	1400.5	3.146270
1871	123 45 02.165	52.0	61 22 52.2	241 22 19.2	Navarro Head	1421.5	3.152752
			78 50 21.2	258 49 53.4	N. R. West Base	1074.36	3.031150
Johnson	39 12 49.489	1526.2	328 01 22.7	148 01 42.3	N. R. East Base	1398.6	3.145708
1871	123 45 33.034	792.5	12 39 49.0	192 39 40.8	N. R. West Base	1429.2	3.155105
Salmon Point	39 12 51.655	1593.0	272 47 31.7	92 48 07.7	Johnson	1368.5	3.136231
1871	123 46 30.007	719.9	324 12 08.8	144 12 36.6	N. R. West Base	1801.5	3.255638
			336 01 35.2	156 01 57.9	Navarro Head	2116.8	3.325673
McPherson	39 13 58.104	1791.9	340 35 51.2	160 36 10.8	Johnson	2243.3	3.350895
1871	123 46 04.097	98.3	352 59 01.1	172 59 12.5	N. R. West Base	3536.9	3.548626
			16 52 28.3	196 52 11.9	Salmon Point	2141.4	3.330690
Mal Paso 2*	39 02 19.756	609.3	165 51 28.4	345 50 57.8	Red Bluff	4797.4	3.681009
1871	123 41 24.258	583.4	191 37 56.7	11 38 17.3	Peak	3903.0	3.591394
			314 45 01.7	134 45 29.9	Round	1514.3	3.180219
			331 51 18.4	151 51 55.0	Black	2967.5	3.472389
			4 48 46.0	184 48 38.9	Lane	3253.1	3.512291
Stewart *	39 03 19.112	589.4	358 32 37.8	178 32 39.7	Round	2897.5	3.462023
1871	123 40 42.609	1024.5	14 06 40.4	194 06 07.0	Lane	5229.7	3.718474
			28 41 26.2	208 41 00.0	Mal Paso 2	2086.5	3.319414
			142 23 55.7	322 22 59.7	Red Bluff	3561.7	3.551661
			173 51 46.9	353 51 41.2	Peak	2003.9	3.301870
Herrick*	39 05 54.838	1691.2	329 22 10.7	149 22 54.2	Peak	3265.3	3.513917
1871	123 42 00.727	17.5	352 28 00.5	172 28 23.4	Mal Paso 2	6690.3	3.825445
			8 29 14.2	188 29 06.4	Red Bluff	2002.6	3.301589
			137 57 47.5	317 57 19.5	Elk Creek	1592.7	3.202143
			148 05 18.1	328 03 59.3	Cuffey Cove	5672.7	3.753789
			184 08 41.1	4 08 46.7	Greenwood	2924.4	3.466033
Bight	39 09 59.063	1821.5	143 36 42.9	323 36 20.5	Saddle Point	1438.4	3.157874
1871	123 44 29.312	703.6	148 59 49.8	328 58 56.2	Navarro Head	3953.1	3.596943
			314 22 31.2	134 23 08.8	Cavanagh	1998.4	3.300676
			348 09 23.2	168 09 38.2	Cuffey Cove	2775.6	3.443364

*See p. 295.

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Kennedy	39 10 27.121	836.4	325 33 31.1	145 35 04.4	Cavanagh	2743.2	3.438265
1871	123 44 34.415	826.1	349 03 42.6	169 04 00.8	Cuffey Cove	3648.0	3.562060
			351 56 29.6	171 56 32.8	Bight	873.8	2.941435
			111 49 29.7	291 49 10.5	Saddle Point	787.3	2.896121
			142 49 14.7	322 48 24.3	Navarro Head	3166.8	3.500624
Navarro Point	39 11 40.990	1264.1	236 20 35.9	56 20 45.6	Navarro Head	442.0	2.645442
1871	123 46 09.498	227.9	288 44 22.2	108 44 55.7	Tichenor	1343.3	3.128174
			314 56 23.9	134 57 24.0	Kennedy	3224.4	3.508453
			319 49 08.5	139 50 49.4	Cavanagh	5942.3	3.773952
			321 59 27.3	142 00 08.2	Saddle Point	2519.5	3.401316
			333 04 32.5	153 05 50.8	Cuffey Cove	6571.5	3.817665
Monroe*	39 01 42.898	1323.0	356 40 46.0	176 40 48.3	Black	1482.6	3.171032
1870	123 40 29.646	713.2	5 36 06.3	185 35 48.5	Shoemake	6955.2	3.842312
			32 43 20.1	212 40 58.9	Pt. Arena NW. Base	10001.6	4.000068
			37 00 51.5	217 00 10.0	Lane	2636.0	3.420951
Welch*	39 04 15.600	481.1	335 35 18.2	155 36 14.2	Monroe	5170.9	3.713567
1870–1	123 41 58.492	1406.1	355 22 45.2	175 22 59.6	Lane	6836.1	3.834809
White Rock	39 05 43.481	1340.9	306 59 14	127 00 40	Peak	4087.3	3.611434
1870–1	123 43 07.334	176.2	336 26 33	156 28 15	Black	9707.1	3.987089
			347 44 07	167 45 29	Shoemake	14675.4	4.166590
House chimney near big barn*	39 04 13.943	430.0	1 48 13	181 48 08	Lane	6766.2	3.830342
	123 41 26.751	643.1	10 47 07	190 46 04	Sand	12954.7	4.112427
1870			13 59 28	193 57 58	Pt. Arena SE. Base	14362.3	4.157224
Stillwell	39 15 15.433	476.0	334 44 32.6	154 45 02.4	McPherson	2636.6	3.421047
1871	123 46 51.005	1222.9	337 25 48.1	157 26 37.4	Johnson	4873.6	3.687855
			353 31 06.2	173 31 19.5	Salmon Point	4462.3	3.649561
Little River	39 16 32.601	1005.4	324 45 31.8	144 46 16.2	Stillwell	2913.5	3.464417
1871	123 48 01.120	26.8	332 41 15.2	152 42 48.9	Johnson	7742.7	3.888892
			342 12 45.6	162 13 43.3	Salmon Point	7155.3	3.854628
Stickney	39 15 58.426	1801.8	353 56 10.3	173 56 14.0	Stillwell	1333.3	3.124923
1871	123 46 56.879	1363.5	124 23 33.6	304 22 52.9	Little River	1866.1	3.270924
Kent	39 17 00.308	9.5	332 40 43.7	152 41 09.7	Stickney	2147.9	3.332004
1871	123 47 38.002	910.8	32 58 03.6	212 57 48.9	Little River	1018.4	3.007903
Mendocino	39 18 20.292	625.8	331 57 31.2	151 58 05.9	Kent	2794.5	3.446311
1871	123 48 32.816	786.2	347 06 51.7	167 07 11.8	Little River	3406.8	3.532342
Randlett	39 17 52.451	1617.6	358 13 14.3	178 13 15.6	Kent	1608.8	3.206498
1871	123 47 40.086	960.6	124 12 10.8	304 11 37.4	Mendocino	1527.6	3.184003
Gray	39 19 30.056	926.9	354 56 47.9	174 56 54.9	Randlett	3021.7	3.480258
1872	123 47 51.194	1226.3	24 52 11.4	204 51 45.0	Mendocino	2371.2	3.374977
Point	39 20 06.638	204.7	304 41 54.0	124 42 37.1	Gray	1981.5	3.296985
1873	123 48 59.206	1418.0	349 05 14.9	169 05 31.6	Mendocino	3339.9	3.523735
Russian Gulch	39 19 42.380	1307.0	141 57 33.6	321 57 18.1	Point	949.8	2.977648
1873	123 48 34.766	832.7	290 00 25.2	110 00 52.9	Gray	1110.7	3.045603
			358 56 33.2	178 56 34.4	Mendocino	2531.9	3.403452
Rees	39 20 16.131	497.5	357 02 01.3	177 02 02.7	Russian Gulch	1042.2	3.017967
1873	123 48 37.019	886.6	61 08 45.6	241 08 31.5	Point	606.7	2.782973
Cabrillo	39 20 57.724	1780.2	312 53 37.5	132 54 14.1	Rees	1884.3	3.275147
1873	123 49 34.661	829.9	331 40 31.7	151 40 54.2	Point	1789.7	3.252772
Handley	39 13 33.473	1032.3	157 57 00.5	337 56 01.4	Little River	5960.2	3.775261
1871	123 46 27.770	666.1	169 57 11.0	349 56 56.3	Stillwell	3193.2	3.504224
			216 46 38.0	36 46 53.0	McPherson	948.3	2.976964
			315 55 31.3	135 56 05.9	Johnson	1887.8	3.275964
			321 03 59.2	141 04 53.4	N. R. East Base	3261.1	3.513364
			340 01 15.3	160 01 41.7	N. R. West Base	2927.0	3.466417
			345 57 43.0	165 57 43.5	Navarro Head	3323.1	3.521544
			2 22 58.0	182 22 56.6	Salmon Point	1290.7	3.110835
Albion	39 13 28.976	893.6	220 01 11.0	40 01 30.9	McPherson	1173.0	3.069296
1871	123 46 35.546	852.6	309 04 16.4	129 04 55.9	Johnson	1931.8	3.285951
			335 34 03.2	155 34 34.5	N. R. West Base	2869.0	3.457731
			353 24 46.0	173 24 49.4	Salmon Point	1158.6	3.063920
			160 05 21.7	340 04 27.5	Little River	6022.9	3.779808
			173 33 33.0	353 33 23.2	Stillwell	3303.8	3.519009

* See p. 295.

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Chaparral	39 17 25.026	771.8	153 14 48.2	333 14 25.5	Mendocino	1908.7	3.280738
1871	123 47 56.956	1365.0	205 32 43.8	25 32 54.5	Randlett	937.4	2.971920
			329 12 25.8	149 12 37.8	Kent	887.4	2.948095
			338 24 42.3	158 25 24.0	Stillwell	4297.7	3.633239
			3 32 02.3	183 31 59.6	Little River	1619.8	3.209449
Mendocino City Latitude Station	39 18 13.461	415.1	306 28 56.3	126 29 19.5	Randlett	1089.7	3.037288
	123 48 16.649	398.9	337 40 37.5	157 41 02.0	Kent	2438.6	3.387149
1871			342 27 54.4	162 28 06.9	Chaparral	1566.4	3.194916
Grave	39 18 32.519	1002.9	2 40 21.2	182 40 18.6	Chaparral	2083.7	3.318826
1873	123 47 52.901	1267.4	68 29 05.5	248 28 40.2	Mendocino	1028.0	3.011977
			151 19 05.7	331 18 23.6	Point	3308.6	3.519645
			181 19 13.9	1 19 15.0	Gray	1774.8	3.249155
			346 02 36.8	166 02 44.9	Randlett	1273.2	3.104907
Knoll	39 19 59.725	1841.9	14 50 17.1	194 50 13.4	Russian Gulch	553.3	2.742980
1872	123 48 28.850	691.0	106 20 40.5	286 20 21.3	Point	757.6	2.879447
			158 51 48.3	338 51 43.2	Rees	542.5	2.734372
			315 24 27.7	135 24 51.7	Gray	1284.8	3.108824
Hargrave	39 20 07.456	230.0	337 52 29.6	157 52 42.1	Gray	1245.0	3.095184
1872	123 48 10.771	258.0	351 40 51.4	171 41 01.8	Grave	2958.9	3.471123
			9 04 50.5	189 04 36.5	Mendocino	3346.7	3.524619
			36 37 18.4	216 37 03.2	Russian Gulch	963.5	2.983837
			61 09 49.7	241 09 38.2	Knoll	494.3	2.693990
			88 45 26.6	268 44 55.9	Point	1160.3	3.064556
Gordon	39 20 47.768	1473.2	356 40 58.3	176 41 00.2	Point	1270.5	3.103986
1872	123 49 02.276	54.5	111 36 11.4	291 35 50.9	Cabrillo	834.1	2.921190
Meierkoff	39 20 40.607	1252.3	144 13 24.7	324 13 14.6	Cabrillo	650.7	2.813377
1873	123 49 18.774	449.6	240 47 27.5	60 47 37.9	Gordon	452.6	2.655729
			307 02 29.3	127 02 55.8	Rees	1252.8	3.097881
			335 53 49.7	155 54 02.1	Point	1147.6	3.059783
Pine Grove	39 20 34.216	1055.2	6 11 23.5	186 11 21.1	Point	855.5	2.932201
1872	123 48 55.355	1325.6	109 21 46.9	289 21 32.1	Meierkoff	594.4	2.774101
			127 36 59.9	307 36 35.0	Cabrillo	1188.6	3.075050
			158 22 09.9	338 22 05.5	Gordon	449.6	2.652818
Mendocino, flagstaff	39 18 07.682	236.9	212 53 29	32 53 43	Grave	912.2	2.960075
1871–72	123 48 13.577	325.3	300 20 18	120 20 40	Randlett	929.9	2.968414
			343 09 11	163 09 22	Chaparral	1374.4	3.138125
White spire cross	39 18 31.562	973.4	348 05 05.6	168 05 12.3	Randlett	1232.7	3.090854
1872	123 47 50.707	1214.9	70 59 44.0	250 59 17.3	Mendocino	1067.1	3.028193
			119 18 32.9	299 18 31.5	Grave	60.3	1.780240
Caspar Point	39 22 08.229	253.8	345 11 57.8	165 12 15.2	Gordon	2566.5	3.409333
1873	123 49 29.655	709.9	3 09 19.9	183 09 16.7	Cabrillo	2177.6	3.337976
Scaffold Tree	39 22 40.582	1251.5	23 16 11.5	203 15 35.4	Cabrillo	3452.8	3.538170
1873	123 48 37.695	902.2	51 16 05.2	231 15 32.2	Caspar Point	1594.5	3.202627
Carleson	39 21 24.688	761.4	13 58 41.9	193 58 34.4	Gordon	1173.3	3.069413
1873	123 48 50.440	1207.6	51 51 34.7	231 51 06.7	Cabrillo	1346.3	3.129142
			145 02 36.3	325 02 11.4	Caspar Point	1638.4	3.214422
			187 25 34.9	7 25 42.9	Scaffold Tree	2360.3	3.372969
Beaver Point	39 24 24.411	752.8	343 58 43.4	163 59 07.8	Scaffold Tree	3331.3	3.522616
1873	123 49 16.108	385.4	4 24 56.3	184 24 47.6	Caspar Point	4212.2	3.624511
Bald Hill	39 28 06.701	206.7	22 51 29.7	202 49 37.2	Scaffold Tree	10913.1	4.037949
1874	123 45 40.580	970.1	36 57 26.4	216 55 09.5	Beaver Point	8576.8	3.933324
Soldier Harbor	39 26 21.176	653.0	236 42 38.2	56 44 50.0	Bald Hill	5932.1	3.773206
1874	123 49 08.021	191.8	353 54 34.8	173 54 54.2	Scaffold Tree	6841.5	3.835153
			3 04 32.5	183 04 27.5	Beaver Point	3606.1	3.557042
			3 47 54.0	183 47 40.4	Caspar Point	7817.9	3.893086
Pudding Creek	39 27 31.734	978.7	255 11 51.8	75 13 40.4	Bald Hill	4225.1	3.625839
1874	123 48 31.468	752.3	21 53 13.2	201 52 50.0	Soldier Harbor	2344.9	3.370131
Laguna Point	39 29 19.367	597.2	301 27 59.3	121 29 36.7	Bald Hill	4291.4	3.632604
1874	123 48 13.708	327.6	7 17 21.3	187 17 10.0	Pudding Creek	3346.4	3.524578
			13 17 53.9	193 17 19.4	Soldier Harbor	5646.6	3.751790

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Ten Mile River Bluff	39 33 47.339	1459.9	356 34 23.9	176 34 40.6	Bald Hill	10524.0	4.022180
1874	123 46 06.895	164.6	20 08 21.1	200 07 00.4	Laguna Point	8801.7	3.944569
Cunningham Ridge	39 34 18.237	562.2	2 24 45.5	182 24 32.6	Bald Hill	11468.3	4.059498
1874	123 45 20.384	486.4	24 12 01.9	204 10 11.6	Laguna Point	10104.0	4.004493
			49 21 50.6	229 21 21.0	Ten Mile River Bluff	1463.1	3.165274
Brushy Point	39 34 42.008	1295.5	291 15 35.6	111 16 25.9	Cunningham Ridge	2021.1	3.305590
1874	123 46 39.298	937.9	335 21 17.9	155 21 38.6	Ten Mile River Bluff	1854.9	3.268330
			12 46 32.7	192 45 32.6	Laguna Point	10202.4	4.008704
Claxton Hill	39 32 10.058	310.2	40 58 16.4	220 56 14.7	Laguna Point	6970.1	3.843240
1874	123 45 02.464	58.8	152 51 29.8	332 50 48.8	Ten Mile River Bluff	3371.5	3.527828
			173 49 28.3	353 49 16.9	Cunningham Ridge	3976.1	3.599461
Ten Mile River Beach, South Base	39 31 36.714	1132.2	188 13 44.0	8 13 59.5	Ten Mile River Bluff	4070.4	3.609636
	123 46 31.300	747.6	198 46 01.5	18 46 46.6	Cunningham Ridge	5261.3	3.721092
1874			244 07 58.3	64 08 54.8	Claxton Hill	2357.7	3.372489
Ten Mile River Beach, North Base	39 32 23.742	732.2	16 57 44.3	196 57 32.5	Ten M. R. B., S. B.	1516.3	3.180786
	123 46 12.778	305.1	183 07 09.3	3 07 09.3	Ten Mile River Bluff	2581.9	3.411946
1874			199 30 07.6	19 30 40.9	Cunningham Ridge	3746.1	3.573574
			284 06 05.3	104 06 50.0	Claxton Hill	1731.3	3.238384
Whipple Ridge	39 35 19.205	592.2	330 55 25.1	150 55 53.0	Cunningham Ridge	2151.3	3.332696
1874	123 46 04.185	99.9	1 18 29.5	181 18 27.9	Ten Mile River Bluff	2833.9	3.452384
			36 09 00.3	216 08 37.9	Brushy Point	1420.6	3.152473
Mitchell Gulch	39 23 31.440	969.7	174 41 13.2	354 41 09.2	Beaver Point	1640.6	3.215006
1873	123 49 09.758	233.5	333 55 34.9	153 55 55.2	Scaffold Tree	1740.1	3.242064
			10 30 53.9	190 30 41.2	Caspar Point	2610.0	3.416636
Bloom Knoll	39 25 18.069	557.2	2 07 52.4	182 07 47.6	Scaffold Tree	4860.1	3.686646
1874	123 48 30.144	721.1	33 36 29.2	213 36 00.0	Beaver Point	1986.8	3.298153
			155 02 32.0	335 02 07.9	Soldier Harbor	2146.7	3.331770
			217 55 37.1	37 57 24.7	Bald Hill	6594.3	3.819171
South Noyo	39 25 28.214	870.1	176 30 11.2	356 30 08.5	Soldier Harbor	1636.4	3.213878
1874	123 49 03.847	92.0	224 49 19.7	44 51 28.7	Bald Hill	6892.9	3.838405
			291 12 28.6	111 12 50.0	Bloom Knoll	864.8	2.936895
			353 05 45.6	173 06 02.2	Scaffold Tree	5207.3	3.716616
			5 43 13.7	185 42 57.3	Caspar Point	6198.2	3.792268
			8 28 46.3	188 28 38.5	Beaver Point	1989.4	3.298717
North Noyo	39 25 53.188	1640.4	11 06 58.1	191 06 43.8	Beaver Point	2790.1	3.445626
1874	123 48 53.624	1282.5	17 36 52.1	197 36 45.6	South Noyo	808.1	2.907441
			158 15 15.8	338 15 06.6	Soldier Harbor	929.3	2.968143
			228 14 54.6	48 16 57.1	Bald Hill	6185.4	3.791365
			332 35 19.6	152 35 34.5	Bloom Knoll	1220.0	3.086359
McPherson's flagstaff	39 25 47.314	1459.2	7 52 32.3	187 52 29.0	Bloom Knoll	910.5	2.959266
1873–74	123 48 24.928	596.2	57 40 47.1	237 40 22.4	South Noyo	1101.6	3.042013
			104 47 19.8	284 47 01.6	North Noyo	709.8	2.851154
			135 22 56.1	315 22 28.7	Soldier Harbor	1467.2	3.166489
Ten Mile River Beach	39 31 07.847	242.0	189 50 59.2	9 51 22.0	Ten Mile River Bluff	4992.3	3.698304
1874	123 46 42.671	1019.3	196 57 35.2	16 57 54.3	T. M. R. B. N. B.	2447.1	3.388644
			196 57 52.2	16 57 59.4	T. M. R. B. S. B	930.8	2.968837
			198 29 39.9	18 30 32.3	Cunningham Ridge	6191.7	3.791807
			231 16 25.9	51 17 29.7	Claxton Hill	3067.4	3.486771
			345 07 15.1	165 07 54.6	Bald Hill	5780.1	3.761938
			33 02 16.4	213 01 18.5	Laguna Point	3990.4	3.601012
Sandhill	39 30 04.392	135.4	57 45 01.4	237 44 02.8	Laguna Point	2601.6	3.415240
1874	123 46 41.636	994.8	179 16 34.3	359 16 33.6	Ten Mile Riv. Beach	1957.1	3.291607
			184 57 18.6	4 57 25.2	T. M. R. B. S. B.	2857.9	3.456042
			186 52 39.1	6 53 01.2	Ten Mile River Bluff	6925.5	3.840451
			211 25 35.3	31 26 38.4	Claxton Hill	4542.2	3.657263
Kibesillah Hill	39 36 08.605	265.2	322 21 30.6	142 22 02.0	Whipple Ridge	1923.9	3.284172
1873	123 46 53.422	1274.7	345 41 51.6	165 42 21.0	Ten Mile River Bluff	4495.9	3.652818
			352 48 21.9	172 48 30.6	Brushy Point	2691.8	3.430044
Bell Mountain	39 37 23.934	738.1	352 00 11.6	172 00 26.0	Whipple Ridge	3884.4	3.589326
1873	123 46 26.831	639.9	15 16 27.0	195 16 10.0	Kibesillah Hill	2408.2	3.381696
Bell Point	39 37 37.860	1167.6	293 25 24.4	113 25 50.9	Bell Mountain	1080.2	3.033516
1873	123 47 08.389	200.1	352 36 30.7	172 36 40.2	Kibesillah Hill	2775.7	3.443375

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Packard Hill	39 39 17.943	553.4	357 29 48.9	177 29 53.0	Bell Mountain	3519.4	3.546472
1873	123 46 33.276	793.3	4 42 20.8	184 42 08.0	Kibesillah Hill	5859.0	3.767822
			15 10 49.0	195 10 26.6	Bell Point	3198.1	3.504898
Abalone Point	39 40 03.416	105.4	316 34 01.6	136 34 37.1	Packard Hill	1931.0	3.285792
1874	123 47 28.964	690.4	343 13 56.0	163 14 35.6	Bell Mountain	5136.7	3.710687
			353 19 17.3	173 19 40.0	Kibesillah Hill	7291.1	3.862792
			353 45 43.0	173 45 56.1	Bell Point	4515.7	3.654726
Gordon Hill	39 40 12.661	390.5	348 58 30.6	168 58 39.4	Packard Hill	1719.3	3.235340
1874	123 46 47.067	1121.9	6 04 49.0	186 04 35.4	Bell Point	4801.1	3.681343
			74 04 06.1	254 03 39.4	Abalone Point	1038.5	3.016419
Grave Knoll	39 42 05.887	181.6	331 07 02.0	151 07 53.6	Gordon Hill	3987.8	3.600731
1873	123 48 07.880	187.7	346 12 06.6	166 12 31.5	Abalone Point	3889.3	3.589870
South Cottaneva Ridge	39 43 20.247	624.4	323 54 54.9	143 55 39.8	Grave Knoll	2837.5	3.452936
1873	123 49 18.030	429.4	336 48 55.4	156 50 04.0	Abalone Point	6603.2	3.819757
South Cottaneva Point	39 43 23.221	716.1	281 07 49.3	101 08 01.8	S. Cottaneva Ridge	475.0	2.676664
1873	123 49 37.597	895.5	318 07 48.7	138 08 46.0	Grave Knoll	3202.4	3.505475
			333 32 39.5	153 34 01.6	Abalone Point	6882.2	3.837728
Cottaneva Ridge	39 43 40.179	1239.1	342 05 49.0	162 05 54.3	S. Cottaneva Ridge	646.0	2.810226
1873	123 49 26.368	628.0	27 05 01.3	207 04 54.1	S. Cottaneva Point	587.4	2.768950
Cottaneva Point	39 43 41.390	1276.5	276 56 46.5	96 56 54.7	Cottaneva Ridge	308.8	2.489607
1873	123 49 39.237	934.4	356 00 46.7	176 00 47.7	S. Cottaneva Point	561.7	2.749517
Smith Point	39 35 36.757	1133.6	189 21 32.6	9 21 36.9	Kibesillah Hill	995.5	2.998023
1874	123 47 00.207	5.0	292 02 17.5	112 02 53.2	Whipple Ridge	1442.2	3.159032
			343 32 04.1	163 32 17.1	Brushy Point	1760.6	3.245662
Bruhel Point	39 36 05.220	161.0	182 54 35.2	2 54 39.1	Bell Point	2860.7	3.456477
1874	123 47 14.478	345.4	205 05 07.3	25 05 37.7	Bell Mountain	2680.5	3.428211
			258 15 37.6	78 15 51.0	Kibesillah Hill	513.1	2.710197
			338 47 52.7	158 48 01.9	Smith Point	941.6	2.973847
			341 52 57.5	161 53 19.7	Brushy Point	2700.1	3.431374
Harford Hill	39 45 12.786	394.3	346 14 11.1	166 14 29.8	Cottaneva Ridge	2940.5	3.468421
1873	123 49 55.744	1327.0	352 03 38.3	172 03 48.8	Cottaneva Point	2846.0	3.454237
Williams Point	39 45 10.180	314.0	257 45 37.0	77 45 47.0	Harford Hill	379.2	2.578830
1873	123 50 11.309	269.3	338 54 48.7	158 55 17.4	Cottaneva Ridge	2974.8	3.473465
			344 24 53.5	164 25 14.0	Cottaneva Point	2842.9	3.453755
Soldier Frank Point	39 45 27.219	839.4	313 55 13.4	133 55 25.9	Harford Hill	641.6	2.807286
1873	123 50 15.159	360.8	340 36 31.3	160 37 02.5	Cottaneva Ridge	3499.6	3.544020
			345 18 46.8	165 19 09.8	Cottaneva Point	3374.0	3.528149
			350 06 32.5	170 06 34.9	Williams Point	533.4	2.727043
Soldier Frank Hill	39 45 35.524	1095.6	356 12 56.0	176 12 57.3	Harford Hill	702.8	2.846833
1873	123 49 57.692	1373.3	22 31 30.0	202 31 21.3	Williams Point	846.2	2.927469
			58 21 37.6	238 21 26.5	Soldier Frank Point	488.3	2.688725
South Ussal	39 48 35.339	1089.8	354 45 27.8	174 45 40.0	Soldier Frank Hill	5568.9	3.745772
1872	123 50 19.071	453.7	354 55 13.0	174 55 28.0	Harford Hill	6271.5	3.797373
			358 19 39.1	178 19 44.1	Williams Point	6330.0	3.801403
			359 04 49.8	179 04 52.3	Soldier Frank Point	5802.6	3.763621
Timber Point	39 50 51.543	1589.5	321 57 20.8	141 58 49.3	South Ussal	5333.1	3.726978
1872	123 52 37.241	885.5	338 42 31.7	158 44 13.9	Soldier Frank Hill	10459.3	4.019503
			341 18 59.2	161 20 30.2	Soldier Frank Point	10558.2	4.023590
Timber Ridge	39 50 54.253	1673.1	326 49 25.2	146 50 40.6	South Ussal	5118.1	3.709106
1872	123 52 16.813	399.7	341 22 50.6	161 24 19.7	Soldier Frank Hill	10372.1	4.015866
			343 58 45.5	164 00 03.4	Soldier Frank Point	10493.1	4.020904
			80 14 09.5	260 13 56.4	Timber Point	492.8	2.692662
Little Jackass	39 51 29.543	911.1	296 47 42.3	116 48 40.4	Timber Ridge	2413.7	3.382678
1872	123 53 47.439	1127.6	305 04 28.2	125 05 13.2	Timber Point	2039.2	3.309454
Jackass Ridge	39 52 17.379	536.0	314 34 34.3	134 35 44.4	Timber Ridge	3652.2	3.562550
1872	123 54 06.241	148.3	321 21 47.9	141 22 45.0	Timber Point	3388.8	3.530041
			321 42 57.3	141 45 22.8	South Ussal	8721.8	3.940604
			343 08 47.4	163 08 59.5	Little Jackass	1541.5	3.187957
Jackass South	39 52 05.769	177.9	210 29 21.6	30 29 27.3	Jackass Ridge	415.5	2.618590
1872	123 54 15.112	359.2	308 05 58.4	128 07 14.2	Timber Ridge	3573.8	3.553133
			329 30 43.7	149 31 01.4	Little Jackass	1296.5	3.112780

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Anderson Cliff	39 52 32.550	1003.8	297 44 02.7	117 44 26.7	Jackass Ridge	1005.4	3.002319
1872	123 54 43.684	1038.1	320 34 26.4	140 34 44.7	Jackass South	1069.3	3.029082
Jackson	39 54 22.957	708.0	337 23 39.7	157 24 23.2	Jackass Ridge	4195.2	3.622751
1872	123 55 14.094	334.8	341 40 08.0	161 40 45.8	Jackass South	4457.2	3.649058
			348 01 04.1	168 01 23.6	Anderson Cliff	3481.0	3.541698
Bear Harbor	39 55 25.735	793.7	156 48 47.4	336 46 50.7	Chemise Mountain	10943.2	4.039144
1872	123 57 11.522	273.6	304 45 33.7	124 46 49.0	Jackson	3395.2	3.530861
			325 47 10.9	145 49 03.9	Jackass South	7456.6	3.872538
			326 39 41.1	146 41 15.9	Anderson Cliff	6392.5	3.805671
Jumper Ridge	39 55 47.856	1475.9	318 42 11.8	138 43 13.9	Jackson	3484.8	3.542174
1872	123 56 50.914	1209.0	331 36 04.1	151 37 43.9	Jackass South	7785.6	3.891294
			333 20 37.4	153 21 59.0	Anderson Cliff	6739.3	3.828615
			35 39 08.4	215 38 55.2	Bear Harbor	839.6	2.924081
Smoky Ridge	39 56 04.588	141.5	323 16 17.7	143 16 28.1	Jumper Ridge	643.9	2.808788
1872	123 57 07.130	169.3	4 58 29.6	184 58 26.8	Bear Harbor	1202.8	3.080208
Laurie Flat	39 56 34.046	1050.0	308 01 05.8	128 01 37.1	Smoky Ridge	1475.0	3.168784
1872	123 57 56.069	1331.1	333 20 14.5	153 20 43.1	Bear Harbor	2357.5	3.372444
Cliff Ridge	39 56 34.971	1078.5	337 55 00.7	157 55 11.0	Smoky Ridge	1011.3	3.004860
1872	123 57 23.142	549.4	352 38 13.4	172 38 20.9	Bear Harbor	2153.1	3.333071
			87 54 44.9	267 54 23.9	Laurie Flat	782.2	2.893345
Upper Bear Harbor	39 57 55.042	1697.5	342 00 33.9	162 00 55.5	Cliff Ridge	2596.5	3.414382
1872	123 57 56.921	1351.0	346 49 23.2	166 49 52.3	Bear Harbor	4729.4	3.674805
			359 32 10.6	179 32 11.2	Laurie Flat	2498.2	3.397623
Red Hill	39 58 36.947	1139.4	301 35 04.1	121 36 01.0	Upper Bear Harbor	2467.1	3.392183
1872	123 59 25.473	604.4	322 19 40.1	142 20 58.7	Cliff Ridge	4752.2	3.676892
			330 45 04.0	150 46 01.4	Laurie Flat	4344.1	3.637898
			331 39 18.8	151 40 44.8	Bear Harbor	6700.0	3.826075
Manzanita	39 59 38.681	1192.9	319 14 25.1	139 15 39.7	Upper Bear Harbor	4219.3	3.625242
1872	123 59 52.992	1257.3	333 49 20.4	153 51 04.1	Bear Harbor	8691.9	3.939117
			341 04 11.3	161 04 29.0	Red Hill	2012.8	3.303809
Embarcadero	40 01 23.358	720.3	279 22 55.8	99 25 34.9	Chemise Mountain	5947.6	3.774342
1871	124 04 20.626	489.1	296 56 02.5	116 58 54.6	Manzanita	7121.6	3.852580
			306 13 03.7	126 16 13.4	Red Hill	8681.1	3.938576
			317 14 54.6	137 19 30.3	Bear Harbor	15011.6	4.176426
Big Hill	40 02 02.203	68.0	305 30 48.8	125 32 11.2	Chemise Mountain	3734.4	3.572223
1872	124 02 21.370	506.7	321 30 11.7	141 31 47.0	Manzanita	5654.9	3.752425
			326 35 51.3	146 37 44.2	Red Hill	7581.8	3.879770
			328 57 19.6	149 00 38.6	Bear Harbor	14268.1	4.154365
			67 02 55.1	247 01 38.4	Embarcadero	3071.1	3.487288
Harbor (Shelter Cove South Base)	40 01 21.506	663.4	96 09 56.1	276 09 41.8	Embarcadero	531.9	2.725816
1871	124 03 58.326	1383.1	241 21 27.4	61 22 29.8	Big Hill	2619.3	3.418185
			279 42 07.9	99 44 32.7	Chemise Mountain	5416.6	3.733730
			298 34 08.8	118 36 46.6	Manzanita	6627.0	3.821317
			308 04 39.6	128 07 35.1	Red Hill	8225.1	3.915139
			318 37 22.7	138 41 44.2	Bear Harbor	14614.8	4.164794
Shelter Cove, North Base	40 01 41.575	1282.4	257 47 02.4	77 48 22.2	Big Hill	3009.5	3.478488
1872	124 04 25.427	602.9	313 55 22.9	133 55 40.3	Harbor (S.C.S. Base)	892.24	2.950479
			348 32 45.5	168 32 48.6	Embarcadero	573.3	2.758361
Colona Cliff	40 03 13.785	425.2	310 13 08.4	130 14 19.2	Big Hill	3418.4	3.533828
1871	124 04 11.464	271.7	354 51 33.3	174 51 41.7	Harbor (S.C.S. Base)	3476.9	3.541198
			3 39 00.2	183 38 54.3	Embarcadero	3412.8	3.533108
			6 38 24.6	186 38 15.6	Shelter Cove N. Base	2863.2	3.456852
Shelter Cove	40 02 05.316	164.0	26 36 22.0	206 36 03.5	Harbor (S.C.S. Base)	1511.2	3.179324
1871	124 03 29.785	706.2	42 58 27.9	222 57 55.2	Embarcadero	1768.6	3.247627
			154 55 49.0	334 55 22.2	Colona Cliff	2331.5	3.367629
			60 58 23.6	240 57 47.8	Shelter Cove N. Base	1508.9	3.178651
Ray Point	40 02 28.097	866.7	203 14 06.7	23 14 23.1	Colona Cliff	1533.5	3.185693
1871	124 04 36.988	876.9	293 47 30.4	113 48 13.6	Shelter Cove	1741.3	3.240874
			349 00 13.0	169 00 23.5	Embarcadero	2034.1	3.308366
			349 11 02.4	169 11 09.8	Shelter Cove N. Base	1460.8	3.164598

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Alviso Ridge	39 41 42.656	1315.5	339 11 31.8	159 12 00.0	Gordon Hill	2969.1	3.472624
1873	123 47 31.318	746.2	342 46 25.9	162 47 02.9	Packard Hill	4672.5	3.669550
			358 56 58.2	178 56 59.7	Abalone Point	3061.2	3.485885
			129 26 25.0	309 26 01.6	Grave Knoll	1127.9	3.052267
			135 53 11.3	315 51 50.5	S. Cottaneva Point	4320.6	3.635549
			139 49 31.0	319 48 22.7	S. Cottaneva Ridge	3939.6	3.595455
North Ussal	39 50 10.578	326.2	337 55 09.0	157 55 41.1	South Ussal	3169.7	3.501018
1872	123 51 09.163	217.9	348 39 34.3	168 40 20.1	Soldier Frank Hill	8651.7	3.937101
			351 37 53.5	171 38 28.1	Soldier Frank Point	8833.1	3.946113
			121 06 38.4	301 05 42.0	Timber Point	2445.7	3.388402
Devilby	39 47 05.236	161.5	358 45 06.4	178 45 08.0	Soldier Frank Hill	2767.4	3.442074
1873	123 50 00.226	5.4	6 42 24.2	186 42 14.6	Soldier Frank Point	3043.8	3.483410
			148 44 04.3	328 41 26.7	Jackass Ridge	11265.2	4.051738
			151 51 51.8	331 50 11.2	Timber Point	7915.9	3.898500
			155 18 45.5	335 17 18.0	Timber Ridge	7774.5	3.890670
			163 59 59.7	343 59 15.5	North Ussal	5946.8	3.774280
			170 50 12.8	350 50 00.7	South Ussal	2814.8	3.449452
Sheep Ridge	39 51 30.534	941.7	309 50 11.3	129 50 47.5	Timber Ridge	1746.5	3.242175
1872	123 53 13.225	314.4	324 34 15.2	144 34 38.3	Timber Point	1475.7	3.169009
			87 51 05.8	267 50 43.9	Little Jackass	813.8	2.910541
			126 27 44.1	306 27 04.5	Jackass South	1828.9	3.262180
			138 54 41.0	318 54 07.0	Jackass Ridge	1917.1	3.282643
Whale Gulch	39 57 28.763	887.0	132 53 04.2	312 49 34.5	Harbor	10554.0	4.023416
1872	123 58 32.214	764.6	148 59 47.4	328 59 13.2	Red Hill	2453.6	3.389797
			225 56 27.0	45 56 49.7	Upper Bear Harbor	1165.6	3.066541
			315 19 52.0	135 20 36.3	Cliff Ridge	2332.6	3.367837
			333 02 49.7	153 03 12.9	Laurie Flat	1893.2	3.277194
			333 12 16.2	153 13 08.0	Bear Harbor	4250.6	3.628454
Kibesillah Rock	39 34 10.225	315.3	173 58 34.4	353 58 27.2	Smith Point	2683.4	3.428693
1873	123 46 48.405	1155.4	206 22 54.4	26 23 22.6	Whipole Ridge	2374.8	3.375618
			305 27 32.0	125 27 58.5	Ten Mile River Bluff	1216.5	3.085126
			263 17 00.6	83 17 56.7	Cunningham Ridge	2115.5	3.325405
Clear Point	39 59 36.914	1138.4	120 05 57.8	300 03 24.1	Embarcadero	6550.5	3.816273
1872	124 00 21.637	513.3	122 08 02.9	302 06 20.5	Harbor	6068.0	3.783046
			147 38 53.7	327 37 36.8	Big Hill	5305.0	3.724688
			265 24 51.0	85 25 09.4	Manzanita	681.7	2.833611
			324 13 22.4	144 13 58.5	Red Hill	2279.6	3.357853
Big Knoll	40 00 13.256	408.9	111 46 02.5	291 43 35.5	Embarcadero	5835.6	3.766085
1872	124 00 32.082	761.0	113 18 11.2	293 15 58.5	Harbor	5325.1	3.726330
			142 22 00.8	322 20 50.5	Big Hill	4243.6	3.627734
			200 37 06.6	20 37 18.7	Chemise Mountain	1271.8	3.104410
			318 59 14.4	138 59 39.4	Manzanita	1413.1	3.150187
			331 58 50.4	151 59 33.1	Red Hill	3364.6	3.526930
			347 31 59.9	167 32 06.5	Clear Point	1147.9	3.059903
Chemise Flat	40 00 29.122	898.3	343 58 24.3	163 58 36.3	Manzanita	1618.6	3.209146
1872	124 00 11.829	280.6	8 13 20.0	188 13 13.6	Clear Point	1626.9	3.211366
			44 28 17.5	224 28 04.5	Big Knoll	685.7	2.836161
			105 51 01.1	285 48 21.1	Embarcadero	6133.0	3.787670
			106 45 37.8	286 43 12.1	Harbor	5609.3	3.748907
			133 04 25.7	313 03 02.4	Big Hill	4204.6	3.623723
			177 20 49.7	357 20 48.8	Chemise Mountain	701.7	2.846146
McKee Flat	40 00 54.036	1666.6	101 56 01.7	281 54 05.5	Embarcadero	4379.4	3.641415
1872	124 01 19.935	472.8	102 43 31.4	282 41 49.5	Harbor	3850.6	3.585523
			145 17 15.2	325 16 35.7	Big Hill	2557.8	3.407873
			272 26 04.4	92 26 47.3	Chemise Mountain	1584.2	3.199800
			295 26 03.3	115 26 47.1	Chemise Flat	1788.8	3.252552
			317 55 59.8	137 56 30.6	Big Knoll	1694.1	3.228949
Bight Knoll	40 01 39.145	1207.4	49 34 02.1	229 33 44.6	Harbor	838.8	2.923641
1871	124 03 31.403	744.7	67 21 38.5	247 21 06.8	Embarcadero	1264.7	3.101983
			182 43 12.9	2 43 13.9	Shelter Cove	808.1	2.907469
Crusoe Ridge	39 41 00.932	28.8	346 37 47	166 37 56	Gordon Hill	1530.2	3.184739
1872	123 47 01.913	45.6	19 58 35	199 58 17	Abalone Point	1887.4	3.275854
			151 26 02	331 25 43	Alviso Ridge	1465.2	3.165901
Switzers Rock	39 38 50.401	1554.4	179 45 26	359 45 25	Abalone Point	2251.8	3.352538
1873	123 47 28.564	681.0	201 17 54	21 18 20	Gordon Hill	2723.0	3.435047
			331 05 38	151 06 17	Bell Mountain	3046.1	3.483747
			347 51 45	167 51 58	Bell Point	2288.3	3.359514

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Switzer's warehouse, W. gable 1873	39 38 13.560 123 47 08.412	418.2 200.6	171 46 21 202 52 21 327 03 22 359 58 21	351 46 09 22 52 44 147 03 49 179 58 21	Abalone Point Packard Hill Bell Mountain Bell Point	3423.2 2155.1 1823.7 1101.0	3.534436 3.333464 3.260944 3.041790
Chris house, S. gable 1873	39 43 12.648 123 49 14.521	390.1 345.9	318 27 21 322 21 44 336 40 37	138 28 27 142 22 26 156 41 44	Alviso Ridge Grave Knoll Abalone Point	3707.7 2599.9 6354.9	3.569104 3.414950 3.803110
Chris Rock 1873	39 42 54.641 123 49 06.981	1685.1 166.3	314 14 30 316 51 55 336 07 58	134 15 31 136 52 33 156 09 01	Alviso Ridge Grave Knoll Abalone Point	3181.6 2059.0 5774.1	3.502642 3.313666 3.761487
Hardy Rock 1873	39 42 26.141 123 48 24.344	806.2 579.9	335 28 32 343 18 22 348 29 00 349 26 46	155 29 43 163 18 58 168 29 49 169 27 44	Packard Hill Abalone Point Bell Point Kibesillah Hill	6379.2 4595.3 9073.2 11843.5	3.804767 3.662313 3.957762 4.073481
Hardy's house, S. gable 1873	39 42 24.891 123 48 02.800	767.6 66.7	330 03 47 349 31 38 11 40 02	150 04 07 169 32 00 191 39 59	Alviso Ridge Abalone Point Grave Knoll	1503.1 4437.1 598.5	3.176978 3.647096 2.777030
Crusoe's barn, W. gable 1873	39 40 38.854 123 47 17.124	1198.2 408.1	14 28 37 155 44 58 170 14 53	194 28 30 335 44 26 350 14 44	Abalone Point Grave Knoll Alviso Ridge	1128.8 2944.1 1996.5	3.052613 3.468946 3.300280
South Cottaneva Rock 1873	39 43 00.961 123 49 30.688	29.6 731.1	166 31 18 310 19 45 310 43 22 332 04 47	346 31 14 130 21 00 130 44 15 152 06 05	South Cottaneva Pt. Alviso Ridge Grave Knoll Abalone Point	705.9 3730.8 2603.1 6196.3	2.848763 3.571801 3.415493 3.792134
Sealion Rock 1873	39 44 89.583 123 50 13.185	912.3 314.0	323 48 12 331 27 20 337 30 13	143 48 42 151 27 41 157 30 36	Cottaneva Ridge Cottaneva Point S. Cottaneva Point.	1888.0 1691.9 2215.2	3.275998 3.228385 3.345414
Cottaneva Rock 1872	39 43 19.360 123 49 52.259	597.0 1244.6	311 36 08 312 20 07 322 31 12 327 29 12 330 31 18	131 37 38 132 21 14 142 33 10 147 31 39 150 32 50	Alviso Ridge Grave Knoll Gordon Hill Packard Hill Abalone Point	4490.8 3364.0 7254.3 8827.1 6940.9	3.652325 3.526860 3.860594 3.945816 3.841414
Timber Ridge Rock 1872	39 50 51.814 123 52 44.997	1597.9 1069.6	299 09 36 320 29 01 330 42 04	119 10 37 140 30 34 150 43 48	North Ussal South Ussal Devilby	2609.4 5455.1 8011.9	3.416538 3.736806 3.903734
Big White Rock 1872	39 50 48.379 123 53 02.756	1492.0 65.5	293 20 17 316 29 40 327 44 19	113 21 30 136 31 25 147 46 16	North Ussal South Ussal. Devilby	2941.6 5655.8 8137.0	3.468591 3.752492 3.910463
Middle Rock 1872	39 46 41.334 123 50 19.021	1274.7 452.7	169 31 58 179 58 51 211 14 37	349 31 26 359 58 51 31 14 48	North Ussal South Ussal Devilby	6562.7 3516.1 862.2	3.817081 3.546058 2.935026
Jackass Tree 1873	39 51 59.696 123 54 18.510	1841.0 440.0	300 05 31 304 53 37 311 07 05	120 06 13 124 54 55 131 08 10	Sheep Ridge Timber Ridge Timber Point	1793.5 3527.3 3195.8	3.253712 3.547443 3.504573
Shoreline Rock 1873	39 49 18.220 123 50 51.086	561.9 1214.9	138 45 32 145 28 14 165 05 42	318 44 24 325 27 20 345 05 30	Timber Point Timber Ridge North Ussal	3828.2 3595.4 1671.0	3.582998 3.555750 3.222987
Ussal Rock 1872	39 48 14.424 123 50 40.752	444.8 969.4	150 15 17 169 19 16 335 40 49	330 14 02 349 18 57 155 41 14	Timber Point North Ussal Devilby	5581.8 3645.5 23415.5	3.746771 3.561763 4.369503
Double Cone W. Rock 1873	39 46 31.669 123 50 21.988	976.7 523.3	170 34 01 181 02 33 206 34 27	350 33 30 1 02 35 26 34 41	North Ussal South Ussal Devilby	6844.1 3814.8 1157.6	3.835315 3.581470 3.063542
Cottaneva Needle 1872	39 44 59.025 123 50 11.512	1820.3 274.1	180 48 07 221 29 25 336 08 53	0 48 07 41 29 35 156 09 22	Williams Point Harford Hill Cotteneva Ridge	344.1 566.6 2658.7	2.536643 2.753273 3.424666
Morgan Rock 1872	39 55 03.038 123 56 48.005	93.7 1140.0	141 25 01.7 177 08 18.3 298 59 16.1	321 24 46.6 357 08 16.4 119 00 16.3	Bear Harbor Jumper Ridge Jackson	895.5 1384.0 2550.2	2.952070 3.141135 3.406574
Cluster Cone 1872	39 54 42.451 123 56 23.604	1309.2 560.6	139 33 27.1 162 10 44.6 290 00 11.2	319 32 56.4 342 10 27.1 110 00 55.8	Bear Harbor Jumper Ridge Jackson.	1754.2 2118.9 1757.1	3.244080 3.326116 3.244794

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Jackson Pinnacle	39 53 36.349	1121.0	337 12 10.0	157 12 32.5	Anderson Cliff	2134.4	3.329275
1872	123 55 18.485	439.2	141 29 43.3	321 28 30.8	Bear Harbor	4311.7	3.634644
			151 34 58.1	331 33 58.8	Jumper Ridge	4611.9	3.663884
Ray's barn S. gable	40 01 43.885	1353.6	241 43 26.7	61 44 00.0	Shelter Cove	1395.6	3.144747
1872	124 04 21.623	512.7	321 19 29.7	141 19 44.7	Harbor	884.1	2.946484
			357 51 40.4	177 51 41.1	Embarcadero	633.5	2.801776
Ray's dairyhouse, S. gable	40 01 45.394	1400.2	186 55 00.9	6 55 09.8	Colona Cliff	2746.2	3.438732
1872	124 04 25.418	602.7	245 01 02.7	65 01 38.5	Shelter Cove	1455.1	3.162902
			318 54 43.9	138 55 01.3	Harbor	977.5	2.990110
Needle Rock	39 56 41.941	1293.4	154 59 16	334 58 58	Whale Gulch	1593.6	3.202376
1872	123 58 03.827	90.8	184 09 27	4 09 32	Upper Bear Harbor	2260.6	3.354215
			282 32 34	102 33 00	Cliff Ridge	989.5	2.995419
Upper Bear Harbor barn,	39 57 16.743	516.4	322 23 54	142 24 40	Smoky Ridge	2808.7	3.448501
W. gable	123 58 19.307	458.3	334 49 03	154 49 47	Bear Harbor	3783.1	3.577849
1872			337 16 08	157 16 23	Laurie Flat	1427.7	3.154652
			140 25 56	320 25 48	Whale Gulch	480.9	2.682072
			147 35 51	327 35 10	Red Hill	2930.0	3.466868
Jackass Cone	39 51 39.636	1222.4	150 06 36	330 04 48	Bear Harbor	8044.4	3.905492
1872	123 54 22.714	539.9	155 18 54	335 17 19	Jumper Ridge	8426.4	3.925642
			163 01 05	343 00 52	Anderson Cliff	1706.4	3.232082
Black Rock	40 01 12.712	392.1	314 55 26	134 57 36	Red Hill	6801.0	3.832576
1871	124 02 48.405	1147.9	99 17 49	279 17 04	Harbor	1680.1	3.225342
			128 38 57	308 38 29	Bight Knoll	1305.5	3.115762
White Rock	39 58 59.250	1827.2	127 10 10.4	307 07 31.4	Embarcadero	7360.3	3.866893
1871	124 00 13.295	315.5	136 24 02.9	316 21 55.5	Bight Knoll	6811.8	3.833260
			129 26 21.4	309 23 56.5	Harbor	6909.6	3.839450
Cottaneva Cone	39 44 18.509	570.8	164 54 57	344 53 28	Timber Ridge	12641.4	4.101795
1873	123 49 58.430	1391.2	327 08 26	147 08 46	Cottaneva Ridge	1407.2	3.148369
			338 14 07	158 14 19	Cottaneva Point	1232.6	3.090835
Squatter's Cabin, N. gable	39 56 23.412	722.0	341 34 14	161 34 30	Bear Harbor	1875.0	3.273003
1872	123 57 36.482	866.1	125 11 53	305 11 41	Laurie Flat	569.0	2.755137
			147 52 32	327 51 23	Red Hill	4863.5	3.686950
Forty-acre Opening	39 11 18.203	561.4	73 23 32.2	253 15 00.5	Paxton	20308.1	4.307670
1897	123 05 12.967	311.2	178 51 04.4	358 50 45.0	Mount Sanhedrin	36412.4	4.561249
Cleland	39 07 01.533	47.3	106 49 09.3	286 46 07.7	Paxton	7221.8	3.858644
1897	123 13 55.427	1331.6	194 50 45.9	14 55 57.7	Mount Sanhedrin	45860.0	4.661434
			237 42 17.8	57 47 47.7	Forty-acre Opening	14833.4	4.171242
Cole 2	39 08 11.973	369.2	89 10 18.3	269 07 46.5	Paxton	5776.3	3.761646
1897	123 14 42.775	1027.3	247 10 38.3	67 16 38.3	Forty-acre Opening	14836.7	4.171338
			332 21 35.4	152 22 05.3	Cleland	2452.0	3.389514
Dihel	39 08 57.826	1783.3	253 31 13.8	73 37 40.3	Forty-acre Opening	15308.9	4.184945
1878	123 15 24.644	591.7	324 34 48.4	144 35 14.8	Cole 2	1735.0	3.239312
			72 33 49.0	252 31 43.6	Paxton	4999.8	3.698953
Ukiah:							
South Base	39 08 28.854	889.8	44 37 44	224 36 34	Cleland	3783.1	3.577851
1897	123 12 04.799	115.2	82 12 04	262 10 24	Cole 2	3829.6	3.583150
			100 33 48	280 31 41	Dihel	4881.6	3.688560
North Base	39 09 09.228	284.6	349 49 10	169 49 16	South Base	1265.0	3.102077
1897	123 12 14.109	338.8	31 43 23	211 42 19	Cleland	4629.1	3.665494
			63 41 54	243 40 20	Cole 2	3982.9	3.600196
			85 37 19	265 35 18	Dihel	4588.7	3.661687
Court-house cupola,	39 09 02.294	70.7	29 49 04	209 48 08	Cleland	4291.9	3.632651
flagstaff	123 12 26.593	638.5	64 37 41	244 36 15	Cole 2	3619.9	3.558695
1878			88 10 12	268 08 19	Dihel	4277.7	3.631209
			234 29 50	54 29 58	North Base	368.2	2.566134
			333 05 18	153 05 32	South Base	1156.4	3.063108
Magnetic Station	39 08 04.81	148.2	183 48 51	3 48 54	Court-house	1776.8	3.24963
1897	123 12 31.52	756.9	220 51 50	40 52 07	South Base	980.7	2.99152
Longitude Station	39 08 58.88	1815.7					
1897	123 12 28.13	675.4					

Point Arena to Shelter Cove—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Ukiah—Continued.	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Latitude Station	39 08 58.87	1815.4					
1897	123 12 28.23	677.8					
Mal Paso *†	39 02 19.76	609.4	331 51 32	151 52 08	Black	2967.6	3.47241
1870	123 41 24.25	583.3	4 48 52	184 48 45	Lane	3253.3	3.51232
In Line base	39 33 16.29	502.4	329 53 29	149 54 01	Claxton Hill	2361.3	3.37316
1874	123 45 52.06	1242.9	16 58 06	196 57 41	T. M. R. B. S. Base	3210.9	3.50663
Middle test Base	39 31 59.67	1840.2	260 27 11	80 28 02	Claxton Hill	1932.3	3.28608
1874	123 46 22.26	531.7	16 57 41	196 57 35	T. M. R. B. S. Base	740.3	2.86940
Stillwell's chimney *	39 15 25.16	775.9	141 39 00	321 38 17	Little River	2652.3	3.42363
1871	123 46 52.46	1257.9	174 06 34	354 06 32	Stickney	1031.4	3.01344
Stillwells Pt.	39 15 16.44	507.0	325 58 19	145 59 02	McPherson	2913.8	3.46446
1871	123 47 12.10	290.2	347 15 08	167 15 35	Salmon Point	4578.3	3.66070
Powell's barn, N gable *	39 33 23.58	727.2	134 46 36	314 46 16	T. M. R. Bluff	1040.6	3.01729
1873	123 45 35.95	858.3	192 25 44	12 25 54	Cunningham Ridge	1726.3	3.23712
Caspar flag	39 22 06.43	198.3	325 32 03	145 32 29	Carleson	1560.6	3.19329
1873	123 49 27.33	654.3	346 06 40	166 06 56	Gordon	2499.0	3.39777
			4 44 18	184 44 13	Cabrillo	2125.8	3.32753
Gordon's barn, W gable *	39 39 39.33	1212.9	138 57 21	318 57 03	Abalone Point	984.8	2.99336
1873	123 47 01.83	43.6	198 54 05	18 54 14	Gordon Hill	1086.5	3.03602
Timber Ridge, dead tree *	39 50 55.74	1718.9	130 44 04	310 42 57	Jackass South	3310.6	3.51991
1872	123 52 29.56	702.8	137 37 26	317 36 24	Jackass Ridge	3409.0	3.53263
Round Rock *	40 00 33.98	1048.1	115 59 59	295 58 37	Harbor	3345.4	3.52445
1871	124 01 51.52	1222.0	130 19 35	310 18 30	Bight Knoll	3106.5	3.49227
A plot	39 51 01.71	52.7	350 14 48	170 14 55	North Ussal	1600.1	3.20414
1872	123 51 20.56	488.8	80 14 48	260 13 59	Timber Point	1849.7	3.26710
			108 22 23	288 21 06	Sheep Ridge	2821.8	3.45053
B plot	39 45 59.34	1830.0	5 56 32	185 56 20	Cottaneva Ridge	4315.0	3.63498
1873	123 49 07.61	181.1	58 22 10	238 21 26	Soldier Frank Point	1888.5	3.27611
			148 22 10	328 21 35	Devilby	2387.1	3.37787
C plot *	39 45 14.15	436.4	356 00 42	176 00 47	Cottaneva Point	2867.7	3.45753
1873	123 49 47.61	1133.5	77 45 53	257 45 38	Williams Point	577.2	2.76136

Shelter Cove to Trinidad Head.

Horse Mountain	40 05 17.578	542.2	347 23 06.2	167 23 29.4	Colona Cliff	3912.5	3.592458
1871	124 04 47.515	1125.7	357 16 00.5	177 16 07.3	Ray Point	5233.2	3.718768
Fire Hill	40 07 34.434	1062.1	321 20 31.0	141 22 02.8	Horse Mountain	5404.5	3.732755
1871	124 07 10.020	237.2	332 13 55.3	152 15 50.3	Colona Cliff	9084.1	3.958283
			338 59 33.9	159 01 12.5	Ray Point	10120.1	4.005184
Shubrick Peak	40 09 18.086	557.8	298 31 31.5	118 34 11.6	Fire Hill	6689.7	3.825404
1871	124 11 18.256	432.0	308 41 08.1	128 45 19.9	Horse Mountain	11858.9	4.074043
			317 59 08.6	138 03 43.7	Colona Cliff	15114.0	4.179379
			323 02 00.4	143 06 19.0	Ray Point	15819.1	4.199183
North Slide	40 11 01.640	50.6	321 14 07.0	141 16 26.9	Fire Hill	8194.1	3.913502
1871	124 10 46.705	1104.9	13 09 33.1	193 09 12.7	Shubrick Peak	3280.1	3.515881
			301 33 58.4	121 36 09.0	King Peak	5621.2	3.749831
Hadley Peak	40 10 25.423	784.2	241 49 04.2	61 50 01.1	North Slide	2365.9	3.374000
1871	124 12 14.857	351.5	306 08 12.5	126 11 29.1	Fire Hill	8937.1	3.951198
			327 10 35.2	147 11 11.7	Shubrick Peak	2471.3	3.392930
Chaparral Peak	40 15 09.994	308.3	312 21 15.9	132 25 05.2	North Slide	11363.0	4.055492
1871	124 16 41.653	984.4	324 16 03.7	144 18 56.0	Hadley Peak	10809.1	4.033799
			324 47 59.7	144 51 28.6	Shubrick Peak	13278.2	4.123138

* No check on this position.

† This point is in the area of the 1906 earthquake disturbance.

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Gorda	40 14 48.483	1495.5	255 20 24.9	75 21 34.3	Chaparral Peak	2623.3	3.418844
1871	124 18 29.038	686.3	302 34 37.0	122 39 35.6	North Slide	12979.7	4.113264
			312 29 06.7	132 33 08.4	Hadley Peak	12005.5	4.079380
			314 58 00.6	135 02 38.8	Shubrick Peak	14410.3	4.158672
Uncle Tommy	40 16 18.704	576.9	305 56 29.5	125 57 49.4	Chaparral Peak	3609.7	3.557467
1871	124 18 45.310	1070.5	352 07 51.9	172 08 02.4	Gorda	2809.2	3.448583
Barksdale Table	40 16 40.527	1250.1	284 53 30.7	104 54 39.9	Uncle Tommy	2617.5	3.417882
1871	124 20 32.373	764.8	297 06 03.9	117 08 33.0	Chaparral Peak	6125.2	3.787123
			319 50 49.4	139 52 09.1	Gorda	4520.7	3.655207
Moore Hill	40 18 18.898	582.9	332 02 19.0	152 03 12.9	Uncle Tommy	4196.9	3.622929
1871	124 20 08.598	203.0	10 29 16.5	190 29 01.1	Barksdale Table	3085.7	3.489348
Petrolia	40 19 04.030	124.3	359 01 31.2	179 01 33.6	Uncle Tommy	5100.0	3.707571
1871	124 18 48.982	1156.5	53 29 20.3	233 28 28.8	Moore Hill	2339.2	3.369076
Mussel Knoll	40 20 16.011	493.9	309 37 18.9	129 38 32.4	Petrolia	3480.7	3.541668
1871	124 20 42.536	1004.0	342 39 12.8	162 40 39.2	Gorda	10582.9	4.024604
			347 29 25.9	167 29 47.8	Moore Hill	3700.0	3.568204
Windy Point	40 16 16.366	501.7	188 11 09.6	8 11 38.7	Mussel Knoll	7470.9	3.873371
1871	124 21 27.602	652.2	206 15 12.5	26 16 03.6	Moore Hill	4217.7	3.625080
			240 09 40.3	60 10 16.0	Barksdale Table	1504.2	3.177299
			268 51 42.6	88 53 27.5	UncleTommy	3835.2	3.583788
			286 48 19.9	106 51 24.7	Chaparral Peak	7059.5	3.848771
			302 40 12.3	122 42 07.7	Gorda	5013.6	3.700154
McNutt	40 21 42.941	1324.5	339 22 01.1	159 22 51.7	Petrolia	5237.2	3.719096
1871	124 20 07.146	168.6	0 18 45.1	180 18 44.2	Moore Hill	6293.6	3.798898
			17 18 17.5	197 17 54.6	Mussel Knoll	2808.4	3.448454
South of Cape	40 25 11.150	343.9	324 43 30.8	144 45 35.5	McNutt	7864.8	3.895686
1869	124 23 19.637	463.0	337 50 06.3	157 51 48.0	Mussel Knoll	9828.8	3.992500
Mount Blank	40 24 50.400	1554.6	345 01 06.3	165 01 48.8	McNutt	5985.3	3.777089
1869	124 21 12.722	300.0	355 11 17.1	175 11 36.7	Mussel Knoll	8493.2	3.929072
			102 05 08.1	282 03 45.8	South of Cape	3059.9	3.485706
			208 29 15.1	28 31 34.7	Bear Ridge	10610.2	4.025722
Cape Ridge	40 26 44.019	1357.8	356 27 24.9	176 27 30.9	Mount Blank	3511.3	3.545464
1869	124 21 21.926	516.7	44 05 48.9	224 04 32.5	South of Cape	3987.9	3.600747
Mendocino	40 26 39.598	1221.4	267 25 43.1	87 27 07.1	Cape Ridge	3053.5	3.484791
1869	124 23 31.364	739.1	315 51 06.8	135 52 36.7	Mount Blank	4693.1	3.671458
			354 12 49.6	174 12 57.2	South of Cape	2742.1	3.438083
Bear River	40 27 50.319	1552.1	308 27 14.2	128 28 25.0	Cape Ridge	3287.6	3.516884
1869	124 23 11.175	263.3	333 17 03.3	153 18 20.0	Mount Blank	6212.2	3.793244
			12 18 18.3	192 18 05.2	Mendocino	2232.6	3.348815
			244 17 51.5	64 21 27.8	Bear Ridge	8712.0	3.940117
Odell	40 29 23.379	721.1	258 06 43.2	78 08 41.7	Bear Ridge	4393.4	3.642798
1869	124 20 40.382	951.0	5 10 28.6	185 10 07.5	Mount Blank	8454.4	3.927083
			11 15 53.3	191 15 26.3	Cape Ridge	5011.9	3.700003
			51 04 15.7	231 02 37.8	Bear River	4566.8	3.659615
False Cape	40 30 34.701	1070.4	305 01 47.7	125 03 14.2	Odell	3831.5	3.583364
1869	124 22 53.601	1262.0	4 40 06.5	184 39 55.1	Bear River	5087.2	3.706482
Oil Creek	40 31 10.825	333.9	294 46 13.0	114 48 36.9	Bear Ridge	5748.6	3.759562
1869	124 21 19.475	458.5	344 28 28.9	164 28 54.3	Odell	3439.6	3.536510
			63 18 49.2	243 17 48.1	False Cape	2480.3	3.394502
Miller Peak	40 07 50.727	1564.7	135 29 41.8	315 28 29.6	Shubrick Peak	3778.6	3.577333
1871	124 09 26.342	623.6	162 06 25.1	342 05 33.3	North Slide	6187.9	3.791544
			278 50 14.4	98 51 42.3	Fire Hill	3266.5	3.514087
			305 33 05.8	125 36 05.5	Horse Mountain	8119.0	3.909504
			325 24 39.4	145 27 45.9	Ray Point	12083.6	4.082195
Shipman	40 07 11.868	366.1	119 51 03.5	299 50 06.6	Miller Peak	2408.5	3.381744
1871	124 07 58.111	1376.1	238 33 44.1	58 34 15.1	Fire Hill	1334.6	3.125348
			307 58 04.6	128 00 07.4	Horse Mountain	5727.6	3.757969
			323 48 16.4	143 50 42.4	Colona Cliff	9096.9	3.958895
			331 24 56.2	151 27 05.8	Ray Point	9965.5	3.998498

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Miller Ridge	40 08 05.129	158.2	61 59 26.0	241 59 03.3	Miller Peak	945.8	2.975797
1871	124 08 51.073	1209.2	122 52 14.4	302 50 39.5	Shubrick Peak	4147.4	3.617780
			153 19 25.7	333 18 11.2	North Slide	6093.2	3.784848
			291 34 47.3	111 35 52.4	Fire Hill	2573.0	3.410446
			311 50 10.5	131 52 47.4	Horse Mountain	7744.5	3.888991
			322 38 20.1	142 38 54.2	Shipman	2066.6	3.315265
Wyman	40 04 59.619	1838.8	133 03 07.5	313 00 33.7	Miller Peak	7733.8	3.888395
1871	124 05 27.644	654.9	138 52 06.3	318 50 29.4	Shipman	5416.6	3.733729
			153 05 14.7	333 04 08.8	Fire Hill	5355.4	3.728788
			331 02 54.6	151 03 43.7	Colona Cliff	3730.2	3.571730
			345 35 18.2	165 35 50.8	Ray Point	4825.1	3.683506
Midway	40 06 17.239	531.7	121 34 00.4	301 31 52.6	Miller Peak	5510.9	3.741222
1871	124 06 08.019	189.9	122 52 57.5	302 51 46.6	Shipman	3104.3	3.491961
			148 20 41.4	328 20 01.5	Fire Hill	2797.2	3.446730
			313 58 14.5	133 59 06.4	Horse Mountain	2650.0	3.423250
			333 58 26.1	153 59 41.2	Colona Cliff	6296.2	3.799080
			343 01 08.1	163 02 06.8	Ray Point	7389.2	3.868599
Big Flat	40 07 52.766	1627.6	271 27 42.3	91 28 48.7	Miller Peak	2449.7	3.389119
1871	124 11 09.777	231.5	292 22 49.8	112 26 04.2	Midway	7729.3	3.888140
			303 21 23.4	123 25 03.7	Wyman	9704.6	3.986979
			317 03 49.6	137 08 02.5	Ray Point	13670.0	4.135770
Oat Hill	40 11 56.107	1730.6	143 52 04.5	323 50 05.0	Chaparral Peak	7405.9	3.869575
1871	124 13 36.878	872.3	292 38 13.1	112 40 02.9	North Slide	4361.9	3.639673
			325 14 34.4	145 15 27.3	Hadley Peak	3404.1	3.532006
			127 36 37.7	307 33 28.9	Gorda	8716.9	3.940362
Wild Oat	40 11 22.275	687.1	228 36 04.7	48 36 37.0	Oat Hill	1578.1	3.198139
1871	124 14 26.928	637.0	276 56 42.0	96 59 04.1	North Slide	5248.4	3.720027
			299 17 21.2	119 18 46.4	Hadley Peak	3583.0	3.554241
			310 36 47.4	130 38 49.1	Shubrick Peak	5882.3	3.769545
Spanish Hill	40 12 12.333	380.4	136 54 36.0	316 52 32.7	Gorda	6596.8	3.819336
1871	124 15 18.366	434.4	281 46 05.7	101 47 11.2	Oat Hill	2452.0	3.389512
			307 11 14.1	127 14 12.5	Hadley Peak	5451.4	3.736510
			321 45 24.2	141 45 57.4	Wild Oat	1965.7	3.293528
Spanish Creek	40 11 27.191	838.7	177 54 32.0	357 54 30.6	Spanish Hill	1393.3	3.144037
1871	124 15 16.217	383.6	249 12 20.9	69 13 25.0	Oat Hill	2513.3	3.400242
			277 24 18.0	97 24 49.8	Wild Oat	1175.8	3.070318
Lake Hill	40 12 49.378	1523.1	151 25 34.0	331 24 39.1	Gorda	4183.4	3.621531
1871	124 17 04.381	103.6	294 29 28.0	114 30 36.4	Spanish Hill	2755.2	3.440156
			305 47 36.8	125 49 18.4	Wild Oat	4591.9	3.661993
			314 43 43.3	134 44 53.1	Spanish Creek	3601.4	3.556475
Reynolds Point	40 12 21.132	651.8	188 21 49.7	8 21 53.2	Lake Hill	880.6	2.944762
1871	124 17 09.798	231.7	275 52 11.1	95 53 23.0	Spanish Hill	2649.3	3.423134
			301 45 36.1	121 46 49.4	Spanish Creek	3159.9	3.499677
Cooskie Creek	40 13 02.643	81.5	166 10 19.1	346 09 56.9	Gorda	3361.9	3.526589
1871	124 17 55.040	1301.5	288 51 13.1	108 51 45.8	Lake Hill	1265.9	3.102385
			320 06 47.7	140 07 16.9	Reynolds Point	1668.5	3.222333
Four Mile Creek	40 15 14.199	438.0	152 10 17.0	332 09 49.3	Windy Point	2164.8	3.335417
1871	124 20 44.829	1059.4	186 18 23.9	6 18 31.9	Barksdale Table	2678.9	3.427955
			234 49 33.1	54 50 50.3	Uncle Tommy	3454.7	3.538406
			283 52 13.1	103 53 40.8	Gorda	3305.9	3.519289
Coyote	40 15 06.711	207.0	97 24 21.2	277 23 32.6	Four Mile Creek	1793.6	3.253722
1871	124 19 29.569	698.9	127 34 37.5	307 33 21.2	Windy Point	3518.8	3.546393
			152 51 17.2	332 50 36.6	Barksdale Table	3252.0	3.512149
			291 26 54.6	111 27 33.7	Gorda	1537.1	3.186714
			320 58 08.6	140 59 42.6	Lake Hill	5451.9	3.736546
Morgan	40 14 45.433	1401.4	137 22 24.2	317 22 01.9	Four Mile Creek	1205.9	3.081323
1871	124 20 10.272	242.8	235 41 41.5	55 42 07.8	Coyote	1164.6	3.066160
			309 08 47.0	129 10 47.4	Lake Hill	5668.1	3.753436
			314 44 54.6	134 46 22.3	Cooskie Creek	4502.4	3.653447
Mackey Hill	40 14 32.699	1008.6	325 34 21.9	145 35 21.9	Lake Hill	3863.1	3.586937
1871	124 18 36.741	868.4	340 27 17.4	160 27 44.7	Cooskie Creek	2947.4	3.469437
			100 04 56.6	280 03 56.2	Morgan	2245.5	3.351285
			130 02 26.7	310 01 52.6	Coyote	1630.8	3.212400

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Mackey Ridge	40 13 40.934	1262.6	138 11 54.1	318 11 05.5	Morgan	2669.0	3.426345
1871	124 18 55.004	1300.4	195 07 44.1	15 07 55.9	Mackey Hill	1654.0	3.218530
			309 47 18.0	129 47 57.1	Cooskie Creek	1845.2	3.266046
Mackey Beach	40 13 49.506	1527.0	145 16 14.2	325 15 41.5	Morgan	2099.0	3.322018
1871	124 19 19.678	465.2	217 17 56.3	37 18 24.0	Mackey Hill	1674.8	3.223973
			294 22 54.1	114 23 06.9	Mackey Ridge	640.5	2.806498
Mattole Point	40 18 22.203	684.8	183 21 01.7	3 21 07.3	Mussel Knoll	3516.3	3.546086
1871	124 20 51.241	1210.1	275 46 33.7	95 47 01.3	Moore Hill	1012.2	3.005255
			322 00 07.5	142 01 29.0	Uncle Tommy	4833.0	3.684219
			332 58 53.1	153 00 25.1	Gorda	7398.7	3.869154
			351 54 36.1	171 54 48.3	Barksdale Table	3167.6	3.500727
			12 28 16.4	192 27 52.9	Windy Point	3978.2	3.599686
Bagley	40 16 51.715	1595.2	189 16 08.2	9 16 20.6	Mattole Point	2827.9	3.451466
1871	124 21 10.530	248.7	208 32 23.5	28 33 03.6	Moore Hill	3061.2	3.485886
			290 56 41.8	110 57 06.5	Barksdale Table	965.2	2.984627
			20 14 58.5	200 14 47.5	Windy Point	1165.4	3.066482
Taylor Peak	40 22 39.300	1212.2	154 50 13	334 47 20	Bear Ridge	14772.3	4.169449
1871	124 13 11.078	261.3	274 37 45	95 03 37	Mount Lassic	56791.8	4.754286
			341 27 08	161 30 52	King Peak	25798.1	4.411587
			350 58 51	171 00 24	North Slide	21787.3	4.338203
			19 45 19	199 43 02	Chaparral Peak	14723.6	4.168013
			27 22 03	207 18 37	Gorda	16348.1	4.213467
			50 51 18	230 46 47	Moore Hill	12713.3	4.104258
Mattole Beach	40 17 38.602	1190.7	231 53 31.4	51 54 14.8	Moore Hill	2014.2	3.304099
1871	124 21 15.710	371.1	304 43 57.0	124 45 34.2	Uncle Tommy	4323.9	3.635874
			355 11 32.8	175 10 36.1	Bagley	1450.8	3.161619
Chaparral Mountain	40 15 24.070	742.4	317 55 20	137 58 39	North Slide	10900.5	4.037445
1871	124 15 55.480	1311.2	332 55 36	152 57 06	Oat Hill	7202.9	3.857505
			68 18 24	248 17 54	Chaparral Peak	1174.4	3.069815
			73 11 08	253 09 29	Gorda	3791.5	3.578811
			112 47 36	292 45 47	Uncle Tommy	4352.4	3.638732
			148 52 47	328 50 56	Petrolia	7926.2	3.899065
Widow Cranks	40 20 01.487	45.9	320 33 51.5	140 34 31.5	Petrolia	2294.4	3.360672
1871	124 19 50.711	1197.1	348 41 33.4	168 42 26.3	Gorda	9845.1	3.993219
			7 36 15.6	187 36 04.1	Moore Hill	3192.3	3.504104
			25 01 25.4	205 00 46.4	Mattole Point	3379.4	3.528837
			110 07 03.7	290 06 30.2	Mussel Knoll	1302.8	3.114868
			172 56 08.6	352 55 58.0	McNutt	3153.2	3.498753
Mussel Ridge	40 20 35.324	1089.6	211 22 16.6	31 22 51.5	McNutt	2442.8	3.387892
1871	124 21 01.041	24.6	302 09 02.4	122 09 47.9	Widow Cranks	1960.9	3.292446
			323 44 52.1	143 45 04.1	Mussel Knoll	738.6	2.868430
			343 35 59.7	163 36 33.7	Moore Hill	4386.3	3.642094
			356 46 28.3	176 46 34.8	Mattole Point	4112.5	3.614103
Oil Creek West	40 31 28.837	889.5	198 59 13.6	19 01 21.1	Eel River	13432.3	4.128149
1871	124 21 48.148	1133.3	309 27 26.1	129 27 44.7	Oil Creek	874.2	2.941605
			42 42 20.4	222 41 37.9	False Cape	2272.1	3.356430
Mount Blank 2	40 24 39.769	1226.7	111 34 54.7	291 33 47.4	South of Cape	2632.6	3.420381
1871	124 21 35.799	844.1	143 37 07.5	323 35 52.6	Mendocino	4591.5	3.661956
			184 52 34.5	4 52 43.6	Cape Ridge	3846.4	3.585051
			238 55 29.7	58 55 44.7	Mount Blank	635.3	2.802958
			339 00 58.1	159 01 55.5	McNutt	5841.3	3.766507
			351 12 55.6	171 13 30.1	Mussel Knoll	8231.9	3.915500
Davies Creek	40 22 51.737	1595.8	147 29 37.0	327 28 21.7	South of Cape	5099.6	3.707534
1871	124 21 23.393	551.8	174 59 00.1	354 58 52.1	Mount Blank 2	3345.0	3.524399
			319 42 17.9	139 43 07.3	McNutt	2781.8	3.444330
			348 38 50.9	168 39 17.4	Mussel Knoll	4899.0	3.690111
			352 51 13.7	172 51 28.2	Mussel Ridge	4240.5	3.627417
Walker Ridge	40 22 49.196	1517.4	349 37 48.2	169 38 23.0	Petrolia	7060.3	3.848822
1871	124 19 42.810	1009.8	15 41 41.8	195 41 26.0	McNutt	2122.7	3.326892
			16 36 51.6	196 36 12.9	Mussel Knoll	4930.6	3.692899
			24 05 37.2	204 04 46.5	Mussel Ridge	4523.0	3.655428
			91 54 05.1	271 52 59.9	Davies Creek	2373.9	3.375468
			150 26 49.2	330 25 50.9	Mount Blank	4297.9	3.633258

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Davies Ridge	40 23 04.110	126.8	289 57 14.8	109 57 49.6	Walker Ridge	1347.7	3.129578
1871	124 20 36.511	861.2	344 31 50.1	164 32 09.1	McNutt	2597.7	3.414586
			1 34 17.5	181 34 13.6	Mussel Knoll	5186.8	3.714902
			7 11 26.4	187 11 10.5	Mussel Ridge	4625.6	3.665164
			70 57 54.7	250 57 24.3	Davies Creek	1169.9	3.068135
			135 32 39.0	315 30 53.3	South of Cape	5491.1	3.739660
Domingo	40 21 35.973	1109.6	170 38 17.0	350 38 06.4	Davies Creek	2368.5	3.374468
1871	124 21 07.059	166.6	194 50 43.1	14 51 02.9	Davies Ridge	2812.5	3.449085
			221 20 32.8	41 21 27.4	Walker Ridge	3008.6	3.478367
			261 20 58.5	81 21 37.3	McNutt	1429.9	3.155320
			346 47 31.7	166 47 47.6	Mussel Knoll	2533.3	3.403690
			355 39 29.6	175 39 33.5	Mussel Ridge	1876.0	3.273244
Devils Gate	40 24 30.324	935.3	306 55 32.6	126 57 09.8	Davies Ridge	4424.9	3.645906
1871	124 23 06.478	152.7	321 20 55.2	141 22 02.0	Davies Creek	3893.2	3.590310
			332 20 40.2	152 21 57.4	Domingo	6070.8	3.783246
Fraser Ridge	40 10 55.206	1702.8	126 44 06.0	306 43 35.5	Wild Oat	1396.0	3.144892
1871	124 13 39.633	937.6	135 32 10.5	315 31 06.8	Spanish Hill	3333.7	3.522925
			181 59 11.6	1 59 13.4	Oat Hill	1879.5	3.274051
			294 35 57.4	114 36 52.1	Hadley Peak	2206.1	3.343624
Lower Hadley	40 10 26.677	822.8	125 30 08.3	305 29 34.7	Fraser Ridge	1515.4	3.180524
1871	124 12 47.487	1123.5	126 05 52.3	306 04 48.2	Wild Oat	2911.2	3.464075
			157 02 50.0	337 02 18.2	Oat Hill	2995.6	3.476485
			272 51 48.1	92 52 09.2	Hadley Peak	773.0	2.888191
Rancheria Beach	40 09 58.274	1797.5	147 01 43.5	327 00 57.7	Wild Oat	3088.5	3.489750
1871	124 13 15.874	375.6	217 28 31.9	37 28 50.2	Lower Hadley	1103.9	3.042938
			322 21 21.8	142 22 45.4	Big Flat	4887.9	3.689122
Mount Blank 3	40 24 40.807	1258.7	8 12 04.6	188 11 50.9	Walker Ridge	3478.1	3.541346
1871	124 19 21.778	513.4	11 02 29.7	191 02 00.2	McNutt	5589.6	3.747378
			30 35 10.8	210 34 22.3	Davies Ridge	3464.4	3.539625
			40 27 36.9	220 26 18.0	Davies Creek	4420.9	3.645507
			96 27 48.7	276 26 36.8	Mount Blank	2632.5	3.420367
			121 56 11.6	301 53 29.8	Mendocino	6931.0	3.840798
			143 19 00.4	323 17 42.5	Cape Ridge	4739.7	3.675747
Little Spanish	40 12 15.889	490.1	96 27 05.4	276 26 26.3	Reynolds Point	1440.4	3.158484
1871	124 16 09.274	219.3	128 24 11.6	308 23 36.0	Lake Hill	1663.0	3.220891
			275 12 01.2	95 12 34.0	Spanish Hill	1208.9	3.082376
Cape Mendocino Latitude Station	40 26 21.018	648.3	303 34 39.7	123 36 35.5	Mount Blank	5051.7	3.703435
1869	124 24 11.230	264.6	330 33 30.6	150 34 04.1	South of Cape	2474.5	3.393487
Steamboat Rock	40 24 56.389	1739.3	179 26 02	359 26 02	C. Mendocino Latitude Station	2610.4	3.416713
1871	124 24 10.135	239.0	314 20 27	134 22 15	Davies Creek	5499.6	3.740328
			325 02 53	145 04 52	Domingo	7540.6	3.877403
Light-house No. 1	40 26 32.292	996.0	247 04 13.4	67 04 28.1	Mendocino	578.4	2.762255
1869	124 23 53.968	1271.9	309 34 16.6	129 36 01.2	Mount Blank	4932.0	3.693025
			342 04 44.8	162 05 07.1	South of Cape	2630.4	3.420016
Light-house No. 2	40 26 30.795	949.9	257 04 09	77 04 15	Light-house No. 1	206.3	2.314495
1869	124 24 02.500	58.9	337 38 25	157 38 52	South of Cape	2656.3	3.424274
Cape Mendocino L. H.	40 26 25.726	793.5	250 11 14	70 11 26	Light-house No. 2	461.4	2.664033
1869–71	124 24 20.917	493.0	327 52 03	147 52 42	South of Cape	2716.2	3.433960
			338 51 12	158 55 00	Gorda	23053.7	4.362740
Fortunas	40 29 36.572	1128.1	22 47 04.9	202 46 27.0	Bear River	3554.6	3.550794
1869	124 22 12.745	300.1	151 47 18.2	331 46 51.7	False Cape	2034.8	3.308516
			203 19 53.8	23 20 28.4	Oil Creek	3166.2	3.500545
			280 35 17.6	100 36 17.6	Odell	2212.9	3.344961
Odell 2	40 29 22.329	688.7	125 14 01.8	305 14 00.5	Odell	56.1	1.749312
1869	124 20 38.435	905.1	257 34 16.1	77 36 13.6	Bear Ridge	4355.4	3.639025
			5 30 18.7	185 29 56.5	Mount Blank	8426.4	3.925643
Blunts Reef, N. Rock	40 26 59.086	1822.5	227 04 01	47 07 18	False Cape	9768.9	3.989846
1869	124 27 57.389	1352.4	256 47 11	76 50 16	Bear River	6926.5	3.840515
			275 27 11	95 30 04	Mendocino	6297.8	3.799192
			292 33 27	112 37 50	Mount Blank	10331.3	4.014156
			296 55 49	116 58 49	South of Cape	7344.5	3.865962

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Blunts Reef, S. Rock	40 26 56.939	1756.3	227 30 47	47 34 10	False Cape	9950.0	3.997823
1869	124 28 05.252	123.8	256 36 25	76 39 38	Bear River	7122.1	3.852607
			274 42 46	94 45 43	Mendocino	6476.5	3.811342
			291 49 59	111 54 27	Mount Blank	10477.9	4.020275
			295 50 02	115 53 08	South of Cape	7481.1	3.873965
Mussel Rock	40 20 56.046	1728.8	164 23 51	344 22 50	South of Cape	8170.0	3.912220
1871	124 21 46.428	1095.7	188 39 30	8 39 44	Davies Creek	3609.6	3.557458
			202 39 37	22 40 22	Davies Ridge	4280.7	3.631512
			217 01 36	37 02 01	Domingo	1542.6	3.188262
Devils Gate Rock	40 23 49.742	1534.3	188 58 20	8 58 31	South of Cape	2542.1	3.405194
1871	124 23 36.454	859.8	288 19 54	108 21 51	Davies Ridge	4471.3	3.650436
			319 29 07	139 30 44	Domingo	5426.2	3.734497
Walker's house, chimney	40 22 22.367	689.9	23 39 06	203 38 51	McNutt	1327.6	3.123053
1871	124 19 44.575	1051.5	53 40 49	233 39 56	Domingo	2415.6	3.383027
			111 14 45	291 13 41	Davies Creek	2501.0	3.398110
Sealion Rock	40 19 33.577	1035.7	227 16 31	47 17 10	Mussel Knoll	1929.3	3.285399
1871	124 21 42.582	1005.2	316 03 34	136 04 35	Moore Hill	3198.4	3.504936
			331 09 24	151 09 58	Mattole Point	2513.1	3.400215
Gorda Rock	40 14 59.476	1834.6	198 59 16	18 59 38	Windy Point	2504.8	3.398775
1871	124 22 02.094	49.5	256 01 41	76 02 31	Four Mile Creek	1881.7	3.274550
			279 17 51	99 19 03	Morgan	2678.2	3.427842
Reynolds Rock	40 12 07.490	231.0	165 53 02.2	345 52 50.5	Cooskie Creek	1754.1	3.244058
1871	124 17 36.948	873.9	210 47 50.4	30 48 11.4	Lake Hill	1504.1	3.177282
			236 45 39.8	56 45 57.3	Reynolds Point	767.7	2.885194
Island Peak	40 04 07.522	232.0	45 28 14	225 26 49	Ray Point	4371.9	3.640667
1871	124 02 25.524	604.9	56 34 50	236 33 41	Colona Cliff	3008.5	3.478352
			122 43 23	302 41 52	Horse Mountain	3998.5	3.601894
Shipman Tree	40 07 11.551	356.3	229 49 29.2	49 49 29.5	Shipman	15.1	1.180285
1871	124 07 58.600	1387.7	302 35 45.1	122 36 56.3	Midway	3108.7	3.492583
			307 49 10.8	127 51 13.9	Horse Mountain	5730.7	3.758207
Petrolia flagstaff	40 19 28.661	884.0	63 05 18	243 03 22	Moore Hill	4751.4	3.676823
1871	124 17 09.228	217.9	104 53 06	284 51 22	Widow Cranks	3945.2	3.596070
			149 38 19	329 36 40	Walker Ridge	7169.5	3.855487
Outer Break	40 24 39.218	1209.7	203 16 11	23 16 55	Mendocino	4042.0	3.606599
1871	124 24 39.122	922.4	242 16 03	62 16 54	South of Cape	2117.1	3.325734
			318 28 23	138 30 40	Domingo	7547.6	3.877807
Mackey's house, chimney	40 13 58.626	1808.3	56 32 45	236 32 33	Mackey Beach	510.2	2.707757
1871	124 19 01.672	39.5	131 41 08	311 40 24	Morgan	2171.1	3.336685
			209 16 47	29 17 03	Mackey Hill	1204.9	3.080958
Domingo's house, chim-	40 21 50.62	1561.4	146 00 59	326 00 24	Davies Creek	2273.6	3.356722
1871 [ney*	124 20 29.52	696.5	294 09 34	114 09 48	McNutt	578.5	2.762317
Bagley's house, chimney*	40 17 13.77	424.7	190 41 26	10 41 37	Mattole Point	2147.9	3.332017
1871	124 21 08.11	191.6	214 58 44	34 59 22	Moore Hill	2451.7	3.389464
False Cape Rock	40 30 36.094	1113.3	239 20 22	59 21 37	Oil Creek West	3191.2	3.503956
1869	124 23 44.768	1054.1	272 02 15	92 02 48	False Cape	1205.4	3.081146
			310 15 59	130 16 58	Fortunas	2840.0	3.453325
Griffith Hill	40 25 01.626	50.2	111 01 32	290 55 18	Bear River	14537.7	4.162496
1869	124 13 35.201	829.9	128 54 13	308 49 39	Odell	12837.6	4.108485
			147 32 10	327 29 32	Bear Ridge	10643.3	4.027076
East Twin	40 24 47.706	1471.5	137 37 20	317 35 50	Cape Ridge	4857.6	3.686419
1869	124 19 02.995	70.6	164 54 20	344 53 17	Odell	8807.3	3.944843
			91 34 04	271 32 40	Mount Blank	3059.8	3.485687
Mount Pierce	40 25 00.650	20.0	113 00 52	292 52 06	Odell 2	20707.3	4.316124
1869	124 07 09.160	216.0	103 05 04	282 54 40	Bear River	23269.0	4.366777
			121 21 41	301 14 53	Bear Ridge	17336.2	4.238955
			280 36 32	100 58 32	Mount Lassic	48899.9	4.689308
Rainbow Peak*	40 23 41.11	1268.0	124 50 20	304 43 23	Odell 2	18450.2	4.26600
1869	124 09 55.45	1307.7	136 29 19	316 24 19	Bear Ridge	15813.9	4.19904

* No check on this position.

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Monument Ridge lone tree*	40 28 07.74	238.7	63 32 10	243 26 34	Mount Blank	13636.4	4.134699
1869	124 12 34.96	823.6	78 17 58	258 12 16	Cape Ridge	12682.2	4.103194
Joel Flat*	40 23 36.15	1115.0	150 05 41	330 02 51	Odell	12358.3	4.091960
1869	124 16 18.76	442.4	170 53 38	350 52 47	Bear Ridge	11762.6	4.070502
Cape Rock	40 26 21.578	665.6	198 45 08	18 46 21	False Cape	8245.7	3.916229
1869	124 24 46.191	1088.6	203 51 06	23 53 12	Oil Creek West	10363.8	4.015521
			210 59 37	31 01 17	Fortunas	7017.4	3.846174
Mattole Mt. tree	40 15 28.182	869.3	149 41 28	329 36 39	South of Cape	20836.6	4.318826
1869	124 15 53.600	1266.7	151 04 54	330 59 43	Light-house No. 1	23411.1	4.369421
			156 32 58	336 29 31	Mount Blank	18906.5	4.276612
Outer Twin Rock*	40 26 42.72	1317.7	203 48 06	23 49 33	False Cape	7821.4	3.893283
1869	124 25 07.67	180.8	217 31 30	37 33 23	Fortunas	6763.0	3.830138
Mattole Peak, tree	40 15 09.813	302.7	153 28 51	333 23 37	South of Cape	20738.1	4.316769
1869	124 16 46.646	1102.4	154 27 24	334 21 48	Light-house No. 1	23341.7	4.368133
			160 41 47	340 38 55	Mount Blank	18977.2	4.278232
Cape Knob*	40 26 36.15	1115.0	190 36 08	10 36 46	False Cape	7486.1	3.874255
1869	124 23 52.10	1227.9	202 48 09	22 49 13	Fortunas	6037.4	3.780847
Barksdale Ridge, E. peak*	40 09 06.64	204.8	142 24 32	322 14 03	South of Cape	37588.1	4.575050
1869	124 07 07.02	166.2	145 36 50	325 27 43	Mount Blank	35305.1	4.547838
Keeper's house, chimney*	40 26 20.84	642.8	302 48 14	122 50 13	Mount Blank	5146.8	3.711535
1869	124 24 16.20	381.8	328 10 59	148 11 36	South of Cape	2529.5	3.403035
Conical Rock*	40 15 43.38	1338.1	173 06 41	353 05 43	South of Cape	17640.3	4.246505
1869	124 21 49.89	1178.9	182 58 24	2 58 48	Mount Blank	16895.2	4.227763
Rock awash*	40 30 39.33	1213.1	332 47 12	152 48 55	Cape Ridge	8160.6	3.911724
1869	124 24 00.28	6.6	354 44 03	174 44 22	Mendocino	7425.9	3.870751
Eel River	40 38 42.871	1322.4	355 31 56.5	175 32 31.8	Bear Ridge	16403.7	4.214942
1869	124 18 33.074	753.6	15 46 55.6	195 45 06.7	Oil Creek	14488.7	4.161031
Table Ridge	40 40 22.616	697.6	14 37 32.8	194 35 12.7	Bear Ridge	20079.6	4.302756
1869	124 14 02.498	58.7	64 06 42.6	244 03 46.9	Eel River	7040.6	3.847610
Table Bluff	40 41 52.889	1631.4	311 40 08.6	131 41 35.4	Table Ridge	4187.4	3.621945
1869	124 16 15.679	368.1	4 58 32.5	184 57 39.0	Bear Ridge	22299.1	4.348287
			28 40 17.2	208 38 48.3	Eel River	6679.6	3.824752
Eel River Beach	40 40 00.698	21.5	211 35 44.9	31 36 44.0	Table Bluff	4063.3	3.608874
1869	124 17 46.353	1088.8	262 39 09.5	82 41 35.4	Table Ridge	5301.1	3.724370
			24 06 31.6	204 06 01.8	Eel River	2630.0	3.419956
Nelson	40 40 42.907	1323.5	214 41 03.8	34 41 45.3	Table Bluff	2625.3	3.419183
1869	124 17 19.311	453.5	277 41 37.2	97 43 45.5	Table Ridge	4664.5	3.668804
			26 00 22.0	206 00 04.4	Eel River Beach	1448.6	3.160958
Sisson	40 42 54.720	1687.8	30 24 46.3	210 23 29.8	Table Ridge	5439.8	3.735584
1854	124 12 05.249	123.2	72 02 53.6	252 00 10.3	Table Bluff	6180.4	3.791020
Humboldt L. H.	40 46 09.060	279.5	345 10 33.9	165 11 18.0	Sisson	6200.9	3.792456
1869	124 13 12.841	301.1	28 30 59.1	208 28 59.8	Table Bluff	8992.5	3.953834
Red Bluff Latitude Sta.	40 44 44.184	1362.8	340 18 12.1	160 18 45.7	Sisson	3586.3	3.554646
1854	124 12 56.746	1331.3	10 50 08.4	190 49 25.5	Table Ridge	8214.7	3.914591
			41 28 56.8	221 26 47.0	Table Bluff	7051.0	3.848252
			171 47 45.2	351 47 34.8	Humboldt L. H.	2645.2	3.422460
Bucksport (69)	40 46 43.429	1339.6	6 41 01.3	186 40 38.3	Sisson	7103.1	3.851447
1869	124 11 30.028	704.1	28 56 57.8	208 56 01.2	Red Bluff Lat. Sta.	4203.2	3.623582
			66 16 26.9	246 15 19.8	Humboldt L. H.	2633.9	3.420595
Sandhill (R)	40 47 18.800	579.9	308 01 07.6	128 01 46.5	Bucksport (69)	1771.2	3.248274
1869	124 12 29.534	692.4	7 37 27.9	187 37 09.9	Red Bluff Lat. Sta.	4811.9	3.682314
			25 16 28.1	205 15 59.8	Humboldt L. H.	2378.9	3.376372
Humboldt Bay N. B.	40 47 44.540	1373.8	18 22 54.7	198 22 37.3	Bucksport (69)	1986.39	3.298065
1870	124 11 03.315	77.7	68 33 46.8	248 32 50.5	Sandhill (R)	2171.7	3.336807

* No check on this position.

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Humboldt Bay Middle B. 1870	40 47 08.172	252.1	9 04 45.9	189 04 11.0	Sisson	7917.2	3.898569
	124 11 12.022	281.9	28 57 09.9	208 56 01.3	Red Bluff Lat. Sta.	5075.5	3.705476
			28 57 10.5	208 56 58.8	Bucksport (69)	872.221	2.940626
			100 13 58.2	280 13 07.6	Sandhill (R)	1846.7	3.266404
			190 18 43.8	10 18 49.5	Humboldt Bay N.B.	1140.265	3.057006
Curlew 1853	40 47 48.151	1485.2	277 06 30.4	97 06 55.3	Humboldt Bay N. B.	899.6	2.954066
	124 11 41.395	970.5	330 49 04.5	150 49 23.6	Humboldt Bay M. B.	1412.5	3.149980
			352 23 44.0	172 23 51.4	Bucksport (69)	2014.2	3.304093
			51 16 03.4	231 15 31.9	Sandhill (R.)	1446.9	3.160434
Peninsula 1870	40 48 22.687	699.8	321 07 23.4	141 07 49.8	Humboldt Bay N. B.	1511.4	3.179385
	124 11 43.780	1026.2	342 02 58.3	162 03 19.0	Humboldt Bay M. B.	2416.1	3.383117
			356 59 42.7	176 59 44.2	Curlew	1066.8	3.028076
			28 33 46.1	208 33 16.2	Sandhill (R.)	2243.7	3.350962
Eureka Methodist Church 1870	40 48 15.461	476.9	61 50 31.0	241 49 41.3	Humboldt Bay N. B.	2020.7	3.305511
	124 09 47.320	1109.2	65 19 51.0	245 18 05.0	Sandhill (R.)	4185.2	3.621721
			94 40 41.7	274 39 25.6	Peninsula	2738.9	3.437579
Sand Bluff 1870	40 49 24.442	753.9	334 57 23.8	154 57 51.5	Eureka Meth. Ch.	2348.6	3.370801
	124 10 29.732	696.7	14 19 53.9	194 19 31.8	Humboldt Bay N. B.	3180.6	3.502507
			42 20 27.0	222 19 38.6	Peninsula	2576.9	3.411103
West Point 1870	40 49 42.327	1305.6	347 36 54.4	167 37 10.8	Eureka Meth. Ch.	2743.3	3.438280
	124 10 12.421	291.0	36 19 36.7	216 19 25.4	Sand Bluff	684.8	2.835545
East Point 1870	40 48 42.317	1305.3	61 10 54.6	241 10 12.6	Eureka Meth. Ch.	1718.3	3.235096
	124 08 43.094	1010.0	117 28 53.6	297 27 43.9	Sand Bluff	2816.8	3.449751
			131 29 36.4	311 28 38.0	West Point	2794.4	3.446293
Eureka Plaza, flagstaff 1870	40 48 12.173	375.5	66 08 41.1	246 07 47.3	Humboldt Bay N. B.	2107.1	3.323679
	124 09 41.114	963.8	96 26 45.5	276 25 25.3	Peninsula	2893.5	3.461429
			152 55 51.4	332 55 19.6	Sand Bluff	2503.6	3.398560
			165 13 22.0	345 13 01.5	West Point	2876.1	3.458805
			235 38 00.3	55 38 38.1	East Point	1647.4	3.216809
Eureka Azimuth Station 1869	40 48 11.981	369.6	132 12 09.5	312 12 06.2	Eureka Meth. Ch.	159.8	2.203513
	124 09 42.270	990.8	165 46 29.8	345 46 10.1	West Point	2875.0	3.458644
			257 41 33.7	77 41 34.5	Eureka Plaza flgstf.	27.7	1.443164
Eureka Congregational Church 1870	40 48 11.663	359.8	63 20 17.7	243 19 31.2	Humboldt Bay N. B.	1864.2	3.270490
	124 09 52.251	1224.8	97 25 13.1	277 24 00.2	Peninsula	2636.3	3.420990
			158 38 00.2	338 37 35.7	Sand Bluff	2410.7	3.382142
			170 24 29.3	350 24 16.1	West Point	2836.3	3.452755
			267 36 00.3	87 36 06 8	Eureka Az. Sta.	234.2	2.369527
Wheeler 1870	40 51 10.632	328.0	347 17 45.2	167 18 14.0	East Point	4689.8	3.671154
	124 09 27.098	634.8	5 00 48.0	185 00 34.8	Eureka Meth. Ch.	5424.2	3.734336
			21 18 01.2	201 17 31.6	West Point	2923.6	3.465915
Green Bluff 1870	40 49 37.259	1149.3	68 35 55.9	248 32 48.4	Eureka Cong. Ch.	7227.4	3.858984
	124 05 05.185	121.5	69 08 20.6	249 05 16.2	Eureka Meth. Ch.	7077.3	3.849868
			71 39 37.2	251 37 14.8	East Point	5380.6	3.730832
			87 03 12.7	266 59 40.6	Sand Bluff	7615.4	3.881693
			115 10 09.0	295 07 17.7	Wheeler	6778.5	3.831131
Arcata Church 1870	40 52 18.647	575.2	359 28 47.4	179 28 48.7	Green Bluff	4978.5	3.697101
	124 05 07.114	166.6	37 11 26.2	217 09 05.0	East Point	8374.5	3.922959
			54 36 52.4	234 33 21.5	Sand Bluff	9273.1	3.967226
			71 00 39.8	250 57 49.8	Wheeler	6440.2	3.808898
Morgan 1870	40 49 32.724	1009.4	321 36 08.1	141 37 00.8	Eureka Meth. Ch.	3040.8	3.482981
	124 11 07.893	185.0	324 39 25.1	144 40 14.6	Eureka Cong. Ch.	3065.1	3.486449
			21 16 27.4	201 16 04.0	Peninsula	2318.4	3.365186
Cut Hill 1870	40 51 03.279	101.2	251 36 50.2	71 40 05.9	Arcata Church	7381.3	3.868133
	124 10 06.238	146.1	290 35 21.6	110 38 38.5	Green Bluff	7535.8	3.877128
			355 06 12.9	175 06 25.3	Eureka Meth. Ch.	5195.6	3.715635
			356 27 21.2	176 27 30.4	Eureka Cong. Ch.	5303.9	3.724595
			27 20 59.0	207 20 19.6	Morgan	3144.7	3.497576
Slough 1870	40 48 15.921	491.1	89 45 41.6	269 44 11.2	Eureka Meth. Ch.	3240.6	3.510632
	124 07 29.071	681.4	115 08 47.6	295 07 59.2	East Point	1916.6	3.282531
			116 32 38.8	296 30 40.7	Sand Bluff	4732.4	3.675082
			152 50 42.9	332 49 25.7	Wheeler	6057.5	3.782291
			203 56 16.1	23 57 48.9	Arcata Church	8192.8	3.913430
			233 20 11.7	53 21 45.7	Green Bluff	4203.2	3.623576

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Slough Fork	40 48 02.141	66.0	105 33 24.5	285 32 41.9	Slough.	1585.5	3.200166
1870	124 06 23.909	560.4	110 48 45.1	290 47 14.1	East Point	3489.9	3.542815
			192 48 14.9	12 49 05.1	Arcata Church	8114.4	3.909256
			212 09 23.0	32 10 14.4	Green Bluff	3466.0	3.539826
Marsh Point	40 51 29.883	921.8	247 46 34.6	67 48 17.3	Arcata Church	3979.4	3.599823
1870	124 07 44.430	1040.6	312 56 47.4	132 58 31.5	Green Bluff	5097.8	3.707379
			25 39 27.8	205 38 07.4	Eureka Meth. Ch.	6652.7	3.823000
			76 08 16.0	256 07 08.8	Wheeler	2477.0	3.393921
John Brown	40 52 13.166	406.1	268 11 27.4	88 13 58.5	Arcata Church	5417.7	3.733814
1870	124 08 58.358	1366.5	307 37 53.7	127 38 42.1	Marsh Point	2186.4	3.339723
			19 14 18.2	199 13 59.4	Wheeler	2043.1	3.310282
Mosquito Point	40 53 02.669	82.3	286 31 23.4	106 33 31.0	Arcata Church	4769.9	3.678505
1870	124 08 22.397	524.4	342 44 26.0	162 44 50.9	Marsh Point	2997.1	3.476700
			23 40 44.9	203 40 02.6	Wheeler	3773.6	3.576753
			28 52 34.6	208 52 11.1	John Brown	1743.8	3.241496
Northerner	40 34 00.997	30.8	2 51 53.6	182 51 46.3	Oil Creek	5255.5	3.720618
1869	124 21 08.317	195.6	11 17 49.2	191 17 23.3	Oil Creek West	4786.1	3.679979
Eccentric	40 35 56.225	1734.3	22 22 41.5	202 21 01.4	Oil Creek	9519.3	3.978604
1869	124 18 45.520	1070.3	27 31 57.5	207 29 58.8	Oil Creek West	9299.7	3.968467
			43 23 20.9	223 21 48.1	Northerner	4889.9	3.689301
			183 30 59.6	3 31 08.4	Eel River	5150.0	3.711811
Centerville	40 37 20.794	641.4	204 00 51.5	24 01 22.8	Eel River	2771.7	3.442748
1869	124 19 20.082	472.0	342 41 46.7	162 42 09.2	Eccentric	2732.2	3.436517
			350 06 58.7	170 08 05.2	Bear Ridge	14030.1	4.147061
Centerville South	40 36 25.384	783.0	204 59 55.4	25 00 17.3	Centerville	1885.9	3.275524
1869	124 19 53.992	1269.3	299 11 09.4	119 11 53.9	Eccentric	1844.1	3.265776
			11 43 02.1	191 42 06.4	Oil Creek	9908.9	3.996026
			16 22 18.0	196 21 03.7	Oil Creek West	9533.2	3.979237
			21 26 04.7	201 25 16.4	Northerner	4784.4	3.679829
Russ Cut Off	40 36 30.989	955.9	329 03 00.3	149 03 18.0	Eccentric	1250.3	3.097010
1869	124 19 12.867	302.5	349 40 28.0	169 41 29.7	Bear Ridge	12487.8	4.096487
			16 47 40.4	196 46 18.0	Oil Creek	10314.9	4.013467
			21 24 57.2	201 23 16.2	Oil Creek West	10010.3	4.000445
			30 24 56.6	210 23 41.5	Northerner	5364.4	3.729518
			79 51 57.1	259 51 30.4	Centerville South	982.1	2.992174
			173 42 01.8	353 41 57.0	Centerville	1545.7	3.189115
Picket Pile	40 37 09.214	284.2	9 46 23.1	189 46 17.5	Russ Cut Off	1196.5	3.077906
1869	124 19 04.227	99.4	40 52 20.7	220 51 48.5	Centerville South	1787.8	3.252327
			133 47 19.4	313 47 09.1	Centerville	516.2	2.712832
			194 39 16.5	14 39 37.5	Eel River	2986.1	3.475106
Russ house, north chimney	40 34 57.573	1775.8	146 14 28.5	326 13 38.4	Centerville South	3258.2	3.512975
1869	124 18 36.979	869.6	167 05 00.2	347 04 32.0	Centerville	4532.6	3.656346
			173 39 52.4	353 39 46.8	Eccentric	1820.3	3.260151
East Point	40 38 31.493	971.4	34 14 57.0	214 14 15.9	Centerville	2638.1	3.421286
1869	124 18 16.915	397.6	134 34 31.8	314 34 22.0	Eel River	500.0	2.699008
			194 37 16.8	14 37 37.1	Eel River Beach	2843.7	3.453891
Fishhouse, N. gable	40 39 36.669	1131.1	46 49 07.9	226 48 18.9	Eel River	2424.7	3.384656
1869	124 17 16.826	395.2	136 54 11.2	316 53 52.0	Eel River Beach	1015.1	3.006523
			178 21 47.4	358 21 45.9	Nelson	2044.0	3.310488
Flag Tree	40 37 49.768	1535.1	66 02 30.0	246 01 34.3	Centerville	2200.2	3.342472
1869	124 17 54.537	1281.7	151 41 58.6	331 41 34.2	Eel River	1860.4	3.269607
			157 46 37.6	337 46 23.0	East Point	1390.3	3.143118
South Beach	40 43 45.250	1395.7	237 34 12.1	57 35 31.7	Red Bluff Lat. Sta.	3390.8	3.530307
1869	124 14 58.736	1378.3	290 55 56.0	110 57 49.2	Sisson	4359.8	3.639465
			348 04 03.6	168 04 40.3	Table Ridge	6388.4	3.805395
South Spit	40 44 49.383	1523.2	276 24 50.4	96 25 30.0	Red Bluff Lat. Sta.	1434.3	3.156640
1869	124 13 57.498	1348.9	323 18 48.7	143 20 01.9	Sisson	4410.0	3.644439
			30 47 38.7	210 46 08.5	Table Bluff	6336.9	3.801875
White Barn	40 52 26.184	807.6	2 14 39.6	182 14 31.1	Slough	7725.8	3.887942
1870	124 07 16.164	378.5	20 52 00.9	200 51 42.4	Marsh Point	1858.6	3.269188
			52 46 33.7	232 45 08.0	Wheeler	3851.6	3.585637
			80 28 59.9	260 27 53.0	John Brown	2426.5	3.384979
			125 58 32.5	305 57 49.1	Mosquito Point	1916.1	3.282427
			274 23 18.2	94 24 42.4	Arcata Church	3030.8	3.481560

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Round Top	40 52 28.810	888.6	271 34 07.1	91 35 29.3	White Barn	2936.6	3.467847
1870	124 09 21.528	504.2	272 59 21.3	93 02 07.8	Arcata Church	5965.7	3.775659
			21 39 03.6	201 38 34.4	Cut Hill	2838.6	3.453099
Ocean	40 55 06.709	207.0	344 39 06.1	164 39 44.2	White Barn	5134.7	3.710518
1870	124 08 14.205	332.4	17 56 04.7	197 55 20.6	Round Top	5119.3	3.709213
			19 15 52.0	199 14 38.7	Cut Hill	7954.0	3.900587
Trinidad Head	41 03 17.141	528.8	355 58 56.1	175 59 25.9	Ocean	15165.8	4.180867
1870	124 08 59.615	1392.3	1 28 10.8	181 27 56.4	Round Top	20066.0	4.301161
			3 56 36.8	183 55 53.3	Cut Hill	22691.4	4.355861
			6 44 27.9	186 43 05.0	Morgan	25607.5	4.408368
			7 56 22.6	187 54 35.3	Peninsula	27857.6	4.444944
Fir Tree	40 52 58.624	1808.3	14 11 00	194 10 40	Marsh Point	2823.4	3.450777
1870	124 07 14.893	348.6	59 56 49	239 55 41	John Brown	2799.2	3.447031
			94 31 15	274 30 31	Mosquito Point	1585.4	3.200129
Laguna	40 54 05.314	163.8	332 27 13	152 27 43	Fir Tree	2320.1	3.365514
1870	124 08 00.722	16.9	341 09 35	161 10 04	White Barn	3230.9	3.509324
			14 42 51	194 42 37	Mosquito Point	1997.9	3.300577
			170 32 28	350 32 20	Ocean	1920.0	3.283294
Onsley	40 54 21.561	665.1	352 30 41	172 30 50	Fir Tree	2580.4	3.411685
1870	124 07 29.257	684.7	55 45 58	235 45 37	Laguna	890.8	2.949786
			142 56 23	322 55 53	Ocean	1745.3	3.241865
Canal	40 54 59.257	1827.8	343 42 12	163 42 22	Onsley	1211.5	3.083318
1870	124 07 43.782	1024.5	13 24 09	193 23 58	Laguna	1710.6	3.233143
			107 53 43	287 53 23	Ocean	748.1	2.873965
Mad River	40 56 57.981	1788.4	12 58 02.4	192 57 40.3	Ocean	3522.2	3.546814
1870	124 07 40.429	945.4	171 00 58.2	351 00 06.3	Trinidad Head	11841.7	4.073415
Dows Prairie	40 59 14.955	461.3	14 56 36.7	194 55 39.5	Ocean	7925.5	3.899025
1870	124 06 46.868	1095.6	16 30 54.1	196 30 19.0	Mad River	4407.0	3.644146
			157 27 59.7	337 26 32.6	Trinidad Head	8089.1	3.907902
Little River	41 01 43.306	1336.1	4 36 41.7	184 36 31.3	Dows Prairie	4591.2	3.661923
1870	124 06 31.077	726.2	10 26 33.0	190 25 47.5	Mad River	8949.7	3.951807
			129 51 09.9	309 49 32.4	Trinidad Head	4518.3	3.654977
Underwood Creek	40 57 59.785	1844.1	166 31 41.1	346 30 35.2	Trinidad Head	10067.1	4.002905
1870	124 07 19.182	448.5	189 15 24.7	9 15 56.3	Little River	6986.2	3.844241
			198 02 35.2	18 02 56.4	Dows Prairie	2438.8	3.387176
Worth	40 49 07.130	219.9	306 34 59.5	126 35 59.4	Eureka Meth. Ch.	2673.8	3.427122
1870	124 11 18.914	443.3	351 49 52.8	171 50 03.0	Humboldt Bay N. B.	2573.8	3.410568
			12 13 22.2	192 12 07.5	Curlew	2492.6	3.396654
			23 01 57.3	203 01 41.1	Peninsula	1489.7	3.173096
			26 21 33.3	206 20 47.2	Sandhill (R.)	3729.2	3.571616
Fay's mill	40 47 26.604	820.6	237 29 09	57 29 33	Humboldt Bay, N. B.	1029.5	3.012611
1870	124 11 40.345	945.9	310 34 01	130 34 19	Humboldt Bay, M. B.	874.2	2.941610
			349 42 16	169 42 22	Bucksport (69)	1353.6	3.131477
Worth's house, chimney	40 48 59.581	1837.8	224 43 23	44 43 44	Sand Bluff	1079.4	3.033175
1870	124 11 02.144	50.2	0 40 46	180 40 45	Humboldt Bay, N. B.	2314.9	3.364538
			40 36 57	220 36 30	Peninsula	1499.2	3.175851
Duff's mill, stack,	40 48 19.007	586.3	32 25 42	212 25 03	Humboldt Bay, M. B.	2588.6	3.413058
1870	124 10 12.822	300.6	48 04 27	228 03 54	Humboldt Bay, N. B.	1591.1	3.201688
			65 22 51	245 21 52	Curlew	2284.1	3.358721
			93 03 20	273 02 20	Peninsula	2135.1	3.329421
Jones's mill, stack	40 48 45.076	1390.4	40 11 17	220 10 33	Humboldt Bay, N. B.	2444.2	3.388131
1870	124 09 56.038	1313.4	74 42 51	254 41 40	Peninsula	2618.1	3.417982
			146 58 03	326 57 41	Sand Bluff	1448.5	3.160910
Cousin's mill, stack	40 48 39.466	1217.3	38 22 41	218 22 04	Humboldt Bay, N. B.	2161.1	3.334674
1870	124 10 06.083	142.6	77 16 21	257 15 17	Peninsula	2347.7	3.370638
			158 13 34	338 13 19	Sand Bluff	1494.0	3.174344
Little River Beach	41 00 39.224	1210.1	4 24 59.2	184 24 53.5	Dows Prairie	2607.3	3.416183
1870	124 06 38.279	894.5	145 53 07.6	325 51 34.8	Trinidad Head	5884.8	3.769733
			184 51 53.9	4 51 58.6	Little River	1984.0	3.297532
Little River Rock	41 02 08.729	269.3	303 39 45.5	123 40 18.6	Little River	1414.7	3.150656
1870	124 07 21.479	501.7	339 54 59.7	159 55 28.1	Little River Beach	2939.7	3.468310
			351 25 01.9	171 25 24.5	Dows Prairie	5421.2	3.734098
			132 38 44.7	312 37 40.3	Trinidad Head	3115.6	3.493541

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Shelton	41 03 32.600	1005.7	330 17 45.3	150 18 26.8	Little River Rock	2978.5	3.473996
1870	124 08 24.663	575.9	335 04 08.3	155 05 18.2	Little River Beach	5897.4	3.770663
			343 57 08.8	163 58 12.9	Dows Prairie	8269.7	3.917491
			59 42 19.7	239 41 56.8	Trinidad Head	945.3	2.975574
Timber Ridge	41 04 09.672	298.4	339 39 44.3	159 39 56.2	Shelton	1219.6	3.086226
1870	124 08 42.815	999.6	343 23 54.7	163 25 10.7	Dows Prairie	9486.3	3.977099
			13 36 32.6	193 36 21.6	Trinidad Head	1667.3	3.222016
Off Trinidad Rock	41 03 35.448	1093.5	233 13 01.7	53 13 41.4	Timber Ridge	1763.4	3.246342
1870	124 09 43.307	1011.2	298 57 46.8	118 58 15.5	Trinidad Head	1166.1	3.066752
			321 29 47.3	141 31 48.8	Little River Beach	6944.9	3.841668
North Trinidad	41 04 29.403	907.1	316 31 16.9	136 31 33.1	Timber Ridge	838.8	2.923650
1870	124 09 07.536	175.9	355 15 23.9	175 15 29.0	Trinidad Head	2236.8	3.349634
			26 38 59.5	206 38 36.0	Off Trinidad Rock	1862.2	3.270024
Scottys Point	41 06 06.250	191.2	345 32 11.5	165 32 33.2	North Trinidad	3085.3	3.489300
1870	124 09 40.545	946.1	349 37 02.7	169 37 29.6	Trinidad Head	5303.5	3.724564
			0 47 39.1	180 47 37.3	Off Trinidad Rock	4652.4	3.667681
Cone Rock	41 06 33.176	1023.5	292 58 40.7	112 59 35.8	Scottys Point	2127.0	3.327773
1870	124 11 04.462	104.0	324 26 06.2	144 27 23.0	North Trinidad	4693.1	3.671465
			334 15 32.3	154 16 54.3	Trinidad Head	6712.9	3.826913
			340 55 55.0	160 56 48.3	Off Trinidad Rock	5800.6	3.763474
Trinidad Head L. H.	41 03 08.571	264.4	306 39 27	126 41 06	Little River	4404.2	3.643865
1873	124 09 02.315	54.1	323 50 42	143 52 16	Little River Beach	5705.0	3.756252
			350 29 21	170 30 15	Mad River	11591.0	4.064120
			130 54 05	310 53 38	Off Trinidad Rock	1266.4	3.102563
Patricks Point South	41 07 48.600	1499.4	356 11 46.0	176 11 51.9	Scottys Point	3164.3	3.500279
1870	124 09 49.541	1155.5	358 55 55.5	178 55 59.6	Off Trinidad Rock	7810.7	3.892688
			36 55 15.0	216 54 25.8	Cone Rock	2910.1	3.463909
Inner Turtle Rock	41 07 54.448	1679.8	276 31 26.2	96 32 10.6	Patricks Pt. South	1586.3	3.200388
1870	124 10 57.108	1332.0	331 50 19.8	151 51 10.1	Scottys Point	3785.6	3.578138
			347 49 41.8	167 50 30.3	Off Trinidad Rock	8173.2	3.912393
Auxiliary Dow	40 59 09.774	301.4	159 47 37.8	339 46 18.9	Trinidad Head	8131.8	3.910184
1870	124 06 59.340	1387.2	174 38 53.5	354 38 39.1	Little River Rock	5544.6	3.743870
			190 06 44.5	10 06 58.5	Little River Beach	2802.9	3.447607
			241 15 59.2	61 16 07.5	Dows Prairie	332.5	2.521758
			12 07 44.1	192 07 31.1	Underwood Creek	2208.3	3.344056
Pilot Rock	41 02 37.702	1163.2	208 39 40	28 40 07	Shelton	1930.0	3.285566
1870	124 09 04.305	101.0	295 06 14	115 07 55	Little River	3953.0	3.596930
			316 57 33	136 59 09	Little River Beach	4999.6	3.698932
			332 48 31	152 50 02	Dows Prairie	7030.6	3.846992
Trinidad, flagstaff	41 03 32.122	990.9	54 00 51	234 00 34	Trinidad Head	786.5	2.895702
1870	124 08 32.362	755.6	93 33 02	273 32 16	Off Trinidad Rock	1659.8	3.220047
			168 06 09	348 06 03	Timber Ridge	1183.8	3.073270
Blank Rock	41 03 19.350	596.9	304 51 49	124 53 49	Little River	5180.9	3.714405
1870	124 09 33.044	771.7	320 24 39	140 26 34	Little River Beach	6408.3	3.806742
			332 44 13	152 46 03	Dows Prairie	8480.1	3.928400
Smith's Chute	41 03 20.610	635.9	336 21 26	156 22 27	Little River Beach	5434.2	3.735138
1870	124 08 11.542	269.5	345 21 41	165 22 36	Dows Prairie	7831.9	3.893866
			84 33 30	264 32 58	Trinidad Head	1127.7	3.052186
			102 04 00	282 03 00	Off Trinidad Rock	2191.1	3.340672
Mad River Tree	40 57 47.675	1470.5	26 01 56	206 01 35	Mad River	1706.0	3.231977
1870	124 07 08.418	196.9	146 01 44	326 01 37	Underwood Creek	450.4	2.653630
			184 47 25	4 47 32	Auxiliary Dow	2541.4	3.405080
In Line	40 55 25.569	788.7	192 57 47.0	12 58 36.4	Mad River	2925.2	3.466157
	124 08 08.484	198.5	324 32 25.0	144 32 41.2	Canal	996.4	2.998448
			12 57 29.8	192 57 26.1	Ocean	597.0	2.775973
Mad River Bluff	40 56 23.628	728.8	19 47 12.5	199 46 48.6	Ocean	2521.6	3.401670
1870	124 07 37.726	882.5	21 53 33.7	201 53 13.6	In line	1930.1	3.285581
			176 35 11.3	356 35 40.6	Mad River	1061.6	3.025947
Island	40 49 38.732	1194.8	334 08 52.7	154 09 16.2	East Point	1933.7	3.286381
1870	124 09 19.069	446.8	14 27 24.4	194 27 05.8	EurekaMethodistCh	2652.6	3.423669
			75 05 59.8	255 05 13.6	Sand Bluff	1713.5	3.233887
			95 04 29.1	275 03 54.2	West Point	1255.1	3.098670
			176 12 15.6	356 12 10.3	Wheeler	2841.1	3.453485
			230 05 16.3	50 08 01.0	Arcata Church	7692.0	3.886037

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
Carson's mill	40 48 24.422	753.3	140 56 27	320 55 45	Sand Bluff	2384.5	3.377402
1870	124 09 25.613	600.3	183 49 39	3 49 43	Island	2297.3	3.361226
			241 00 52	61 01 19	East Point	1139.3	3.056621
Arcata wharf	40 50 44.960	1386.9	41 20 34	221 19 01	East Point	5038.1	3.702263
1870	124 06 21.104	494.4	63 54 46	243 52 50	Island	4643.1	3.666810
			100 19 08	280 17 01	Wheeler	4428.2	3.646228
Windmill	40 53 02.230	68.8	57 56 07	237 54 59	John Brown	2850.2	3.454872
1870	124 07 15.213	356.2	90 29 57	270 29 13	Mosquito Point	1573.0	3.196729
			151 18 19	331 17 48	Laguna	2218.5	3.346054
Barn window	40 53 29.059	896.4	132 37 03	312 36 29	Laguna	1651.8	3.217970
1870	124 07 08.788	205.7	163 31 18	343 31 04	Onsley	1088.9	3.227614
			163 36 01	343 35 38	Canal	2900.4	3.462460
Shebang	40 54 33.479	1032.7	47 39 23	227 39 12	Onsley	548.1	2.738822
1870	124 07 12.023	281.4	125 05 39	305 04 58	Ocean	1780.5	3.250537
			136 48 57	316 48 36	Canal	1088.5	3.036828
Skeleton Stump	40 54 54.410	1678.3	3 31 00	183 30 58	Onsley	1015.2	3.006543
1870	124 07 26.597	622.4	108 48 37	288 48 06	Ocean	1176.9	3.070745
			110 24 00	290 23 48	Canal	429.1	2.632526
Signal House	40 50 29.902	922.3	327 57 36	147 58 04	Island	1862.0	3.269983
1870	124 10 01.224	28.7	331 06 31	151 07 22	East Point	3790.2	3.578658
			10 08 09	190 08 02	West Point	1490.8	3.173420
Vance's mill, stack *	40 48 21.84	673.7	67 54 38	247 53 27	Curlew	2762.4	3.44129
1870	124 09 52.21	1223.8	90 34 52	270 33 39	Peninsula	2615.4	3.41753
House door	40 48 03.363	103.7	135 59 00	315 58 27	East Point	1671.0	3.222983
1870	124 07 53.556	1255.5	145 44 29	325 43 33	Island	3559.7	3.551411
			235 58 43	55 58 59	Slough	692.4	2.840352
Red house, N. gable *	40 47 20.20	623.1	152 53 13	332 52 49	Slough	1931.1	3.28581
1870	124 06 51.52	1207.9	206 34 48	26 35 06	Slough Fork	1446.8	3.16039
Dead tree	40 46 59.836	1845.6	121 11 42	301 09 16	East Point	6106.9	3.785820
1870	124 05 00.212	5.0	123 56 06	303 54 28	Slough	4205.7	3.623835
			141 04 09	321 01 15	Wheeler	9948.4	3.997752
Ferndale *	40 34 29.80	919.2	125 23 38	305 21 19	Centerville South	6158.4	3.78947
1869	124 16 20.45	481.0	141 19 45	321 17 48	Centerville	6757.3	3.82977
Topographic Tree *	40 39 30.142	929.8	128 17 13	308 16 40	Eel River Beach	1521.4	3.182233
1869	124 16 55.514	1304.1	166 01 06	346 00 50	Nelson	2313.1	3.364189
Union House, S. chimney *	40 38 14.18	437.4	112 26 04	292 22 23	Eel River Beach	8620.6	3.93554
1869	124 12 07.11	167.1	122 03 18	301 59 55	Nelson	8650.7	3.93705
Red chimney *	40 40 07.15	220.6	88 00 27	267 57 50	Eel River Beach	5660.3	3.75284
1869	124 13 45.52	1069.2	102 24 34	282 22 15	Nelson	5140.9	3.71104
McNulty's barn, S. gable *	40 40 45.88	1415.2	67 46 00	247 44 25	Eel River Beach	3681.2	3.56599
1869	124 15 21.28	499.8	88 06 57	268 05 40	Nelson	2773.4	3.44301
Guthrie's house, W. gable *	40 33 05.95	183.4	2 33 51	182 33 47	Oil Creek	3554.6	3.55079
1869	124 21 12.72	299.3	15 33 26	195 33 03	Oil Creek West	3109.4	3.49267
Guthrie's tree	40 33 11.07	341.5	354 28 07	174 28 17	Oil Creek	3726.1	3.57126
1869	124 21 34.74	817.4	5 43 07	185 42 58	Oil Creek West	3169.0	3.50092
Mussel Rock *	40 31 22.84	704.5	265 16 48	85 17 50	Oil Creek West	2251.8	3.35253
1869	124 23 23.49	552.9	334 38 40	154 39 00	False Cape	1643.1	3.21567
Fort Humboldt, flagstaff *	40 46 37.53	1157.7	32 57 36	212 56 33	Red Bluff Lat. Sta.	4166.8	3.61980
1869	124 11 20.12	471.8	128 02 05	308 01 20	Sandhill (R.)	2066.2	3.31518
Centerville City *	40 34 28.52	879.7	200 42 56	20 43 34	Centerville South	3854.1	3.58592
1869	124 20 51.98	1222.6	211 39 50	31 40 55	Russ Cut Off	4438.7	3.64726
Red Bluff	40 44 44.64	1377.0	340 10 52	160 11 26	Sisson	3604.0	3.55679
1854	124 12 57.31	1344.6					
Martin	40 45 33.06	1019.8	14 40 08	194 39 32	Sisson	5048.5	3.70316
1854	124 11 10.78	252.8	59 08 51	239 07 41	Red Bluff	2911.2	3.46407

* No check on this position.

Shelter Cove to Trinidad Head—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
	° ′ ″	*m*	° ′ ″	° ′ ″		*meters*	
North Base	40 46 29.010	894.9	302 14 36	122 15 52	Martin	3234.3	3.509784
1854	124 13 07.407	173.7	355 47 30	175 47 37	Red Bluff	3228.1	3.508951
Bucksport	40 46 42.89	1323.0	344 34 11	164 34 28	Martin	2234.6	3.34920
1854	124 11 36.13	847.2	78 42 01	258 41 01	North Base	2182.8	3.33902
			176 29 03	356 29 00	Curlew	2017.0	3.30470
Sandhill	40 47 18.82	580.6	231 14 30	51 15 01	Curlew	1445.1	3.15991
1854	124 12 29.47	691.0	311 32 37	131 33 12	Bucksport	1671.4	3.22307
			30 04 07	210 03 42	North Base	1775.5	3.24931
South Base	40 45 29.81	919.5	185 39 07	5 39 12	North Base	1835.3	3.26371
1854	124 13 15.11	354.4	268 01 07	88 02 28	Martin	2918.1	3.46510
			343 18 37	163 18 47	Red Bluff	1454.4	3.16268
Road	40 47 33.73	1040.5	40 01 32	220 00 55	Bucksport	2047.9	3.31130
1854	124 10 39.96	936.9	107 10 02	287 09 22	Curlew	1507.5	3.17827
Indian Island*	40 48 53.23	1642.0	22 59 58	202 59 29	Road	2664.2	3.42556
1854	124 09 55.56	1302.2	51 01 43	231 00 34	Curlew	3191.5	3.50399
Point*	40 49 15.18	468.3	358 53 32	178 53 34	Road	3129.9	3.49553
1854	124 10 42.54	996.9	27 12 17	207 11 39	Curlew	3018.3	3.47976
Bother	40 48 19.27	594.4	322 30 04	142 30 34	Road	1770.1	3.24801
1854	124 11 25.92	607.5	20 42 48	200 42 38	Curlew	1025.9	3.01112
Paddle*	40 48 00.12	3.7	293 37 29	113 37 53	Curlew	921.4	2.96443
1854	124 12 17.41	408.1	12 31 14	192 31 06	Sandhill	1305.0	3.11562
Hammon	40 46 41.68	1285.7	174 36 56	354 36 53	Sandhill	1150.6	3.06094
1854	124 12 24.87	583.2	268 08 22	88 08 54	Bucksport	1143.5	3.05825
Fort Humboldt*	40 46 38.32	1182.1	33 04 41	213 03 37	Red Bluff	4184.4	3.62163
1854	124 11 19.97	468.3	83 30 37	263 29 27	North Base	2535.8	3.40411
Meridian Mark	40 46 09.57	295.2	294 22 09	114 23 18	Martin	2729.0	3.43601
1854	124 12 56.74	1330.8	0 16 52	180 16 52	Red Bluff	2619.9	3.41828
Elk*	40 45 41.99	1295.2	80 06 21	260 05 21	South Base	2185.3	3.33951
1854	124 11 43.33	1016.3	126 20 58	306 20 03	North Base	2447.8	3.38878
South Spit	40 45 05.95	183.4	200 48 57	20 49 05	South Base	787.4	2.89618
1854	124 13 27.04	634.4	313 17 26	133 17 45	Red Bluff	958.3	2.98151
Rudder*	40 44 24.58	758.2	219 50 52	39 51 39	South Base	2621.2	3.41850
1854	124 14 26.71	626.7	253 32 51	73 33 49	Red Bluff	2187.3	3.33991
A*	40 43 32.05	988.6	162 53 33	342 53 14	Red Bluff	2342.7	3.36971
1854	124 12 27.94	655.7	205 52 01	25 52 51	Martin	4148.2	3.61786

*No check on this position.

Latitudes, Longitudes, Azimuths, and Lengths Corrected for the 1906 Earthquake.

The following table gives the resulting values of the coordinates after corrections for the 1906 earthquake have been applied. These corrections have been computed in accordance with the method described on pages 182–4. In those cases where the corrections have appreciably exceeded the probable errors of the quantities under consideration, the corrected values are tabulated below. These corrected values are to supersede the corresponding quantities in the main body of the tables of positions. Corrections to the latitudes and longitudes have been applied to hundredths of seconds and the results are given to hundredths. All azimuth corrections of ten seconds or more have been applied and the results are given to seconds. All length corrections as large as one part in 5 000 have been applied and the results are given to tenths of meters.

In combining inferred displacements with those actually observed, some contradictions have arisen. For example, lines lying entirely on one side of the fault were turned in azimuth in a counter clockwise direction, at the time of the 1906 earthquake, according to the assumed laws of displacement. It will be found on examination that clockwise corrections have been applied to such lines in cases where the observed displacement of one end of the line did not conform closely with the assumed laws of displacement as applied to the other end.

Positions corrected for earthquake movements.

Station	Latitude and longitude	Azimuth	Back azimuth	To station	Distance
	° ′ ″	° ′ ″	° ′ ″		*meters.*
Cement	37 46 59.4 122 30 23.9				
Pillar Point	37 29 54.87 122 29 52.28				
Point Lobos 3	37 47 13.78 122 30 05.97	44 49 01	224 48 50	Cement	
Cemetery	37 46 57.27 122 29 56.82	95 44 34	275 44 17	Cement	
Under Cement	37 47 04.18 122 30 27.51	240 39 58	60 40 11	Point Lobos 3	
Sand	37 46 45.50 122 30 21.59	239 04 57	59 05 12	Cemetery	
Point Bonita fog-siren	37 48 58.82 122 31 40.62				
Bonita Bluff	37 49 17.42 122 31 32.74				
Bonita Bluff 2	37 49 23.52 122 31 25.94				
Ocean House flagstaff	37 44 21.79 122 30 20.38	186 51 29 243 14 55 253 49 40	6 51 43 63 16 15 73 51 06	Cemetery Black Ridge Black Ridge 2	
Sutro's stable red spire	37 46 38.00 122 30 28.73	190 03 31 217 03 54 232 43 17	10 03 34 37 03 58 52 43 36	Cement Sand Cemetery	
Sutro's Observatory tower	37 46 41.61 122 30 40.49	216 23 34 245 40 44 255 27 30	36 23 44 65 41 11 75 27 42	Cement Cemetery Sand	
Tetlow's southeast chimney	37 46 41.26 122 30 39.72	214 34 12	34 34 22	Cement	
Santa Cruz Point	36 57 05.57 122 01 32.71				
St. Johns Hill	36 58 38.08 122 05 31.45				
Balcraft 1	36 57 18.37 122 05 30.11				
Parsons	36 57 48.28 122 07 05.73				
Rice	36 58 49.51 122 06 48.50				
Lagoon	36 58 36.82 122 09 07.02				
Butler	36 59 30.79 122 08 22.81				

Positions corrected for earthquake movements—Continued.

Station	Latitude and longitude	Azimuth	Back azimuth	To station	Distance
	° ′ ″	° ′ ″	° ′ ″		*meters.*
Glassell	36 59 58.17 122 10 56.32				
Redwood	37 02 07.47 122 09 58.56				
Point	37 01 31.67 122 13 19.88				
Manzanita	37 02 44.24 122 12 25.34				
Cook	37 03 49.01 122 14 22.32				
Pine	37 05 30.74 122 13 07.04				
Tranta	37 05 47.06 122 16 03.82				
Steele	37 08 13.07 122 16 54.31				
Point Ano Nuevo	37 06 52.10 122 19 47.81				
Johnston	37 26 20.03 122 26 27.05				
Halfmoon Bay	37 29 19.42 122 25 53.54				
Gushee	37 09 47.92 122 18 50.30				
Middle Point	37 09 00.76 122 21 34.61				
Cutts No. 2	36 58 07.50 122 07 59.66				
Topog No. 2	37 00 52.68 122 12 18.21				
Topog No. 3	37 02 00.23 122 13 35.62				
Topog No. 1	36 59 20.67 122 10 05.26				
Purcell's flagstaff	37 24 15.82 122 25 07.98				
Topog No. 5	37 04 21.75 122 15 23.25				
Topog No. 7	37 08 25.70 122 20 32.50				
Topog No. 4	37 03 21.86 122 14 31.93				
Mount Tamalpais Latitude Station	37 55 27.53 122 35 45.45				
Walalla	38 51 24.70 123 29 50.30				
Point Reyes Head	37 59 48.31 123 00 50.81	196 05 48 234 20 58	16 08 19 54 26 23	Tomales Bay Point Reyes Hill	
Redwood	38 24 12.02 123 01 16.31	18 56 16	198 54 43	Bodega Head	11168.3
Bodega Hill	38 22 13.33 123 03 21.63	219 43 13 4 47 50	39 44 31 184 47 36	Redwood Bodega Head	6929.2

Positions corrected for earthquake movements—Continued.

Station	Latitude and longitude	Azimuth	Back azimuth	To station	Distance
	° ′ ″	° ′ ″	° ′ ″		*meters.*
Adams	38 59 38.87	28 47 19	208 44 51	High Bluff	
	123 37 57.89	45 33 43	225 30 09	Arena	
		65 06 13	245 02 10	Point Arena L. H.	
		108 10 54	288 08 38	Lane	
Sand	38 57 21.32	87 34 49	267 34 01	Point Arena L. H.	
	123 43 07.48				
Point Arena Southeast Base	38 56 42.05	204 25 58	24 27 23	Lane	7876.8
	123 43 50.99	220 51 46	40 52 13	Sand	
Knox	38 53 38.42				
	123 38 25.87				
Anderson Tree	38 51 26.76				
	123 36 55.90				
Marr	38 54 18.83	9 36 01	189 35 59	High Bluff	465.6
	123 41 50.14	132 34 35	312 34 17	Sinclair	949.2
Point Arena Longitude Station	38 54 36.22	49 03 13	229 02 57	Marr	
	123 41 24.48	94 35 35	274 35 00	Sinclair	
Iversen Point	38 50 47.29	245 14 40	65 15 49	Anderson Tree	
	123 38 45.39				
Havens Neck	38 48 32.57				
	123 36 04.16				
Triplet Hill	38 49 32.71	10 19 31	190 19 22	Havens Neck	
	123 35 50.15				
Rocky Peak	38 49 20.98	47 18 59	227 18 17	Havens Neck	
	123 34 57.08	105 46 19	285 45 45	Triplet Hill	
Sandstone	38 44 33.16				
	123 30 47.38				
Robinson Point	38 46 24.86				
	123 32 20.10				
Rutherford Tree	38 45 00.66	53 53 39	233 53 09	Sandstone	
	123 29 59.25				
Knipp	38 43 20.43				
	123 28 25.60				
Stengel	38 42 04.71				
	123 26 41.32				
Helmke Ridge	38 36 59.32	338 39 10	158 40 06	Salt Point	
	123 21 26.89	46 52 41	226 52 15	Horseshoe Point	
Rocky Point	38 37 49.23			Horseshoe Point	3015.7
	123 23 18.93				
Harbeck	38 38 35.88	337 09 26	157 10 09	Horseshoe Point	4277.9
	123 23 18.12	0 46 40	180 46 39	Rocky Point	
Bihler Point	38 40 45.79				
	123 25 52.77				
Stewart Point	38 39 18.37				
	123 24 30.54				
Lark	38 42 37.54	348 43 14	168 43 32	Bihler Point	
	123 26 21.20	25 39 21	205 39 08	Stengel	
		113 45 56	293 44 38	Knipp	
Ross Tree	38 40 59.15	71 45 53	251 45 21	Bihler Point	
	123 25 01.07				
Sandy Point	38 38 41.93	280 55 42	100 56 07	Harbeck	
	123 23 58.14			Horseshoe Point	4895.0
Fisk Tree	38 39 42.00	2 08 40	182 08 38	Sandy Point	
	123 23 55.27	49 29 41	229 29 19	Stewart Point	

Positions corrected for earthquake movements—Continued.

Station	Latitude and longitude	Azimuth	Back azimuth	To station	Distance
	° ′ ″	° ′ ″	° ′ ″		*meters.*
Bourns Landing	38 47 05.94 123 33 38.48				
Island	38 45 05.53 123 31 40.34	273 30 53	93 31 56	Rutherford Tree	
False Ford	38 45 10.88 123 31 31.98	277 59 59	98 00 57	Rutherford Tree	
Walalla Tree	38 46 37.14 123 31 53.34	59 36 34	239 36 17	Robinson Point	
Knipp & Stengel's ranch chimney	38 43 03.60 123 27 02.67	104 32 26	284 31 34	Knipp	
Peter Tree	38 43 52.90 123 27 47.38	42 41 34	222 41 10	Knipp	
Junction	38 52 54.46 123 40 41.09	197 28 49 197 56 09 247 24 19	17 30 31 17 57 54 67 25 43	Adams Clark Knox	
Morse	38 50 31.29 123 36 12.17				
Saunders Hill	38 51 45.39 123 39 01.20				
Black	39 00 54.87 123 40 26.05	8 01 37 69 30 59	188 01 17 249 30 16	Shoemake Lane	5491.6
Spur Mountain		20 24 36 64 55 45	200 23 27 244 53 01	Dixon Henry Hill	
Russian River	38 27 52.02 123 08 41.15	205 56 10	25 57 07	Ross Mountain	
Benitz	38 30 00.37 123 10 51.41	188 04 16 263 22 52	8 04 46 83 25 11	Spur Mountain Ross Mountain	
Dry Creek	38 28 31.88 123 09 39.19	227 18 41	47 20 14	Ross Mountain	
Fox	38 49 55.42 123 37 27.61	286 35 04	106 36 05	Triplet Hill	
Sail Rock	38 49 52.93 123 38 03.06	246 08 12 187 51 24	66 09 22 7 52 08	Morse Tomales Bay	
Richards	38 04 03.13 122 57 58.95	260 52 39	80 56 20	Point Reyes Hill	
Steele	38 02 11.46 122 53 59.11	210 45 35	30 46 48	Point Reyes Hill	
Number 1	38 01 41.36 122 52 29.86	186 58 27	6 58 45	Point Reyes Hill	
Point Reyes East	37 59 26.80 122 57 54.16	220 57 08	41 00 46	Point Reyes Hill	
Number 2	38 01 08.40 122 50 48.56	165 25 46	345 25 01	Point Reyes Hill	
Estero	38 02 11.84 122 56 37.20	234 20 46	54 23 36	Point Reyes Hill	
Ocean Beach	38 19 57.32 123 03 54.32	190 42 51 297 15 07	10 43 12 117 17 30	Bodega Hill Bodega	4268.0 6302.6
Bay Beach	38 18 49.64 123 02 42.61	171 25 25 281 42 43	351 25 01 101 44 21	Bodega Hill Bodega	6351.2 3943.0
Bodega Latitude Station	38 18 29.92 123 03 15.71	178 48 15 232 53 17 272 21 12	358 48 11 52 53 38 92 23 11	Bodega Hill Bay Beach Bodega	6889.9 4668.9
Bodega Rock	38 17 47.21 123 02 52.01	174 59 28 186 45 29 254 37 01	354 59 09 6 45 35 74 38 45	Bodega Hill Bay Beach Bodega	8236.8 1918.6 4241.0

Positions corrected for earthquake movements—Continued.

Station.	Latitude and longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″		*meters.*
Lagoon	38 18 42.05	83 26 09	263 24 43	Bodega Head	3412.3
	123 01 25.96	285 50 30	105 51 21	Bodega	
Rocky Point	38 23 39.54	170 10 06	350 09 10	Ross Mountain	
	123 05 40.78	343 40 27	163 41 38	Bodega Head	9964.3
Pigott's (Dr.) house, southwest gable	38 19 23.48	37 08 56	217 08 36	Bay Beach	1308.8
	123 02 10.09	54 15 50	234 14 51	Bodega Head	2855.3
		112 24 33	292 23 28	Ocean Beach	2738.4
Cheney's house, flagstaff	38 19 02.89	28 26 18	208 26 03	Bodega Head	
	123 03 22.49	180 12 02	0 12 03	Bodega Hill	5871.9
		284 02 40	104 04 44	Bodega	4978.4
		292 51 12	112 51 37	Bay Beach	1051.1
Preston's house, stovepipe	38 12 46.21	19 54 33	199 54 02	Tomales Bay	3628.2
	122 55 56.09	89 49 02	269 47 37	Tomales Point	3368.9
Lone house, south gable	38 12 28.07	34 12 00	214 11 11	Tomales Bay	3447.9
	122 55 27.22	97 40 45	277 39 01	Tomales Point	4108.0
Frost's house, east chimney	38 54 14.37	136 39 59	316 39 40	Sinclair	1071.9
	123 41 48.62	220 47 30	40 47 45	Pt. Arena Longitude Station	
Point Arena Methodist Church, south gable	38 54 44.61	27 14 44	207 14 33	Marr	
	123 41 33.15	82 08 17	262 07 48	Sinclair	
Shepherd's chimney	38 56 58.68	73 52 59	253 52 13	Pt. Arena, S. E. Base	
	123 42 38.02				
Round	39 01 45.15	31 47 43	211 47 07	Lane	
	123 40 39.52				
Cuffey Cove	39 08 30.95	1 13 15	181 13 03	Point Arena L. H.	
	123 44 05.57				
Peak	39 04 23.70	8 32 08	188 31 40	Lane	
	123 40 51.50				
Red Bluff	39 04 50.58	292 55 45	112 56 36	Peak	
	123 42 13.00				
Elk Creek	39 06 33.17				
	123 42 45.10				
Greenwood	39 07 29.40	36 23 19	216 22 45	Elk Creek	
	123 41 51.92				
Cavanagh	39 09 13.72	33 04 12	213 03 50	Cuffey Cove	
	123 43 29.81				
Mal Paso 2	39 02 19.72	191 37 42	11 38 02	Peak	
	123 41 24.23				
Stewart	39 03 19.09	358 32 27	178 32 29	Round	
	123 40 42.59	14 06 26	194 05 53	Lane	
		28 40 54	208 40 28	Mal Paso 2	
Herrick	39 05 54.82	8 29 03	188 28 55	Red Bluff	
	123 42 00.71				
Monroe	39 01 42.87	5 37 04	185 36 46	Shoemake	6951.2
	123 40 29.62	37 00 32	216 59 50	Lane	
Welch	39 04 15.57				
	123 41 58.47				
House chimney, near big barn	39 04 13.92	10 47 37	190 46 34	Sand	12951.9
	123 41 26.73	13 59 55	193 58 25	Pt. Arena, S E. Base	

Descriptions of Stations.

This list may be conveniently consulted by reference to the illustrations at the end of this publication and to the index.

All directions in the descriptions given in the form of azimuths are reckoned continuously from south around by west to 360°, west being 90°, north 180°, and east

270°. The azimuths are true; where magnetic bearings are given they are indicated as such.

In general, the surface and underground marks are not in contact, so that a disturbance of the surface mark will not usually affect the underground mark. The underground mark should be resorted to only when there is evidence that the surface mark has been disturbed.

Any person who finds that one of the stations here described has been disturbed, or that the description no longer fits the facts, is requested to send such information to "Superintendent, Coast and Geodetic Survey, Washington, D. C."

GENERAL NOTES IN REGARD TO STATION MARKS.

NOTE 1.—The station was marked by a copper tack in the center of a redwood block buried 3 feet below the surface of the ground. Over this was placed a stub projecting 1 foot above the ground. Four stubs were driven, each 6 feet from the center, and usually to the north, south, east, and west, and the lines joining them diagonally intersect at the center.

NOTE 2.—The station was marked by a pine stub 3 feet long with its top even with the surface of the ground. The reference marks were four stubs, placed each 6 feet from the center, and usually to the north, south, east, and west of it. Usually there was a nail, covered with a cartridge shell, in the center stub, and a nail in each of the four reference stubs.

NOTE 3.—The station was marked by a stub in the top of which was a nail with a cartridge placed over it. Four witness stubs, each with a nail in top, were placed 6 feet from the center, to the north, south, east, and west.

NOTE 4.—The station was marked by a stone with a drill hole one-half to 1½ inches deep, buried 3 feet below the surface of the ground, and the three theodolite stubs were left. In many cases a mound of earth was made over the station, making the underground mark about 6 feet below the top of the mound.

NOTE 5.—The station was marked by a nail in a large stub, and by four similar stubs, each 6 feet from the center. Diagonal lines connecting these stubs intersect at the center at approximately right angles.

NOTE 6.—The station was marked by a stub 3 feet long, the top level with the surface of the ground, and by four stubs, each 6 feet from the center, and to the north, south, east, and west of it.

NOTE 7.—The station was marked by a stub, usually of redwood, and 3 feet long, with its top even with the surface of the ground.

NOTE 8.—The station was marked by a drill hole three-fourths inch in diameter and 3 inches deep, in a stone buried 3 feet underground; over this stone was placed a redwood stub projecting about 1½ feet above the ground, and having a copper nail in its top. The reference marks were four stubs, each with a nail in its top, placed 6 feet from the center and projecting 1¾ feet above ground.

NOTE 9.—The station was marked by a one-half-inch drill hole in a stone buried 2 feet underground. The reference marks were drill holes in three stones placed even with the surface of the ground, 6 feet from the center in the directions given.

NOTE 10.—The station was marked by three stubs, each having a copper nail in its top, 6 feet from the center of the station, two placed in line with the station, and the third at right angles to that line.

NOTE 11.—The station was marked by a section of 5-inch earthenware pipe filled with coal cinders, its top level with the surface of the ground.

NOTE 12.—The station was marked by a bottle buried 3 or more feet deep, and by three stubs each with a copper nail in its top, driven in the ground even with the surface, and 6 feet from the center.

NOTE 13.—The station was marked by a stone buried 3 feet or less below the surface of the ground, and having in its top a lead bolt marked with cross lines. Three stones similarly marked were placed at or near the surface of the ground, 6 feet from the center, usually two in line with the center and the third at right angles to that line.

NOTE 14.—The station was marked by a bottle set neck up, 2½ feet below the surface of the ground. Over it was driven a stub 2 feet long, top level with the surface, and usually having a tack in its top to mark the exact center.

NOTE 15.—The station was marked by a section of 2½-inch iron gas pipe, 2 feet long, set so that from 2 to 5 inches of its top projects above the surface of the ground.

NOTE 16.—The station was marked by a bottle buried about 2 feet below the surface of the ground, and by a surface mark consisting of a one-half-inch drill hole in the upper face of an irregular shaped stone.

NOTE 17.—The station was marked by a copper tack in the top of a redwood stub, 3 inches square and 2½ feet long, placed in the ground with its top level with the surface, and by three other stubs, two in line with the station, the third at right angles to that line, and each 3 feet from the center.

NOTE 18.—The station was marked by a cross on a lead plug in a stone buried from 2 to 4 feet below the surface of the ground. The reference marks were copper tacks in the tops of three stubs, each 6 feet from the center, two in line with it, and the third at right angles to that line.

NOTE 19.—The station was marked by a large nail driven into the center of a piece of 3 by 4 inch scantling, 1 foot long, with its top about 2 feet below the surface of the ground. The reference marks consist of copper tacks driven in four stakes, which are each 6 feet from the center. Lines drawn diagonally between these tacks intersect at the center of the station at approximately right angles.

PRIMARIES AND SECONDARIES, 1906–7.

Sierra Morena (San Mateo County, Cal., G. D., 1883; 1907).—On the range of mountains extending northwest and southeast along the San Francisco peninsula, about 50 meters from the county road following along the ridge from Kings Mountain House, which is about 12 miles by good road from Redwood City. Station is on land belonging to the Virginia Mill Company, about 2½ miles south from Kings Mountain House, and on the highest knoll in the vicinity, near where the road forks, one road going to the south, and the other circling the hill to the north and west. The top of the hill was covered with growth of trees 20 feet or more high, all of which were cut, except five large redwood trees standing about 75 feet southwest of the station. These were left standing as a landmark for the peak in all directions. The station was marked

by a copper bolt in a stone 2 feet below the surface. Over this was built a hexagonal pier, 26 inches in diameter, 4 feet above the ground, in the top of which a copper bolt one-half inch in diameter marks the station. In 1907 an observatory 8 feet by 10 feet was left standing over the station.

Loma Prieta (Santa Clara and Santa Cruz counties, Cal., R. D. C., 1851–52; 1906).—On Mount Bache, the highest peak of the range of mountains forming the boundary line between the counties of Santa Clara and Santa Cruz. It is S. 27° W., and distant 15½ miles from San Jose, and N. 30° E., 14 miles from the village of Santa Cruz. Mount Bache (Loma Prieta) is the highest mountain within a circuit of 50 miles; the peak itself, being some 300 or 400 feet above the surrounding ridges, presents a bold and remarkable appearance, and can easily be distinguished at first glance from the valleys of San Jose and Santa Cruz. The mountain is steep and covered on all sides with chaparral. A good mountain road runs from Wrights station on the Southern Pacific Railroad 10 miles to the base of the last rise, thence by trail up north end of the ridge to the station. The home of Doctor Jones is about 1 mile northwest of the station. The subsurface mark is a brown stone with copper bolt in the center. A rock with a drill hole filled with lead, having a cross, was lowered 24⅜ inches and placed above and three-eighths inch west of the copper bolt in brown stone. A concrete foundation 3½ feet square and 9 inches deep was laid around the rock and on it was built a hexagonal pier, 30 inches in diameter at the base, and 26 inches at the top. In 1906 this pier was enlarged about 3 inches at the base, extending up about 1 foot. An 8 by ½-inch copper bolt in top of the pier marks the station.

Mount Toro (Monterey County, Cal., G. D., 1885; 1906).—On the smooth, untimbered range of mountains bordering the Salinas Valley on the west; on the smooth, grassy hill about 500 yards south of A. B. Parson's house, and on his land. It is easily reached from Salinas City and is in full view of the town. The station is marked by a copper bolt set in a flat-topped rock 2 feet beneath the surface of the ground, and by a cross in copper bolt in top of pier built of concrete and topped with brick and cement. Two other piers are standing northwest of the station.

Gavilan (Monterey County, Cal., R. D. C., 1851–52; 1906).—About 1 mile northwest of Fremont Peak, at the northwest foot of a small summit that rises 20 feet above it and cuts off the view to the southeast. About 4 miles to the southward of the Mission of San Juan, and on the crest of the mountain separating the Pajaro Valley from the broad valley of the Salinas. The crest, composed of a line of sharp, rocky peaks, 2 800 to 3 000 feet above the sea, forms a conspicuous object and can be seen and recognized for many miles to the northward, and from Monterey to the southward. The station is on the western extremity of the crest, on a small platform of level land, just where the land commences to fall rapidly. Approach is from the Salinas plains by following the road to the Stokes ranch, thence along one of the ridges leading to the summit. Or from the north, by starting from San Juan and following up the canada (White's) for about 3½ miles, then turning to the right and ascending one of the spurs of the summit till the crest is reached, then along the south side of the crest to the station. The station is marked by a stone block 2½ feet in the ground, with a leaden bolt one-third inch in diameter, and cross lines. For reference three other blocks, similarly marked, are placed flush with the ground, two in line and the other at right

angles, each 6 feet from the station. Also three rocks projecting above the surface and firmly bedded, each with a drill hole filled with lead and bearing as follows: S. 59° W., 8.45 feet; N. 16° 40′ E., 5.77 feet; S. 63° 40′ E., 3.17 feet.

The surface mark is a stone with a drill hole in it.

Santa Cruz (Santa Cruz County, Cal., R. D. C., 1851–1854; 1906).—On the heights back of the village of Santa Cruz, on a round, smooth hill about 170 yards southwest of Gordon's limekiln, on ground claimed by Medear. The station bears N. 69° 30′ W., 2 miles from the embarcadero, and S. 74° W., one-half mile from the Mission Church. (Note 13, p. 297.)

Pajaro Mouth 2 (Monterey County, Cal., C. H. S., 1906).—On the southern end of the ridge of sand hills on the north side of the mouth of the Pajaro River. The station is marked by four drain tiles, 3 feet long and 4 inches in diameter. The center one is filled with concrete and has a small iron rod centered in it to mark the point. The other tiles were placed two in line with the station along the ridge, and the third at right angles, all 6 feet from the station.

Point Pinos Latitude Station (Monterey County, Cal., G. D., 1851; 1906).—On the northeasterly part of Point Pinos, 680 meters east of the light-house and 200 meters from the shore. The center of a rocky knoll, with pine tree standing on the western edge, bears N. 15° E. by compass, distant 153 feet from the center of the station, and is in range with and south of another rocky knoll and a large broken rock on the beach, the first large rock east of Luces Point triangulation station. From the center of the station another rocky knoll bears N. 73° W. by compass, distant 104 feet. This knoll is in the direction of and in range with the whistling buoy off Point Pinos and White Rock stations. There are three pine trees northwest of the knoll and one south of it within a short distance. The station was marked by a stone block, the top of which was even with the surface and had in it a drill hole filled with lead. West of the station 6.5 feet, east 6 feet, and south 8 feet are bottles buried with necks even with the ground. Eighteen feet southwest and 18 feet southeast are stones with holes drilled in top. The center stone and each of these reference marks were covered with a pile of stones; 18.8 feet northeast was a hole drilled in a large rock. A copper nail in a double pine tree was 75.7 feet S. 55° W. of the station.

Santa Cruz Magnetic Station (Santa Cruz County, Cal., C. H. S., 1906–7).—On Point Santa Cruz, in the light-house grounds, between the old light-house foundation and the present light-house, and 84.9 meters from the latter. The station is marked by a block of marble 6 inches square, with the letters U. S. C. & G. S. cut in its top surface.

Mount Tamalpais (Marin County, Cal., G. D., 1859–60; 1909).—On a bold ridge running east and west, about 10 miles north of the Golden Gate, on the top of the western and highest of three peaks. The center of the station was marked by a stone bottle set in concrete, with the neck 20 inches below the surface of the ground. Over this was built a stone and concrete pier, about 36 inches in diameter at the base and 26 inches at the surface. Here there was placed an irregular-shaped stone, the top even with the ground, with a copper bolt to mark the center of the station. Upon this was built a hexagonal pier with the same diameter to a height of 24 inches from the ground, where a stone bottle was placed and the pier continued 29 inches higher. In the top was put a

two-third-inch copper bolt, with a hole marking the center of the station. The reference marks were three stones, with drill hole in the top, on the surface of the ground, each 6 feet from the center; one along the ridge to the east, one to the south, and the other to the west. In a rock 18 feet 9¼ inches distant from the center was a mass of lead. There were three other concrete piers, one bearing N. 76° 47′ W. (true), distant 18.36 feet; one N. 79° 48′ W. (true), distant 23.20 feet; and one N. 5° 54′ E. (true), distant 41.12 feet from the center.

Red Hill (Alameda County, Cal., R. D. C., 1851; 1907).—About 3 miles a little south of east of the town of Alvarado, on what are known as the Coyote or Red Hills, a range 3¼ miles long, remarkable and readily distinguished by their isolated position, being nearly surrounded by marsh and separated from the main Contra Costa range by 7 or 8 miles of level land. The station is not on the highest part of the hill, but on a spur or shoulder running off to the southwest from the high rocky peak at the north end of the range and is about 500 meters from it. The station is on the old Briggs ranch, and is best reached from Alvarado, by way of the Brown and Sweazey dairy in the hills and up the swale to the northwest of the cow barn to the saddle, from which the station can be seen about 300 meters to the northwest. The station was marked as follows: A surface stone with lead in the drill hole to mark the station was put in place, top level with the surface. Concrete was then filled in a hole around the stone (but not touching it) 5 feet square and 10 inches deep. The stone was then covered with a wooden box and over the station center was built a cement pier 21 inches square by 45 inches high; embedded in the top of the pier was a stone block 6 by 8 by 15 inches, top level with the top of the pier and with hole filled with lead to mark the station. The top of the pier bears the letters C. & G. S., 1907. Three cement blocks 5 by 5 by 6 inches on which to mount the theodolite were placed on the pier. There are two reference marks 6 feet from the center and flush with the ground. They are stones with drill holes. Two rocks projecting above the surface were marked by drill holes filled with lead; one is in azimuth 38°, distant 7.9 feet; the other 71° 30′, distant 7.8 feet. Azimuth to a tall redwood tree on San Jose plain is 30°, to Guano Island, called "Little Coyote," 98° 45′, to Union Island 232°. An observatory 8 by 10 feet was left standing in 1907.

Rocky Mound (Contra Costa and Alameda counties, Cal., R. D. C., 1851–1854; 1906).—About 6 miles northward from Oakland, a few degrees west of the high peak of the Contra Costa ridge, directly north of the principal street of Oakland. The hill slopes slightly to the westward and on the summit are a few dark clumps of small laurel trees and a quantity of loose rock. About 1,000 meters northwest of Rocky Mound is another and lower hill, the only summit in the vicinity which at all resembles the hill on which the station is located. The station is not on the highest part of the hill but on the westward slope, 59.3 feet, S. 86° W. from the top of the highest rock on the hill and almost exactly in line from the rock to Table Mountain Peak. The station was marked by a lead plug in a stone block buried 1¼ feet below the surface of the ground and resting on solid rock. Two holes were drilled in the rocks and filled with lead, as follows: 13.7 feet from the station, N. 86° 30′ W., and 15.3 feet, N. 7° 45′ W.

Sonoma Mountain (Sonoma County, Cal., R. D. C., 1851–1854; 1907).—Upon a prominent hill about 6 miles due north from the town of Petaluma, on a knoll immediately south of Trundle's house. The station was marked by a stone 6 inches long,

buried 1 foot 4 inches below the surface, in the top of which was a leaden plug with a small hole in the center. Over this earth was filled in and another stone, 1.1 feet long, was placed just below the surface and with lead plug and cross in top. Four other similar stones were placed to the northwest, northeast, southeast, and southwest, and exactly 6 feet from the center, each marked by a plug and cross. The distances between the stones were 8.84 feet, 8.25 feet, 8.95 feet, and 7.85 feet, beginning with the distance from the northwest to the northeast stone. In 1859 the southeast stone was found to be only 5 feet 11 inches from the center; the southwest stone was not found.

Point Reyes Hill (Marin County, Cal., G. A. F., 1855; 1906).—On the summit of the highest hill to the northward of the road leading from the head of Tomales Bay to the Point Reyes ranch and easily distinguished after passing about 1 mile over that road. This hill from its height and steepness is inaccessible to loaded vehicles, but may be conveniently ascended with pack animals on several of the ridges leading from the Point Reyes road on the southwest side. Between this hill and a hill of nearly the same height toward Bolinas is a ridge covered with pines. The station was marked by a flat stone 15 inches below the ground, the top of which was marked by a five-eighth-inch drill hole and the letters U. S. C. S. Three stones similarly marked were placed each 6 feet from the center, one a little to the eastward of the line to the east peak of Table Mountain, another exactly in line with this to the northwest, and the third toward the east point of Point Reyes. A hole was drilled into a rock projecting a foot above the ground, to the northwest, distant 15.58 feet, and bearing 19° 10½′ west of the line to Tomales, and a large spike was driven in a rock bearing N. 69° W., at a distance of either 14 feet 9 inches, or 14.9 feet from the center.

Tomales Bay (Sonoma County, Cal., G. A. F., 1855; 1906).—Upon the highest hill of Tomales Point, immediately opposite the embarcadero; on the highest point of the Pierce ranch, and about one-half mile south of the ranch house. The station was marked by a stone, in the top of which was a leaden plug with a small hole in its center. Reference marks are three large stones set with tops 2 inches above the surface, holes drilled in them being at the following azimuths and distances: 180° 21′, 25.07 feet; 00° 00′, 24.75 feet; 89° 43′, 24.94 feet.

Ross Mountain (Sonoma County, Cal., R. D. C., 1855; 1906).—On the mountain locally known as Pole Mountain, on land belonging to Baker and sons. It may best be reached from Duncans Mills on the railroad by a good wagon road for about 10 miles to the station. A good camping place with fine spring of water is about one-fourth mile southeast and about 250 feet below the station. The station is marked by a copper bolt in the top of a concrete pier, 42 inches high and 24 inches square. The reference marks are three stones, each with a one-half-inch drill hole in the top, placed level with the surface of the ground, and 6 feet from the station, one nearly in line to Tomales Bay, one toward Mount Helena and the third toward Walalla. A charred oak stump with a wrought-iron nail in the top was 20 feet 4 inches N. 54° 01′ W. (true), from the station.

Bodega (Sonoma County, Cal., G. A. F., 1855; 1860).—On the highest point of the ridge just north of the Estero Americano and on the Gale ranch, one-fourth mile from the estero. To reach the station, follow the Bodega post road to the highest point on the last ridge, within a mile of the embarcadero, then turn to the eastward and follow the ridge. The underground mark is a rock with a hole in it, buried 2 feet. The

surface mark is a large irregular shaped rock with hole 5½ inches deep, top being 2 inches above the surface. One reference mark was in line to the point of Tomales, another to the south tangent of Bodega Head, and the third toward Sonoma Mountain triangulation station. A large cairn of rock is built over and around the station.

Black Mountain (Santa Clara County, Cal., R. D. C., 1852; 1906.)—On the northwestern part of the level summit of the most easterly and prominent spur of the Redwood range, easily distinguished by its superior height; on rocky ground just within the line of chaparral. The station was marked as in note 13, p. 297.

Pise Hill 2 (San Mateo County, Cal., C. H. S., 1906).—On the range of hills that lies between the lake (Crystal) of the Spring Valley Water Company and the coast; about 2½ miles south of where the Halfmoon Bay road, between San Mateo and Halfmoon Bay, crosses the ridge; on the east side of the road leading along this ridge to Kings Mountain House, about 100 feet from the road and about 400 meters north of where the road enters the redwood timber; about 200 meters north of the ranch house on the McFarland ranch. The hills are bare of trees and in grain north of the redwoods. The underground mark is a bottle, mouth up, 2½ feet below the surface; over the bottle is 1 foot of dirt and a large stone set flush with the surface, with drill hole and triangle to mark the station. A concrete pier 21 inches square and 45 inches high and resting on a foundation 5 feet square and 10 inches thick was built over this stone, which was protected from the pier by having a box placed over it. The top of the pier was marked C. & G. S., 1907, and an iron bolt one-half inch in diameter and 12 inches long marks the station. For reference marks drill holes were made in three fixed rocks at the following azimuths and distances: 292° 29′, 30.60 feet; 12° 58′, 136.76 feet; 66° 33′, 100.25 feet.

Ridge 2 Eccentric (San Mateo County, Cal., C. H. S., 1906).—On the range of bare hills between Crystal Lake, of the Spring Valley Water Company, and the coast; about 1½ miles north of the Halfmoon Bay road where it crosses the summit and about 75 feet east of the road which runs from Halfmoon Bay road along the ridge to the Carl ranch, and about 400 meters south of the Carl ranch house. The land on the west side of the Carl ranch road is cultivated, but on the east side belongs to the Spring Valley Water Company and is covered with a growth of low bushes. The land on the west side of the road and northwest of the station is considerably higher than at the station. The station was marked as follows: A bottle was buried, mouth up, 2½ feet below the surface of the ground. The center of the station is 0.115 meter due north of the center of the bottle; over the bottle was placed 1 foot of dirt, and over this a large rock weighing about 500 pounds, set with its top level with the surface of the ground. A drill hole in top of the rock is surrounded by a triangle cut in the rock, and 0.115 meter due north of the drill hole is cut a cross, which marks the center of the station. Over this rock was built a concrete pier 21 inches square and 45 inches high, resting on a concrete foundation 5 feet square and 10 inches thick. A box was placed over the surface stone to protect it from the pier. The top of the pier was marked with letters C. & G. S., 1907, and inserted in it is an iron bolt one-half inch in diameter and 12 inches long. The center of the station is 0.115 meter due north of the bolt.

San Bruno Mountain (San Mateo County, Cal., F. M., 1899; 1907).—On the highest peak of the San Bruno Mountains in an outcropping ledge, which is about 4½ feet

long northwest and southeast, 1 foot wide in the middle, and 4 inches above the surface; at a point 27 feet south of a ledge of rock that projects about 4 feet above the ground and forms the highest part of the peak. Marked by a one-half-inch drill hole 2 inches deep at the center of the station and three reference marks, consisting of one-half-inch drill holes one-half inch deep in sides of rocks facing the station, and 5.95 feet north of it, 12.40 feet east of it, and 4.82 feet west of it.

Guano Island (San Mateo County, Cal., R. D. C., 1851; 1907).—About 18 miles south of San Francisco, on the summit of a small island known as Little Coyote, in the marsh on the west side of the bay, 270 meters from the bay shore and on a large dairy ranch belonging to Frank McC. Brewer, who lives at San Mateo. The island is about 1 mile northeast from the ranch house and dairy buildings. Coyote Island is composed of very good road material, and it is only a question of time ere the whole island will have been carted away.

The center is marked as follows: A stone block is sunk 3 feet in the ground and has embedded in it a lead bolt with cross lines. Over the stone was placed 6 inches of dirt, then a bottle, set mouth up and central with the station. Over the bottle was placed 6 inches more of dirt, and then a large rock set with its top level with the surface of the ground, a drill hole in it marking the station. Over this rock was placed a concrete pier 21 inches square and 45 inches high, resting on a foundation 4 feet square and 12 inches thick. A box placed over the rock protects it from the pier. The top of the pier was marked with the letters C. & G. S., 1907, and a one-half inch iron bolt 12 inches long set in the top of the pier marks the center of the station. In 1851 three reference marks were set, each consisting of a stone block with leaden bolt and cross lines set even with the surface of the ground and each 6 feet from the center of the station.

Pulgas East Base (San Mateo County, Cal., R. D. C., 1851–52; 1907).—On the Cooley ranch and about 1½ miles west of the landing called Ravenswood; on the north side of the road going from Redwood City to Ravenswood, about 300 meters from the road, opposite the Cooley house, and plainly visible from the road, being in an open field. The station is marked by a monument of Benicia freestone, consisting of a square shaft and pedestal; the shaft is 5 feet high, its top is 1 foot 10 inches square, its base 2 feet square, and it weighs 1½ tons. The pedestal weighs three-fourths of a ton, and is 2 feet 8 inches square and 1 foot 3 inches high, including the inch bevel on top, upon which the shaft rests. The following inscriptions were cut on the shaft: On the east side, "United States Coast Survey;" on the west side, "Measured in July, 1853," and on the north side, "Alex. Dallas Bache, Superintendent."

Pulgas West Base (San Mateo County, Cal., R. D. C., 1853; 1907.—At the southern extremity of the county, on the west side of the bay, and about 30 miles distant from San Francisco; 1 mile northwest of Redwood City and just west of Wellsley Park; on a hill about 130 feet above high water; about 2½ miles south of Angelo House, 1½ miles S. 52° 30′ W. of the embarcadero of the Pulgas ranch. The station was marked by a monument similar in every way to the one at Pulgas east base.

VICINITY OF COLMA, 1907.

Black Ridge 2 (San Mateo County, Cal., F. M., 1899; 1907).—On the summit of the highest knoll of the Black Ridge range. The station was marked by a stone about 12 inches in diameter and 5 inches deep, with a three-quarter-inch drill hole marking the

center. A marble post, 5¼ inches square and 2½ feet long, marked with a drill hole and the letters U. S. C. S., was set over it.

Black Bluff (San Mateo County, Cal., R. D. C., 1852; 1907).—Four and one-half miles south of Point Lobos, on a hill 202 feet above tide, between the ocean and Laguna Merced and overlooking both, 140 meters from the coast line and 400 meters from the lake shore. The station is marked by a bottle buried 3 feet deep and surmounted by a marble post 2½ feet long, 5¾ inches square on top, marked U. S. C. S. Six feet to the southeast a glass bottle was buried and there were also two stubs set with copper nails in the top, 6 feet from the center.

Colma 2 (San Mateo County, Cal., E. S., 1907).—West of the town of Colma, on a bluff overlooking the ocean, and on the highest point of a knoll. An old line fence once crossed this knoll from east to west, and in plowing along this fence a steep bank about 7 feet high has gradually been formed. The station is about 13 feet south of this bank. It is marked by a drill hole in a triangular-shaped rock 15 inches on a side and 8 inches thick, buried with its top 18 inches below the surface of the ground.

Fog Cap 2 (San Mateo County, Cal., E. S., 1907).—In cultivated ground, on the highest point of the bluff overlooking the ocean, southwest of the town of Colma. Marked by a hole drilled in a smooth-topped rock, 10 by 12 inches and 8 inches thick. The top of the stone is even with the subsoil and the surface soil is 1 foot deep.

Road (San Mateo County, Cal., F. M., 1899; 1907).—About 1 mile back from the coast, abreast of the northern end of the Salt Lagoon, which is about 3 miles north of Point San Pedro; on a prominent knoll overlooking the ocean, around the base of which winds the road from Colma to Halfmoon Bay. The station was marked underground by a stone about 4 by 8 inches on top and 4 inches deep, having a three-fourth-inch hole drilled in it one-fourth inch deep to mark the center. Four rough stones about 5 inches in diameter were set on the surface, north, south, east, and west and 6 feet from the station, marked by very shallow depressions, three-fourth-inch in diameter, sufficiently deep, however, to be recognized. A line fence runs across the knoll about northwest and southeast. A fence post in line with the station and the first knob to the right of the highest peak of the San Bruno Mountain has three nails driven in a triangle near the top. These nails are 41.7 feet from the station.

Flat (San Mateo County, Cal., F. M., 1899; 1907).—On the northern end of the flat ridge that runs north and south between the San Bruno Mountain ridge and the Montara Mountain ridge, and about in line between the highest peaks of these two ranges; on a little rocky shoulder of the ridge where the best view could be obtained toward the north and west. It can be reached by wagon from Colma by taking the Halfmoon Bay road and following it till it turns toward the ocean abreast of the Salt Lagoon. At the turning point a lane leads straight ahead (south) toward Sneath's Jersey farm dairy, where information can be obtained as to the way up the ridge and the keys to the gates secured. The road from the farmhouse winds around on the eastern and southern sides of the ridge on which the station is located and comes out on top of the ridge about half a mile to the south of the station. Once on top of the ridge a wagon can be driven along the crest and up to within 100 yards or so of the station, where an east and west cross fence stops further progress. The station is marked by a three-fourth-inch hole

drilled about 1 inch deep in a rough stone about 15 inches square and 18 inches thick, and weighing about 200 pounds, set with its surface level with the ground.

False Cattle Hill 2 (San Mateo County, Cal., F. M., 1899; 1907).—On a small rocky hill on the coast just south of the Salt Lagoon within about one-fourth mile of the Halfmoon Bay road. The station was marked by a stone about 8 inches in diameter, buried 18 inches below the surface of the ground. A saucer-shaped depression about 5 inches in diameter is in the upper surface of the stone and in this depression is a shallow hole, marking the center of the station. The witness marks are holes drilled in solid outcropping ledges, facing the station, one three-fourth inch in diameter and 1 inch deep and 9.65 feet north of the station; another of the same dimensions 10.4 feet south of the station, and one one-half inch in diameter and three-fourths inch deep 13.55 feet southwest. The true azimuths of certain points are as follows: Montara Mountain (highest point) 164° 49′ 50″; a rock off Point San Pedro, sharpest peak (inshore) 230° 38′ 45″; the top of the largest rock off next point north of the station (nearest inshore rock) 335° 45′ 35″; the outermost peak of an arch rock, off point 4 miles north, 357° 52′ 50″.

TOMALES BAY, 1907.

Bodega Head 2 (Sonoma County, Cal., W. B. F., 1906).—On a high hill about one-half mile north of the extreme end of Bodega Head, on the highest point of the Campbell ranch, which is the ranch on the extreme point of the head, the highest point on the head being on the Grafney ranch and 400 yards northwest of the station. Marked as follows: 20 inches below the surface is the solid ledge; in it a cavity 15 inches in diameter was made, and in the center of this cavity was drilled a hole three-fourths inch in diameter and 5 inches deep, and a copper bolt three-fourths inch in diameter and 5 inches long driven in. Ten inches of dirt was placed over the bolt, and on it was placed a large irregular-shaped stone weighing about 300 pounds; in the upper surface of this rock, which was flat and even with the surface of the ground a drill hole 4 inches deep, with a triangle cut around it marks the station. For reference marks holes three-fourths inch in diameter and 4 inches deep were drilled in five large fixed rocks at the following azimuths and distances: 204° 10′, 99.00 feet; 241° 17′, 41.08 feet; 241° 57′, 128.08 feet; 309° 59′, 58.55 feet; 339° 31′, 65.87 feet. A large cairn of rocks was built over and around the station.

Smith (Marin County, Cal., G. A. F., 1855; 1906).—About 2 miles from Preston's embarcadero, and one-fourth mile north of the house occupied in 1855 by a German named Smith, on the top of a plowed hill which has on its side some large and noticeable bowlders. Station is on the old Smith ranch now owned by Andrew Gaver; it is on the road to Dillon's ranch from Tomales. The underground mark is a piece of 4-inch terra-cotta pipe placed flange down and top 18 inches below the surface of the ground. For a surface mark a piece of 4-inch terra-cotta pipe was set in black earth brought from a distance. For reference marks four 4-inch drain-tile pipes, inside each of which was a redwood stub with a nail in its top, were set at the following azimuths and distances: 179° 40′, 49.98 feet; 269° 55′, 49.98 feet; 359° 41′, 49.99 feet; 89° 48′, 49.93 feet.

Tomales Point (Marin County, Cal., G. A. F., 1856; 1906).—About 2 miles southeast of the extreme end of Tomales Point on the Pierce ranch about one-half mile north of the fence dividing the upper and lower ranches. It is on one of the rocky points (not

the highest) and on the eastern edge of the hill, about 150 yards east of the ranch road. It is marked as follows: Underground mark is a spike in the rock, above which is a stone with hole drilled in it, set with its top 18 inches below the surface of the ground. The surface mark is a large stone with drill hole to mark the station, a triangle being cut around the drill hole. Reference marks are three-fourth-inch drill holes 4 inches deep in fixed rocks at the following azimuths and distances: 211° 22′, 8.45 feet; 309° 51′, 9.67 feet; 20° 16′, 18.15 feet; 83° 23′, 13.76 feet. A large cairn of rocks 6 feet high and 8 feet in diameter was built over the station.

Preston 2 (Marin County, Cal., W. B. F., 1906).—On the east side of Tomales Bay, south of Keys Creek, about three-fourths mile southeast of Preston's store, on a rocky point or ledge about 60 feet back from the edge of the bluff, and 60 feet west of the county road, on what is known as Hamlet ranch and directly back of the railroad station, the track being at the foot of the bluff. The center is marked by a drill hole in a fast rock with a triangle cut around it. Reference marks are drill holes in fixed rocks, the first whose azimuth and distance are given below being in the top of a large bowlder 10 feet high. Azimuths and distances of reference marks are as follows: 354° 14′, 34.93 feet; 106° 51′ 18.62 feet; 158° 10′, 7.49 feet.

Mershon (Marin County, Cal., G. A. F., 1856; 1906).—On top of a hill on the east side of Tomales Bay, about three-eighths mile from the shore, on the Miller ranch, now leased by Mr. McDonald, and about one-half mile east from the ranch house. Marked by a hole drilled in the top of a large stone 18 inches below the surface of the ground, above which for a surface mark another stone with drill hole in it was set. Reference marks are two 4-inch drain tile pipes set at the following azimuths and distances: 180° 32′, 50.02 feet; and 270° 05′, 49.97 feet; and drill holes in two fixed rocks at the following azimuths and distances: 288° 48′, 23.71 feet; 78° 40′, 91.85 feet.

Foster (Marin County, Cal., G. A. F., 1857; 1906).—On the west side of Tomales Bay, about one-half mile south of Foster's landing, on a round bare knoll on the bay side of the top of a prominent hill, the sides of which are covered with a growth of low bushes, and on the south side of which are a few pine trees, the farthest northward of the Punta Reyes forest. Ninety yards north of the tallest tree on the ridge, 20 yards northeast of the station, the ridge descends abruptly to a gully; 30 yards northward it descends moderately to a gully one-fourth mile distant. Station is on Shafter ranch, about 1 mile south of the ranch house. Station is marked by an iron nail in a stub 22 inches below the surface of the ground, over which was placed a stone with a hole drilled in it and its top set 18 inches below the surface and over this for a surface mark another stone with drill hole was set. A triangle was cut around the hole in the surface mark. For reference marks 3 stones with drill holes in them were set at the following azimuths and distances: 179° 54′, 31.35 feet; 269° 32′, 32.15 feet; 0° 45′, 34.73 feet.

Reynolds 2 (Marin County, Cal., W. B. F., 1906).—On the east side of Tomales Bay, a few hundred yards north of Reynolds Landing, and about three-fourths mile south of Marshall railroad station; about 14 feet back from the edge of and on the highest point of a low perpendicular cliff rising from the shore and presenting a reddish appearance from the bay. About one-fourth mile south of the station is a Portuguese fishing hamlet, back of which on the side hill is a cemetery; station is about 160 yards west of county road. The station was marked as follows: A bottle was buried, mouth up,

20 inches below the surface; above the bottle dirt was filled in, and over this was set a 4-inch drain tile pipe, flange down, in which is a 2 by 4 inch redwood stub with nail to mark the center of the station. For reference marks two 4-inch drain tile pipes were set, flange down, one to the north, distant 24.81 feet, the other east of the station, distant 24.72 feet.

Mike 2 (Marin County, Cal., W. B. F., 1906).—On the west side of Tomales Bay, about 2½ miles north of Inverness, on the first cleared grassy point north from Cavallo Point; this bluff is quite prominent and the station is on the slope of the bluff, back from the edge, just where the grass ends and the wood begins. Marked as follows: A bottle was buried, mouth up, 2 feet below the surface; over this was placed 6 inches of dirt, then a large rock was set with drill hole in to mark the station. Reference marks are: A drill hole in a rock, distant 57.21 feet in azimuth 5° 14′, and triangles cut in two pine trees back from the station, one distant 102.0 feet, in azimuth 73° 24′ and the other in azimuth 85° 23′.

Hans (Marin County, Cal., G. A. F., 1857; 1906).—On a small knoll on the east side of Tomales Bay, about 1 mile south of Reynold's embarcadero, 150 paces from shore, and about 200 yards east of the county road. Marked as follows: A rock 15 inches square, and 6 inches thick, with a hole drilled in it was set with its top 2 feet below the surface of the ground; over this was put 6 inches of dirt, and then another rock, having drill hole to mark the station, and weighing about 175 pounds was set with top level with the surface. For reference marks three 4-inch drain tile pipes, with redwood stakes 2 by 4 inches and nails in top, were set as follows: One north, distant 25.00 feet; one east, distant 24.97 feet; and the third west, distant 24.85 feet.

Frink 2 (Marin County, Cal., W. B. F., 1906).—On the east side of Tomales Bay, about 200 yards from the shore, about one-half mile north of Millerton railroad station, on the Miller ranch and on the slope of the hill just back of the first Portuguese cabin on the county road north of Millerton. It is marked as follows: A rock 15 by 15 by 10 inches with drill hole in it was set 2½ feet below the surface; this stone was covered with dirt and another rock weighing about 125 pounds, set top level with the surface, a drill hole in its top marking the station. Reference marks were nails in the tops of redwood stubs 2 by 4 inches, and 2 feet long, in 4-inch drain tile pipes 2 feet long, set flange down at the following azimuths and distances: 180° 57′, 25.22 feet; 270° 33′, 25.43 feet; 359° 53′, 24.90 feet.

Agnew 2 (Marin County, Cal., W. B. F., 1906).—On the little cleared bluff, known as Cavallo Point, that is just north of where the county road leaves the bay shore and runs up into the hills. On top of the bluff, 30 feet back from its edge, and 15 feet south of the fence running east and west; a house occupied by Italians is at the foot of the bluff. Marked as follows: A bottle was buried, mouth up, 22 inches below the surface of the ground; 6 inches of dirt was placed above the bottle, then a large stone set with drill hole in it, marking the station. Reference marks are: Two rocks with drill holes in them set at the following azimuths and distances: 170° 43′, 23.04 feet; and 54° 42′, 34.30 feet.

Sigvart 2 (Marin County, Cal., W. B. F., 1906).—On the east side of Tomales Bay, about 200 yards from the shore, and about three-fourths mile southeast of Millerton

railroad station, almost directly across the bay from Inverness, on the first rise of the hill, and about 100 feet below and to the west of a clump of trees growing over and among the rocks of a rocky point; these trees are the only ones on the hill and show prominently from all directions. From station, Tomales Bay triangulation station and southeast gable of large cow barn at Millerton are almost exactly in line. The station is about 300 yards east of the county road. Marked as follows: A large rock 15 by 18 by 12 inches with hole drilled in it was buried with top 18 inches below the surface; dirt was filled in, and another rock weighing about 200 pounds was set, its top projecting about 8 inches above the surface of the ground, and having a drill hole 4½ inches deep surrounded by a triangle to mark the station. For reference marks holes were drilled in three fixed rocks at the following azimuths and distances, 149° 38′, 36.40 feet; 221° 21′, 66.93 feet; 262° 45′, 36.95 feet.

Willow Point 2 (Marin County, Cal., W. B. F., 1906).—On the western shore of and near the head of Tomales Bay, about 15 feet from the edge of the woods on a prominent point, about one-half mile south of Young's house, on Hamilton ranch and one-half mile north and east of the ranch house, on a narrow sand ridge surrounded by soft marsh, and 250 yards from the workman's cottage on the county road, now occupied by a man who keeps a harness and repair shop. Marked as follows: Center mark is a 4-inch drain tile pipe, 2 feet long, set in cement, flange down, and filled with cement; top of pipe is marked C. G. S. 1906, and has a nail to mark center. Reference marks are nails in redwood stubs, 2 by 4 inches, and 2 feet long, in 4-inch drain tile pipe, 2 feet long, set along the same ridge, at the following azimuths and distances: 329° 42′, 38.86 feet; 329° 42′, 65.56 feet.

Creek 2 (Marin County, Cal., W. B. F., 1906).—On the western shore of and near the head of Tomales Bay, on the Piedmont ranch owned by Mrs. Hamilton, about 50 feet from the edge of the woods, and 150 yards from the estero; 150 yards from the cottage of one of Mrs. Hamilton's laborers, living about one-half mile from the Hamilton house, in the direction of Point Reyes station on the county road between Inverness and Point Reyes station. Center mark is a 4-inch drain tile pipe, 2 feet long, set in and filled with cement, having a nail to mark the station, and marked with the letters C. G. S. 1906. For reference marks, two 4-inch drain tile pipes with redwood stubs 2 by 4 inches and 2 feet long, having nails in their tops were set as follows: One north (magnetic), distant 33.05 feet, and the other east (magnetic), distant 56.15 feet.

Hammond (Marin County, Cal., G. A. F., 1857; 1906).—On the summit of a small knoll, on the east side of Tomales Bay, on the Berdel ranch, about one-fourth mile northwest of the ranch house and some 300 yards from the county road. Marked as follows: A bottle was buried, mouth up, 2 feet below the surface of the ground; over this some dirt was placed, and then a large rock weighing about 250 pounds was set, with a drill hole in its top and a triangle cut around it to mark the center. For reference marks three large stones were set with drill holes in them, at the following azimuths and distances: 180° 28′, 29.67 feet; 359° 53′, 31.71 feet; 90° 13′, 34.78 feet.

Bodega Head (Sonoma County, Cal., G. A. F., 1855; 1906).—Station is 1.65 meters from Bodega Head 2, in azimuth 202° 11′ from it. It is marked by an iron spike driven into the solid rock. For full description see Bodega Head 2, page 305.

Teton 2 (Marin County, Cal., W. B. F., 1906).—On top of a sharp rocky hill which bears N. 48° E., and 2 miles distant from the extreme point of Tomales. This hill is

very prominent, is just above a resort called Dillons Beach, and is on Dillon's ranch. The top of the hill is not more than 8 feet across. The station is marked by a hole drilled in the solid ledge, with a triangle cut around it.

Trainor (Marin County, Cal., E. S., 1906).—On the northernmost hill or elevation of Tomales Point, on the lower Pierce ranch, and about one-half mile from the extreme northern part of Tomales Point; the hill is covered with a growth of large sagebrush. The station is marked by a drill hole in a large stone placed 6 inches below the surface of the ground. A pile of stones was placed over and around the station.

Hog Island 2 (Marin County, Cal., W. B. F., 1906).—On the east side of Hog Island in Tomales Bay, 15 feet from the edge of the bluff, which is just west of the dwelling house, on line with the north side of the house, and about 30 feet from its ridgepole. Marked as follows: A rock 10 by 15 by 10 inches with hole drilled in its top was buried 2 feet below the surface, 10 inches of dirt was then filled in, and a large irregular rock weighing about 250 pounds was set with its top level with the surface, with a drill hole to mark the station. A 4 by 4 inch redwood post, 10 inches high and 2 feet in the ground is distant 49.4 feet in azimuth 129° 40′.

VICINITY OF FORT ROSS, 1906.

Peaked Hill (Sonoma County, Cal., G. D., 1860; 1906).—About 1 mile below the mouth of Russian River, on a sharp-pointed, isolated hill, and on land belonging to the Winfield Wright estate. About one-half mile up the coast from the ranch house. It is 5 miles by road from the nearest railroad station, Duncan Mills, and one can drive to within 200 yards of it. The azimuth of a smaller hill, inland, and covered with loose rock, is 167° 30′, and of a white rock in the water, distant 500 or 600 yards, is 359°. Marked by a one-half inch drill hole in a rock sunk 1 foot below the surface. Two reference marks were in line with the station and Bodega Head, and a third at right angles to that line.

Chaparral (Sonoma County, Cal., G. D., 1860; 1906).—About 3½ miles below Fort Ross, 200 yards from the old abandoned coast road, on land belonging to Frank Fisk, and on the center of small hill south of his house. Station is now reached by ridge road, from which it can be seen. A team can be driven to within 100 yards of the station. It is marked by a one-half inch drill hole in a stone sunk 2 feet below the surface of the ground. Reference marks are drill holes in rocks, two in line with the station and Ross Mountain, and the third at right angles to that line.

Dixon (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—At the head of Timber Gulch, on the highest point of a little round-top hill, about one-fourth mile west of the ridge road. This is the only hill in the vicinity having a bare top. Land is owned by A. Schroyer, and is occupied by James Doda. The underground mark is a drill hole three-fourths inch deep in a rock sunk 3 feet below the surface of the ground. The surface mark is a stone with a drill hole. Rocks were piled around the signal pole and braces.

Fort Ross (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—About one-fourth mile north of the Fort Ross landing, on the extreme western point, within 10 meters of the edge of the perpendicular bluffs forming the shore line, and on land owned by G. W. Call. The underground mark is a drill hole three-fourths inch deep in a rock 3 feet below surface of the ground, and the surface mark is a stone with drill hole in it.

Henry Hill (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—About three-fourths mile west of Sea View Hotel, on a round-top hill covered with oak and fir timber, and about 100 yards south of the ridge road from Russian River to Salt Point; on land owned by the D. H. McEwen Lumber Company. The subsurface mark is a three-fourth-inch drill hole in a rock sunk 6 feet below the top of a mound which has been thrown up 3 feet over the station. A redwood post 1 foot in diameter and 10 feet long was set firmly over the station mark.

Table Mount 2 (Sonoma County, Cal., E. S., 1906).—Near the center of the top of the mountain locally known as Table Mount. Marked by a drill hole in a flat stone set 7 inches below the surface of the ground, in a hole picked in the rock, the soil being only 4 inches deep. From the station 2 large pine or fir trees are at the following azimuths and distances: 94° 07′, 102.9 feet; 130° 52′, 63.0 feet; a stump is in azimuth 63° 22′, distant 32.3 feet, and a hole in a large rock at the foot of the second pine tree bears 122° 00′, distant 62.4 feet.

Funcke (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—A fir tree about 2 miles back of Salt Point, on the left and above the road just before reaching what is known as the prairie, and on land owned by —— Walsh. When first used this tree was cut off at an elevation of 80 feet above the ground, its branches cut off and a triangle, inside of which were the letters C.S., cut in its side 5 feet above the ground. In 1906 only a badly burned and rotted stump 27 feet high remained and this was cut off 20 feet above the ground and the center used as station. For reference marks 4 stones with drill holes were set, two being in line with Henry Hill, distant 81.3 feet, and 60.5 feet, and the other two in line with Salt Point, distant 303.3 feet, and 90.8 feet.

Lancaster 2 (Sonoma County, Cal., E. S., 1906).—On the farm of Jacob Lancaster, on the east end of a ridge of bare rocks in hay field and near fence. Marked by a stone with drill hole set even with the ground. For reference marks two stones with drill holes were set near the fence, one 1.42 meters from the station, the second stone 8.25 meters from the first, easterly along the fence, and 4.7 meters from Lancaster station of 1876–1879, which is 8.6 meters from the station of 1906. A rock beyond the fence is in azimuth 312° 32′, distant 36.66 meters from the station of 1906.

Salt Point (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—On the extreme point, north of Gerstle's cove or Salt Point landing (now abandoned) on a little mound or rise, near the edge of the bluff, on land owned by Funcke & Co. It is marked by a one-half-inch drill hole in a flat rock sunk 3 feet below the surface of the ground.

Chamisal (Sonoma County, Cal., E. S., 1906).—In the chamisal brush, 347 meters from station Funcke in azimuth 110° 08′. Marked by a bottle, the top of which is even with the subsoil. Over this was placed a stone with a drill hole. For reference marks two stones with drill holes in them were set in line with Horse Shoe Point, one on each side of Chamisal. There are no other large stones in this vicinity, and in setting the center mark the soil, which is gravel, and the subsoil, which is yellow clay, were well mixed.

Horseshoe Point (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—On the northwest extremity of the high round-topped hill near the coast line and about a mile north of Helmke, or Fisk Mill landing. Marked by a one-half-inch drill hole in a large flat rock 3 feet below the ground. Reference marks are two holes drilled in two natural rocks,

one toward the ocean being flat and of a triangular shape, the hole is 12.17 feet from the station in azimuth 48° 00′. The other rock is a bowlder projecting 2 feet above the ground; the hole is 6.85 feet from the station, in line with it and the other reference mark, the station being between the two reference marks.

Henry Tree (Sonoma County, Cal., E. S., 1906).—On Henry Hill, a fir tree 1.45 meters in circumference and about 70 feet high. A triangle cut on it about 10 feet from the ground is 9.15 meters and in azimuth 98° 08′ from Henry Hill. The tree was trimmed at the top and flag fastened to it. The tree leans toward the northwest; its top only was determined.

Timber Cove (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—On top of the highest rocky hill back of the north point of Timber Cove, about 4 feet east of the highest bowlder on the hill. From the station the east gable of Miller's barn is in range with the southeast edge of his home. Marked by drill hole one-half inch deep in the upper surface of a slab of sandstone 14 inches square, buried 1 foot below the surface of the ground and resting on a solid bowlder. The owner of the land is named Miller.

Stockhoff 2 (Sonoma County, Cal., E. S., 1906).—On the extreme outer bluff formed about halfway between Timber Cove and Salt Point landings, near the bluff and on land occupied by Stockhoff, but also claimed as a light-house reservation. The bluff is bare of soil for about 40 feet inshore. The station is marked by a drill hole in a flat rock 2 feet below the surface and by a similarly marked stone placed a few inches below the surface. At the fence line 611.3 feet distant in line to Henry Tree was placed a stone with drill hole in it. Stones were piled about the signal pole and braces.

Lancaster (Sonoma County, Cal., L. A. S., 1876–1879, 1906).—For description of location, see Lancaster 2, page 310. Marked by a drill hole one-half inch deep in a rock sunk 3 feet below the surface of the ground.

Pinnacle Rock (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—About 1 mile south of Fort Ross Landing, being the highest part of the largest rock on the Fort Ross Reef. The station is about 35 feet above high water.

Stockhoff (Sonoma County, Cal., L. A. S., 1876–1879; 1906).—Station is 3.38 meters from Stockhoff 2, approximately on the extension of the line from Timber Cove. Marked by a one-half-inch drill hole in a flat rock sunk 3 feet below the surface of the ground. (See description of Stockhoff 2, p. 311.)

VICINITY OF POINT ARENA, 1906.

Dunn (Mendocino County, Cal., B. A. C., 1878; 1906).—On a hill, best reached by the tan-bark road through Denman's fields, not on the highest part of the hill, but 10 or 15 paces from it in the direction of Point Arena Light-house. The station was marked by a black bottle, buried with the top 11 inches below the surface. Over this was placed a stone about 12 by 14 by 8 inches, with the top even with the surface, and bearing a one-half-inch drill hole three-fourths inch deep. The reference marks are drill holes in stones, two in range to Point Arena Light-house, the one nearer the light-house being rounded on top, with its smaller end in the ground and the top 4 inches above the surface, the farther one having a sharp end, with the larger end in the ground, and one at right angles and almost in the direction of Clark triangulation station, having a kind of sag on its top, in which the drill hole was made.

Clark (Mendocino County, Cal., B. A. C., 1878; 1906).—In a plowed field of the old ranch formerly occupied by Frank Adams, who lives about 3 miles from the station (1891). The station was marked by a square glass bottle 9 inches high, placed with the top of the bottle 22 inches below the surface. Over this a stone, irregular but somewhat square, 12 inches long, 8 inches wide, and 5 inches thick, was placed, a drill hole in the top being 13 inches below the surface. Above this was a stone, rounded on top, with a flat base, and about 12 inches deep, the top of the stone 3 inches above the surface. The reference marks are two 3-inch terra-cotta pipes, 26 inches long, set in the fence lines; one in the prolongation of the line from station Dunn is 185.3 feet distant and the other in prolongation of the line from the station Cold Spring is distant 182 feet. A fir tree marked by spike in triangle is 227 feet southeast of the station.

Lane (Mendocino County, Cal., L. A. S., 1870; 1906).—About one-fourth mile west of Denman's house on the county road on the most westerly point of a field formerly belonging to —— Lane, but in 1891 to L. Redermeyer; 30 feet 7 inches east from edge of bluff. The bluff is all earth, no stone being visible, and an earthquake crack is about 50 feet inshore from the station. Marked by a three-fourth-inch drill hole 3 inches deep in a stone buried 3 feet below the surface. The surface mark set in 1906 is a 3-inch terra-cotta pipe projecting 3 inches above the ground. Two reference marks, consisting of drill holes in rocks, were set, one in line to station Spur, distant 32.1 feet, and the other in line to station Dunn, distant 32¼ feet.

Arena Latitude Station (Mendocino County, Cal., L. A. S., 1870; 1906).—About one-third mile north of the northern point of the Point Arena Cove, near the edge of the bluff and north of the first small stream. The bluff has an earthquake crack about 50 feet inshore from the station. The station was marked by a brick pier, which in 1906 was found broken down to the ground and was not rebuilt. The center was preserved by a large nail driven into the top of the remains of the pier. Reference mark is a 3-inch terra-cotta pipe set in the direction of station Clark and 109.8 feet from the center.

Smith 2 (Mendocino County, Cal., E. S., 1906).—On the point of the bluff south and just above Point Arena harbor; this bluff is of rock with very shallow soil where the station is situated. The station is marked by a hole drilled in the natural rock about 1 foot below the surface of the ground; above this was placed, level with the ground, a rock with a hole drilled in it. The reference mark is a 3-inch terra-cotta pipe set in the fence line 585.5 feet distant and in line with station High Bluff.

Spur 2 (Mendocino County, Cal., E. S., 1906).—On the top of the first and highest spur north of Brush Creek, about 30 feet down the slope of the hill, in the direction of station Lane, in cultivated ground owned by Courtney Kendall and his father. The station is marked with a white glass bottle, the bottom of which is in the subsoil and whose top is 18 inches below the surface of the ground. The surface mark is a drill hole in a rounded stone projecting about 4 inches above the ground. The reference marks are drill holes in two rocks set one on each side of the center and in line with station Shoemake. The one toward Shoemake is flat and the drill hole is 5.2 feet from the center; the one on the line from Shoemake extended is a rounded one and the drill hole is 4.9 feet from the center. Close to the fence on the west side was set another stone with drill hole 79½ feet from the center in azimuth 86° 40′. (See description of Spur, p. 313.)

Shoemake 2 (Mendocino County, Cal., E. S., 1906).—On a rocky hill, the first high point off the county road just south of Manchester. The soil is only 2 or 3 inches deep. A hole was picked in the solid rock, in which was set a stone with a drilled hole to mark the center. Reference mark is a hole drilled in the natural rock 63.3 feet from the center of the station and in line with station Lane; this reference mark is about 10 feet from the fence, which is north of the station. From the station the chimney of Fairbanks house is in azimuth 178° 09′ and the bell tower of schoolhouse is in azimuth 126° 04′. (See also description of Shoemake, p. 313.)

Spur (Mendocino County, Cal., L. A. S., 1870; 1906).—On top of the first and highest spur north of Brush Creek, and 4.32 meters from Spur 2, in azimuth 108° 30′. The station is marked by a three-fourth-inch drill hole 3 inches deep in a stone buried 3 feet below the surface of the ground. For a surface mark a stone with a drill hole was set, projecting about 3 inches above the surface. (See also description of Spur 2, p. 312.)

Shoemake (Mendocino County, Cal., L. A. S., 1870; 1906).—Distant 74.18 meters from station Shoemake 2, in azimuth 304° 15′; near the county road about south from the bridge over Brush Creek, on top of the northern end of the hill back of Andrews's house; elevation about 230 feet. Magnetic bearings to various points are as follows: Andrews's house S. 144° W.; Fairbanks's house, N. 19° E.; light-house S. 120° W. The station is marked by a three-fourths-inch drill hole, 3 inches deep, in a stone buried 3 feet below the surface. Above this was placed a large stone with a drill hole to mark the center. (See also description of Shoemake 2, p. 313.)

High Bluff (Mendocino County, Cal., L. A. S., 1879; 1906).—Upon the point of the highest bluff, about 1 mile south of Point Arena Landing, 48 feet from the nearest edge of the bluff; under the top of the bluff and to the south and southwest of the station were a number of scrub pines. The station was marked by a slate stone sunk 1½ feet below the surface of the ground and filled over about 2 feet above the natural surface. In the upper face of the stone a hole one-half inch deep was drilled to mark the station, in which rests the end of a spike driven in center of the signal pole.

Sinclair (Mendocino County, Cal., E. F. D., 1891; 1906).—Situated on the mesa, on the south side of the gulch or canyon leading from the cove to Point Arena, in a small fenced field. In the direction of the light-house it is about 160 meters to the bluff on the south side of the canyon. In the direction of the Catholic Church it is about 30 meters to the eastern fence of the inclosure. In the direction of High Bluff triangulation station it is about 50 meters to the southern fence of the inclosure. The station was marked by a stone ale bottle buried about 2 feet below the surface of the ground and by 4 witness stubs, each 6 feet from the station, one in line to the light-house and one on prolongation of the same line to the southeast, and the other two at right angles, to the northeast and southwest.

SAN FRANCISCO BAY.

Ridge (San Mateo County, Cal., R. D. C., 1851–1859).—About 20 miles south of San Francisco, 4½ miles south 20° 45′ west of the Public House at San Mateo and 6 miles south 69° 30′ west of the old Angelo, Flashner or Porter House, a well-known hotel at the San Jose road; on a broad ridge forming the northern spur of the Redwood range and

which, at that point, divides the waters flowing, respectively, into the bay and the ocean. The ridge in the vicinity of the station has no remarkable peculiarity; it is comparatively level, free from trees, undergrowth, or outcroppings of rocks. A rich greensward covers the summit of the ridge for 3 or 4 miles north and south. A high round point bears N. 72° W., distant 1¼ miles and between the point and the station there is a narrow canyon about 200 feet in depth. (Note 13, p. 297.) Station was not found in 1907, and a new station, Ridge 2 Eccentric, was established. (Page 302.)

Pise Hill (San Mateo County, Cal., R. D. C., 1854).—Near San Francisco Bay, on the top of the range of redwood hills, about a quarter of a mile from the northwest terminus of the redwood forest; about one-half mile from Mr. Pise's house, on the road from the house of Pena in the valley to the northeast of the range of hills to Pise's house on top of the hill and thence to the ocean, about 200 meters from where the road on reaching the crest of the ridge turns to the south, and 24 meters west of the road. The bearings of certain points are as follows: The end of San Mateo Point, N. 6° W.; a high steep hill covered with bushes, S. 4° E.; the northeast corner of a fence (within one-fourth mile) S. 64° 30′ E.; a rocky knoll (within 300 or 400 meters) S. 42° 00′ E. (Note 12, p. 297.) Station was not found in 1907, and a new station called Pise Hill 2 established. (Page 302.)

Contra Costa (1) (Alameda County, Cal., R. D. C., 1851–52).—On the east side of San Francisco Bay, about 7 miles southeast of the village of San Antonio, 460 feet S. 30° 10′ E. from a small wharf on the creek, and about 30 feet from high water mark. The azimuth of Estredello's house is 210° 30′ and of Hick & Co.'s house, which is in line with the wharf, 167° 40′. (Note 13, p. 297.)

Point Avisadero (San Francisco County, Cal., R. D. C., 1851; 1903).—About 4½ miles south of San Francisco, on the summit of a symmetrical, round-top hill, about 169 feet high. The station was marked by a stone block, sunk 3 feet in the ground, bearing a leaden bolt, marked with cross lines and covered with coal cinders. A stone block at the surface marking Point Avisadero 2 is 6 feet distant to the south.

San Antonio Creek (Alameda County, Cal., R. D. C., 1851–52).—Within 600 yards of San Antonio, on the north side of the head of San Antonio Creek, on the first hill immediately back of the town; about 85 feet above tide, and 800 meters from the end of Lain's wharf, within 3 feet of a corner of a fence. (Note 13, p. 297.)

Yerba Buena Island (San Francisco County, Cal., R. D. C., 1851–52; 1897).—Upon the highest point of Yerba Buena Island. The station was originally marked according to note 13, page 297. It was recovered in 1881 and in 1894, but there was given no description of the recovered marks nor any new description. In 1897 the center stone was described as level with the surface and bearing a drill hole and cross lines. In 1907 the United States engineer in charge of the Twelfth Light-House District reported that one of his assistants finding the center post badly rotted had replaced it with a new post of redwood with a copper tack carefully centered over the bottle. The marking of this station is in doubt.

San Leandro Point 2 (Alameda County, Cal., A. F. R., 1894–1896).—On San Leandro Point, now usually known as Bay Farm Island, about 20 feet from the shore line on a nearly vertical bluff 6 to 8 feet in height, upon the property of Amos McCartney, about 300 meters south of his house. The nearest house is one occupied by a man named Kammer. (Note 14 p. 297.)

Sierra Point (San Mateo County, Cal., R. D. C., 1851–52; 1894).—On the west side of San Francisco Bay, on the point where the high range of San Bruno makes down to the water. The station is marked by a bottle and coal cinders.

Stony Hill (San Francisco County, Cal., R. D. C., 1851; 1903).—Marked by a bottle, neck up, 2½ feet below the surface of the ground.

South (Alameda County, Cal., R. D. C., 1851–52).—On the east side of the bay, about 1⅓ miles north of Oakland, on a slight elevation on the east side of the road leading from Oakland to the house of Vincent Peralta; 100 meters from the road and 304 meters N. 19° E. from a house on the road, occupied by Vanhooter. (Note 13, p. 297.)

North (Alameda County, Cal., R. D. C., 1851–52).—On the eastern side of the bay, about 5½ miles from Oakland, on the county road to San Paolo, on the open plain 920 meters from the bay side and 83 meters east of the road. (Note 13, p. 297.) Center stone buried 2½ feet.

Telegraph Hill 2 (San Francisco County, Cal., L. A. S., 1881; 1897).—On the summit of Telegraph Hill in San Francisco, a wall of concrete and rubble surrounds the summit and on the north side there is an entrance for carriages through the wall; on each side of the entrance is a post of the same material as the wall. The station is 56 feet from the center of the northeast post and 62 feet 3 inches from the northwest post. The station was marked by a basalt paving block 7½ by 6½ by 4 inches, set with its upper surface 2 feet below the surface of the ground, the center being marked by a hole 1 inch deep and one-half inch in diameter, into the bottom of which was forced a copper tack. A granite block 2 feet long and 6 inches square on top, was set over the stone, its top projecting 3 or 4 inches above the surface and marked U. S. C. AND G. SURVEY 1881.

Angel Island Peak (Marin County, Cal., R. D. C., 1852; 1881).—About 30 meters from the western end of the summit of Angel Island. The station was marked by a stone block buried 3 feet in the ground, in which was a lead plug marked with cross lines. Above this was a stake, 5 inches in diameter and projecting 6 inches above the surface.

Point San Jose (San Francisco County, Cal., R. D. C., 1851–52).—On the second point west of Fishermans Bay or North Beach, called on Wilkes chart, Point de San Jose; on the highest part of the bluff, 114.85 feet above high tide and about 150 meters from the water's edge. Reported lost, 1892. (Note 12, p. 297.)

Presidio Hill (San Francisco County, Cal., R. D. C., 1851–52; 1904).—Upon the highest part of the ridge about a quarter of a mile southwest of the barracks at the Presidio military post, at the edge of the woods, in a northwest direction from the gate on the south side of the grounds. The station was marked by cross lines on a lead plug in a sandstone post set 2½ feet below the surface of the ground. Over this was placed a granite block, 2 feet long, 6 inches square, projecting about 6 inches above the surface. The top was marked U. S. C. AND G. SURVEY 1881. At a distance of 60.68 feet and in azimuth 295° 47′ is another block of granite, 6 inches square on top.

Lime Point Bluff (Marin County, Cal., R. D. C., 1852; 1857).—On a high bluff nearly due north of the rock known as Lime Rock. It was reported in 1886 that the station marks were all destroyed.

Rocky Island (Contra Costa County, Cal., R. D. C., 1851–52).—On the highest part of the small island lying on the Contra Costa side of the bay, and bearing from the island

of Yerba Buena N. 10° W., and distant 5½ miles. (Note 13, p. 297.) Reported lost in 1895. (See Brooks Island, p. 321).

Angel Island Peak 2 (Marin County, Cal., L. A. S., 1881; 1903).—On the summit of Angel Island. The station was marked underground by a spike in the end of a stake 1 foot long, 5 inches in diameter, buried 2½ feet below the surface. Above this was set a granite block 2 feet long, 6 inches square, with its top projecting slightly above the surface and marked U. S. C. AND G. SURVEY, 1881. Three witness stones were set each 6 feet from the station to the north, south, and east of it.

Russian Hill (San Francisco County, Cal., L. A. S., 1881–83).—On the summit of Russian Hill, San Francisco; from the station the smokestack of the Clay Street Hill Railroad Company is in range with the right-hand corner of the chimney of the small cottage on the corner of Vallejo and Florence streets. The old tower of Point Bonita Light is about in range with the east gable of the house on top of the hill, corner of Green and Leavenworth streets and the shot tower shows about twice its diameter to the right of a cupola, surmounted by a flagpole. The station was marked by a basalt paving block 8 by 4 by 4 inches, set with its upper surface about 2½ feet below the general level of the ground with a hole 1 inch deep and one-half inch in diameter drilled in the upper surface, the center of the hole marking the center of the station. A copper tack was pounded into the bottom of the hole. A block of granite 1 foot long by 6 by 4 inches was set on end with its top level with the surface of the ground and in the upper surface a hole was drilled.

Reservoir (San Francisco County, Cal., L. A. S., 1881–1883; 1900).—On the embankment of the Spring Valley Water Company's reservoir, on the corner of Hyde and Lombard streets, San Francisco; in the middle of the embankment on the north or Lombard street side, and 33 feet from the northeast corner of the roof of the reservoir, 28 feet 9 inches from the edge of the rim of the large pipe at the northeast corner of the reservoir, 34 feet 8 inches from the outer angle of the old gutter and 6 feet 6 inches from the top of the concrete incline at the south edge of the coping of the reservoir. The station was marked by a basalt paving block 8 by 5 by 4½ inches, 2 feet below the surface, in the largest face of which a one-half-inch hole was drilled about 1 inch deep and a copper tack pounded into the bottom. The center of the hole is the center of the station.

Point Cavallo 2 (Marin County, Cal., L. A. S., 1881; 1900).—On the United States reservation about 1½ miles south of Sausalito, near the south end of a bank above a level space which had been excavated in the side of a ridge north of the fortifications. The station was marked by a stone 10 by 12 by 8 inches, set 3 feet below the surface, with a hole drilled in its upper face to mark the center. Above this was set a granite block 2 feet long and 6 inches square on top, projecting above the surface and marked U. S. C. AND G. SURVEY 1881. Three witness stubs were set to the north, south, and east of the station and 6 feet distant therefrom.

Point Lobos 2 (San Francisco County, Cal., R. D. C., 1851; 1894).—About the center of the knoll back from the bluff on the south head of the entrance to San Francisco Bay. The station was marked by a bottle buried 3 feet below the surface, over which were placed about 10 inches of sand, then a stone about 6 inches square on top and 2½ feet long, with a three-fourths-inch hole, 3 inches deep, drilled in the top of it.

Fort Point (San Francisco County, Cal., R. D. C., 1851–52; 1857).—On the high ground about 220 meters south of the old fort. Reported lost, 1892. (Note 12, p. 297).

Point Lobos (San Francisco County, Cal., R. D. C., 1851; 1886).—On the south head of the entrance to San Francisco Bay, on the top of the bluff. The station is marked by a bottle buried 3 feet below the surface, over which was placed a rough gray stone block about 6 inches square on top and 2½ feet long, with a three-fourth-inch hole, 3 inches deep, drilled in the top of it. Northwest of the station was a granite block about 6 by 8 inches on top, with the number 330 cut on it. Reported lost in 1892.

Black Ridge (San Francisco County, Cal., R. D. C., 1852; 1877).—On one of the summits of the range of hills which run parallel with the coast and form the eastern boundary of the sand or drifts, about 751.5 feet above tide and a little over 2 miles from the ocean shore. The station was marked by a stone with a hole in one side of it about one-half inch deep; over this was a bottle, neck up, and over it a marble block 2½ feet long and 5¾ inches square, the top marked with a drill hole and the letters U. S. C. S. Reported lost, 1892.

Sand Knoll (San Francisco County, Cal., R. D. C., 1851–52).—On the ocean shore, about 2 miles south of Point Lobos, on a sand hill, 226 feet above high water and 1 410 meters from shore. (Note 12, p. 297.)

Green Bluff (San Mateo County, Cal., R. D. C., 1852).—About 7 miles south of Point Lobos, on top of the bluff, 511 feet above tide and 135 meters from high-water mark. (Note 12, p. 297.)

Cattle Hill (San Mateo County, Cal., R. D. C., 1852).—About 2¼ miles northeast of the prominent rocky point called Point San Pedro or Point Piedras, on the summit of a high hill, south of the valley of the Calera and distant from the shore or outlet of the Calera 1 290 meters. (Note 12, p. 297.)

Cement (San Francisco County, Cal., B. A. C., 1877; 1900).—About 340 meters northeast of the western terminal of the Ferries and Cliff House Railroad, on the southeast extremity of Point Lobos, on a barren drift, at a point where the sandstone crops out, and about 50 yards east by south of some rough barren rocks. The station was marked by the neck of a bottle set in cement in the bottom of a hole made in the stone over which was set a granite block 6 inches square, projecting about 4 inches above the surface of the ground and bearing a drill hole filled with lead, marked with cross lines.

Lone Mountain Cross (San Francisco County, Cal., B. A. C., 1877; 1892).—A large wooden cross on the top of the sand hill called Lone Mountain, in the Catholic cemetery.

Colma (San Mateo County, Cal., F. M., 1899).—West of the town of Colma, on a bluff overlooking the ocean, in plowed ground, on a knoll and a little to the south of the highest part of it. An old line fence once crossed the knoll from east to west. In plowing along this a steep bank about 6 or 7 feet high has gradually been formed. The station is about 10 feet from the edge of the bank and south of it. The station was marked by a bottle 3 feet below the surface, over which earth was filled in and a square piece of board was put about 2 inches above the top of the bottle.

Fog Cap (San Mateo County, Cal., F. M., 1899).—Southwest of the town of Colma, on the highest point of the bluff overlooking the ocean, about 10 feet inside of the edge of the bluff, and placed so near it to be as far as possible out of the way of the market gardeners who cultivate all the surrounding land. In the course of a few years the

bluff will probably be washed away and the station will be lost. The station was marked by a bottle set 3 feet below the surface, over which earth was filled to the depth of about 2 inches and a square piece of board was put over it.

Pillar Point (San Mateo County, Cal., R. D. C., 1854; 1863).—On land belonging to Mr. Dennison, on top of the hill which is at the extremity of Point Miramontes, between 5 and 6 miles north of, and across Halfmoon Bay from Johnston station. Center marked by the intersection of two lines upon a flat pebble stone buried 2 feet in the ground. Reference marks are copper tacks in the top of three stubs, two in line with the station and the third at right angles to this line, and each 6 feet from the station.

Point Cavallo (Marin County, Cal., R. D. C., 1851–52).—About 1¼ miles to the southward of Sausalito, on the summit of a hill, about 124 feet above the tide, forming the eastern point of Horseshoe Bay, about midway of the summit and 30 feet from the edge of the bluff. Reported lost, 1892. (Note 13, p. 297.)

Angel Island Northwest (Marin County, Cal., R. D. C., 1851–52).—On the northwest extremity of Angel Island, nearly at the end of the ridge. Reported lost in 1895. (See Angel Island Northwest, 2, p. 322.)

Sausalito Point (Marin County, Cal., R. D. C., 1851–52).—On the western side of the entrance to Richardson Bay, about 650 meters north of Sausalito, 91½ feet above tide, and about 100 feet from the shore. (Note 12, p. 297.)

Peninsula Hill (Marin County, Cal., R. D. C., 1851–52).—On the summit of the hill opposite Sausalito, which forms the northern point of the west entrance to Raccoon Strait and which is connected with the mainland by a narrow beach and strip of marsh. (Note 12, p. 297.)

Strawberry Hill (Marin County, Cal., R. D. C., 1851–52).—On the summit of the sharp point which makes down from the northward and divides Richardson Bay into two parts. (Note 12, p. 297.)

Point Bonita (Marin County, Cal., R. D. C., 1851–52).—On the highest part of the point (282 feet above high-water mark), being the northern headland of the entrance to San Francisco Bay, on the top of the bluff on the ocean side 430 meters from the extreme end of the point, 140 meters from the bay, and 50 meters from the ocean. The station was reported lost in 1892. (Note 12, p. 297.)

Lafayette Park (San Francisco County, Cal., L. A. S., 1881; 1896).—In Lafayette Park, just north of the intersection of Clay and Octavia streets. The latitude pier was 5.1 feet east of the station and the "Davidson Equatorial" was mounted upon a pier 37.60 feet south and 16.83 feet east of the station.

Heights (San Francisco County, Cal., J. J. G., 1896; 1897).—At Pacific Heights on the northeast quarter of the block bounded by Pacific avenue, Broadway, Baker, and Lyons streets, 7 paces back from the bluff bordering Broadway, 8 paces east of a board fence, and 30 feet from a corner of the fence, in line with the northeast corner of the fence and with the southwest corner of the school building in the next block east. The station was marked 16 inches below the surface by a stone 12 by 12 by 4 inches, with a copper bolt set in the center and projecting 2 inches above the surface of the stone.

East Diablo (Marin County, Cal., A. F. R., 1887).—On the first point east of Point Diablo and 380 meters distant from it, near the bluff which is rock bound and falls abruptly to the water. (Note 11, p. 297.)

New Lime Point (Marin County, Cal., A. F. R., 1887).—Near the top of the steep slope leading from Lime Point fog-station to the battery on Lime Point, about 480 feet above tide. It was reported probably lost by the United States engineers in 1900. (Note 11, p. 297.)

West Diablo (Marin County, Cal., A. F. R., 1887; 1892).—Upon the round point 350 meters west of Point Diablo, about 160 feet above the water. The ground falls rapidly to the southward and terminates in a rock-bound bluff. (Note 11, p. 297.)

Diablo Hill (Marin County, Cal., A. F. R., 1887).—On the most prominent elevation, 980 meters northwest from Point Diablo, about 400 meters from the nearest point of the beach. (Note 11, p. 297.)

Rob (San Francisco County, Cal., G. D., 1877).—Lost. (See Rob 3.)

Rob 2 (San Francisco County, Cal., A. F. R., 1887).—Lost. (See Rob 3.)

Rob 3 (San Francisco County, Cal., A. F. R., 1892; 1900).—Upon an artificial bench, graded level, within 50 meters of the Presidio reservation road. The location is known to the United States Army officers at the Presidio. (Note 15, p. 297.)

Spring Valley (San Francisco County, Cal., A. F. R., 1892).—Upon the bluff about 40 feet above tide and 75 meters southwest of the outlet of Mountain Lake at the western end of Baker Beach, 120 feet west of a small one-story house belonging to the Spring Valley Water Company. A line from the station parallel to the rear of the house, passes through the center of the rear porch and crosses the board fence west of the house and at a point 35.31 meters from the station. (Note 15, p. 297.)

Point Lobos 3 (San Francisco County, Cal., A. F. R., 1892).—Upon the beach 80 feet below and 312 meters northwest from Point Lobos 2 and about 200 meters west from the site of Point Lobos 1. The station was marked according to note 15, page 297, and in addition by a stone block. Recovered in 1900.

Cemetery (San Francisco County, Cal., A. F. R., 1892; 1897).—Upon the southern verge of the higher portion of Point Lobos, slightly lower in elevation and 371 meters from Point Lobos 2. Reported in 1900 as probably lost. (Note 15, p. 297.)

Under Cement (San Francisco County, Cal., A. F. R., 1892).—Upon a comparatively level beach, on the northern slope of Point Lobos, about 150 feet below and 170 meters northwest of Cement. Recovered in 1900. (Note 15, p. 297.)

Highland (Alameda County, Cal., L. A. S., 1881).—On the summit of a hill, called by the residents of the neighborhood "Ceritos" (not, however, the hill so named by the Coast and Geodetic Survey), near the railroad station of the same name, just north of West Berkeley. The station was marked by a stone, 1½ feet below the surface, with a hole picked in it. The reference marks were three stones, north, south, and east of the station, and 6 feet distant, the north and east stones having holes in them, the south stone none.

High Hill (Contra Costa County, Cal., R. D. C., 1851–52; 1897).—On the summit of the range of hills on the eastern side of San Francisco Bay. The station was marked according to note 13, page 297, and in 1897 a surface mark was added, consisting of an irregular-shaped rock, the top even with the ground, with a half-inch hole drilled in its upper face to mark center.

Point San Quentin (Marin County, Cal., R. D. C., 1851–52; 1899).—On the summit of Point San Quentin 700 meters N. 29° 30′ E. from the state prison. The station

was marked by a stone block, bearing a leaden bolt with cross lines, buried 3 feet; above it and about 2 feet below the surface was placed a sandstone block about 5 inches square on top, with a half-inch hole drilled in its upper face to mark the center. The following measures were made for reference: To the highest rock cropping out of the summit of the knoll, 42.3 feet; to a rocky ledge in line to Marin Island East and San Pedro Point stations, 27.2 feet; to a drill hole in a rock in line to California City Point, 43.2 feet.

Mound (Contra Costa County, Cal., L. A. S., 1881).—On a slight mound to the west of San Pablo road and about 1¼ miles south of San Pablo, on land owned by a man named Boyd, whose house is just at the foot of the mound, to the east. The station was marked underground by half a brick with a hole one-fourth inch in diameter drilled in it. Azimuths of certain points are as follows: Boyd's windmill, 15° 12′; the nearest corner of a square spire in San Pablo, 151° 51′; flagstaff, San Pablo, 161° 09′; north gable of Boyd's barn, 308° 19′.

Topog (Contra Costa County, Cal., L. A. S., 1881).—On a small hill on the western side of San Pablo road, on the northwest side of and in a corner close to a ledge of rocks that crop out on the summit. The station was marked by a stone with a hole in it, set about 1 foot below the surface of the ground.

El Cerrito (Contra Costa County, Cal., L. A. S., 1881).—On a hill of the same name, on the north side and about 12 feet from a fence running east and west across the hill. To aid in the recovery of this station, three of the fence posts are notched; the one nearest the station has two notches in it, on one corner about 1 foot from the ground, the other two posts have one notch each. The station was marked by a stone with a hole in it, buried about 1½ feet below the surface.

Red Rock=Molate Island (Contra Costa County, Cal., R. D. C., 1851; 1900).—On top of Molate Island, about 2 miles southwest of the entrance to San Pablo Bay. The station was marked by a bottle, with neck broken off buried 3 feet deep; above it was placed an irregular-shaped sandstone rock, the top even with the surface of the ground, with a half-inch hole drilled in the upper face to mark the center.

California Point (Marin County, Cal., R. D. C., 1851–52).—On the west side of the bay, 3 miles north of Raccoon Strait, on a low point (65 feet above tide) which extends from the shore and is connected with the mainland by a marsh only; on the northern part of the rather flat top. (Note 12, p. 297.) Reported lost in 1897. (See California Point 2, p. 320.)

Corte Madera (Marin County, Cal., R. D. C., 1851–52).—About 1 000 meters south of the entrance to Corte Madera Creek, in the bight between Point San Quentin and California Point, on the shore in the edge of the marsh. (Note 12, p. 297.)

Point Richmond 2 (Contra Costa County, Cal., E. F. D., 1897).—On the outer knob of the point, which is connected with the main point by a narrow ridge of rock, about 40 feet above tide. (Note 16, p. 297.)

California Point 2 (Marin County, Cal., E. F. D., 1897; 1900).—For location, see California Point, p. 320. The station was marked with a brick, with a hole drilled in its upper end, buried about 3 feet below the surface and above it a 2 by 3 inch pine scantling extending about a foot above the surface, sawed off square on top, with a wire nail driven into it to mark the center.

Bluff Point 2 (Marin County, Cal., E. F. D., 1897; 1903).—About two-thirds mile north of Raccoon Strait, on the first ridge south of Lynde & Hough's fishery, about 180 or 200 feet above tide. The northwest tangent of Molate Point is in range with the southeast extremity of Red Rock and the summit of the knoll on the northeast end of Yerba Buena Island is in range with the summit of the northeast point of Angel Island. (Note 16, p. 297.)

Brooks Island (Contra Costa County, Cal., A. F. R., 1895; 1897).—On the island formerly called Rocky Island, marked underground by a bottle as in note 14, page 297 and on the surface by a 4 by 4 inch redwood stub, projecting 3 inches above the ground, with a nail in the top. Reported in 1905 as lost.

Marin Island East (Marin County, Cal., E. F. D., 1897; 1899).—On the summit of the larger of the two small islands lying on the western side of the channel, about halfway between Point San Quentin and Point San Pedro; about 75 feet above tide. (Note 16, p. 297.)

Molate Point 2 (Contra Costa County, Cal., E. F. D., 1897).—The present station is located on the first knoll of Molate Point, about 120 feet above tide. The station was marked by an irregularly shaped rock about 2 feet long and 8 by 5 inches on top, buried with the top even with the surface of the ground and having a half-inch hole drilled in its upper face to mark the center of the station.

San Pablo Ridge (Contra Costa County, Cal., E. F. D., 1897).—On the eastern side of a prominent knoll of the ridge running up from Point San Pablo to High Hill station about three-fourths mile from the point, about 340 feet above tide. (Note 16. p. 297.)

Point San Pablo 2 (Contra Costa County, Cal., E. F. D., 1897).—About 100 feet above tide, on a flat bench of the ridge which makes back from Point San Pablo at the head of San Francisco Bay. Marked by a copper bolt in a large flat-top rock 2½ feet underground, and on the surface by a drill hole in the flat top of another rock. Recovered in 1899.

Point San Pedro (Marin County, Cal., R. D. C., 1851–52; 1886).—On the conical hill which forms the northern head of the entrance to San Pablo Bay, 44.7 feet N. 39° W. of the rock on the summit. The top of the hill is inclosed by a barbed wire fence. (Note 13, p. 297.) Over the center was placed in 1887 a sandstone block 8 inches square and 27 inches long, projecting above the ground, dressed square on top and bearing the letters U. S. C. & G. S. and a drill hole.

Quarry (Marin County, Cal., A. F. R., 1895; 1897).—On the summit of Quarry Point, on the eastern shore of Angel Island. (Note 14, p. 297.)

Judson Point (Alameda County, Cal., A. F. R., 1895).—On the reservoir which is thought to cover the site of Contra Costa (3) the property of the Judson Powder Company. The station was marked by a hole 6 inches deep, excavated in the rim of the reservoir, and filled with pounded glass.

North Brooks (Contra Costa County, Cal., A. F. R., 1895).—On the northern extremity of Brooks Island, on a little islet joined at low water to Brooks Island, but cut off from the main island at high water. Not permanently marked.

Angel Island Southeast 2 (Marin County, Cal., A. F. R., 1895).—On a shoulder of Angel Island in San Francisco Bay. This shoulder is on the southeastern part of the island, and viewing the island from the south appears to be the first prominent shoulder from the east and to be about halfway up the peak. Station is marked by a stone post

Alcatraz Flagstaff (Marin County, Cal., A. F. R., 1892–1895).—The flagstaff of the United States Army post on Alcatraz Island.

Belvedere Point (Marin County, Cal., A. F. R., 1895; 1897).—Upon the extremity of Peninsula or Belvedere Point. The station was marked according to note 14, page 297, except the stub projected about 2 inches.

Peninsula Hill 2 (Marin County, Cal., A. F. R., 1895).—Near the center of what is now known as Belvedere Hill. The station was marked according to note 14, page 297, except that the stub projects about 3 inches.

Angel Island Northwest 2 (Marin County, Cal., A. F. R., 1895; 1897).—Upon Point Stuart, at the northwest extremity of Angel Island in Raccoon Strait. (Note 14, p. 297, except the top of the stick was about 4 inches above the surface.)

Tiburon Gate Tower (Marin County, Cal., A. F. R., 1895).—North of Tiburon Ferry landing and in sight from all parts of Raccoon Strait; the ornament at the apex of the conical roof of a circular tower of gray stone.

Ridge Rock (Marin County, Cal., A. F. R., 1895).—A stub in a small outcropping rock on the ridge northeast from Tiburon Ferry slip.

Under Cavallo (Marin County, Cal., A. F. R., 1895).—Marked by a stub.

Halfway (Marin County, Cal., A. F. R., 1895).—Near Sausalito, marked by a stub.

Richardson East (Marin County, Cal., A. F. R., 1895).—About 150 meters south of the county road from Sausalito to Mill Valley, and west of the most southern point of the road before its junction with the road from Point Bonita. (Note 14, p. 297.)

Strawberry Hill 2 (Marin County, Cal., A. F. R., 1895).—About 190 feet above the tide, on the summit of the sharp point which makes down from the northward and divides Richardsons Bay into two parts. Not marked.

Oakland Point (Alameda County, Cal., L. A. S., 1881).—On the Central Pacific Railroad filling at Oakland Point about 200 yards outside of the old shore line, on the outside of the filling clear of all tracks and 7 feet from the outer rail of the outer track of the four parallel lines of track; at a point 18½ feet to the west of the station there is a switch in the outer track, and it divides and begins to curve to the right, looking shoreward; this switch is the farthest one out from shore in that locality. The station was marked by a smooth oval stone in which a hole is drilled one-half inch deep. The upper surface of the stone is 1½ feet below the surface of the ground.

Alameda Wharf (Alameda County, Cal., L. A. S., 1881).—On the northern arm of the ferry slip (no longer used as such) at Alameda wharf and close to its outer extremity. The station was marked by a nail driven into the planking of the wharf and surrounded by four other nails in the form of a square. The following distances and reference marks are given to aid in finding the station: A small notch in the plank of the extreme end of the slip is 19 feet 5½ inches from the station; three nails in a vertical row facing the station, on a hitching pile projecting through the planking of the wharf, near the end of the slip, are 10 feet 5½ inches from the station; three nails in the side of the stringer, on which the planking rests over the edge of the wharf, between it and the row of fender piles, abreast of the station, are 5 feet 6 inches from the station.

North Twin (San Francisco County, Cal., A. F. R., 1894).—Upon the northern one of the Twin Peaks known as Las Papas, about 925 feet above high water, and very nearly on the western prolongation of Market street, San Francisco. (Note 14, p. 297.)

Point Avisadero 2 (San Francisco County, Cal., R. D. C., 1851–52).—See Point Avisadero, page 314.

Visitation Knob (San Francisco County, Cal., F. M., 1903).—On top of the most marked summit close to the bay shore south of San Francisco, in a deep crevice of the outcropping rocks. Station was marked by a tack in the end of a piece of scantling 4 inches long, and by two reference marks consisting of holes drilled in neighboring rocks, as follows: One, in the top of a large rock which shows a little to the left of the Catholic Orphan Asylum, is distant 6.15 feet from the station; the other drill hole is in the top of a rock which shows a little to the right of Shag Rock, and is 6.57 feet from the station.

Candlestick Point (San Francisco County, Cal., A. F. R., 1894).—On the shore line point southeast from and under Visitation Knob; about 130 feet above high water, on a point immediately under which, near high water mark, is a sharp pinnacle rock about 8 feet in height. (Note 14, p. 297.)

Lower Sierra Point (San Mateo County, Cal., A. F. R., 1894).—On the point where the San Bruno Mountain terminates. (Note 14, p. 297.)

Baden Hill (San Mateo County, Cal., A. F. R., 1894).—On a well-defined peak, 165 feet high and 300 meters northwest of the stock yards at Baden or South San Francisco. (Note 14, p. 297.)

Oyster Point (San Mateo County, Cal., A. F. R., 1894).—On the summit of the marked point rising to 50 feet above high water, the first point south of Sierra Point, forming a small shoal-water bay. (Note 14, p. 297.)

Belair Island (San Mateo County, Cal., A. F. R., 1894).—On the summit of the little island in the salt marsh lands on the western shore of San Francisco Bay, about 1¼ miles southwest from San Bruno Point, about 60 feet above high water. (Note 14, p. 297, except the stub projects 2 inches above the ground.)

Point San Mateo Extremity (San Mateo County, Cal., A. F. R., 1894).—On the northeast extremity of Big Coyote or San Mateo Point, on a narrow point about 15 feet above high water, to the southeast of the eastern one of two northern peaks of the promontory. (Note 14, p. 297.)

Angelo 2 (San Mateo County, Cal., A. F. R., 1894).—Near Belmont, on the railroad from San Francisco to San Jose, on land owned by Wm. M. Newhall, about 400 meters north of his house, on the top of a hill. The station was marked by a stone marked ANGELO U. S. C. AND G. S., the top placed level with the ground.

Union City Creek (Alameda County, Cal., A. F. R., 1894).—Upon the eastern shore of San Francisco Bay, upon the south side of the mouth of Union City Creek, close to the bay shore. The station was marked by a bottle 2½ feet below the surface of the ground.

Coyote Hill Creek (Alameda County, Cal., A. F. R., 1894).—At the mouth of Coyote Hill Creek. Signal was a redwood scantling, 4 inches square and 12 feet long, supported by 4 braces. Not marked.

West Point (San Mateo County, Cal., A. F. R., 1894).—On the western shore of the southern part of San Francisco Bay, nearly 2 miles north of Ravenswood warehouse; on the shore of the bay and edge of the salt marsh at a place where the marsh holds deposits of white shells. (Note 14, p. 297.)

South Red Hill (Alameda County, Cal., A. F. R., 1895; 1896).—On top of the spur of Coyote Hills making out to the southward, about 200 meters southwest of the highest point on all these hills. The station was marked by a bottle buried 2 feet for a center mark, over which was set a redwood block 4 inches square by 2½ feet long, with top of the block 6 inches above the surface and the center marked by a copper tack.

Dumbarton oysterhouse (San Mateo County, Cal., A. F. R., 1894).—The flagstaff on a substantial white building supported by piles, the property of the Morgan Oyster Company, about the center of the open area shoal water at the southern end of San Francisco Bay and about 1⅝ miles south of Potrero or Dumbarton Point.

San Francisquito Creek 2 (San Mateo County, Cal., A. F. R., 1894).—About one-half mile northwest of the mouth of San Francisquito Creek, on the edge of the newly made marsh land. Not marked.

Alviso (Santa Clara County, Cal., A. F. R., 1896).—On the marsh land 700 meters west of the entrance of Alviso Slough and 10 paces back from the bank. The station was marked by a copper tack in a piece of redwood scantling 4 inches square and 6 feet long, driven through the sod and into the soft mud beneath until it projects only 10 inches above the ground. Three stubs, 4 inches square and 4 feet long, were driven in flush with the surface to hold the tripod. The pole, 4 inches square and 18 feet long, stood on the top of the center stub and was secured to four other stubs driven in the ground for the purpose.

Mowry's oysterhouse (Alameda County, Cal., A. F. R., 1894–96).—The flagstaff on the substantial white building of the Morgan Oyster Company, built on piles and located near the channel entering Mowrys Creek.

Albrae (Alameda County, Cal., A. F. R., 1896).—On the platform at the side of the narrow gauge railroad at the proposed town site of Albrae, about 200 meters north of a small station house designated "Albrae." The platform is 36 feet long and 8 feet wide and elevated about 2 feet above the track. The station was marked by a wire nail driven in the 2-inch plank over the middle of the five bents which support the platform and on the third plank from the east, or 31 inches from the east edge of the platform.

Dyke (Santa Clara County, Cal., A. F. R., 1896).—About 1 200 meters west of Milpitas landing on Coyote Creek on top of the dyke inclosing some 300 acres of reclaimed land, known as "The Island." Station is 31 paces southeast of the south bank of a slough 15 meters wide, which is cut off by the dyke, 310 paces northwest of a flood gate for draining the canal which surrounds the island inside the dyke, and 15 paces west of a bend in the dyke and canal and on the highest knob of the dyke in this vicinity. The flagstaff of Warmsprings schoolhouse is in line with the right tangent of old limestone quarry near the top of Contra Costa hills. The station was marked by the mouth of a bottle sunk 2 feet below the surface, over which was a fir block, projecting 2 feet above the surface, on which the center was marked by a wire nail. The hole was partly filled with cinders.

Goucher (Alameda County, Cal., R. D. C., 1851–52).—At the head of Mowrys Creek in the southeastern part of San Francisco Bay, about 960 meters from the small white house at Mowrys landing, on the land of Doctor Goucher, and about 214 meters from his house. The country is almost uniformly level in this vicinity, without distinguishing

marks; the spot, however, where the station is forms a slight elevation scarcely perceptible from a distance. (Note 13, p. 297.) Center stone 1 foot 5 inches below the surface. Each reference stone has no lead bolt, but has cross lines cut in the stone.

Union Island (Alameda County, Cal., R. D. C., 1851, 1857).—On the summit of Union Island, the northernmost of two small islands lying about 3 200 yards to the southward of Union City and to the northwest of the Red Hills. The mouth of a small creek bears S. 70° W. Station is on summit of island 130 feet above tide and 47 feet S. 80° W. from a large rock. Center is marked by a stone block sunk 3 feet in the ground, while for reference marks three other blocks were set 6 feet from the center, with squared tops just above the surface of the ground.

Point San Mateo (San Mateo County, Cal., R. D. C., 1851, 1895).—On San Mateo Point, an island on the west side of San Francisco Bay, about 15 miles to the southward of San Francisco and 1¼ miles northwest of the mouth of San Mateo Creek. Known as Big Coyote and separated from the mainland by creeks and marsh. (Note 12, p. 297, coal cinders being placed over the bottle.)

Mowrys Creek (Alameda County, Cal., R. D. C., 1852).—On the northeastern bank of the southern entrance to Mowrys Creek in the southeastern part of San Francisco Bay. On the open marsh, 8 meters from high-water line. (Note 12, p. 297.)

San Antonio Point (Alameda County, Cal., R. D. C., 1852).—On the east side of San Francisco Bay, 1 mile N. 47° 30′ W. from the mouth of San Antonio Creek; on the fast land 20 feet from the edge of the bank. (Note 12, p. 297.)

Middle Point (Alameda County, Cal., R. D. C., 1852).—On the east side of San Francisco Bay on the extreme western point of the peninsula formed by San Antonio and San Leandro creeks; 40 feet from high-water line and 330 meters S. 26° 30′ E. from the junction of the line of marsh and the fast land. (Note 12, p. 297.)

Ditch (Cutts) (Alameda County, Cal., R. D. C., 1852).—In the marsh on the east side of San Francisco Bay, about 3½ miles southeasterly from Contra Costa (1), or Wicks landing. Locality is distinguished by a fresh-water pond and a ditch connecting it with the bay. Station is 6 yards south of the ditch, 250 yards from the pond, and 90 yards from the bay shore. Center is marked by a stone, while three redwood reference stubs are 6 feet from the center.

Dumbarton Point (Alameda County, Cal., A. F. R., 1895).—On Potrero Point on the salt marsh near the red flume house of the Spring Valley Water Company. Marked by a bottle 2½ feet below the surface of the ground and a 2-foot stub projecting 3 inches above the ground.

Ravenswood old wharf flagstaff (San Mateo County, Cal., A. F. R., 1895).—On the southeast corner pile of the remains of the old wharf at Ravenswood landing in the southern part of San Francisco Bay.

South South Tree (San Mateo County, Cal., A. F. R., 1894).—A prominent tree, the upper half of which is dead.

Peak flag (Alameda County, Cal., A. F. R., 1894).—In the center of a pile of rocks on the summit of the Coyote or Red Hills. A flag placed by the United States Geological Survey.

Chinahouse east gable (San Mateo County, Cal., A. F. R., 1894).—East gable of a small unpainted house or shanty on the north bank of Redwood City Creek and on the south side of the first creek making into Redwood City Creek west of its mouth.

Redwood City Creek (San Mateo County, Cal., A. F. R., 1894).—On the point on the northern side of Redwood City Creek on the salt marsh close to the shore of San Francisco Bay. It is close and south of a small building belonging to the Morgan Oyster Company and known as the Redwood Oyster House. Marked by a bottle 2½ feet below the surface.

Angelo Creek (San Mateo County, Cal., A. F. R., 1894).—About one-half mile north of the mouth of Angelo Creek. (Note 14, p. 297.)

San Mateo oysterhouse north gable (Alameda County, Cal., A. F. R., 1894).—North gable of a small white building belonging to the Morgan Oyster Company, on the salt marsh lands near the shore of San Francisco Bay.

Coyote warehouse south gable (Alameda County, Cal., A. F. R., 1894).—The south gable of an old and apparently deserted building supposed to belong to the Morgan Oyster Company, and situated about one-fourth mile east of Coyote Creek triangulation station.

San Mateo eucalyptus tree (San Mateo County, Cal., A. F. R., 1895).—About the center of the grove of eucalyptus trees covering San Mateo Point, sometimes called Big Coyote. The trees are planted in rows not over 10 feet apart, and are about 50 feet high; the tree observed on and determined is about 10 feet higher than any other in the grove.

Coyote house stovepipe (San Mateo County, Cal., A. F. R., 1894).—The stovepipe of a white building on the south side of Coyote Creek.

Red house cupola (Alameda County, Cal., A. F. R., 1894).—Cupola with flagstaff on the center of the roof of a small red building used as a lodging and boarding house by the Union Pacific Salt Company. On the south side of Union City Creek, and about 300 meters from the shore of the bay.

Bay Farm (Alameda County, Cal., A. F. R., 1894).—On the southeasterly extremity of Bay Farm Island. (Note 14, p. 297.)

San Leandro eucalyptus tree (Alameda County, Cal., A. F. R., 1894).—The tallest tree on Bay Farm Island, being about 60 feet high and overtopping the hedges of osage orange trees. On land belonging to an old settler named Cleveland.

Boardinghouse flagstaff (Alameda County, Cal., A. F. R., 1894).—Flagstaff in the center of a lookout platform surmounting a salt warehouse, belonging to the American Salt Company. It is about 1 mile south of Haywards landing and within 100 meters of the bay shore.

Triple warehouse northeast gable (Alameda County, Cal., A. F. R., 1894).—At Haywards landing, close to the shore. The northeast gable of what was at the time it was observed upon a triple warehouse, or three-gabled building. Later a fourth building was added on the east, making the station the gable next to the northeast gable. The new building is painted white; the old dark red.

Mulford Landing (Alameda County, Cal., A. F. R., 1894).—On the eastern side of San Francisco Bay, on the southern side of the salt marsh slough which makes in from the bay at Mulford landing; 3½ miles southward from Bay Farm Island, and 170 meters from the warehouse at the landing, which is on the opposite side of the slough from the station. (Note 14, p. 297.)

Roberts Landing (Alameda County, Cal., A. F. R., 1894).—On the bay shore, on the west side of the slough entering the bay at Roberts landing, formerly called Thompsons landing, on land owned by a man named Roberts. (Note 14, p. 297.)

Double Rock east peak (San Francisco County, Cal., A. F. R., 1894).—The eastern peak of a rock in the bight southwest of Point Avisadero, within 200 meters of the shore line. At extreme low tide it is surrounded by mud flats.

Bernal (San Francisco County, Cal., F. M., 1903).—On the crest of the ridge making off from the south side of Bernal Heights, and 4 meters north of the highest point in the vicinity. In the city block between Putnam and Bronte streets, and east of the line of Ellert street. It is about 32 meters from the center of the sewer manhole in Putnam street, and 16 meters from the north line of Bronte street as fixed by the fence line. It is marked by a hole in a buried stone.

Start (San Francisco County, Cal., F. M., 1903).—On the sidewalk on the west side of Kentucky street, and about 100 meters north of Army street. It is 3.2 feet inside of the outer edge of the curbstone, and 3.2 feet from the southwest corner of pole No. 176 of the Independent Electric Light and Power Company. Marked by a drill hole one-half inch deep in a small piece of serpentine buried 2 feet below the surface of the ground.

Mile (San Francisco County, Cal., F. M., 1903).—About 60 feet above the bay on the side hill back from the first point north of Hunters Point, and about at the intersection of Avenue S and I street south, neither of which are at present cut through. A drill hole with a triangle cut around it in an outcropping ledge about 8 feet long is 10.5 feet from the station in the direction of Hunters Point; a rock southwest of the station has a hole drilled in face toward the station distant 29.4 feet; from this second reference mark the station is in line with the left tangent of Goat Island. Station is marked by a hole in a buried stone.

Army (San Francisco County, Cal., F. M., 1903).—On crest of ridge south of Army street, and as nearly as can be judged from city maps (streets not being cut through south of Army street) in the block bounded by Army, Marin, Arkansas, and Wisconsin streets. About 52 meters south from the edge of the bluff of the Army street cut. Center is marked by a small drill hole in the ledge, even with the surface of the ground.

Quarter (San Francisco County, Cal., F. M., 1903).—At Butchertown on the sidewalk on the west side of Kentucky street, about 6 meters north of the building line of the slaughterhouses on the north side of First avenue, 4 feet inside of the outer edge of the curbstone and 48 feet south of a fire hydrant. Marked by a shallow hole in a stone buried 2 feet below the surface of the ground.

Half (San Francisco County, Cal., F. M., 1903).—Located among the hogpens of Butchertown, in what would be Fourth avenue south if that street were cut through, and between M and N streets south. Station is 23.6 feet from the southwest corner of Cohen's China Duck House, 34.7 feet from the northwest corner of McCarty's shanty, and 92.3 feet from the northeast corner of the wagon shed attached to the east end of Monehan & Sons' stable. Marked by a stake driven in the soft muck.

Two-Mile (San Francisco County, Cal., F. M., 1903).—On ridge leading south from Point Avisadero triangulation station and about 205 meters from it. From the station Shag Rock is in range with the point coming down from San Bruno Mountain ridge; the low point below Baden is in range with left hand of two wooded peaks; and Grizzly

Peak is over the middle of the pump house at the dry dock. Station is marked by a shallow hole in a buried stone (piece of jasper).

Hunters Point chimney 2 (San Francisco County, Cal., F. M., 1903).—The large brick smokestack of the pumping plant at the Hunters Point Dry Dock.

Melrose smelting-works chimney (Alameda County, Cal., A. F. R., 1894).—On the line of the Central Pacific broad gauge, about 3 miles south of Fruit Vale railroad station and 650 meters south of the Alameda race track. A brick chimney.

South Shag Rock (San Francisco County, Cal., A. F. R., 1894; 1903).—On the highest point of Shag Rock, a small islet about one-half mile southwest of Point Avisadero. Center marked by a bottle 2½ feet below the surface of the ground.

San Leandro Point, McCartney's white tank (Alameda County, Cal., A. F. R., 1894).—Water tank with windmill attached 150 meters north of McCartney's house, belonging to Amos McCartney. The vertical shaft of the windmill was determined.

Roberts' warehouse (Alameda County, Cal., A. F. R., 1894).—A black streak down the front of a building at Roberts Landing, on the east side of the slough and about 350 meters from its mouth.

South Point (San Mateo County, Cal., A. F. R., 1894).—Located at the southern extremity of the ridge under Visitation Knob. (Note 14, p. 297.)

Pinnacle Rock (San Mateo County, Cal., A. F. R., 1894).—A pinnacle-shaped rock off Candlestick Point, just below San Francisco; the only rock in the immediate vicinity.

Agnews (Santa Clara County, Cal., A. F. R., 1896).—A tall square spire (the largest and most conspicuous) at the Agnews Insane Asylum.

Old hut southeast gable (Santa Clara County, Cal., A. F. R., 1896).—Southeast gable of an old abandoned hut near the east bank of Alviso slough and about midway between the mouth of the slough and the town of Alviso.

Old shed southeast gable (Santa Clara County, Cal., A. F. R., 1896).—Southeast gable of an old abandoned shed near the east bank of Alviso slough and about halfway from the mouth of the slough to the town of Alviso.

Tuft (Alameda County, Cal., A. F. R., 1896).—A little more than 2 miles northeast of Albrae, a tall tree, probably an eucalyptus standing near a farmhouse, has its limbs trimmed for a space below the top of the tree, leaving a tufted top, which is quite a conspicuous object.

Warehouse southeast gable (Santa Clara County, Cal., A. F. R., 1896).—The southeast gable of a large unpainted warehouse standing by itself on the marsh west of the town of Alviso.

Albrae tile chimney (Alameda County, Cal., A. F. R., 1896).—A small tile chimney on a dwelling house which stands 235 meters east of station Albrae (see page 324). It belongs to the company which laid out the town site of Albrae.

Noonan water tank (San Mateo County, Cal., A. F. R., 1894).—A large white water tank, adjoining a large white building about 2 miles south of San Bruno House, and one-half or three-fourths of a mile westward of the line of the San Bruno wagon road. On the property of Jeremiah Noonan, a furniture dealer of San Francisco.

San Bruno House minaret (San Mateo County, Cal., A. F. R., 1894).—An ornament on the ridge of the roof of the San Bruno House, 15 miles by road from San Francisco on the San Francisco to San Jose Railroad.

Red cupola (San Mateo County, Cal., A. F. R., 1894).—The cupola of the public school building at Baden or South San Francisco.

Ewells XL Dairy smokestack (San Mateo County, Cal., A. F. R., 1894).—The black iron stack of Ewell's XL Dairy, about 10 miles south of San Francisco on the San Bruno road.

Point Lobos Windmill (San Francisco County, Cal., G. D., 1883).—Center of the standard of a windmill, which, with a white wooden tank, stands on an unpainted wooden scaffold in that part of the city cemetery belonging to the French Benevolent Society, near Point Lobos 2 station (see page 316), on the south side of the entrance to San Francisco Bay.

Fort Point Life-Saving Station (San Francisco County, Cal., A. F. R., 1895).—The flagstaff in front of the keeper's dwelling at the Fort Point Life-Saving Station.

Bonita Bluff (Marin County, Cal., A. F. R., 1887).—On the shore 120 meters from the southeast end of the Bonita Light-House reservation fence, south and a little west from the end of that fence on the bluff. Reported in 1900 by the United States engineers as probably lost. (Note 11, p. 297.)

North Bonita (Marin County, Cal., A. F. R., 1887; 1900).—Upon the most northern projection of Bonita Point, on the ocean cliff; on a knoll 260 feet high, the west side of which is nearly vertical and the east side a gradual slope; about one-fourth mile northwest of the old white tower, a conspicuous object on Point Bonita. (Note 11, p. 297.)

High Bluff (Marin County, Cal., A. F. R., 1887–1892).—On a prominent eroded bluff 450 feet above high water and 1400 meters west of Lime Point fog-station.

Alcatraz fog-bell (Marin County, Cal., A. F. R., 1892).—The center of the bell on the southeastern extremity of Alcatraz Island.

Point Diablo (Marin County, Cal., R. D. C., 1851; 1886).—On Point Diablo, on the northern side of the Golden Gate. This point is connected with the highland behind it by a very narrow ridge which makes the station a difficult and dangerous one to reach. Marked by a hole drilled 2 feet into the rock (sandstone) to receive the end of the pole.

Oakland Point Railroad depot flagstaff (Alameda County, Cal., G. D., 1881; 1895).—The flagstaff on the inner or eastern end of the depot building of the Southern Pacific Railroad at Oakland Point.

Point Blunt Rock (Marin County, Cal., A. F. R., 1892).—The most prominent detached rock, about 15 feet high, lying off the southeastern extremity of Angel Island.

Angel Island, United States flagstaff (Marin County, Cal., A. F. R., 1895).—The flagstaff at the United States Army post on the western side of Angel Island.

Angel Island fog-bell (Marin County, Cal., A. F. R., 1892; 1900).—The center of the bell at Angel Island fog-station on Point Knox, on the western side of the island.

Contra Costa (3) (Alameda County, Cal., R. D. C., 1852).—On the northern and highest part of the hill at what is now called Fleming Point, directly on the bay shore about 5 miles above the Oakland piers. This hill is isolated from the mainland by a marsh and a narrow sand beach. Station is marked by a small drill hole in a flat rock 3 feet under the surface of the ground. Surface marks are three reference marks, stone blocks 4 inches square and 14 inches long with squared tops level with the surface of the ground, in each of which is a lead plug with cross lines exactly 6 feet from the center of the station.

Quarry hyd. (Marin County, Cal., A. F. R., 1895).—At high water mark, under Quarry Point, on eastern side of Angel Island.

Fence signal (Marin County, Cal., A. F. R., 1895).—A flag and pole nailed on the fence in the bight north of Strawberry Hill station.

Marsh Point (Marin County, Cal., A. F. R., 1895).—On the little marsh point about 1 mile west of Strawberry Hill station, and projecting into the channel of Richardson Bay which leads into Reeds Creek. Not marked save by signal, a redwood scantling.

Brooks Island 2 (Contra Costa County, Cal., B. A. B., 1905).—On the highest point of Brooks Island. Marked by a large wire nail driven in the top of a 4 by 4-inch pine stub.

Black-roof house (Marin County, Cal., A. F. R., 1895).—A house with pyramidal red roof, fronting the bay, on the line of the San Francisco and Northern Pacific Railway, three-fourths mile north of Belvedere, and owned by John Reed, of Reed's ranch.

Bridge Point (Marin County, Cal., A. F. R., 1895).—A point of rock undermined by the waves, and projecting close to the water line. This is on the point on the northern side of Raccoon Strait, and about midway between Tiburon Point and Bluff Point.

Angel Island white tank (Marin County, Cal., A. F. R., 1895). The northern and eastern of three water tanks on the hill above the quarantine station at Angel Island.

Isabel Pile (Contra Costa County, Cal., A. F. R., 1895).—A single pile, the remains of an old wharf at Point Isabel.

Bluff Point North Base (Marin County, Cal., H. C. D., 1903).—Near the northern boundary of the property of Lynde and Hough, at California City, being 6 inches inside or south of said boundary fence. Marked by a piece of water pipe 1 inch in diameter driven into the ground 4 feet, 3 inches of it remaining above the surface. A tree with a 10-inch triangle cut in it bears northeast from the station, distant 135½ feet; a small bowlder, about 2 feet above the ground, is 4 feet southeast of the station.

Fence (Marin County, Cal., H. C. D., 1903).—Located on the western boundary of the property of Lynde and Hough, at California City, 52½ feet from the northwest corner of the fence line. Marked by a beer bottle buried 6 inches below the surface of the ground.

Bluff Point South Base (Marin County, Cal., H. C. D., 1903).—At California City, 4 feet south of the south side of the wharf on the Lynde and Hough property, and 42½ feet from the southeast corner of the wharf. Marked by a rock drill 1 inch in diameter driven 2 feet into the ground, 4 inches remaining above ground.

Corinthian Clubhouse flagstaff (Marin County, Cal., A. F. R., 1895).—The flagstaff on the clubhouse on the southern end of the small island in Raccoon Strait, cut off from Belvedere by a slough, and joined to the mainland northeast of it by a sand spit.

Belvedere telegraph pole (Marin County, Cal., A. F. R., 1895).—On the southwestern end of the sand spit which connects Belvedere hill with the mainland. The pole is irregular in shape, knotty, and larger than any other in the vicinity. On its south side, toward the town of Belvedere, a triangle surrounding the letters U. S. C. S. was formed of wire nails driven in.

Reservoir (Marin County, Cal., A. F. R., 1895).—On the northwest shore of Raccoon Strait, on the inshore side of an old abandoned tank or reservoir, excavated, lined with brick, and covered with boards.

Raccoon Point (Marin County, Cal., A. F. R., 1895).—At the southeast extremity of Bluff Point, on the rocky beach close to high water mark. The fragments of a bottle were placed in a crevice under the foot of the signal.

Railroad Curve Telegraph Pole (Marin County, Cal., A. F. R., 1895).—A telegraph pole at the northern end of a curved trestle, the second railway trestle north of Sausalito. It is the third pole from the northern end of the trestle, it stands alongside of a fence, and is marked with a triangle surrounding the letters U. S. C. S. formed of wire nails driven in.

San Pablo flagstaff (Contra Costa County, Cal., G. D., 1881).—A large flagstaff on the main street in the town of San Pablo.

Ellis Landing barn inner gable (Contra Costa County, Cal., G. D., 1881).—The east gable of the southernmost of two large barns situated on the marsh at Ellis Landing, west of El Cerrito.

San Rafael Creek (Marin County, Cal., R. D. C., 1852).—On the summit of a point about one-half mile to the eastward of the mouth of San Rafael Creek. Station is about 102 feet above high water mark. (Note 12, p. 297.)

Cove (Marin County, Cal., R. D. C., 1852).—On the bay shore in the little cove lying just west of Point San Pedro, and not more than a foot or two above high water line. (Note 12, p. 297.)

Point Cavallo tip (Marin County, Cal., A. F. R., 1892).—The extreme southern end or tip of Point Cavallo.

Flat Rock (San Francisco County, Cal., A. F. R., 1892).—A shelving flat rock, the highest part not over 5 feet above high water, 200 meters southwest from Pyramid Rock (p. 333) and the same distance from the shore.

Bonita Bight (Marin County, Cal., A. F. R., 1887).—Approximately halfway between Point Bonita and Point Diablo, and 100 meters inshore from the very marked object called "Shore-Cone." Station is approximately 160 feet above the water. (Note 11, p. 297.)

Rock Point (Marin County, Cal., A. F. R., 1895).—A sharp pointed rock jutting over the shore line in the bight northeast of Strawberry Hill.

Carson telegraph pole (Marin County, Cal., A. F. R., 1895).—The only telegraph pole on the bluff 1 mile northwest of Belvedere Hill. The line of the San Francisco and Northern Pacific Railway crosses and cuts this bluff. The pole is 20 meters north of the railway, and alongside the railway fence.

Railroad tank (Marin County, Cal., A. F. R., 1895).—A prominent red-painted tank on the bluff west of the northern end of the first railroad trestle north of Sausalito.

Marin Island (Marin County, Cal., R. D. C., 1852).—About 63 feet above tide, on the eastern end of the larger of the two small islands in the northern end of San Francisco Bay, on the western side of the channel. (Note 12, p. 297.)

Angel Island East Point (Marin County, Cal., A. F. R., 1895).—On the northeast point of Angel Island, on the point called Point Campbell. Not marked.

Angel Island Middle Point (Marin County, Cal., A. F. R., 1895).—On the abrupt rocky point which forms the western head of quarantine hospital cove. The point is very rocky and covered with oak brush.

Alcatraz Rock (Marin County, Cal., A. F. R., 1895).—The well-known rock projecting but little above high water, approximately 140 meters westerly from the northwest extremity of Alcatraz Island.

Lime Point fog-station (Marin County, Cal., A. F. R., 1892).—The south smokestack at Lime Point fog-station. The station building and the rock upon which it is built are white and the station has two black stacks.

Needles (Lime Rocks) (Marin County, Cal., A. F. R., 1892).—The largest and highest rock under Lime Point, being one of the Needles, so called because of their slender pointed shapes.

Yellow Bluff tip (Marin County, Cal., A. F. R., 1892).—A sharp rock marking the extremity of the shore line at the yellow bluff under Point Cavallo 2 station. This point is rock bound and is remarkable for the strong rush of the tide setting past it on the ebb.

Point Richmond tip (Contra Costa County, Cal., A. F. R., 1895).—A knob or projection just above the water on the extreme western end of Point Richmond.

Brooks Rock (Contra Costa County, Cal., A. F. R., 1895).—The center and highest point of the rock about 150 meters west of Brooks Island.

Fort Rock (San Francisco County, Cal., A. F. R., 1892).—The wash rock northeast of Fort Point Light-House, and less than 50 meters from the face of the sea wall at Fort Point.

Blackhead Rock (San Francisco County, Cal., A. F. R., 1892).—A small seaweed-covered rock under the Point Lobos shore. Near to and southwest of Pyramid Rock. (Page 333.)

Fort Point Rock (San Francisco County, Cal., A. F. R., 1887).—The largest of the cluster of rocks about 300 meters southwest of Fort Point Light-House.

Spring Valley Rock (San Francisco County, Cal., A. F. R., 1892).—A rock on the south shore of the Golden Gate, barely detached from the bluff behind it, 550 meters southwesterly from the Baker Beach Life-Saving Station, and 400 meters westerly from the mouth of Mountain Lake outlet.

Cone Rock (Sail Rock) (Marin County, Cal., A. F. R., 1895).—A rock about 10 feet in height, in the entrance to Richardson Bay. It is the shape of an irregular cone, but from its resemblance to a boat when seen from certain directions is also called Sail Rock; also called Richardson Rock. It is about one-fourth mile south of Pescada landing on the western shore of Belvedere Hill.

Helmet Rock (San Francisco County, Cal., A. F. R., 1887–1892).—The largest of two prominent detached rocks 1 050 meters southwesterly from Fort Point Light-House and approximately halfway between the light-house and Bakers Beach Life-Saving Station.

Belvedere Rock (Marin County, Cal., A. F. R., 1895).—The highest point of a small flat rock in Raccoon Strait off Belvedere Point. The rock is not over 8 feet in diameter, and less than 18 inches above high water.

Angel Island Wharf House West Gable (Marin County, Cal., A. F. R., 1895).—The west gable of a red-painted warehouse on the wharf at the military post on Angel Island.

Tiburon Rock (Marin County, Cal., A. F. R., 1895).—A small round rock about 10 feet high and 10 feet in diameter, in Raccoon Strait east of the Tiburon Ferry Landing.

Lobos Rock (San Francisco County, Cal., A. F. R., 1887; 1892).—A prominent rock 600 meters south from the larger Mile Rock. It is 30 feet in height and 210 meters from the nearest point on the shore line. A similar looking but larger rock, 50 feet in height, is 170 meters southeasterly from Lobos Rock, and at low water has a rock-ribbed connection with the Point Lobos shore.

Pyramid Rock (San Francisco County, Cal., A. F. R., 1887–1892).—A prominent rock, of the shape of an irregular pyramid, about 30 feet high, and is the most northern of the outlying shore rocks along the Point Lobos shore. It is 150 meters distant from the nearest land on the Point Lobos shore, called Lands End or Railroad Point.

Mile Rock (San Francisco County, Cal., A. F. R., 1887–1892).—The larger of the two rocks known as Mile Rocks, about 700 meters from the nearest shore line on Point Lobos.

Little Mile Rock (San Francisco County, Cal., A. F. R., 1887–1892).—The smaller of the two well-known Mile Rocks, about 50 meters southeast of the larger rock, 650 meters from the nearest shore line on Point Lobos, and a little less than 2 miles from the extremity of Point Bonita.

Double White (Marin County, Cal., A. F. R., 1892).—Two slight projections of rock separated by only a few feet, and just above high-water line in the deepest part of the indentation of shore line between Points Bonita and Diablo.

Bonita Rock (Marin County, Cal., A. F. R., 1887–1892).—The most prominent and most southern outlying rock south of Point Bonita Light-House. It is 20 feet high and cone shaped when seen from the Point Lobos shore.

Bonita Bluff 2 (Marin County, Cal., A. F. R., 1887).—On the shore about 120 meters north of the east end of the Bonita Light-House reservation fence. Approximately 80 feet above the water. (Note 11, p. 297.)

Shore Cone Rock (Marin County, Cal., A. F. R., 1887–1892).—A detached and rather flat rock about 20 meters from the shore line, and under Shore Cone.

White-top Rock (Marin County, Cal., A. F. R., 1887–1892).—The first prominent rock, 15 feet high, 250 meters east of Shore Cone. It is quite close to the line of low water.

Grayback White Tip (Marin County, Cal., A. F. R., 1892).—A small detached grayish looking rock with white tip, 850 meters northeast from Point Bonita Light-House, and less than 50 meters from the rock-bound shore line.

Point Diablo tip (Marin County, Cal., A. F. R., 1887–1892).—A small knob or rock hummock close down to the water line on the most eastern extremity of Point Diablo, on the north shore of Golden Gate.

Under Rock (Marin County, Cal., A. F. R., 1887–1892).—The most easterly of three rocks, all about 20 feet high and less than 100 meters from the shore, close under what is called High Bluff, the highest eroded bluff three-fourths mile west of Lime Point fog-station. It is 250 meters south of the beach known as Gravelly Beach.

Bird Point (Marin County, Cal., A. F. R., 1892).—The west part of the large white rock 1 150 meters north of Point Bonita Light-House. The rock is about 90 feet high, with nearly vertical sides, and is separated from the shore by only a narrow opening 20

meters wide, through which the sea washes at all the stages of the tide. The extreme western end of the rock, as seen from the Point Lobos stations, was determined.

Whale Point (Marin County, Cal., A. F. R., 1887).—A projection of Lime Point into the water, 150 meters west of the white buildings at Lime Point Fog Station.

Grayback (Marin County, Cal., A. F. R., 1892).—A small rock, 6 or 8 feet high, about 100 meters from the nearest shore line, and approximately 1 190 meters northeast from the Point Bonita Light-House, and 140 meters southwest from Double White Station. (See p. 333.)

Cluster Rock (Marin County, Cal., A. F. R., 1892).—The largest one of a cluster of rocks lying close to the beach in the eastern end of the first sand-beach bight west of Point Diablo on the north shore of Golden Gate.

Diablo Diamond (Marin County, Cal., A. F. R., 1892).—A diamond-shaped indentation or crevice in the west face of Point Diablo. It is about 20 feet above high water, and about 2 feet in diameter, being very difficult to identify.

East Diablo east tip (Marin County, Cal., A. F. R., 1892).—The eastern extremity of the shore-line tip under East Diablo station. (See p. 318.)

East Diablo west tip (Marin County, Cal., A. F. R., 1892).—The western extremity of the shore-line tip under East Diablo station. (See p. 318.)

Second Under Rock (Marin County, Cal., A. F. R., 1892).—The middle of the three well-defined rocks under High Bluff, the highest eroded bluff three-fourths mile west of Lime Point fog-station, on the north shore of Golden Gate. The rock is about 20 feet in height and less than 100 meters offshore.

Third Under Rock (Marin County, Cal., A. F. R., 1892).—The westernmost of the three rocks mentioned in the preceding description. The rock is about 20 feet high and less than 100 meters from the rocky shore.

Andrew Rock (Marin County, Cal., A. F. R., 1892).—A large rock close to the bluff on the northern shore of Golden Gate, being the first prominent rock east of the indentation commonly called Gravelly Beach.

Under high tip (Marin County, Cal., A. F. R., 1892).—A whitewashed projection or tip of rock forming part of the very precipitous shore line under High Bluff, referred to in describing Under Rock (see p. 333). Under High Tip is approximately 100 meters south of the shore line at the beach known as Gravelly Beach.

Point III (Marin County, Cal., A. F. R., 1892).—A whitewashed projection on the southwestern extremity of the prominent point 690 meters west of Lime Point fog-station.

Bird Lime Point (Marin County, Cal., A. F. R., 1892).—The point under the shoulder of the extremity of the main ridge forming the first headland west of Lime Point.

Point II (Marin County, Cal., A. F. R., 1892).—The extreme tip of the southwest extremity of the rocky point 400 meters west of Lime Point fog-station. This point is washed by the water at all stages of the tide, and at low tide a sand beach is exposed between it and Lime Point fog-station.

H (Marin County, Cal., A. F. R., 1892).—A large 6-foot H whitewashed on the rocky bluff just above high-water mark in the center of the sand-beach bight immediately under Lime Point battery, the first sand beach west of Lime Point fog-station.

Lime Point Rock (Cross) (Marin County, Cal., A. F. R., 1892).—A cross whitewashed on the south face of the rock under the southern extremity of Lime Point, and about 90 meters west of Lime Point fog-station. This rock is 30 feet in elevation, quite close to and separated from the shore line only at extreme high water.

Bonita Outer Rock (Marin County, Cal., A. F. R., 1892).—The most western of the group of low rocks, 150 meters west of Bonita Rock (see p. 333) and 100 meters south of the western extremity of the point on which the light-house is built.

Shag Rock (Marin County, Cal., R. D. C., 1851, 1892).—On account of being a danger to navigation this rock has been destroyed.

Ladies Pavilion flagstaff (San Francisco County, Cal., A. F. R., 1892).—The flagstaff on the ladies' pavilion in Golden Gate Park, San Francisco, on the beach about 1 000 meters south of the Cliff House.

McLain water tank tower (San Francisco County, Cal., A. F. R., 1894).—On the city block bounded by the following streets: Divisidero, Broderick, Pacific, and Broadway. This tower is the property of Doctor McLain and is a frame structure upon which stand two tanks, one above the other. A spiral staircase leading from the ground to the railed inclosure on top of the tanks winds several times around the structure. A flagstaff in the southeast corner of the tower was determined.

Hopkins Art Institute (San Francisco County, Cal., B. A. C., 1877; 1897).—On Powell street, San Francisco, between California and Pine streets, a large house in the style of a villa, having a square tower on top with a flag pole in one corner of it.

Selby shot-tower (San Francisco County, Cal., G. D., 1881, 1897).—A very prominent tower located on First street, San Francisco, between Howard and Folsom streets.

Selby smelting-works chimney (San Francisco County, Cal., A. F. R., 1895).—A round brick stack, the larger of two smokestacks at the smeltingworks westerly from Powell Street wharf.

Telegraph Hill, United States time-ball flagstaff (San Francisco County, Cal., A. F. R., 1894-95).—The tallest flagstaff, the one rising from the center of a castellated tower on a building on Telegraph Hill, San Francisco. This tower has four other staffs, one at each corner. The time-ball of the hydrographic office is dropped at noon each day from the one determined.

Butchertown smokestack (San Francisco County, Cal., A. F. R., 1894).—A tall slender black stack about the center of the collection of tumble-down buildings known as Butchertown.

Fort Point wharf (San Francisco County, Cal., A. F. R., 1895).—The northeast corner (dolphin) of the Fort Point wharf, about 650 meters east of the light-house.

Engineers' warehouse (San Francisco County, Cal., A. F. R., 1895).—The west gable end of the engineers' warehouse at the torpedo station on Yerba Buena or Goat Island, in San Francisco Bay.

Sutro's Observatory tower (San Francisco County, Cal., A. F. R., 1892).—The glass-inclosed tower in the Sutro gardens on Point Lobos, erected as an outlook for visitors to the gardens.

Baker Beach windmill (San Francisco County, Cal., A. F. R., 1892).—The center of a windmill approximately 1 mile southwest from Fort Point Light-House and on the side hill about 50 feet above tide mark on Baker Beach.

Children's playhouse (San Francisco County, Cal., G. D., 1889).—The front face of the monument on the north gable of the stone building in Golden Gate Park used as a children's playhouse.

Cogswell Monument (San Francisco County, Cal., A. F. R., 1892).—A bluestone monument, with a height of about 12 feet from the base to summit, standing about 30 feet below (in elevation) and 72 meters east of Point Lobos 2 (see p. 316). It is plainly visible from the vicinity of Fort Point and from Lime Point. Recovered in 1900 by the United States engineers.

Broderick Monument (San Francisco County, Cal., G. D., 1877).—A tall white monument in Laurel Hill Cemetery. The highest monument in the cemetery in 1877.

Parker Monument (San Francisco County, Cal., G. D., 1877).—In the eastern part of the Odd Fellows' cemetery, San Francisco, just under the foot of Lone Mount. It is a granite shaft 25 or 30 feet high and has the name PARKER on its east side and BOHEN on its west side, and other inscriptions relating to these two names on its north and south sides.

Edison Light and Power Company's dynamo stack (San Francisco County, Cal., A. F. R., 1894).—An octagonal brick stack 150 feet high and 7½ feet in diameter, with an iron ladder on its east side. This stack is on a building belonging to the Edison Light and Power Company, and is on the corner of Townsend and Clarence streets near Third street. The stack stands well back toward Brannan street.

Chronicle tower flagstaff (San Francisco County, Cal., A. F. R., 1894).—The flagstaff on the tower of the San Francisco Chronicle building on the northeast corner of Kearney and Market streets.

Gas Tank (San Francisco County, Cal., A. F. R., 1894).—The center of the large gas tank one-fourth mile southwest of Fort Mason. It is a prominent object seen from either land or water and is about 150 meters from the bay shore.

Mariners Church spire (San Francisco County, Cal., G. D., 1881).—A spire surmounted by a flagstaff on the church on the corner of Drumm and Sacramento streets, San Francisco.

Blue Mountain (San Francisco County, Cal., G. D., 1889).—On the hill called Blue Mountain, in San Francisco, south of the Golden Gate Park. In 1889 this hill was planted with young forest trees. Station is located on about the highest part and 6 feet 9 inches from the east face of a rock which is the highest point on the hill. This rock is about 2 to 2½ feet through and of the same height. The station is marked by an empty quart ink bottle set with its top about 1 foot below the surface of the ground.

Market Street powerhouse stack (San Francisco County, Cal., A. F. R., 1894).—A large brick chimney at the powerhouse of the Market Street Railway Company. About 100 feet south of the southern line of Market street, San Francisco.

Grace Church cross (San Francisco County, Cal., A. F. R., 1894).—A gilt cross 5 or 6 feet in height about the center of the ridge roof of the tower on Grace Church, an Episcopal church located on the southeast corner of California and Stockton streets, San Francisco.

Edison Light and Power Company electric stack (San Francisco County, Cal., A. F. R., 1894).—A round brick chimney 175 feet high and 12 feet in diameter on

top, and having an iron ladder on its eastern side. It is located on the north line of Jessie street, San Francisco, on the block bounded by Stevenson, Jessie, Third, and Fourth streets. It is about 100 feet westward from an octagonal-shaped stack, 150 feet high and 6 feet in diameter on top.

Potrero Presbyterian Church spire (San Francisco County, Cal., G. D., 1881).—The spire of the Presbyterian church located on the side hill to the south of the cut at the end of the long bridge from San Francisco to South San Francisco. The church stands about 100 yards from the cut on the right-hand side when going to South San Francisco, and care must be taken not to mistake for it a church situated at the north end of the cut.

Tannery ventilator flagstaff (San Francisco County, Cal., A. F. R., 1894).—The flag pole on the ventilator of a tannery in Visitation Valley. The tannery is a wooden building, large and prominent.

Jewish Synagogue east spire (San Francisco County, G. D., 1881).—In San Francisco, on Sutter street, between Stockton and Powell streets.

St. Patrick's Church spire (San Francisco County, Cal., G. D., 1881).—On Mission street, San Francisco, between Third and Fourth streets. The church is a brick structure and the spire is tall and prominent.

Washington Square (San Francisco County, Cal., G. D., 1869–1873, 1887).—On the eastern side of Washington square, San Francisco. Two massive piers were placed on a good foundation of Sacramento brick, laid in Oregon cement, and coated on the outside with cement. The transit pier is one piece and the clock pier also one shaft. The depth of the foundations is about 3 feet below the (1869) grade of the square. Between the bottom of the transit block and the brick work was placed a flat granite cap 8 inches thick.

Presidio Longitude Station (San Francisco County, Cal., A. F. R., 1896; 1903).—On what is known as Drill Plain Knoll, in the Presidio military reservation, and about 130 meters from the terminus of the Union street car-line. The station is 20 paces from the highest part of the knoll and about 8 feet below it. Nearly in line to Point Cavallo and 53 paces from the station is a small building used as a range station by the military. Two small eucalyptus trees are marked with small triangles just above the ground; from one of these trees the station is distant 36 feet 10½ inches and closely in line with Arch Rock; from the other tree the station is distant 29 feet 2 inches and is in line with the nubbin of the ridge over Horseshoe Bay. Station is marked by a granite pier with a copper bolt in its top. The zenith telescope pier is 4.84 feet east of the station.

Presidio Magnetic Station (San Francisco County, Cal., G. D., 1852; 1898).—Marked by a stone post 6 inches square on top and projecting about 2 feet above the ground. Reported in 1904 as being probably covered by one of the buildings of the Presidio military post.

Presidio wharfhouse (San Francisco County, Cal., A. F. R., 1895).—A small window in the north end of a building on Presidio wharf.

Artesian well-tower (San Mateo County, Cal., A. F. R., 1894).—The frame tower over an artesian well 50 feet high and 150 meters north of the packing house in South San Francisco, a large brick structure close to the shore.

Packing-House smokestack (San Mateo County, Cal., A. F. R., 1894).—A large brick chimney on the Meat-Packing Company's building, in South San Francisco.

Linden House cupola (San Mateo County, Cal., A. F. R., 1894).—The cupola on the west front of the Linden House, at South San Francisco.

Armour Hotel flagstaff (San Mateo County, Cal., A. F. R., 1894).—The flagstaff on the east gable of the Armour Hotel, in South San Francisco. The building is on the west side of the main driveway through the town.

California University building (Alameda County, Cal., G. D., 1881).—The west peak of the tower or cupola surmounting the Bacon Art Building, one of the buildings of the University of California at Berkeley.

Shellmound flagstaff (Alameda County, Cal., G. D., 1881).—The flagstaff on the roof of a circular building at Shellmound Park, in Berkeley. The building stands on top of a shell mound.

Powder wharf (Alameda County, Cal., A. F. R., 1895).—The pile at the southwest corner of the wharf at Judson Point (Fleming Point) belonging to Judson and Sheppard.

Corder tannery chimney (Alameda County, Cal., A. F. R., 1895).—The brick chimney of the stock-yard tannery on the water front at Berkeley. It is within 40 meters of the shore and is the property of T. W. Corder.

Pipe-Works chimney (Alameda County, Cal., A. F. R., 1895).—A brick chimney of peculiar shape, something like an old-fashioned lamp chimney, on the Berkeley water front, on the property of William Everdine.

Reduction-works chimney (Alameda County, Cal., A. F. R., 1895).—A brick chimney said to be the property of the Robinson & Holland Base Ore Reduction Works, approximately 300 meters north from Shellmound Park, in Berkeley.

Berkeley lumber wharf (Alameda County, Cal., A. F. R., 1895).—The southwest corner pile or dolphin of Stege's wharf, the first wharf north of the Berkeley avenue ferry wharf.

Cap-Works wharf (Alameda County, Cal., A. F. R., 1895).—The southeast corner of the wharf of the cap-works which are located on the shore line of the bay north of Berkeley.

Butchertown windmill (Alameda County, Cal., G. D., 1881).—The vane surmounting the roof of the tallest windmill at Butchertown, the stock-yards south of West Berkeley.

Oakland Methodist Church spire (Alameda County, Cal., G. D., 1881).—On the southeast corner of Clay and Fourteenth streets, Oakland.

Oakland Presbyterian Church spire (Alameda County, Cal., G. D., 1881).—The taller of the two spires on the church located on the northeast corner of Franklin and Fourteenth streets, Oakland.

County Court-House dome flagstaff (Alameda County, Cal., G. D., 1881).—On Broadway between Fourth and Fifth streets, Oakland.

Oakland Mole outer switch-house (Alameda County, Cal., A. F. R., 1895).—A small building used as a switch-house by the Southern or Central Pacific Railway, located on the outer end of the mole or earth embankment near the Oakland Ferry landing.

Nevada Smith wharf-house gable (Alameda County, Cal., A. F. R., 1895).—The west gable of the small house sheltering the pile-driver engine on the outer end of a long unfinished wharf of the so-called California-Nevada Railway.

Crag Hazel boathouse flagstaff (Marin County, Cal., A. F. R., 1895).—The flagstaff on a small boathouse having on its eastern gable the words "Crag Hazel" in gilt letters and belonging to Gen. John M. Dickinson, of Sausalito. The boathouse is on the shore in the southern part of Sausalito and about one-fourth mile north from the tidal station wharf.

South dock-light (Marin County, Cal., A. F. R., 1895).—The pyramidal white cover of the dock-light on the south end of Sausalito Ferry wharf, the property of the North Pacific Coast Railway.

North dock-light (Marin County, Cal., A. F. R., 1895).—The pyramidal white cover on the dock-light on the north end of the double-ender ferry wharf at Sausalito belonging to the North Pacific Coast Railway.

Baron Wharf (Marin County, Cal., A. F. R., 1895).—The northeast gable of a small white house on the boathouse wharf one-fourth mile northwest of the North Pacific Coast Railway ferry landing at Sausalito. The owner of the wharf hires out boats, has an eating place, and is known in Sausalito as "the baron."

Railroad depot inner flagstaff (Marin County, Cal., A. F. R., 1895).—The western or inshore flagstaff on the North Pacific Coast Railway Ferry Depot at Sausalito.

Railroad depot outer flagstaff (Marin County, Cal., A. F. R., 1895).—The eastern or outer flagstaff on the North Pacific Coast Railway Ferry Depot at Sausalito.

Tide station wharf (Marin County, Cal., A. F. R., 1895).—The weather-vane staff on the outer end of the tide wharf at Sausalito. This staff is on the southeast corner of the wharf and is within 5 feet of the self-registering tide gauge.

Tiburon dock-bell (Marin County, Cal., A. F. R., 1895).—The bell on the west side of the ferry slip at Tiburon.

Tiburon Depot flagstaff (Marin County, Cal., A. F. R., 1895).—The flagstaff on the south gable of the San Francisco and Northern Pacific Railroad ferry depot at Tiburon.

Tiburon Catholic Church (Marin County, Cal., A. F. R., 1895).—The cross on the west gable of a lone church known as St. Hilary, situated on the land of B. F. Lyford, on the hillside across the valley and estuary north of the village of Belvedere and also north of the ferry landing at Tiburon.

Bluff Point South Range East (Marin County, Cal., A. P. O., 1897; 1902).—A small tripod with pole on the front of the low part of the ridge directly inland from the northeast end of Raccoon Strait. Marked by a hole filled with lead in the center of a granite post 8 inches square on top, projecting 2 inches above the ground and marked "U. S. Range."

Bluff Point South Range West (Marin County, Cal., A. P. O., 1897; 1905).—A tripod situated a little to the northward and eastward of the ridge of rocks above the third cut road and directly back from South Range East (see preceding description). Marked by a hole filled with lead in the center of a granite post 8 inches square on top, projecting 2 inches above the ground, and marked "U. S. Range."

Bluff Point North Range East (Marin County, Cal., A. P. O., 1897; 1905).—A large tripod situated on a slight projecting point just inside the entrance of a bight to the southward of El Campo and outside of the second brickyard to the southward of El Campo. The brickyards are both abandoned, only the remains of brick marking the locations.

Marked by a hole filled with lead in the top of a granite post 8 inches square on top, projecting 2 inches above the ground, and marked "U. S. Range."

Bluff Point North Range West (Marin County, Cal., A. P. O., 1897; 1902).—A small tripod with center pole at the edge of the grove on the slope of the hill and bearing southwest from North Range East (see preceding description). Marked by a hole filled with lead in the center of a granite post 8 inches square on top, projecting 2 inches above the ground, and marked "U. S. Range."

Borax-Works stack (Alameda County, Cal., A. F. R., 1895).—A conspicuous round brick stack on the building of the Borax-Works, located on the water front of the town of Alameda, between the line of the narrow gauge railway and the bay shore.

Pacific Oilworks stack (Alameda County, Cal., A. F. R., 1895).—A brick stack 14 feet square at the base and 150 feet high, belonging to the Pacific Oilworks Company, and situated within the town limits of Alameda, near the Pacific Avenue station of the narrow gauge railway, between the railway and the bay shore, and less than 80 meters from the shore of San Francisco Bay.

Alameda Pipeworks stack (Alameda County, Cal., A. F. R., 1895).—A brick stack or chimney, 170 feet high, on the building occupied by N. Clark & Sons in Alameda. They are manufacturers of vitrified ironstone sewer pipe.

Narrow gauge landing north tower (Alameda County, Cal., A. F. R., 1895).—The northern one of the twin towers at the narrow gauge ferry landing for Oakland and Alameda, on Point Alameda.

Alameda cupola (Alameda County, Cal., G. D., 1881).—The cupola of the Long Branch bathing establishment at Alameda.

Alameda cupola flagstaff (Alameda County, Cal., G. D., 1881).—The flagstaff surmounting the cupola of the Royal Soap Works, located on the shore of the bay at Alameda near the Alameda wharf.

Redwood City waterworks tank (San Mateo County, Cal., A. F. R., 1894).—This is the upper of three tanks, upon the other two of which it rests. On the main street leading south from Redwood City.

Frank's Tannery stack (San Mateo County, Cal., A. F. R., 1894).—The larger of two black stacks on the tannery situated about one-fourth mile north of the center of Redwood City, and on the bank of Redwood City Creek.

SAN PABLO BAY.

Point Pinole (Contra Costa County, Cal., R. D. C., 1851–52; 1874).—On the south side of San Pablo Bay and about one-third of the distance from its entrance to the Strait of Carquinez, on the westernmost part of the point or bluff and 25 feet from the edge. (Note 13, p. 297.) Lost by the caving in of the bank. (See Point Pinole 2 and Point Pinole 3, p. 341.)

Petaluma Creek (Marin County, Cal., R. D. C., 1851–52; 1897–1899).—On top of the hill, about 125 feet high, on the point forming the western side of the mouth of Petaluma Creek. The station was marked according to note 13, page 297, and in 1887 additionally marked by a sandstone block, 8 inches square on top and 29 inches long, having the letters U. S. C. & G. S. cut on the upper face and a hole drilled to mark the center.

Long Pond (Sonoma County, Cal., R. D. C., 1851–52; 1858).—On the north side of San Pablo Bay, about 5½ miles northwest of the entrance to the Strait of Carquinez and about 4 800 meters from the western extremity of Mare Island, in the marsh, 27 feet from the bay shore and 33.5 feet from the margin of a long pond. (Note 13, p. 297.)

Long Point (2) (Marin County, Cal., J. S. L., 1886; 1897).—On the west shore of San Pablo Bay, on the highest part (about 60 feet) of what is locally known as Pacheco Point, the most easterly projection of the fast land, sparsely wooded, in the marsh about 2¾ miles south of the mouth of Novato Creek and about 2 miles north of Gallinas Creek. Reference marks made in 1897 are as follows: Wire nail in triangle blazed on oak tree 32 feet distant, bearing S. 65° W. (mag.); wire nail in triangle blazed on oak tree 99.2 feet distant, bearing N. 78° W. (mag.); wire nail in dead stump 15.8 feet distant, bearing S. 75° E. (mag.). Station is marked underground by a copper tack driven into a leaden bolt set in a stone placed 2½ feet below the surface of the ground, and on the surface by a stone with a half-inch hole drilled in it 1 inch deep.

Point Pinole 2 (Contra Costa County, Cal., J. S. L., 1886).—The eastern one of the reference stones of Point Pinole (p. 340), a stone marked by leaden bolt and cross lines set even with the surface of the ground. Reported lost, 1897. (See Point Pinole 3, p. 341.)

Tolay Creek 2 (Sonoma County, Cal., J. S. L., 1886).—On the northern side of San Pablo Bay, about midway between the mouths of Tolay and Sonoma creeks, a little nearer the latter. The station is marked by a section of drain tile pipe, 5 inches in diameter and 30 inches long, set perpendicularly in the marsh, flange downward, leaving 7 or 8 inches above the surface of the marsh.

Sears Point (Sonoma County, Cal., J. S. L., 1886; 1899).—Near the extreme southern end of the ridge forming the southern part of the range of hills dividing Sonoma and Petaluma valleys. This ridge is 60 feet high, the southern face is quite steep, and along its base runs the Sonoma Valley Railroad. Formerly all the low land lying between it and the shore line of San Pablo Bay and Petaluma Creek was marsh; now it is retained by dikes and a large part of it is under cultivation. The station was marked by a hole in upper face of a stone placed 2½ feet below the surface, and on the surface by a similar hole in a stone which projects 3 inches above the ground.

Point Pinole 3 (Contra Costa County, Cal., E. F. D., 1897; 1899).—On the south side of San Pablo Bay, on the southern side of the point, about 10 feet back from the edge of the bluff. The station was marked by a soda-water bottle buried about 3 feet below the ground, and above it was placed a sandstone post about 2 feet long and 6 inches square on top, in which is inserted a leaden plug to mark the center, the top of the block being about 2 inches above the ground.

Lone Tree Point (Contra Costa County, Cal., R. D. C., 1852; 1886).—On Lone Tree Point, on the south side of San Pablo Bay, about 2 miles from the entrance to the Carquinez Strait, on a bluff 30 feet high, and near a small buckeye tree, which gives the point its name. A copper tack in the tree is distant 31.5 feet, bearing N. 2° E (mag.). The station was marked in 1852, according to note 13, page 297. In 1886 the north reference stone was gone and a surface mark was put in. It consisted of a nail in a pine stub 2 by 3 by 24 inches, with 2 inches projecting above the ground. In 1906 the station

was reported by the United States Engineers as being almost surrounded by oil tanks and buildings.

Vallejo (3) (Solano County, Cal., R. D. C., 1852; 1886).—On the north side of Carquinez Strait, about 1 mile from the entrance of Mare Island Strait, on a high hill, about 370 feet above high water and 510 meters from the shore. The station was marked in 1852 according to note 13, page 297. In 1886 the north reference mark was gone, the south stone had no lead in the hole in its top, and there was no hole in the mark to the east. The center mark was found to be a triangular-shaped stone, having a hole but no bolt in its top. Broken glass is mixed with the dirt over the center mark. A surface mark was put in consisting of a pine stub 2 by 3 by 24 inches, with a nail in the center of its top. A round rock 3½ feet in diameter, projecting out of the ground, is 121 feet from the station, bearing S. 75° W. (mag.), and another round rock, 2 feet in diameter, and projecting above the ground, is 147.7 feet from the center and bears N. 72° W. (mag.).

Wilson (Contra Costa County, Cal., R. D. C., 1852; 1886).—On the shore of San Pablo Bay, on the point a short distance west of the Pinole railroad station. Marked by a stub 1 by 3 by 42 inches, with its top 20 inches below the surface of the ground, and by a 2 by 3 by 24 inch pine stub, 20 inches in the ground, with a nail in the center of its top to mark the station.

Mare Island Southeast (Sonoma County, Cal., R. D. C., 1852; 1886).—On the highest point of the hills lying at the southeastern extremity of Mare Island and about 280 feet above high water. A row of trees is growing on the hill west of the station, the nearest of them being 17½ feet from the station. The station was marked by a sandstone post, with a lead bolt having a cross cut in it, inserted in its top, which is 6 inches square, and 2⅔ feet below the surface of the ground. Above this is a 2 by 3 by 24 inch pine stub, 22 inches in the ground, with a nail in its top to mark the station. There are fragments of glass in the earth over the center mark. Three reference posts of stone with drill holes in their tops are 6 feet from the station and north, south, and east of it. The east reference post is broken into several pieces. Stones were piled around the station. A rock 30 by 19 by 6 inches is embedded in the ground 237 feet from the station, bearing S. 38° E. (mag.).

Vallejo (1) (Solano County, R. D. C., 1852; 1886).—On the north side of Mare Island Strait, about three-fourths mile from its entrance, on the summit of a low hill 85 feet high and 108 meters from the shore. The center is marked by a bottle 3 feet below the surface of the ground; above this is placed another bottle, and for a surface mark an oval stone 2 feet long, 1½ feet wide, and 1 foot deep, with a three-fourths inch drill hole 2 inches deep in its center, was buried with its top a little above the surface of the ground. The upper of the two bottles is marked "J. J. Bleven & Co., Oakland, Cal." and has a glass stopper on the inside. Reference marks are copper tacks in three stubs, each 6 feet from the center of the station. There are fragments of glass in the earth around the center of the station.

Mare Island Northwest (Sonoma County, Cal., R. D. C., 1852; 1886).—In a plowed field on a low hill, about 98 feet high, and about midway of Mare Island; it is the last elevation of any importance on the island to the northwest and the first hill to the southeast of the Marine Barracks. Marked by a bottle 3 feet in the ground, the top of which was crushed down into it, and in it was placed another bottle 7¼ inches long, marked on

one side "Pacific Congress Water" and on the other side with the figure of a deer. The surface mark is a rough granite block with flat top, in which is a three-fourths inch drill-hole marking the station. The letters U. S. C. S. are cut in the top of the stone.

Lone Tree Point Iron Rod (United States Engineers) (Contra Costa County, Cal., U. S. E., 1903–1906).—An iron rod about three-fourths inch in diameter and 3 feet long, driven into the ground until only 3 inches of it projects above the ground. It is well out on Lone Tree Point, San Pablo Bay, and about 10 feet from the edge of the bluff.

Abbot (Contra Costa County, Cal., R. D. C., 1851).—On the high bluff forming the south point of the entrance to Carquinez Strait, opposite the mouth of Mare Island Strait, on the summit of a round conical hill, about 371 feet above high water. (Note 12, p. 297.) The station was searched for in 1886, but none of the marks found; the ground is in cultivation; a large sandstone block, 1 foot below the surface, whose position as determined by plane table agrees closely with that of the triangulation station, was marked as a topographic station.,

Bush Hill (Contra Costa County, Cal., R. D. C., 1851; 1886).—On the south shore of Carquinez Strait, inshore from Granger's wharf and about 1½ miles west of Port Costa. Marked by a black bottle with its top 23 inches below the surface of the ground; above the bottle is placed a flat stone, while as a surface mark a nail was driven in the top of a pine stub 2 by 3 by 24 inches, set with its bottom resting on the flat stone. A circle of stone was placed around the station, 18 inches distant from it. A triangle was cut into the side of a scrub-oak tree facing the station, and a nail driven into each corner of the triangle; it is 15 feet 4½ inches from the station, in azimuth 44°. The nearest of four scrub oaks is 30 paces from the station, in azimuth 197°.

Vallejo Hill 2 (Solano County, Cal., J. S. L., 1887).—On the highest part of the highest hill, about one-half mile north of the town of Vallejo. The top, which is comparatively level, presents no characteristics which can be used as reference marks. Marked by a bottle 2 feet below the surface of the ground and by a stone post 8 inches square and 20 inches high, set with 3 inches of its top projecting above the ground. This top is dressed and has a three-eighths inch hole drilled in its center and the letters U. S. C. & G. S. cut into it.

Brush (Solano County, Cal., J. S. L., 1887).—On the edge of the marsh on the north side of San Pablo Bay. Marked by a section of drain-tile pipe 6 inches in diameter and 30 inches long, set flange down, with 8 inches of its top projecting above the surface of the marsh; the foot of the signal, a pole 4 inches square and 20 feet long, was wedged into the top of the pipe.

Slaughterhouse Point 2 (Solano County, Cal., J. S. L., 1887).—On the small round hill on Slaughterhouse Point, 4 miles north of Georgia Street wharf, Vallejo, and on the east side of Napa Creek. The underground mark is a brick with a hole drilled in its upper face, buried 2½ feet below the surface of the ground. The surface mark is a hole drilled in the upper face of a stone projecting 3 inches above the ground.

Red Marsh (Solano County, Cal., J. S. L., 1887).—A pole in the marsh on the north side of San Pablo Bay.

Black Marsh (Solano County, Cal., J. S. L., 1887).—A pole in the marsh on the north side of San Pablo Bay.

Marsh Pole (Solano County, Cal., J. S. L., 1887).—A pole in the marsh on the north side of San Pablo Bay.

Grove Point 2 (Marin County, Cal., J. S. L., 1887; 1897).—On the summit of a small knoll or island of fast land in the marsh about 2¾ miles northwest of Point San Pedro, on the west side of San Pablo Bay. In 1897 it could best be reached from San Rafael by following the Petaluma road for about 1½ miles, until about halfway down the first grade; then taking a road leading to the right around the edge of the marsh, passing a dairy ranch, powderworks, and old brickyard at the mouth of Gallinas Creek, until the dairy ranch of Joseph Ford is reached; thence around the south side of the point and across the marsh on an old corduroy road to the station, one-fourth mile distant. Underground mark is a tack in a lead bolt set in a stone placed 2½ feet below the surface of the ground. The surface mark is a hole 1 inch deep drilled in a stone. Three reference stones, each 5 feet from the station, are set approximately north, east, and west; the north stone has a hole drilled in it, the others have copper tacks driven into lead bolts.

Observatory (Sonoma County, Cal., G. D., 1877).—Near the naval observatory on Mare Island, which is a small wooden building with glass slides over the transit. Station is 23¼ feet south from the observatory pier and 5 feet 5 inches east from an abandoned transit pier, which is a granite block 16 by 19 inches, projecting 12 inches out of the ground, with the inscription "Position of Observatory, Lat. 38° 05′ 59″, North,—Long. 122° 15′ 15″ West, in time 8^h 09^m $01^s.2$W." painted on it in black letters. The station is marked by a bottle buried 2 feet below the surface of the ground. This bottle has on it the following inscription: "Vincent Hathaway & Co., Boston, Ginger Ale."

Ferris (Marin County, Cal., J. S. L., 1887).—On the reclaimed marsh belonging to John W. Ferris, about 1 mile from the mouth of Novato Creek and one-fourth mile south of the creek, on the road leading from Mr. Ferris's residence to a dairy house, three-fourths mile east of the residence and one-fourth mile west of the dairy house. Three feet beneath the surface of the ground the station is marked by the neck of a stoneware bottle, and on the surface by a hole drilled in a stone 6 by 6 by 12 inches in size.

Novato Bend (Marin County, Cal., J. S. L., 1887).—On the marsh land on the north bank of Novato Creek, about 1 mile upstream from the mouth of the first large slough coming into the creek from the north, on the sharp bend of the creek where it runs from north to east. It is about 600 yards north of the barn of Mr. John H. Ferris. The subsurface mark is a stoneware bottle, neck up, 3 feet below the surface of the ground. The surface mark is a hole drilled in a stone 6 by 6 by 12 inches in size.

Pacheco (Marin County, Cal., J. S. L., 1887).—On a hill 180 feet high, 1 mile south of Novato Creek and 1½ miles west of San Pablo Bay; this hill is partially covered with buckeye trees and appears like an island standing on the low ground, bordered with marsh. The subsurface mark is a stoneware bottle 17 inches below the surface of the ground, which is rocky, the bottle being set on a rock. The surface mark is a hole drilled in a rock 5 by 5 by 14 inches in size.

Ferris chimney (Marin County, Cal., J. S. L., 1887).—The eastern chimney on the house of Mr. John W. Ferris, near Novato Creek.

North Grass (Marin County, Cal., J. S. L., 1887).—A pole stuck in the mud on the outer margin of the high grass on the west side of San Pablo Bay and south of Novato Creek.

South Grass (Marin County, Cal., J. S. L., 1887).—A pole in the mud on the outer edge of the high grass on the west side of San Pablo Bay and south of Novato Creek.

Sonoma Landing flagstaff (Sonoma County, Cal., J. S. L., 1887).—On the southeast corner of the wharf known as Sonoma Landing, the bay terminus of the Sonoma Valley Railroad. This wharf is on the north shore of San Pablo Bay, and is just outside of the entrance to Petaluma Creek.

Austin's windmill (Sonoma County, Cal., J. S. L., 1887).—On Mr. Austin's place on the reclaimed marsh on the north side of San Pablo Bay near Petaluma Creek, and about three-fourths mile west of the Sonoma Valley Railroad.

Storey's windmill (Sonoma County, Cal., J. S. L., 1887).—Near Mr. Storey's house on the west bank of Tolay Creek (Midshipman slough), and about three-fourths mile from its mouth.

Tubbs's windmill (Sonoma County, Cal., J. S. L., 1887).—The larger of two windmills on the Tubbs place, which is on the west bank of Sonoma Creek, about 1½ miles from its mouth, on the reclaimed part of the marsh island known locally as Tubbs Island. Windmill is 165 meters northwest of the house.

Sonoma Pole (Solano County, Cal., J. S. L., 1887).—A piece of timber 10 inches square and 15 feet high found standing on the eastern side of the mouth of Sonoma Creek. A piece of scantling 2 by 4 inches and 16 feet long was nailed to the top of this timber.

Midshipman Point (Sonoma County, Cal., J. S. L., 1887).—A pole stuck in the marsh on the point on the east side of the mouth of Tolay Creek (Midshipman slough).

Sonoma Creek 2 (Sonoma County, Cal., J. S. L., 1887).—In the edge of the marsh on the north shore of San Pablo Bay; marked by a section of drain-tile pipe set flange down, with 7 or 8 inches projecting above the surface, the foot of the signal pole being set and wedged into the top of the pipe.

Mill (Solano County, Cal., G. D., 1877).—The flagpole on the northwest side of the center of the cupola on a large building used as a flouring mill.

Telegraph (Solano County, Cal., G. D., 1877).—On the side of the hill near Vallejo 1.

Commission Rock Beacon (Solano County, Cal., G. D., 1877).—In Napa Creek, on Commission rock; a beacon constructed of an old smoke pipe filled with cement and stones and placed on the rock, which is nearly bare at low water. From the shore at low tide there seems to be some masonry around the outside of the base of the beacon. The beacon is surmounted by a glass globe silvered on the inside and having sharp spikes projecting from it. The beacon is painted in red and white bands.

Mare Island Navy-Yard tall chimney (Sonoma County, Cal., G. D., 1877, 1896).—A square chimney to the left of the walk as one approaches the commandant's office at the Mare Island Navy-Yard.

Cravens transit pier (Sonoma County, Cal., G. D., 1877).—At Mare Island Navy-Yard, 23¼ feet south of the Mare Island Observatory transit and 5 feet 5 inches west of the triangulation station Observatory. Pier is a granite block 16 by 19 inches, and 12 inches above the ground, with an iron bolt on which a male screw is cut projecting

from its center, and bearing the following inscription painted in black letters: "Position of Observatory, Lat. 38° 05′ 59″ North,—Long. 122° 15′ 15″ West, in time 8^h 09^m $01^s.2$ W."

Mare Island Navy-Yard foundry chimney (Sonoma County, Cal., G. D., 1877, 1896).—A square chimney in the Mare Island Navy-Yard, in the vicinity of the foundry and machine shops.

Swift (Sonoma County, Cal., G. A. F., 1857).—On the eastern side of Petaluma Creek, on the extreme end and on about the highest part of the most southern of the many points of hard land projecting into the marsh. It is the only one of the points from which Tolay Creek signal can be seen. (Note 19, p. 297.)

Novato (Marin County, Cal., G. A. F., 1857).—On a piece of hard marsh on the north side of and about one-fourth mile from the mouth of a small creek emptying into Petaluma Creek some 3⅓ miles above Black Point. This creek is supposed to be Novato Creek. The station is within 6 feet of the water, and just west of the station is a small slough. In the middle of the creek one-fourth mile west of the station is a large marsh island. (Note 19, p. 297.)

Sears (Sonoma County, Cal., G. A. F., 1857).—This station bears N. 65° W. from the station Swift (see p. 346) and is on the first highland above the marsh in that line looking from Swift. The point on which the station is placed is nearly even with the southern end of the long straight reach of Petaluma Creek below Lakeville. (Note 19, p. 297.)

San Antonio (Marin County, Cal., G. A. F., 1857).—On the most eastern hill of the first range north of the large Novato marsh. The hill has some scattering trees on it. The station is about 20 feet above the marsh. West of the station the hill rises gradually. (Note 19, p. 297.)

Lakeville (Sonoma County, Cal., G. A. F.,1857).—On the eastern shore of Petaluma Creek, on the summit of the first round bare knoll north of Lakeville, and one-half mile distant from the Lakeville House. A small slough makes in from Petaluma Creek at the western foot of the knoll. (Note 19, p. 297.)

Haydon (Sonoma County, Cal., G. A. F., 1857).—On the summit of a large round-topped hill nearly west from Haydon's landing on Petaluma Creek. Near the top of the hill is a single tree very much bent over toward the southeast. This is the only tree on the hill and is a distinguishing mark. (Note 19, p. 297.)

Bodwell (Sonoma County, Cal., G. A. F., 1857).—On the rising ground nearly north of and about one-half mile distant from Mr. Bodwell's house, and on the eastern side of Petaluma Creek. The hill on which the signal stands has a very gradual slope on the side toward Petaluma Creek, and the station is placed on this slope in the middle of a cultivated field. (Note 19, p. 297.)

Italian (Sonoma County, Cal., G. A. F., 1857).—On the western side of Petaluma Creek, about 1¼ miles below the town of Petaluma. There is a garden cultivated by Italians at this place, directly on the road from Petaluma to the Haystack; this garden is on the side of the hill and has a fence around it. Station is on the side of the hill about 10 feet above the fence and about 100 yards above the house. (Note 19, p. 297.)

Flat (Sonoma County, Cal., G. A. F., 1857).—On the flat on the north side of Petaluma Creek, in bearing N. 51° E., from the Baptist Church spire in Petaluma. (Note 19, p. 297.)

Swift 2 (Sonoma County, Cal., J. S. L., 1887).—In the same locality as station Swift of 1857 (see p. 346), none of the marks of which could be found. The underground mark is a stoneware bottle 2½ feet below the surface of the ground. The surface mark is a stone 7 by 3 inches and 10 inches deep projecting 2 inches above the surface of the ground. A drill hole one-half inch deep in the top of the stone marks the station.

Green Point (Marin County, Cal., J. S. L., 1887).—On the bluff point on the west side of Petaluma Creek, the first point from and 1 mile north of Black Point, 15 feet above and about 20 feet from high-water mark. Marked by a stoneware bottle 3 feet underground and on the surface by a drill hole in a stone 1 foot long.

Slaten's windmill (Sonoma County, Cal., J. S. L., 1887).—On reclaimed marsh land on the eastern shore of Petaluma Creek, about 3¼ miles north and west of Sonoma Landing. The place is commonly known as "Twin Houses," belongs to Mr. Austin, and is in charge of Mr. Slaten.

SUISUN BAY.

Carquinez Point (Contra Costa County, Cal., R. D. C., 1851; 1886).—On the southern shore of Carquinez Strait, on the first hill up the strait from Port Costa; the steep slope of the hill toward the water is covered with scrub oak and other bushes. The underground mark is a stone bottle, filled with coal cinders, buried, neck up, with its top 2½ feet below the surface of the ground; surface mark is a nail in the center of the top of a 2 by 3 by 24 inch pine stub, 20 inches in the ground. Over the top of the bottle was placed a pile of soft reddish stones (20 in number) and stones were piled around the foot of the signal pole.

Monument Hill (Solano County, Cal., R. D. C., 1851; 1886).—On a hill north of Benicia and quite near the city cemetery. The underground mark is a bottle, with the top 26 inches below the surface of the ground. The bottle is in a small hole dug in the underlying sandstone, and the stones are piled over and around the top of the bottle. Surface mark is a 2 by 3 by 24 inch pine stub, 20 inches in the ground.

Army Point (Solano County, Cal., R. D. C., 1851; 1864).—On Army Point, on the north side of the junction of Carquinez Strait and Suisun Bay. Marked by a one-half-inch drill hole in a rock placed 1½ feet below the surface of the ground. Stubs with copper tacks in them were placed east, west, and south of the station, distant 6 feet from it. Stones were piled around the foot of the pole in the form of a wall. Station was searched for and not found in 1886.

Island (Contra Costa County, Cal., R. D. C., 1851; 1886).—On the western side of Suisun Bay, east of the southern point of the entrance to Carquinez Strait. Marked by a bottle 1¾ feet below the surface of the ground, into the mouth of which was placed a spike driven into the foot of the signal. Copper nails were driven in three stubs placed one in line to the arsenal at Army Point and the others at right angles to this line, one northwest and the other southwest of the station. The nails were each 6 feet from the station. The southwest stub was not found in 1878, and in 1886 three instrument stubs were found. Stones were piled around the center pole.

Goodyear (Solano County, Cal., J. S. L., 1864; 1878).—On a hill northeast of John Monroe's farmhouse. The hill rises directly from the wide belt of marsh on the northern side of Suisun Bay and is the next one to the round bald hill where the trend of the

range changes to the northward, forming the south side of Suisun Valley. The road from Benicia to Suisun City runs along the base of the hill and between it and the bald hill just mentioned. The eastern face of the hill is quite steep, especially near the top, where it is traversed from north to south by a ridge of volcanic rocks projecting 2 to 4 feet above the surface. The station is on a small flat spot moderately clear of rocks, on the southern slope of the hill and a few feet from its highest part, in a position where Army Point signal can be seen over the intervening ridge. Marked by a hole drilled in a stone 10 by 20 inches, 1⅓ feet below the surface of the ground. Center is fixed on the surface by two reference marks, one a hole in a knob of the rocky ridge, distant 17.9 feet in line to the mouth of Suisun Creek, and the other a hole in a stone to the southward, distant 8 feet. In 1878 the reference mark 17.9 feet from the center was not found, the rock being broken away and the mark apparently lost.

Martinez East (Contra Costa County, Cal., G. B., 1878).—On the summit of the first hill overlooking Suisun Bay, just east of the town of Martinez. The station is marked as follows: A large stone 3½ feet below the surface of the ground has a copper bolt in it with a cross to mark the center; above this stone was built a brick pier rising 4 feet above the surface of the ground. A copper bolt was set in the center of the pier 1½ feet below the surface of the ground, and another bolt set in the top of the pier; a cross cut in the top of each bolt marks the station. The station was recovered in 1880, 1886, and 1909.

Benicia B. M. (Solano County, Cal., G. B., 1878).—About 250 feet east of the land end of the army or arsenal wharf at Army Point, in the town of Benicia. Marked by a five-eighth inch iron bolt driven in a hole drilled horizontally into the southeastern face of a large sandstone rock, near high-water mark. The rock is apparently the outcropping of a ledge about 7 feet high, the bench being about 4 feet from the top; the face of the rock was smoothed for the space of a square foot and the letters U. S. C. S. B. M. cut in it.

Naylor (Contra Costa County, Cal., J. J. G., 1880; 1886).—On the north slope of a hill on the south side of Suisun Bay; marked by a stone 22 inches below the surface of the ground, and by copper nails in three stubs placed east, south, and west, each 6 feet from the center of the station. The three tripod stubs were also left in position.

Clayton, Mount Diablo Azimuth Mark (Contra Costa County, Cal., G. D., 1876; 1876).—On the ridge of comparatively low hills that stretch northwestward from the northeastern base of Mount Diablo, having the small Diablo Valley on the western flank. The range terminates at Bay View Point on the south shore of Suisun Bay. The mark is about 2½ miles northeast of the village of Clayton on the highest part of the ridge in the neighborhood, being the western summit of what is known locally as Rattle Weed Hill. The mark is on the NE. ¼ sec. 35, T. 2 N., R. 1 W. of Diablo meridian on land owned by F. A. Hyde, of San Francisco. The nearest farm on the west of the mark is the Bromley ranch, managed by Jefferson McKinney; the small farm about one-half mile to the northward is owned by a negro named Lowry. The underground mark is an oblong-shaped piece of limestone 10 by 14 by 8 inches in size, with its top face about 2 feet below the surface of the ground; in the center of this stone is set a one-half-inch copper bolt, cut into which is a cross to mark the center of the station.

The mark proper is a redwood post 4 by 4 inches and 8 feet long, to which is fastened a board with aperture for showing the lamp.

Hewston 2 (Solano County, Cal., G. D., 1886).—On the south shore of Grizzly Island on the north side of Suisun Bay, 23½ feet inside the center of the levee which protects the island from the waters of the bay and opposite station Hewston. Northeast of the station is a line of rosebushes, the end of the line being about 50 feet from the station. Outside the line of rosebushes and also outside the levee is a willow tree with about a dozen stems rising from the same root; this tree is about 63 feet from the station; the station is marked by a hole drilled in a piece of soft flat sandstone 2 feet below the surface. Above this is driven a 2 by 3 inch stub with a copper tack in it and 3 witness stubs set north, west, and south of the station, each with a copper tack in it, 6 feet from station.

Middle (Solano County, Cal., G. D., 1886).—On the eastern side of the slough separating Wharf and Eads islands in Suisun Bay. These islands form what is known as Simmons Island. The station is 1200 meters above the bridge, which is built across the slough about one-half mile above its mouth and is nearly one-half mile above the mouth of the cross slough leading into Roaring River. About 100 meters above the station the slough begins to curve to the west, and about one-half mile above the station the slough forks. The station is 17 meters from the bank of the slough. Station is marked by a hole drilled in a flat stone 18 inches below the surface of the ground. Above this is set a section of sewer pipe with its top projecting about 15 inches above the ground. Three witness stubs set north, west, and south have copper nails in them each 6 feet from the center of the station.

Collinsville (Solano County, Cal., W. E. G., 1866; 1887).—On the first range of hills bearing about due north from the depot at Collinsville and distant about three-fourths of a mile. The road leading from the depot passes at the foot of the hill and makes a turn there to the northward; just at this turn there is a dwelling with outhouses and inclosures, but they can not be seen from the station. The center was marked by a drill hole in a red stone block buried 2½ feet below the surface, its top being 12 inches below the surface; 3 redwood stubs with copper tacks in their tops were placed north, east, and west of the station and each distant 4 feet from it. In 1887 the station being in plowed ground the red stone block was lowered until its top was 18 inches below the surface of the ground.

Diamond (Contra Costa County, Cal., G. D., 1886).—On the point of hard land running down to the river at the entrance to the New York slough, about 400 meters northwest of the town of Black Diamond, or New York. The place was formerly the site of an old brickyard. The station is on the highest part of the yard south of the old drying ground. Station was marked by a drill hole in a flat stone buried 1½ feet below the surface of the ground.

Meins (Solano County, Cal., G. D., 1886).—On the highest part of the hill back of Meins landing on Montezuma Slough, about 4 miles north of Collinsville; it is marked by a drill hole in the center of a soft stone 10 inches square, buried with its top 18 inches below the surface of the ground. No surface marks were placed, as the ground is plowed yearly.

Anderson (Solano County, Cal., G. D., 1886).—On the hill to the east of Montezuma Island, about one-half or three-fourths of a mile back from the Sacramento River and 2 miles east of Collinsville; this hill is the farthest one to the east from which the signal at Collinsville can be seen. The land on which the station is situated is now owned by a Mr. Anderson, whose house, formerly known as the Marshall house, is the nearest one to the station. The station is marked by a drill hole in a flat stone set 2 feet below the surface of the ground. No surface marks were set, as the ground is plowed yearly.

Sand (Contra Costa County, Cal., G. D., 1886).—On the highest point of the range of low sand hills close to the San Joaquin River and about 1 mile east of the town of Antioch. The hills, though sandy, are covered with brush. A hill about as high as the one on which the station stands is about 400 or 500 yards east of the station and has a few scrub oaks on it. Marked by a wide-mouthed pickle bottle set 2 feet below the surface of the ground. Three witness stubs with copper tacks were set north, east, and south of the station and each is 6 feet distant from it.

Buckler 2 (Solano County, Cal., G. D., 1886).—On Point Buckler on the western end of Simmons Island in Suisun Bay. From the station it is 38 paces to the shore line in the direction of the north point of the island. The line from the station to Naylor triangulation station crosses a little slough about 1 foot wide and at a point where it forks; it is 15 paces to the fork and in a continuation of this line it is 43 paces from the station to the shore line in a little bight that has tule growing in it. The station is marked by a drill hole in a flat stone 10 by 12 inches on top set 2 feet below the surface of the ground. Above this is set a joint of 6-inch earthenware sewer pipe with about 4 inches projecting above the ground.

Coon 2 (Solano County, Cal., G. D., 1886).—On the point of hard marsh ground on the eastern side of the mouth of Montezuma Slough. Tules have grown out in the shallow water off the point for a distance of half a mile, and this point of firm marsh is hard to find. A levee extends around the outer edge of the marsh. The station is located on the outside of the levee at a point where it curves to the north and runs up along the shore of the creek. To the eastward of the station the levee is straight for 200 yards. Station is about on the line of the outside edge of the outer ditch prolonged and it is 4 paces to the outside edge of the ditch in line to an unpainted farmhouse half a mile northeast of the station. Marked underground by a drill hole in a flat rock. Surface mark is a joint of sewer pipe projecting 4 inches above the ground. Three reference stubs with copper tacks were set 6 feet from the station, 2 on the line to the house mentioned above and 1 to the eastward at right angles to this line.

Suisun Hill (Solano County, Cal., L. A. S., 1888).—On the hill southeast of the town of Fairfield. Marked by a half-inch drill hole in an oval rock, 8 by 12 inches in size, 20 inches below the surface of the ground. Three reference stubs were placed 6 feet from and north, east, and south of the center of the station.

Pierce (Solano County, Cal., L. A. S., 1888).—On one of the hills bordering on the western side of the marsh which is north of Suisun Bay. Marked by a half-inch drill hole in a rectangular rock, 8 by 12 inches in size, buried 19 inches below the surface of the ground. Three stubs, with copper tacks, each 6 feet from the center, were placed east, west, and south of the station.

Bridgeport (Solano County, Cal., L. A. S., 1888).—On a hill at the northwest corner of the marsh which is on the north side of Suisun Bay. Marked by a rock 18 inches underground, and by three reference stubs placed north, east, and south of the station, each having a copper tack exactly 6 feet from the center.

Edith (Contra Costa County, Cal., J. S. L., 1864).—On Point Edith, on the south side of Suisun Bay, 2½ miles east of Carquinez Strait. The point is marsh, covered with tule. The station is 20 paces from the steep bank of the shore line in the direction of Suisun Point (Suisun Creek). Marked by a half-inch drill hole in a rock 1½ feet below the surface of the ground and by three reference stubs with copper tacks each 6 feet from the center and placed as follows: One in line to station Island, one in prolongation of that line, and the third to the southward at right angles to that line. Reported in 1909 as lost.

Garnett (Solano County, Cal., J. S. L., 1864).—On the middle one of the three points forming the southwestern end of Kings Island (Ryer Island), a flat marshy island in the center of Suisun Bay. From the station it is 30 paces to the shore line in the direction of Point Green, 30 paces to the northwest point of the island, and 49 paces to the shore line, in line with the hydrographic signal on the end of the same point on which is situated the station. Marked by a hole in the top of a stake 1 foot below the surface; stake is 5 inches square and 2 feet long. Three reference stubs with copper nails each 6 feet from the center were set as follows: One in line to Point Green, one in prolongation of that line, and the third to the eastward at right angles to that line. Reported in 1886 as lost.

Seal Bluff (Contra Costa County, Cal., J. S. L., 1864).—On a bluff of the same name, about 12 feet high, lying on the south side of Suisun Bay, abreast of Preston Island (Roe Island). Station is 28 feet from the edge of the bluff in line to station Green; 86 paces from the southwest corner of an old warehouse standing at the eastern end of the bluff; and 112 paces from the northeast corner of an old whitewashed dwelling house to the westward, the line to which passes tangent to a curve in the bluff. Inshore, at the edge of the marsh, is a pond over which the top of Mount Diablo shows at a point about one-third the length of the pond from its western end. Marked by a half-inch drill hole in rock 1 foot below the surface of the ground, and by three reference stubs with copper nails in each, 6 feet from the center, and placed as follows: One in line to Green station, one in prolongation of that line, and the third to the southeast at right angles to that line. The hole over the underground mark was filled with sand instead of with the soil that was dug out of it.

Simmons (Solano County, Cal., W. E. G., 1866).—On Simmons Island in Suisun Bay. The island is low and wet and Simmons House presents a conspicuous appearance and can be seen from all parts of the bay. Upon the house is a cupola or lookout some 4 or 5 feet square and the station is in the center of this lookout. Center is marked by a copper tack.

Hill (Contra Costa County, Cal., W. E. G., 1866).—On the first ridge east of Quinn's house, and almost due south of Stephensons Point, on the next to the highest point on the ridge. The ridge can easily be distinguished by gullies on each side of it, showing a black appearance when seen from the river. Center mark is a copper tack in a redwood stub. Reference stubs are three stubs north, south, and west of the station, each with a copper tack in top, distant 6 feet from the station.

Mallard (Contra Costa County, Cal., W. E. G., 1866).—On the margin of the first creek east of Picket Point. This creek is known as Mallard Slough, and the station is near its western mouth, opposite the western end of Chipps Island. Station is 12½ feet from high-water mark on the western bank of the slough at the mouth of a smaller creek. (Note 1, p. 296.)

McDuff (Solano County, Cal., W. E. G., 1856).—On the margin of the slough or creek called "Roaring River," about 400 meters from the point where the slough from Honker Bay unites with it. Directly to the northward of the signal is a clump of wild rose bushes, and 7 paces to the eastward is a small creek running into the river. McDuff's house is 97 paces to the eastward of the station. (Note 1, p. 296.)

New York (Contra Costa County, Cal., W. E. G., 1866).—On a natural rise of ground about 15 feet in height and west of the point where the San Joaquin slough (New York slough) and the Sacramento River unite. The station is on the highest point of the rise of ground, about 150 meters from high-water mark, and about 450 meters to the westward of the three houses forming the town of New York. Marked by drill hole in a red stone block sunk 2½ feet in the ground, its top being 12 inches below the surface. Three redwood stubs each have copper tacks in their tops, 4 feet from the station and north, east, and west of it.

Foley (Solano County, Cal., L. A. S., 1888).—On the hills west of the mouth of Suisun Creek. Marked by a drill hole in an irregular rock 14 inches below the surface of the ground. Three reference stubs placed east, west, and south of the station have copper tacks in top, each 6 feet from center.

Delta 2 (Solano County, Cal., G. D., 1886).—On the lower end of Joice Island, between Suisun Creek and Montezuma Slough, on the southernmost point of the island, inside the levee and 23 paces inside the inner ditch. The station is marked by a drill hole in a rock 34 inches below the surface of the ground. Above this is a joint of earthenware sewer pipe projecting 4 inches above the ground. Three stubs with copper tacks in them are placed 6 feet from the station, and north, east, and south of it.

Army Point 2 (Solano County, Cal., G. D., 1886; 1909).—The top of the hill where Army Point, 1852 (see p. 347), was located has been graded off and a reservoir built there. Army Point 2 is on a line with the outside edge of the coping of the north wall of the reservoir, 117½ feet distant from the northeast corner of the brickwork and east of the reservoir. Marked by a drill hole in a flat stone about 1 foot square, set 15 inches below the surface of the ground.

Suisun Point 2 (Contra Costa County, Cal., G. D., 1886; 1909).—On Suisun Point opposite the town of Benicia, back from the edge of the bluff on the north side of the point, and so placed that one can see into Suisun Bay as well as down Carquinez Strait. Two small live-oak trees standing on the edge of the bluff just outside of the plowed ground were blazed and a copper nail driven into each blaze. The most eastern of these trees is 96 feet 3 inches from the station and the other 79 feet 11 inches. The station is marked by a drill hole in a stone about 12 inches square set 18 inches below the surface of the ground. In 1909 two reference stones were set near the edge of the bluff and flush with the ground. One is 6 by 8 by 14 inches in size and a drill hole in its top is 33.50 meters from the station and on the extension of a line from Martinez court-house dome through the station; the other reference stone is 8 by 10 by 12 inches in size and

the drill hole in its top is 36.53 meters from the station on the extension of a line through the station from a chimney near a red building about one-fourth mile to the southeast.

Stake (Contra Costa County, Cal., G. D., 1886).—On Stake Point, on the south side of Suisun Bay. From the station it is 28 paces to the bank in the direction of station Naylor; 25 paces to the bank in the direction of the highest Montezuma hill, and 22 paces to the bank in the direction of the west point of Chipps Island. It is 11 paces from the station to the bank of a little slough that makes into the point from the west in the direction of Dutton's warehouse. The station is marked by a drill hole in a flat stone placed 14 inches below the surface of the ground. The three stubs on which the instrument stood were left standing.

Bark (Contra Costa County, Cal., G. D., 1886).—On a hill immediately back of Middle Point and Stephenson triangulation station, and about 1½ miles distant; not on the highest point of the hill, but on the backbone of the ridge about 60 yards north of the highest point. Marked by a drill hole in a flat piece of sandstone set 20 inches below the surface of the ground. Being in a plowed field, no reference marks were set.

Mass (Contra Costa County, Cal., J. S. L., 1864).—A tall stake standing near the outer end of the Seal Shoal Island in Suisun Bay.

Preston (Solano County, Cal., J. S. L., 1864).—A scantling 3 inches square and 15 feet long, set in the middle of a small island forming the eastern end of Preston Island (Roe Island). Station is 22 paces from shore line in the direction of station Seal Bluff and 18 paces from the shore in prolongation of that line; it is 14 paces from the shore in the direction of station Goodyear and 13 paces from the shore in prolongation of that line.

Marked Tree (Contra Costa County, Cal., J. S. L., 1864).—A scrub oak about 1 foot in diameter, the nearest one to the edge of the bluff on the northeast point of the island; the bluff is about 8 feet high, and the tree is 16 paces from it. The tree has a blaze near its base in which a copper nail was driven.

King (Solano County, Cal., J. S. L., 1864).—A 3 by 3-inch scantling, 15 feet long, set in the eastern end (Point Rose) of Kings Island. The distance from the station to the edge of the tule is 22 paces in the direction of Preston station, and 32 paces at right angles to this line.

Bull 2 (Contra Costa County, Cal., G. D., 1886; 1909).—On the low round mound rising from the marsh just north of the railroad at Avon station, and near the drawbridge on Pacheco Creek. Station is on the highest part of the mound, which is rather indefinite, as the top of the mound is nearly level. The underground mark is a hole in a flat stone. Three reference stones with hole drilled in each were set 6 feet from the center, and northwest, northeast, and southeast of it.

Bay 2 (Solano County, Cal., G. D., 1886).—Located on the first tongue of solid land crossed by the railroad after leaving Army Point going north along the shore of Suisun Bay, in cultivated ground. The station is marked by a hole in a stone 1 foot below the surface of the ground. For reference marks the distances are given to telegraph poles along the railroad track as follows: 342 feet to the first telegraph pole that shows from the station to the left of the bluff at Army Point; this pole is on the marsh and is marked by three copper tacks driven in the side nearest the station, one above the other and about 10 inches above the ground. To the second pole showing to the left of the bluff at Army Point, 173 feet 1 inch; this pole stands on solid ground and is marked by three

copper tacks driven in the side nearest the station, about 1 foot above the ground, in the form of a triangle. To the third telegraph pole the distance is 208 feet 10 inches. This pole is also in solid ground, and is marked by five copper tacks driven in the face nearest the station and 1 foot above the ground; the tacks form a square with a central point.

Green 2 (Solano County, Cal., G. D., 1886).—An unmarked station on Preston Point, eastern end of Roe Island, Suisun Bay. Searched for and reported lost in 1909.

Garnett 2 (Solano County, Cal., G. D., 1886).—On the southwestern point of Ryers Island, in Suisun Bay. The shore line in the direction of the south point of the island is distant 13 paces, and in the direction of the Benicia Arsenal it is distant 10 paces; marked by a drill hole in a flat stone placed underground.

Upper 2 (Solano County, Cal., G. D., 1886).—On the most northern part of Eads Island (Simmons Island), Suisun Bay. The shore line in the direction of a white house with two black barns showing to the right of it on the northern side of the bay is 41 paces. In the direction of a small white house showing to the left of the above the shore line is 18 paces distant. The underground mark is a drill hole in a flat rock 11 inches square, set 22 inches below the surface. The surface mark is a 6-inch sewer pipe projecting above the ground.

Sun (Solano County, Cal., J. S. L., 1864; 1878).—On very soft flat ground on the western side of Suisun Bay. The ground is covered with tules, and the signal is about 50 yards inside the edge of the tules. When the tide is two-thirds flood the water reaches to within 20 feet of the signal. Marked by a 3 by 3 inch scantling signal. Recovered in 1886.

Honker (Solano County, Cal., W. E. G., 1866; 1878).—On the north side of Honker Bay, on the southern shore of Wheelers Island, on low marshy ground covered with tule. There are no distinguishing features to identify the locality. Station is marked by a redwood stub with copper tack in its center, and by copper tacks driven in four other stubs, 4 feet from the station and north, south, east, and west of it.

Freeman (Solano County, Cal., J. S. L., 1864; 1878).—On the southwest part of Holbrook Island (Freeman Island), a low marshy island covered with tule, and having no natural marks to which to refer the station. From the station it is 35 paces to the passage cutting off a small island which is covered at high water; from the station to the shore line in the direction of Mount Diablo is 23 paces, and in line to Point Buckler is 17 paces. Marked underground by a hole in an irregular rough stone, and on the surface by three instrument stubs, and by copper nails in three reference stubs, 6 feet from the station and southwest, northwest, and southeast of it.

Stephenson (Contra Costa County, Cal., J. S. L., 1864; 1878).—On a marshy point of the same name, 2½ miles east of Seal bluff; this point was covered with tule, but it has been destroyed by cattle feeding on it. There are no natural objects by which to identify the location. The shore line is distant from the station 74 paces in the direction of Seal bluff, 43 paces in the direction of Bleak house, and 40 paces in line with the right tangent to Montezuma hills. The subsurface mark is a hole in a triangular wooden block, 5 inches thick and 1 foot below the surface of the ground. Three stubs, with a copper nail in each, 6 feet from the station, are placed as follows: One in line to station Green, one in prolongation of that line, and the third at right angles to that line to the

southwest. In 1878 the stub in prolongation of the line from station Green was not found.

Cupola (Solano County, Cal., W. E. G., 1866).—The cupola or lookout on a conspicuous white house situated on the north side of Montezuma slough and near where it debouches into the upper part of Suisun Bay. It bears about east-southeast from station Hewston.

Dark house ventilator (Solano County, Cal., G. D., 1886).—The ventilator of a dairy house of Montezuma slough, to the westward of Collinsville.

Robinson's large windmill (Contra Costa County, Cal., G. D., 1886).—The standard supporting the wheel of the large windmill at Pittsburg Landing, on the New York slough. There is a tank below the windmill supported by trestle work. The mill stands to the westward of the railroad and only a short distance from the head of the wharf.

White house stovepipe (Solano County, Cal., G. D., 1886).—The stovepipe of a white house located on the west side of Montezuma slough and on the north side of Roaring River, and near their junction.

Black shanty, north gable (Solano County, Cal., G. D., 1886).—The north gable of an old dilapidated shanty standing on the point of Van Sickles Island at the mouth of Montezuma slough.

Brant (Solano County, Cal., W. E. G., 1866).—Located a few feet from the high-water mark on the upper part of Suisun Bay, near the point where the shore trends to the eastward. It bears about north-northeast from station Hewston. To the westward is a fence running from the margin of the bay into the marshes. Station is marked by three stubs 4 feet from and north, south, and east of the station.

MONTEREY BAY TO SAN FRANCISCO BAY.

Santa Cruz Point (Santa Cruz County, Cal., R. D. C., 1852).—About three-fourths mile south of the embarcadero of Santa Cruz and about midway of the point, 270 feet from the extreme end, 130 feet from the edge of the bluff on the east, and 108 feet from the broken bluff on the west; 291.9 feet above high-water mark. The station was marked by a drill hole in a flat stone from 6 to 7 inches in diameter. Three other stones, from 1 to 2 feet in length, similarly marked, were placed with their tops just above the surface, two being in line and one at right angles, each 6 feet from the center of the station.

Moore (Santa Cruz County, Cal., R. D. C., 1852; 1864).—About 2½ miles southwest of the embarcadero of Santa Cruz, on the bluff, about 30 feet above tide. The station was marked by a drill hole in a flat stone 1 foot in diameter. Three other blocks 14 inches in length were placed in the ground, with their tops level with the surface; two in line and one at right angles, and each about 6 feet from the center of the station. Three redwood stubs, each with a nail in the top, were placed 3 feet from the station. In 1904 it was reported by Lieut. F. Swift, U. S. Navy, that one redwood stub with a nail in the end was found, but no stones or other marks.

St. Johns Hill (Santa Cruz County, Cal., R. D. C., 1852; 1864).—About 4½ miles west of Santa Cruz. Follow the road leading up the coast for about 4 miles from the

town of Mission; then turn to the right or northward and the signal will be seen a mile distant, standing on the elevated bluff of the second terrace. The station was marked as in note 9, page 296; the reference stones are two in line and one at right angles.

Balcraft 1 (Santa Cruz County, Cal., R. D. C., 1852; 1864).—About 3¾ miles west of Santa Cruz Point on land claimed by —— Balcraft, on the bluff 38 feet from the edge. The station was marked by a small hole drilled in a flat rock about 9 inches in diameter. (Note 9, p. 296; the reference stones are two in line and one at right angles.) Three redwood stubs, each with a nail in the top, were placed 3 feet from the station.

Parsons (Santa Cruz County, Cal., W. E. G., 1864).—On the bluff about one-third mile south of Rice's house, in full view from it and east of what is known as Parsons Beach. (Note 17, p. 297.)

Rice (Santa Cruz County, Cal., W. E. G., 1864).—On a prominent hill of the second terrace, about three-fourths mile in a northerly direction from Rice's house and in plain view from it. (Note 17, p. 297.)

Lagoon (Santa Cruz County, Cal., W. E. G., 1864).—On the first point to the eastward of the mouth of Lagoona Creek, on the bluff about one-eighth mile east of a large sand hill. (Note 17, p. 297.)

Butler (Santa Cruz County, Cal., W. E. G., 1864).—On a prominent hill on the second terrace and east of what is commonly known as the big Lagoona Creek. (Note 2, p. 296.)

Glassell (Santa Cruz County, Cal., W. E. G., 1864).—Directly opposite Glassell's landing on the bluff point, to which one end of the hawser from the landing is made fast. (Note 17, p. 297.)

Redwood (Santa Cruz County, Cal., W. E. G., 1864).—On the top of a hill about 3 miles from Glassell's landing on the road to his mill, about 50 meters west of the road. (Note 17, p. 297.)

Point (Santa Cruz County, Cal., W. E. G., 1864).—On a prominent bluff point about 2½ miles to the westward of Glassell's landing. (Note 17, p. 297.)

Manzanita (Santa Cruz County, Cal., W. E. G., 1864).—On a conspicuous hill, about three-fourths mile to the eastward of the Jarro Valley and the same distance to the northward of the coast road. (Note 17, p. 297.)

Cook (Santa Cruz County, Cal., W. E. G., 1864).—On a high hill west of Scotts Creek (El Jarro) and distant about one-fourth mile from the road, about 1¾ miles from where the road crosses the creek and about one-fourth mile from Cook's house. (Note 17, p. 297.)

Pine (Santa Cruz County, Cal., W. E. G., 1864).—On a hill to the northward of the Jarro Valley (the upper part) and distant from the new road up that valley about 1½ miles, on the highest part of the ridge and near the northern end. (Note 17, p. 297.)

Tranta (Santa Cruz County, Cal., W. E. G., 1864).—On the high conspicuous knob immediately to the eastward of the valley of the Tranta. (Note 17, p. 297.)

Steele (Santa Cruz County, Cal., W. E. G., 1864).—On a high ridge about 1 mile in a northeasterly direction from A. Steele's house and in a northerly direction from a large gulch about one-eighth mile from Steele's house, near the northern extremity of the summit and about 100 meters from the timber line. (Note 17, p. 297.)

Point Ano Nuevo (San Mateo County, Cal., W. E. G., 1864).—On a sandy ridge on Point Ano Nuevo, about 150 meters from high-water mark and at an elevation of about 60 feet above it. (Note 17, p. 297.)

Masters Hill (Santa Clara County, Cal., R. D. C., 1852).—Eight and one-half miles N. 71° 35′ E. from the town of San Jose, on the first range of hills forming the eastern boundary of the valley of San Jose, on a peak whose northwestern and southwestern slopes are covered with trees and undergrowth, the highest summit of that range within 5 or 6 miles, excepting that about two-thirds mile S. 26° E. of the station there is another round conical summit, somewhat higher than Masters Hill and somewhat similar in appearance. To the northeastward and eastward there is a still higher range running parallel with this and with a small valley between, called Queery's ranch. The summit is about 50 feet in diameter, the slope from the summit being very steep. The station is within 25 feet of the undergrowth to the northwestward. There are two oak trees, one 80.9 feet N. 77° 30′ E. of it, the other 111.8 feet N. 55° 30′ E., each with a nail in a blaze on the side facing the station. An outcropping ledge of rock running in a northwesterly direction lies 17.5 feet S. 23° W., and another ledge 220 feet N. 23° E. (Note 13, p. 297.)

Murphy (Santa Clara County, Cal., R. D. C., 1852–54).—On the summit of the high ridge forming the eastern boundary of the valley of San Jose, about 2 708 feet above tide. (Note 13, p. 297.)

Johnston (San Mateo County, Cal., R. D. C., 1854; 1863).—About 6 miles south of Point Miramontes, on land owned by Mr. Johnston, and about 1 800 meters southwest of Mr. Johnston's house. (Note 18, p. 297.)

Halfmoon Bay (San Mateo County, Cal., R. D. C., 1854).—On the first hill inland from the center of Halfmoon Bay, on land belonging to a Spaniard known as "Tobushy Vascas." (Note 18, p. 297.)

Gushee (San Mateo County, Cal., W. E. G., 1864).—On the western end of a prominent high hill about 1¾ miles from the coast. The north side of the hill is covered with timber. (Note 17, p. 297.)

Middle Point (San Mateo County, Cal., W. E. G., 1864).—On Middle Point, on the coast above Monterey Bay. (Note 17, p. 297.)

Cutts No. 2 (Santa Cruz County, Cal., W. E. G., 1864).—About 1 mile in a westerly direction from and in plain view of Rice's house and about 100 meters from the bluff. (Note 9, p. 296, the reference stones being two in line with the station and the third at right angles.)

Topog No. 2 (Santa Cruz County, Cal., W .E. G., 1864).—On a bluff point about three-fourths mile to the westward of the mouth of Vincente Creek. (Note 17, p. 297.)

Topog No. 3 (Santa Cruz County, Cal., W. E. G., 1864).—On a bluff about one-half mile southeast of the mouth of Scotts Creek. (Note 17, p. 297.)

Topog No. 1 (Santa Cruz County, Cal., W. E. G., 1864).—On the tip of a bluff point about three-fourths mile distant and westward from the mouth of the Big Laguna Creek. A pole 5 inches in diameter was placed in the ground 3 feet, and three redwood stubs with copper tacks in their tops driven in the ground 3 feet from the center of the station.

Topog No. 5 (Santa Cruz County, Cal., W. E. G., 1864).—About 300 meters south of the coast road. (Note 17, p. 297.)

Topog No. 7 (San Mateo County, Cal., W. E. G., 1864).—On the bluff about half way between Point Ano Nuevo and Middle Point. (Note 17, p. 297.)

Topog No. 8 (San Mateo County, Cal., W. E. G., 1864).—On the bluff about 1 mile to the westward of Middle Point. Abbott's house is in full view about one-fourth mile to the north of the station. (Note 17, p. 297.)

Topog No. 6 (Santa Cruz County, Cal., W. E. G., 1864).—On the bluff about one-fourth mile to the eastward of Waddell's wharf. (Note 17, p. 297.)

Topog No. 4 (Santa Cruz County, Cal., W. E. G., 1864).—About 300 meters south of the coast road. (Note 17, p. 297.)

Cutts No. 1 (Santa Cruz County, Cal., W. E. G., 1864).—About one-fourth mile northeast of Rice station (see p. 356). (Note 9, p. 296; the reference stones are two in line and one at right angles.)

Whites Landing (Santa Cruz County, Cal., R. D. C., 1854).—On the shore of Monterey Bay, 4½ miles northwest from the mouth of Pajaro River, 54 feet from the edge of the bluff, and 400 yards northwest of a cluster of stone houses. Station is marked by a drill hole in a rock buried 3 feet in the ground. Reference marks are three stubs with copper tacks in their tops, placed 6 feet from the station, two in line with the station and the other at right angles to that line. The tops of the stubs are even with the surface of the ground.

ASTRONOMIC STATIONS, MOUNTAIN PEAKS, AND MISCELLANEOUS POINTS.

Mount Lola Latitude Station (Nevada County, Cal., G. D., 1879).—Situated 22 feet 3.9 inches north and 21 feet 10.4 inches east of the triangulation station described on page 620, Appendix 9, Report for 1904. Latitude station is marked by a brick pier resting on a rough stone foundation and capped by an unhewn flat stone about 3½ inches thick.

Round Top Latitude Station (Alpine County, Cal., G. D., 1879).—Situated 35.09 feet west of and 1.17 feet south of the triangulation station, for a description of which see page 619, Appendix 9, Report for 1904. The latitude station was marked by a rough stone pier, which was built up from the solid rock. This pier had its foundation some 4 or 5 feet below the floor of the observatory, the west end of which rested on a wall of stones, inside of which and clear back to and around the pier stones were filled in.

Yolo Southeast Base Latitude Station (Yolo County, Cal., G. D., 1860).—Situated 48.71 meters from the triangulation station, in azimuth 253° 36′. (For description of triangulation station see p. 622, Appendix 9, Report for 1904.) The latitude station was marked by a brick and cement pier, with its base 3 feet below the surface of the ground.

Yolo Northwest Base Latitude Station (Yolo County, Cal., G. D., 1880).—Situated 5.95 meters from the triangulation station in azimuth 131° 45′. (For description of triangulation station see p. 623, Appendix 9, Report for 1904.) The latitude station is marked by a brick and cement pier, with its base 3 feet below the surface of the ground.

Monticello Latitude Station (Yolo County, Cal., G. D., 1880).—Situated 31.413 feet north of and 8.823 feet east of the triangulation station, for description of which see page 622, Appendix 9, Report for 1904. The latitude station is marked by a pier of stone and cement, with its foundation 12 inches below the surface of the ground.

Vaca Latitude Station (Solano County, Cal., G. D., 1880).—Located 61.6 feet east of and 37.4 feet south of the triangulation station, for description of which see page 621, Appendix 9, Report for 1904. The latitude station was marked by a concrete pier, with its base 12 inches below the surface of the ground.

Mount Tamalpais Latitude Station (Marin County, Cal., G. D., 1882).—Situated 5.60 meters from the triangulation station, in azimuth 103° 13′. (For description of triangulation station see page 299.) The latitude station was marked by a pier 18 inches square, made of concrete, and having its base well embedded in the ground.

Mocho Latitude Station (Santa Clara County, Cal., G. D., 1887).—Situated 1.60 meters due east of the triangulation station, for description of which see page 621, Appendix 9, Report for 1904. The latitude station was marked by a concrete pier.

Mount Diablo Latitude Station (Contra Costa County, Cal., G. D., 1876).—Situated 51.15 meters from the triangulation station, in azimuth 89° 02′. (For description of the triangulation station see p. 620, Appendix 9, Report for 1904.) The latitude station was marked by a brick pier.

Presidio Latitude Station (San Francisco County, Cal., G. D., 1852).—Situated 5 feet 6⅛ inches west of and 4 inches north of the transit instrument, which was central with Presidio magnetic station, described on page 337. The latitude station was reported in 1904 as lost.

Presidio Latitude Station (San Francisco County, Cal., F. M. and O. B. F., 1896).—In the Presidio Military Reservation, 4.84 feet east of the Presidio longitude station of 1896, for a description of which see page 337. The latitude station is marked by a solid masonry pier.

Lafayette Park Latitude Station (San Francisco County, Cal., G. D., 1888).—Marked by a pier 5.185 feet east of and 0.025 feet north of Lafayette Park longitude station, for description of which see page 318.

Ross Mountain Latitude Station (Sonoma County, Cal., G. D., 1859–60).—A solid spruce block, 3½ feet in the ground and resting on a solid rock. The station is 31 feet 9 inches distant, in azimuth 269° 50′ from the triangulation station, for description of which see page 623, Appendix 9, Report for 1904.

Mount Helena Vertical Circle (Napa County, Cal., W. E., 1876).—A brick pier 109 feet 3½ inches from the triangulation station, in azimuth 314° 03′. (For description of the triangulation station see p. 621, Appendix 9, Report for 1904.)

Mount Helena Latitude Station (Napa County, Cal., W. E., 1876).—A brick pier just east of the transit pier and 58 feet 2½ inches from the triangulation station, in azimuth 330° 10′. (For description of the triangulation station see p. 621, Appendix 9, Report for 1904.)

Mount Conness Vertical Circle Station (Tuolumne County, Cal., G. D., 1890).—A pier located 28.6 feet west and 81.4 feet south of the magnetic pier on Mount Conness, for description of which see the following description.

Mount Conness Magnetic Station (Tuolumne County, Cal., G. D., 1890).—The station is 20.7 feet west and 57.7 feet north of the transit pier (which is 5.07 feet west of the latitude pier) and 28.6 feet east and 81.4 feet north of the vertical circle pier. Magnetic pier is 180.4 meters from the triangulation station, in azimuth 298° 20′. (For description of triangulation station see p. 620, Appendix 9, Report for 1904.)

Mount Conness Latitude Station (Tuolumne County, Cal., G. D., 1890).—A concrete pier 194.5 meters from the triangulation station, in azimuth 301° 59′. See preceding description of magnetic station and description of triangulation on page 620, Appendix 9, Report for 1904.

Marysville Court-House flagstaff (Yuba County, Cal., C. H. S., 1898).—The court-house is built of yellow brick and has two towers, both battlemented, but only one has a flagstaff. It is on the southern tower, the one farthest from the street corner.

Stone (Yuba County, Cal., C. H. S., 1898).—About 10 miles northwest of Marysville on a rocky ridge of the first foothills of Marysville Butte. This ridge is used for pasture only, being too rocky for cultivation, and is only about 50 feet above the general level of the valley. The land belongs to Mrs. Bloomfield. Station is marked by a one-half-inch drill hole in a fast rock about 15 inches in diameter and projecting 10 inches above the ground. From the station the following distances were measured: To a large bowlder, 12 feet east; to an outcrop of rock, 9 feet south; to an outcrop of rock, 14 feet northeast; and to a fast rock, 6 feet northwest.

Walton (Sutter County, Cal., C. H. S., 1898).—In a field, on east side of a north and south road, 3 feet from the fence, and 34 paces north of the road from Colusa to Marysville. It is 2 feet south of the fifteenth fence post from the corner.

Roll (Sutter County, Cal., C. H. S., 1898).—About 10 miles a little north of west of Marysville, on land belonging to F. X. Lenenager. It is on the crest of the first foothill, about 100 feet in altitude above the valley. The land is used for grazing only, on account of the number of large stones on it. Station is marked by a one-half-inch drill hole in a fast rock, about 12 by 18 inches in size, projecting 4 inches above the surface of the ground. From the station it is 5 meters southeast to a large fast stone, 5½ meters northwest to a small fast stone, 14¼ meters east to a large fast stone, 62 paces northwest to a fence corner, 9 paces southwest to a stone fence, and 14 meters north to a wire fence.

Fields (Sutter County, Cal., C. H. S., 1898).—In a field on the west side of a north and south road, 3 feet from the fence and 50 yards north of the yard fence of John Henry Fields. Marked by a 2 by 3-inch stub.

Elmer (Sutter County, Cal., C. H. S., 1898).—In a field belonging to Mr. Elmer, but now rented by Mr. Sterns; 3 feet south of the fence, on the south side of the road from Colusa to Marysville.

Marysville North Base (Sutter County, Cal., C. H. S., 1898).—In the public road, at the northwest corner where it turns to the east between the lands of William Saunders and Lewis Sterns. It is 6 feet from the west fence and 18 feet from the north fence. Marked by a 2 by 3-inch stub.

Marysville South Base (Sutter County, Cal., C. H. S., 1898).—On the west side of the public road, just south of a bridge, 6 feet east of the west fence and about 8 fence panels north of where the road turns east and west. It is between the lands of W. A.

Pinney on the west and William Saunders on the east. The land to the south is owned by Frank Roten. Marked by a 2 by 3-inch stub.

Marysville Presbyterian Church spire (Yuba County, Cal., C. H. S., 1898).—On the southeast corner of D and Fifth streets, built of red brick. Tallest spire in town. It has clock faces on all four sides.

Marysville Catholic Church spire (Yuba County, Cal., C. H. S., 1898).—On the northwest corner of C and Seventh streets; a tall spire of a lead color on a brick church erected in 1855.

Marysville Longitude Station (Yuba County, Cal., C. H. S., 1889).—Located in Cortez square, Marysville. Cortez square is bounded by Fifth, Sixth, B, and C streets, is two blocks west of the Southern Pacific Railroad depot and one block east of the court-house. Station is 126 feet east of C street and 163 feet north of Fifth street. Marked by a pier of brick, with a foundation 22 inches below the surface of the ground, resting on a rock.

Sacramento Longitude Station (Sacramento County, Cal., C. H. S., 1889).—In the capitol grounds on the east side of the capitol. Station is 124.99 meters southeast of the capitol dome, being 78.196 meters south and 97.504 meters east of it. Station is marked by a pier consisting of a granite block 14 by 25 inches and 6½ feet long. Recovered in good condition in 1908.

Mount Hamilton Longitude Station (Santa Clara County, Cal., C. H. S., 1888).—Located about 1 400 feet east of Lick Observatory, upon the east side of the small knoll which is south of the main road running along the ridge. Two piers built of brick are 79½ inches from center to center, and the west pier marks the longitude station.

Mount Hamilton Latitude Station (Santa Clara County, Cal., C. H. S., 1888).—Marked by a brick pier 79½ inches east of the pier marking the Mount Hamilton longitude station, for the description of which see the preceding description.

Jackson Butte (Amador County, Cal., G. D., 1879).—On the summit of Jackson Butte, an isolated steep hill, conical in shape, and covered with a scattering growth of mixed timber. In 1880 the nearest house to the station was that of C. J. Ruffner, situated at the base of the butte, about three-fourths mile northwest of the station and 3 miles east by south from Jackson. The center of the station is marked by a cross in the top of a copper bolt which projects about three-fourths inch above the surface of a rock in which it is fixed. This rock is even with the surrounding surface of the ground. Over the center is placed a pier composed of two stones, one above the other, cemented together. Around this pier is piled a conical cairn of stones. It is about 6 feet in diameter at its base and about 4 feet high. Reference marks are holes drilled in the tops of three isolated rocks which project considerably above the surrounding surface and are at the following distances and magnetic bearings from the station: 66.79 feet, S. 67° 45′ E.; 12.35 feet, S. 1° 26′ W.; 27 feet, N. 64° 40′ W. Recovered in 1898.

Sanel Mountain (Mendocino County, Cal., G. D., 1860; 1878).—On a high round-topped hill about 24 miles northwest of Sulphur Peak. Approached from Cloverdale, the mountain may be identified by two prominent landmarks—a large white rock which crops out about half way up the mountain-side and shows as a white spot on it, and a pine grove which covers about 3 acres and is the only one on the mountain. Center mark is a cross cut on a flat rock even with the surface of the ground. Reference marks

are shallow holes in three flat stones even with the surface of the ground, two being in line with the station and Ross Mountain, and the third at right angles to that line.

Walalla (Mendocino County, Cal., G. D., 1860; 1878).—On a mountain of that name, about 6 miles from the coast, nearly abreast of the Havens anchorage, locally known as Bulls Landing. Station is within 40 feet of the trail from Gualala to Joshua Adam's ranch and is on what is locally known as Signal Ridge. Marked by a bottle set in a hole in the solid rock 18 inches below the surface of the ground. Above the bottle was placed 3 inches of dirt, then a flat rock, above which was set a wooden pier. When filling around the pier, broken glass was mixed with the earth. Around the pier was placed a cairn of stones, the cairn being 6 feet in diameter and 3 feet high. The reference marks are crosses cut in three flat stones placed each 6 feet from the station, two in line with Ross Mountain, and the third at right angles to this line.

Sulphur Peak (Sonoma County, Cal., G. D., 1860; 1878).—On Sulphur Peak, sometimes called Goodwin or Geyser Peak, about 30 miles from the coast, directly inland from Fort Ross. It lies on the eastern side of Russian River Valley, abreast of the town of Geyserville. The summit of the peak is very limited in extent, the ground falling away rapidly in every direction. The peak is covered with chaparral and scrub trees. Center of the station is marked by a hole in a flat rock level with the surface and by three reference marks consisting of holes in stones each 6 feet from the station and placed one in line to Sanel Mountain, one in line to Mount Helena, and the third in line to Ross Mountain.

Sulphur Peak Latitude Station (Sonoma County, Cal., G. D., 1859).—Marked by a wooden pier filled with rocks placed 5.537 meters from the triangulation station in azimuth 271° 21′. (For description of the triangulation station see the preceding description.)

King Peak (Humboldt County, Cal., A. F. R., 1879–1881).—Upon the highest coast summit immediately north of Shelter Cove (Point Delgada). It is about 4 000 feet in elevation. Station is marked by a hexagonal pier of cement, sand, and rubble. The pier was covered with a box of pine boards, and the space between the box and pier filled with disintegrated rock, such as composes the surface of the summit. The center of the station was reproduced on top of the pine box covering the pier.

Mount Lassic (Humboldt County, Cal., A. F. R., 1881; 1892).—On the most westerly and least prominent of those buttes which rise in sharp conical outline about 200 feet above the ground surface of the mountains in the eastern part of Humboldt County. The highest of these buttes is east of and about three-fourths mile from the one on which the station is situated and which is easiest of access. The station was marked by an irregular shaped stone set in cement with its top even with the surface of the ground. In its top was placed a copper bolt to mark the center. Over this stone was erected a concrete pier 20 inches square and 4 feet high, in the top of which was set a copper bolt to mark the center of the station. Two reference marks (holes drilled in the surface rock and filled with lead) were placed, one nearly in line to King Peak, and distant 7 feet 3 inches from the station, and the other in prolongation of that line to the northeast and distant 8 feet 11¼ inches from the station.

Bear Ridge (Humboldt County, Cal., A. F. R., 1869–1883; 1882).—On the first main ridge north of Cape Mendocino which at the ocean forms False Cape; upon that part of the ridge known as Big Hill, the summit of which is round and flat. Station is

marked by a heavy redwood stub 3 feet in the ground with top level with the surface, over which was placed a heavy stand of redwood timber, with its feet firmly set in the ground. Four bottles were placed in the ground north, south, east, and west of the station and 6 feet from it.

Mad River (Humboldt County, Cal., A. F. R., 1870–1883; 1892).—Upon the northern of two summits known as the "Mad River Buttes," on the ranch of Tod & Crawford, 3 300 feet above and 5 miles from their ranch house. Station was marked by a pine stub 1 foot in diameter.

GOLDEN GATE TO POINT ARENA.

Point Reyes Head (Marin County, Cal., G. D., 1859).—On the highest point of Point Reyes, about 580 feet above the ocean and 880 meters from the western extremity of the point, exactly on the prolongation of the base of the bluff shore line running northward, on the southeast side of a round-topped rock. The station was marked by a hole drilled into a rock placed below the surface. The reference mark was a half-inch hole drilled into the top of the round rock, distant 2 feet 1⅓ inches from the station, N. 50½° W. (magnetic).

Redwood (Sonoma County, Cal., G. D., 1860; 1876).—About 5 miles from Russian River ferry, on the ridge along which passes the wagon road from that place, through Colmans Valley to Dutch Bells and Sebastopol, in the forks of the road about one-fourth mile from a gate through which the road passes, about 500 yards from Barnes, 175 paces N. 42° W. of a high, steep, isolated rock near the southern fork of the road, S. 50° E. of a small pile of rocks near the northern fork. (Note 9, p. 296.) Two reference stones in line with the station and Bodega Head, and the third at right angles to that line.

Bodega Hill (Sonoma County, Cal., L. A. S., 1860).—On the highest hill on the north side of Salmon Creek about one-half mile from the mouth, on the west slope of the hill, about 50 yards from the wagon road, up the coast ridge. (Note 9, p. 296.) Two reference marks are in line with the station and Bodega Head and the third nearly at right angles to the line.

Table Mount (Sonoma County, Cal., L. A. S., 1876).—On a mountain locally known by that name, about 25 meters west of and about 10 or 15 feet lower than the top of the hill and at the edge of the timber (note 4, p. 296), and there was also a stub 2 feet above the ground at the center. Reported lost in 1906. (See Table Mount 2, p. 310.)

Lucky Tree (Sonoma County, Cal., L. A. S., 1876).—A tree marked with a triangle and the letters C. S. cut about 5 feet above the ground, on the ridge northwest of Horseshoe Point triangulation station, near the middle fork of the road up the hill. Reported lost in 1906.

Smith (Mendocino County, Cal., L. A. S., 1870; 1891).—On the top of a hill north of the harbor at Point Arena, near the edge of the bluff, at an elevation of about 216 feet. The station was marked by an irregular-shaped sandstone block, flat on top, with a one-half inch hole drilled in it to mark the center of the station, and by four witness stubs, with copper tacks, two to the northwest and northeast, 4 feet from center, and two to the southeast and southwest, 3 feet from center.

Adams (Mendocino County, Cal., L. A. S., 1870).—On a spur near the top of the mountain known as Adams Ridge. The station was marked by a drill hole in a stone

irregular in shape, about 8 by 10 inches, 4½ inches thick, flat, and somewhat concave on top, buried 2 feet below the surface. On this was an inch of earth and then a yellow earthenware bottle 6 inches high, the center of the mouth of which marked the station. Above the bottle was 8 inches of earth and then a stone 18 by 14 inches and about 8 inches deep, with a one-half inch drill hole in it, marking the station. The reference stones were each 6 feet 3¼ inches from the center, two nearly in line to the mouth of Alder Creek, and one at right angles to that line. A triangle was cut on a fir tree and a spike driven in its center, distant 104 feet. A spike in a triangle marked a madrona tree, distant 184 feet 4 inches. To the right of the line to Alder Creek the rocks crop out at a distance of 18 yards.

Point Arena Northwest Base (Mendocino County, Cal., L. A. S., 1870).—Near the northwest extremity of the plateau lying between the two points of Point Arena. Reported lost in 1891.

Hall (Mendocino County, Cal., L. A. S., 1870).—About one-fourth mile northwest of the Garcia River Mill Hoisting Works, on the highest ground of the vicinity. Reported lost in 1891.

Sand (Mendocino County, Cal., L. A. S., 1870).—On one of the prominent high sand hills on the north side of the Garcia River, on the highest top of the third ridge from the river, a few feet west of a deep slide, easily recognized from the top of adjoining ridges, which bend to the northwest and are well defined. The station is marked by a block of redwood 6 by 6 by 15 inches, buried 2 feet 3 inches below the surface, in the top of which a spike was driven. The reference marks were four stubs, each 6 feet from the center.

Point Arena Southeast Base (Mendocino County, Cal., L. A. S., 1870).—Near the southeast extremity of the plateau, lying between the two points of Point Arena, just north of a clump of bushes and a short distance from the timber line. The station was marked by a block of redwood 15 inches long and 6 inches square, in the top of which a 5-inch spike was driven, buried about 10 inches below the surface. The reference marks were four stubs, each driven 6 feet from the center of the station, in each of which was a copper tack.

Knox (Mendocino County, Cal., L. A. S., 1879).—On a high ridge in the timber and on the southern edge of the southern of two large brushy openings, easily recognized from the coast, on land owned by John Knox. (Note 4, p. 296.)

Anderson Tree (Mendocino County, Cal., L. A. S., 1879).—A redwood tree, at the top of which the branches were trimmed, marked by a large blaze on its north side, in which the letters C. and G. S. were cut in a triangle. A large redwood standing about 12 feet to the northward was blazed on the side facing the signal tree, and a smaller redwood standing beside the road was similarly marked and lies northeast of the station and about 226 feet distant. The tree may be reached by ascending the grade coming to the county road a little north of Saunders Landing.

Marr (Mendocino County, Cal., E. F. D., 1891).—On the mesa, about one-half mile southwest of Point Arena and about 125 meters north of Frost's house. The station was marked by a stone ale bottle buried about 2 feet below the surface of the ground and by four witness stubs, each 6 feet from the center, one in line to the light-house, one in the prolongation of the line to the southeast, and the other two at right angles to the northeast and southwest.

Point Arena Longitude Station (Mendocino County, Cal., C. H. S., 1889; 1891).—About 200 meters east of the town of Point Arena, upon the hill where stand the large tanks of the town waterworks. The station was marked by a spike in the center of the top of a brick pier even with the surface of the ground.

Iversen Point (Mendocino County, Cal., L. A. S., 1879).—In the northern part of the point known as Iversen Point, or Rough and Ready Landing, near the edge of the bluff. The station was marked by a drill hole in a large red sandstone about 2 by 1½ feet, sunk 1 foot below the surface, with the ground raised around it about 2 feet.

Havens Neck (Mendocino County, Cal., L. A. S., 1878).—On the northwest extremity of Havens Neck, on the highest ground in the vicinity, south of a boulder of rock higher than the ground at the station. The station was marked by a drill hole three-fourths inch deep in a stone resting upon the solid boulder, over which the ground was leveled and raised 3 feet.

Triplet Hill (Mendocino County, Cal., L. A. S., 1878).—On the top of a rocky hill and in a bushy opening, north of Triplet's house. (Note 4, p. 296.)

Rocky Peak (Mendocino County, Cal., L. A. S., 1878).—On a round-topped yellow appearing rocky hill back of Havens anchorage. It may be reached by taking the first grade coming into the county road, about 200 meters north of Captain Ferguson's store. (Note 4, p. 296, except the stone rests on the solid rock at a depth of about 1½ feet.)

Sandstone (Sonoma County, Cal., L. A. S., 1878).—On the outer point forming the northern extremity of the bight found north of Bihler Point on land owned by William Bihler; near the edge of the bluff. (Note 4, p. 296.)

Robinson Point (Mendocino County, Cal., L. A. S., 1878).—Upon the west end of a bare spur above the railroad track, about 50 meters distant, on land owned by C. D. Robinson and about one-fourth mile north of his chute. (Note 4, p. 296.)

Rutherford Tree (Sonoma County, Cal., L. A. S., 1878).—The tallest fir tree in the vicinity, at the top of the ridge on the east side of the gulch which, coming to the coast, passes just south of R. N. Rutherford's dwelling house. The tree is marked by a triangle and the letters C. S. cut into the tree about 5 feet above the ground, with the branches for some distance from the top trimmed.

Knipp (Sonoma County, Cal., L. A. S., 1878).—On a prominent point about 2 miles north of Stengel and about 250 meters southeast of the end of the fence at the bluff, on land owned by Knipp & Stengel. (Note 4, p. 296.)

Stengel (Sonoma County, Cal., L. A. S., 1878).—On the prominent point in the bight about 2 miles north of Bihler Point, near the edge of the bluff, on land owned by Knipp & Stengel. (Note 4, p. 296.)

Helmke Ridge (Sonoma County, Cal., L. A. S., 1876).—Upon the same ridge as Lucky Tree, and lower down, at an elevation of about 815 feet, about 100 meters north of the road, on land owned by F. Helmke. (Note 4, p. 296.)

Rocky Point (Sonoma County, Cal., L. A. S., 1876).—On a rocky neck which forms the first prominent point north of Horseshoe Point, near the extremity of the bluff. The station was marked by a hole three-fourths inch deep in a solid boulder.

Harbeck (Sonoma County, Cal., L. A. S., 1876).—On an isolated round-top hill about a mile below the settlement at Stewart Point. (Note 4, p. 296.)

Bihler Point (Sonoma County, Cal., L. A. S., 1876).—On the extreme western point of Bihler or Black Point Landing. (Note 4, p. 296.)

Stewart Point (Sonoma County, Cal., L. A. S., 1876).—On the northwestern extremity of the island forming the extreme western point, about one-half mile north of Fisherman Bay, near the upper edge of the bluff. (Note 4, p. 296.)

Lark (Sonoma County, Cal., L. A. S., 1878).—At the western extremity of the highest part of a bare slope, about three-fourths mile east of Knipp & Stengel's house and about 100 meters north of the fence running from the coast, at an elevation of about 475 feet. (Note 4, p. 296.)

Ross Tree (Sonoma County, Cal., L. A. S., 1878).—On the ridge back of Bihler Point, about 350 meters east of a Chinese camp, to which a road leads up the gulch, at a point about 710 feet above high water, a very tall and quite straight and slender tree, the highest in the locality, marked by a triangle cut into the tree, about 5 feet above ground, with the letters C. S. cut within the triangle.

Sandy Point (Sonoma County, Cal., L. A. S., 1876).—On the outer point, about one-third mile south of Fisherman Bay, or Stewarts Point Landing, near the edge of the bluff, immediately back of which is a small, bare, and gravelly spot. (Note 4, p. 296.)

Fisk Tree (Sonoma County, Cal., L. A. S., 1878).—About three-fourths mile north of Stewarts Point and directly back of a large opening in the timber, a tall tree, with the branches trimmed for some distance from its top, marked by a triangle cut into the tree about 5 feet above ground.

Bourns Landing (Mendocino County, Cal., L. A. S., 1876).—Near the extremity of the point and at the edge of the bluff forming the northern lea of Bourns and Walalla Mill Company's landings. (Note 4, p. 296.)

Island (Sonoma County, Cal., L. A. S., 1878).—On the highest part of the island forming the extreme point about 1 mile south of the mouth of the Walalla River, only to be reached from the main shore at very low water. (Note 4, p. 296.)

False Ford (Sonoma County, Cal., L. A. S., 1878).—On the highest part of the point on the main land, directly abreast of Island triangulation station, on land owned by Wm. Bihler. (Note 4, p. 296.)

Walalla Tree (Mendocino County, Cal., L. A. S., 1878).—On the south side of a deep gulch north of Robinson Hotel, about one-fourth mile back from the county road and about 50 meters north of the Robinson grade leading up the hill from the county road, a dead fir tree, marked by a triangle with the letters C. S.

Peter Tree (Sonoma County, Cal., L. A. S., 1878).—About three-fourths mile northeast of Knipp triangulation station, in the dense timber, a fir tree, the tallest in the vicinity, with the branches trimmed for some distance down from the top. Marked by a triangle and the letters C. S.

Junction (Mendocino County, Cal., L. A. S., 1878).—On the outer lower bluff about midway between Iversen's or Rough and Ready Landing and Point Arena Landing, upon the north side of a gulch, near the edge of the bluff on the southernmost point. (Note 4, p. 296, except the stone was buried just below the natural surface of the ground, which was then raised 3 feet.)

Morse (Mendocino County, Cal., L. A. S., 1878).—On a brushy opening on a narrow divide of the first ridge northward of Steen's or Hardscratch Landing, 16 feet south of

a wagon road branching off from the county road about 200 yards north of Steen's landing. (Note 4, p. 296.)

Saunders Hill (Mendocino County, Cal., L. A. S., 1879).—On the second knoll south of Saunders Hill, east of the county road. (Note 4, p. 296, with copper tack in drill hole.)

Black (Mendocino County, Cal., L. A. S., 1870).—On the first and most prominent hill east of Smith's farm, 400 yards west of the timber line. (Note 8, p. 296.)

Spur Mountain.—Sonoma County, Cal., L. A. S., 1875).—On what is locally known as the oak ridge, east of the Walalla River, above a fine spring and watering trough. (Note 4, p. 296.)

Russian River (Sonoma County, Cal., G. D., 1860).—About 1½ miles from the mouth of Russian River and one-half mile south of the mouth of Dry Creek, about one-fourth mile from the coast, on top of a hill, the seaward side of which descends abruptly and along the foot of which passes the wagon road from Russian River Ferry up the coast. A large square-topped rock in the water bears S. 52¼° W. (Note 9, p. 296, except the center stone was sunk 1 foot below the surface of the ground.) Two reference marks are in line with the station and Bodega Head and the third at right angles to that line.

Benitz (Sonoma County, Cal., G. D., 1860; 1875).—On the top of a small ridge which is covered on the northern side with chaparral and the southern side heavily timbered, about 1700 feet above the ocean, about 200 paces northeast of the trail leading from the mouth of Russian River to Fort Ross. The station was marked by a one-half-inch hole drilled into the solid rock about 2 feet below the surface of the ground. As reference marks pieces of rocks having one-half-inch holes drilled in them were placed at the surface of the ground around the station, 6 feet from it—one toward Ross Mountain, another in the opposite direction, and the third to the south, nearly at right angles to the line joining the others. Magnetic bearings to various points are as follows: To a high hill 8 miles distant, N. 29° W.; to the top of a ridge 5 miles distant, N. 3⅓° W., and to the top of a ridge 1½ miles distant, N. 8½° E.

Dry Creek (Sonoma County, Cal., G. D., 1860; 1875).—On a large flat-topped hill about one-half mile from the mouth of Dry Creek and just to the left of the wagon road leading up the coast, 130 yards S. 36° W. from the pile of rocks about 4 yards from the road. (Note 9, p. 296.) Two reference marks were in line with Ross Mountain and the third at right angles to that line.

Silvers Tree (Sonoma County, Cal., L. A. S., 1876).—A tall fir tree about 6 meters to the north of Henry Hill triangulation station. (See p. 310.) Not found in 1906.

Allston Tree, flag (Sonoma County, Cal., L. A. S., 1876).—On the ridge back of Timber Cove and a little north of the road leading from Timber Cove to the ridge road; a fir tree with the branches trimmed off and marked by a triangle with the letters C. S. cut in it about 5 feet above ground. Could not be found in 1906.

Fox (Mendocino County, Cal., L. A. S., 1879).—On a point about one-half mile north of Steen's landing, near the edge of the bluff, on land owned by —— Fox. (Note 4, p. 296, the stone being oval.)

Sail Rock (Mendocino County, Cal., L. A. S., 1878).—About midway between Steen's and Iversen's landings, better known as Hardscratch and Rough and Ready

landings, the very sharp and clearly defined top of a high conical rock, about one-half mile offshore, which from the northward resembles a sailing vessel.

Richards (Marin County, Cal., G. A. F., 1857).—On the first prominent hill bearing nearly south from the ranch house on Point Reyes, distant about 1½ miles. The station was marked by a nail driven in a redwood stake and by three similar stakes placed 6 feet from the center.

Steele (Marin County, Cal., G. D., 1859).—On the small grassy rise inside the Estero de Limantour, about 500 yards from what is now called Steele's landing and nearly in line with the landing and Point Reyes Hill, about one-half mile from the Bay beach and about 800 yards west-southwest of Steele's house, which is on the inside slope of the ridge and not in sight of the station. The station was marked by an iron nail in a stub, driven into the ground, the reference marks were three iron nails in stubs, each 6 feet from the station, two in line with the center and nearly in line with Point Reyes Hill triangulation station, and the third nearly at right angles toward the west.

Number 1 (Marin County, Cal., G. D., 1859).—About 500 yards from the beach, about one-fourth mile southwest of Isaac Steele's house, on the ridge nearest his ranch, and between it and Muddy Hollow, to the east of a pond at the foot of the ridge. Point Reyes Hill is just visible between two hills a little distance northward. The station was marked by one-half-inch hole drilled into a rock placed 2 feet below the surface. The reference marks were iron nails in three stubs, each 6 feet from the station, two in line with the station and Point Reyes Hill and the third nearly at right angles to the westward.

Point Reyes East (Marin County, Cal., G. D., 1859).—On the last small elevation on the eastern extremity of Point Reyes, about 130 meters from the extremity of the point, about 170 feet above the ocean, about 30 yards from the nearest bush to the northwest. The station was marked below the surface by one-half-inch hole drilled into a rock. The reference marks were nails in three stubs, each 6 feet from the station; two in line with the center and nearly in line with Point Reyes Hill triangulation station and the third nearly at right angles to the westward.

Number 2 (Marin County, Cal., G. D., 1859).—On the top of a round knoll about 600 yards from the beach, nearly in line with the mouth of the ravine, where S. G. Irish lives, and Point Reyes Hill; to the northward of where the beach terminates and the trail takes up the bluff, about 75 yards northwest of a curious pile of perpendicular rocks. A hill farther along the shore to the eastward has a large mass of white limestone rocks showing. The station was marked by a one-half-inch hole drilled into a rock placed about 2 feet below the surface of the ground. The reference marks were nails in three stubs, each 6 feet from the station, two in line with the station and nearly in line with Point Reyes Hill, the third nearly at right angles to the eastward.

Estero (Marin County, Cal., G. D., 1859).—About one-third mile back from the point of the bluff, at the west side of the entrance to Estero de Limantour, opening from Sir Francis Drakes Bay, on the eastern part of the third rise, and about 40 yards to the west of a steep gulch at the bottom of which is a pond. The station was marked 2 feet below the surface by a stub into which was driven an iron nail. The reference marks are three stubs with iron nails, each 6 feet from the station, two nearly in line with the center and on the line to Point Reyes Head, and the third to the westward.

Preston (Marin County, Cal., G. A. F., 1856).—On the eastern side of Tomales Bay, south of Keys Creek, about three-fourths mile southeast of Preston's store and about one-fourth mile south of a small house claimed by Preston, upon a small cliff about 80 feet above the water line. (Note 5, p. 296.) In 1906 the station could not be found.

Reynolds (Marin County, Cal., G. A. F., 1857).—On the eastern side of Tomales Bay, a few hundred yards north of Reynolds Landing, on a low perpendicular cliff immediately on the shore and presenting a reddish appearance from the bay. (Note 5, p. 269.) Reported lost in 1906. (See Reynolds 2, p. 306.)

Mike (Marin County, Cal., G. A. F., 1857).—On the edge of a bluff on the west side of Tomales Bay, about 40 feet above the water, and about 1 mile south of the place occupied by a man named Ellins. A pine tree on the south side is blazed. The station was marked by a nail driven in a stub and by three similar stubs to the north, west, and south sides, distant 6 feet. Reported lost in 1906. (See Mike 2, p. 307.)

Frink (Marin County, Cal., G. A. F., 1857).—On the east side of Tomales Bay, about 200 yards from the shore and about one-fourth mile in an easterly direction from the southeast corner of Frink's lot. (Note 5, p. —, except the center was marked by a nail in the rock.) Reported lost in 1906. (See Frink 2, p. 307.)

Agnew (Marin County, Cal., G. A. F., 1857).—On the west side of Tomales Bay, on the bluff above the first rocky point north of the house occupied by Magness and Keatley, about 30 yards distant. The station was marked by a nail in a stub. The reference marks were: A spike driven in a blaze on an oak tree 5 feet 1 inch to the northeast, a similar mark on another tree distant 8 feet 2 inches to the south, and a stub 5 feet distant. Reported lost in 1906. (See Agnew 2, p. 307.)

Young (Marin County, Cal., G. A. F., 1857).—On the first sand point north of Young's house, on the west shore of Tomales Bay, and immediately at the mouth of a small tide-water creek. Reported lost in 1906. (Note 5, p. 296.)

Sigvart (Marin County, Cal., G. A. F., 1857).—On the east side of Tomales Bay, about 200 yards from the shore, and about three-fourths mile southeast from Miller's house; about 50 yards below a small rocky point on the same ridge. (Note 5, p. 296.) Reported lost in 1907.

Willow Point (Marin County, Cal., G. A. F., 1857).—On the western shore and near the head of Tomales Bay, on a prominent point, about one-half mile south of Young's house, covered to high-water mark with a thick growth of willows. (Note 5, p. 296.) Reported lost in 1907.

Creek (Marin County, Cal., G. A. F., 1857).—On the western shore of Tomales Bay, at the entrance of the estero running into the marsh at the head of the bay. (Note 5, p. 296.) Reported lost in 1906.

Teton (Marin County, Cal., G. D., 1860).—On the top of a rocky pointed hill bearing N. 48° E. and 2 miles distant from the extreme tip of Tomales Point. The station was marked by a one-half-inch hole drilled in a rock. Reported lost in 1906. (See Teton 2, p. 308.)

Sugarloaf Hill (Marin County, Cal., G. D., 1860).—On the highest point of a peculiarly shaped hill, bearing N. 72¼° E. and distant 2 miles from the extreme tip of Tomales Point. The station was not marked.

Ocean Beach (Sonoma County, Cal., G. D., 1860).—About 1 mile northeast of Bodega Hill, on an oval-topped sand hill about 60 by 15 feet on top, about 150 yards from high-water mark on the outer beach and a third of a mile northeast of a point of land making out in a northwest direction from Bodega Head. The northwest tangent of Bodega Rock was in range with the southeast tangent of Bodega Head and the southwest tangent of a little island at Bodega Port in range with Bodega station. The station was marked by a bottle buried 3 feet in the sand.

Bay Beach (Sonoma County, Cal., G. D., 1860).—On the sand spit between the lagoon and Bodega Bay, on the top of the first hillock to the east of the end of the sand spit; in the most northerly part of the bend, about three-eighths mile from the present position of the wreck of the schooner Carolina; 12 feet above high-water mark. The station was marked by a bottle sunk 3 feet in the sand. Three stubs, with nails in the tops, were driven 2 feet into the ground, each 5 feet 11 inches from the station, one in line to the outside point of Bodega Head, another in the opposite direction, and a third at right angles toward the southeast.

Bodega Latitude Station (Sonoma County, Cal., G. D., 1853–1860).—Near the western end of the sand spit forming the southern boundary of the inner bay of Bodega. The station was marked by a bottle placed 2 feet below the surface of the ground, and by three stubs with nails in the tops, driven 2 feet in the ground.

Bodega Rock (Sonoma County, Cal., G. D., 1860).—On the top of a small islet about 700 yards southeast of Bodega Head. The station was marked by a nail set in the rock 8 or 9 inches below the surface of the ground.

Lagoon (Sonoma County, Cal., G. D., 1860).—On the bluff at the eastern end of the sand spit forming the southern boundary to the inner bay of Bodega. The marking is not described.

Rocky Point (Sonoma County, Cal., G. D., 1860).—On the extreme end of the first point of any extent north of Bodega Head, 75 yards N. 36° E. (mag.) of a large rock. (Note 9, p. 296.) Two reference marks were in line with the station and Bodega Head and the third at right angles to the line.

Tom Point (Marin County, Cal., G. A. F., 1856).—On the highest land on Tom Point, on the east side of Tomales Bay, near its entrance from the sea, immediately above and to the southward of Tom Vaquero's house. The station is marked by a buried bottle and by four redwood stakes, each with a nail driven in the top, and placed 6 feet from the center.

Point Reyes Beach (Marin County, Cal., G. A. F., 1856).—On a conspicuous sand knoll, immediately upon the north beach of Point Reyes and a short distance northeast from the mouth of the lagoon. The station was marked by a nail driven in the rock and by four stakes, each with nails driven in the top and 6 feet from the center.

Hog Island (Marin County, Cal., G. A. F., 1856).—On the highest and most northern point of Hog Island, the larger of the two islands in Tomales Bay, about 1 mile south of Preston's embarcadero. (Note 5, p. 296.)

Number 3 (Marin County, Cal., G. D., 1859).—On a hill covered with grass and very gravelly, about 150 yards from the beach, on the second rise and about 200 feet above the water, N. 20° E. of a large rock in Sir Francis Drakes Bay. The station was marked by an iron nail in a stub 2 feet below the surface. The reference marks were iron nails in

three stubs, each 6 feet from the station, two are in line with the station and Richards, and the third to the southward.

Wildcat (Marin County, Cal., G. D., 1859).—On the highest part of the second rise of a ridge near Wildcat Gulch, about 700 yards from the beach and about 500 feet above the water, about 400 yards from a deserted shanty, with a field and pond near by. The hill top is grassy with soft sandstone beneath; about 10 yards southeast of the station the side of the hill descends precipitously into a deep gully; to the northwest it is rather steep toward a small deserted shanty, formerly occupied by one of the Perrot family. The station was marked by a one-half-inch hole drilled in the solid rock about 2 feet below the surface. The reference marks are iron nails in three stubs, each 6 feet from the station, two in line with the station and Point Reyes Head, and the third to the southeast of Steele triangulation station.

Joyce (Marin County, Cal., G. D., 1859).—About three-fourths mile from the beach, on a round-topped hill, about a mile from Tom Joyce's house toward Bolinas, 700 or 800 feet above the ocean, exactly in line with the bluff at Perrot triangulation station and Point Reyes. About 10 yards to the east of the station the hill descends rapidly into a gully. The station was marked by a one-half-inch hole drilled into the solid rock about 2 feet below the surface. The reference marks were iron nails in three stubs, each 6 feet from the station, two in line with the station and Point Reyes and the third nearly at right angles to the southward.

Perrot (Marin County, Cal., G. D., 1859).—On the top of the hill, the highest for half a mile around, 12 yards west of the edge of a bluff where the hill falls about 200 feet to a gully in a nearly vertical cliff; 8 feet northeast of the station the hill makes a steep descent for 10 feet and is then comparatively level. About 300 yards S. 86° W. from the station is the bluff rising vertically from the beach, which is seen from Wildcat triangulation station. The station is reached from Perrot's house, which stands in a hollow about 200 yards from the beach, by taking the trail to Bolinas, following it for about 1 mile, and on mounting the last ridge from which a small lake can be seen, striking abruptly to the right and following the ridge to its highest point. The station was marked by a one-half-inch hole drilled in a stone placed 2 feet below the surface of the ground. The reference marks were iron nails in three stubs, each 6 feet from the station, two in line with the station and Point Reyes Head, the third nearly at right angles to that line to the southeast.

Point Reyes Latitude Station (Marin County, Cal., G. D., 1859).—About 1,240 meters from the eastern extremity of Point Reyes, about 40 feet above the water, on the ridge forming the north side of the first gully inside the point, about 12 meters from the edge of the bluff toward Point Reyes Hill, about 75 meters from a large pile of rocks on the ridge going west-southwest; 140 meters S. 36¼° W. from a large black rock in the water. The station was marked by a one-half-inch hole drilled in a rock below the surface. The reference marks were three stubs with iron nails, each 6 feet from the station; two in line with the station and Point Reyes Hill, and the third to the westward, nearly at right angles.

Grasier (Marin County, Cal., G. A. F., 1857).—On the north slope of a very prominent hill, immediately at the head of the salt marsh forming the southern boundary of Tomales

Bay, about 300 yards from the estero, about one-half mile N. 77° 30′ E. of Grasier's house. (Note 5, p. 296.)

Estero (Marin County, Cal., G. D., 1860).—On the first hill southeast of the first gulch south of the mouth of the Estero Americano. The station was marked by a stone with a one-half-inch hole drilled in it, sunk 1 foot below the surface of the ground, and by three stones marked in the same way, each placed a little more than 6 feet from the center, one toward Tomales triangulation station, one southwest, and the third northeast.

Inlet (Marin County, Cal., G. D., 1860).—About 1 mile southeast of the mouth of the Estero Americano, on a high rocky hill which ascends boldly from the beach, the first hill south of a small inlet, called San Antonio. The station was marked by a stone with one-half-inch hole drilled into it, sunk about 1 foot below the surface of the ground, and by three stones with similar marks placed a little more than 6 feet from the center, one toward Tomales triangulation station, one toward Estero triangulation station, and one southwest.

Tomales Bluff (Marin County, Cal., G. D., 1860).—On the extreme end of Tomales Point on a spur of rock. The station was marked by a half-inch hole in a stone sunk 1 foot below the surface of the ground. Reported lost in 1906.

Sandhill (Sonoma County, Cal., G. D., 1860).—At the extreme northern end of the lagoon at Bodega Bay, on a sand mound, 100 feet from high water mark, the only one that rises up directly from the beach. The station was marked by a bottle sunk 3 feet in the ground, and by three stubs with nails driven in them, placed a little more than 6 feet from the center, two in line with Bodega triangulation station and one seaward.

Salmon Creek (Sonoma County, Cal., G. D., 1860).—One hundred and fifty yards north of the mouth of Salmon Creek, on a small sand mound, rising abruptly from the beach, a few yards west of the Russian River road, 100 yards south of a ledge of rock which rises 9 feet above the surface of the ground. The station was marked by a large stone with a hole drilled in it, sunk 2½ feet in the sand, and by three stubs with nails driven in them, placed a little more than 6 feet from the center, two in line with Bodega station and one inland.

Dougherty's house (Sonoma County, Cal., G. D., 1860).—The southwest gable (nearest Bodega triangulation station) of Dougherty's house, on the northeast part of the inner part of Bodega Bay, connected with the shore by a small wharf.

POINT ARENA TO SHELTER COVE.

Round (Mendocino County, Cal., L. A. S., 1871).—Upon the top of a hill about 800 feet high, northwest of Monroe's farm, on the first knob reached upon ascending the hill, close by, and north of, the county road. (Note 1, p. 296.)

Cuffey Cove (Mendocino County, Cal., L. A. S., 1871).—On the top of a prominent, conspicuous knob near the north point of Cuffey Cove Landing, on land owned by James Kenny. (Note 1, p. 296.)

Peak (Mendocino County, Cal., L. A. S., 1871).—On the knob forming the top of the hill back of Thomas Welch's ranch, a little to the westward of the defined timber line, at an elevation of about 1 275 feet. (Note 1, p. 296.)

Red Bluff (Mendocino County, Cal., L. A. S., 1871).—On the most westerly point between Mal Paso and Elk Creek, on land owned by Wm. Curtis. (Note 1, p. 296.)

Elk Creek (Mendocino County, Cal., L. A. S., 1871).—About 500 meters north of the north point of Elk Creek and near the edge of the bluff which, in a westerly direction from the station. extends about 40 meters to a short precipitous point. (Note 1, p. 296.)

Greenwooa (Mendocino County, Cal., L. A. S., 1871).—Near the top of Greenwood Ridge. The station may be reached by taking the road which, starting about 300 meters above the bridge over Greenwood Creek, at the county road, runs up to the top of the ridge through the timber. Upon reaching the top, the road comes into an opening free of timber. When this has been reached the station may then be found by going in a southeasterly direction along the edge of the descent of the different slopes until one is reached where a clump of trees and bushes detached from the main timber will be found. Upon this slope and west of the clump of bushes is the station. (Note 1, p. 296.)

Cavanagh (Mendocino County, Cal., L. A. S., 1871).—On the face of the slope rising immediately back of Cavanagh's house, a little to the westward of the defined timber line at the top of the hill, at an elevation of about 700 feet. (Note 1, p. 296.)

Navarro Head (Mendocino County, Cal., L. A. S., 1871).—On the top and northern extremity of the first knoll, about one-fourth of a mile east of Navarro Point, where the rapid rise from the coast ends, on land owned by Edward Brayton. (Note 1, p. 296.)

Saddle Point (Mendocino County, Cal., L. A. S., 1871).—On the first prominent point about 1¼ miles south of the mouth of Navarro River, on land owned by Wm. McFarland, 203.5 meters from the county road, about 50 meters east of the end of the point. Between the extreme point and the station is a saddle, or hollow, caused by a slide in the bluff, making the extreme point inaccessible. (Note 1, p. 296.)

Tichenor (Mendocino County, Cal., L. A. S., 1871).—On the south side of the Navarro River, on a small knoll covered with pine trees which can be seen to the east of the road when at the top of the grade coming from the north. The station is a little below the top of the knoll, 58.5 meters from the county road, and about 12 feet southwest of six fir trees, which partly hide Navarro Head from view, and between the fourth and fifth of which a large barn to the northward can be seen. (Note 1, p. 296.)

Navarro Ridge West Base (Mendocino County, Cal., L. A. S., 1871).—On the north side of the Navarro River and upon the little knoll forming the western extremity of the Navarro Ridge. The station was marked by a redwood block 12 by 12 by 10 inches, sunk 3 feet below the surface of the ground, in the center of the upper face of which a one-half-inch hole was drilled and a copper tack driven into it. Over this was placed a 6 by 6-inch redwood block, 6 feet long. Four stubs were driven, each 6 feet from, and north, south, east, and west of, the center.

Navarro Ridge East Base (Mendocino County, Cal., L. A. S., 1871).—On the north side of the Navarro River near the eastern extremity of the Navarro Ridge, about 160 meters nearly west-northwest from the hotel, upon a little rise about midway between the county road and a fence meandering the edge of timber. The station was marked by a redwood block 12 by 12 by 10 inches, sunk 3 feet below the surface of the ground, in the center of the upper face of which a hole was drilled one-half inch deep, and a copper tack driven into its center. Over it was placed a 6 by 6 inch block of redwood 6 feet long.

Johnson (Mendocino County, Cal., L. A. S., 1871).—On what is locally known as the Middle Ridge lying between the two branches of Salmon Creek, upon the first summit on ascending the hill, nearly south of Johnson's house, and about 370 feet high. (Note 1, p. 296.)

Salmon Point (Mendocino County, Cal., L. A. S., 1871).—Upon the outer south point of Salmon Creek, about 600 meters from the beach at the landing, a little northeast of the extreme point, and about 20 meters from the edge of the bluff. (Note 1, p. 296.)

McPherson (Mendocino County, Cal., L. A. S., 1871).—About midway between the Albion River and the first deep gulch about a mile to the northward; upon the most prominent spur, which can be easily recognized from either direction, in the timber and at an elevation of about 315 feet. (Note 1, p. 296.)

Mal Paso 2 (Mendocino County, Cal., L. A. S., 1871).—On the northwest point of Mal Paso near the top of the knob east of the edge of the bluff and the clump of bushes. (Note 1, p. 296.)

Stewart (Mendocino County, Cal., L. A. S., 1871).—Upon the southwestern extremity of the first knob back of the Stewart upper ranch, about 250 meters west of a small, bare flat. (Note 1, p. 296.)

Herrick (Mendocino County, Cal., L. A. S., 1871).—On the north end of the first hill south of Elk Creek, on land owned by Herrick Brothers. The hill is about 630 feet high. (Note 1, p. 296.)

Bight (Mendocino County, Cal., L. A. S., 1871).—Near the head of the bight formed by the shore line between Cuffey Cove and the Navarro River, near the edge of the bluff, 64 meters from the county road, on land owned by James M. Nolan. (Note 1, p. 296.)

Kennedy (Mendocino County, Cal., L. A. S., 1871).—On a ranch owned by James Kennedy, upon the steep slope rising south of the bridge which crosses a deep gulch at the county road on this ranch. Back of the station the country rises less rapidly for a distance of about 400 meters, when the defined timber line commences. (Note 1, p. 296.)

Navarro Point (Mendocino County, Cal., L. A. S., 1871).—On the north point of the entrance of the Navarro River, about 300 meters south of another point, the most westerly, which obstructs the view from the station in a northerly direction, 3 meters from the edge of the bluff; 104 meters northerly from the station, a fence ends at a boulder of rocks, and the line to it is tangent to the edge of the bluff of a small bight lying between. (Note 1, p. 296.)

Monroe (Mendocino County, Cal., L. A. S., 1870).—On the ridge northeast of Monroe's house, about east-southeast, 250 meters from the knob at the top of the hill, which is about 60 meters from the end of the fence running up the slope from the house; about 10 meters north of the trail from the timber, which is about 600 feet distant. A fir tree marked by a notch is 194 feet from the station. (Note 8, p. 296.)

Welch (Mendocino County, Cal., L. A. S., 1870).—On land owned by T. Welch, on the top of a bluff, 18.5 feet east of the edge. (Note 8, p. 296.)

Stillwell (Mendocino County, Cal., L. A. S., 1871).—On the top of the most prominent hill lying about midway between the Albion and the Little rivers, close to and west of the county road. Recovered in 1909. (Note 1, p. 296.)

Little River (Mendocino County, Cal., L. A. S., 1871).—About 300 meters north of the outer point of Little River, about 10 meters from the edge of the bluff at the foot of which will be found the largest rock in the vicinity. (Note 1, p. 296.)

Stickney (Mendocino County, Cal., L. A. S., 1871).—Upon the top of a round-top hill, nearly east of Stickney's house. (Note 1, p. 296.)

Kent (Mendocino County, Cal., L. A. S., 1871).—In a very flat field belonging to Kent, north of his house, and west of the county road, a little west of the highest part. (Note 1, p. 296.)

Mendocino (Mendocino County, Cal., L. A. S., 1871).—On the westernmost point of a bluff lying about midway between the north point of Mendocino Bay and the next point of the bight to the northward, near the edge of the bluff and just south of where a long, detached, large island commences. (Note 1, p. 296.)

Randlett (Mendocino County, Cal., L. A. S., 1871).—About 500 meters south of the south point of Big River, and about 100 meters back from the edge of the bluff, and about 60 feet above the road, upon a chaparral-covered spur, timbered at the station, with a little, bare valley to the south. (Note 1, p. 296.)

Gray (Mendocino County, Cal., L. A. S., 1872).—Between Jack Peters and Russian gulches, to the east of the county road, and on the eastern end of the top of a bald hill back of Gray's house. (Note 1, p. 296.)

Point (Mendocino County, Cal., L. A. S., 1872).—On the most westerly point about one-half mile north of the north point of Russian gulch, about 14½ feet east of the edge of the bluff, on land owned by Charles Hargrave. Recovered in 1909. (Note 1, p. 296.)

Russian Gulch (Mendocino County, Cal., L. A. S., 1872).—On the extreme north point of Russian gulch, upon a little rise of ground near the edge of the bluff. (Note 2, p. 296.)

Rees (Mendocino County, Cal., L. A. S., 1872).—On a hill about half a mile inland, upon a rise covered with timber, at an elevation of about 170 feet, on land owned by Charles Hargrave. (Note 1, p. 296.)

Cabrillo (Mendocino County, Cal., L. A. S., 1872).—Upon the most westerly point between Point Arena and Cape Mendocino; also the most westerly point of the Pine Grove ranch, on land owned by Albert Maxwell; 9 feet 10 inches from edge of the bluff to the west, 16 feet 10 inches from the edge of bluff to the south, and 14 feet from the edge of the bluff to the north. Recovered in 1909. (Note 1, p. 296.)

Handley (Mendocino County, Cal., L. A. S., 1871).—Upon the top of the knoll lying nearest to the south point of Albion River, on the east side and at the base of which is suspended a chute from the edge of the bluff known as Handley's chute. (Note 1, p. 296.)

Albion (Mendocino County, Cal., L. A. S., 1871).—Upon the extreme westerly point of the bluff; also the south point of the Albion River, about 10 meters from the edge of the bluff, which on either side bends in, leaving the station about midway between the two inner points. (Note 1, p. 296.)

Chaparral (Mendocino County, Cal., L. A. S., 1871).—About 300 meters south of the extreme south point of Mendocino Bay, on the top of the first chapparal-covered hill. (Note 1, p. 296.)

Mendocino City Latitude Station (Mendocino County, Cal., G. D., 1853; 1870).—On the north point of Mendocino Bay, on the narrowest part of the neck formed by the

cove from the outside and the bight inside the chute, or landing point; in the midst of lumber piles. The station was marked by a 6 by 6-inch block of redwood solidly driven in the ground with about 1 foot above the surface, in the top of which was cut a hole 3 inches square and about 5 inches deep.

Grave (Mendocino County, Cal., L. A. S., 1872).—In the Catholic Cemetery at Mendocino City, at the top of the hill on the east side of the county road north of the town. (Note 1, p. 296.)

Knoll (Mendocino County, Cal., L. A. S., 1872).—On the west side of the county road, upon the first hill north of the north point of the bluffs of Russian gulch, on an elevation of about 170 feet, on land owned by Charles Hargrave. (Note 1, p. 296.)

Hargrave (Mendocino County, Cal., L. A. S., 1872).—East of Charles Hargrave's house, upon a rise at the edge of timber, about 260 feet high. (Note 1, p. 296.)

Gordon (Mendocino County, Cal., L. A. S., 1872).—Upon a bare flat about half way between the Pine Grove Hotel and Meierkoff, on land owned by Gordon Brothers, about 160 meters above a cultivated field. (Note 1, p. 296.)

Meierkoff (Mendocino County, Cal., L. A. S., 1872).—About one-third of a mile below Point Cabrillo, on the southern point of the Gordon ranch, and upon the edge of the bluff, 30 feet from the edge to the north and 39.8 feet from the edge to the south. (Note 1, p. 296.)

Pine Grove (Mendocino County, Cal., L. A. S., 1872).—About one-third of a mile from the coast line, on a rise and among timber, near the northern boundary line of the Hargrave ranch. Recovered in 1909. (Note 1, p. 296.)

Caspar Point (Mendocino County, Cal., L. A. S., 1873).—About 82 meters west-northwest from Caspar Landing in the outer north point of Caspar Creek, near the edge of the bluff, on land owned by Caspar Mill Company. Recovered in 1909. (Note 1, p. 296.)

Scaffold Tree (Mendocino County, Cal., L. A. S., 1873).—On the north side of Jug Handle Creek and about 200 meters back of Marsh's house, within about 150 meters of the edge of timber land, at an elevation of about 130 feet; a fir tree about 3 feet at the base and 31 inches in diameter at the top.

Carleson (Mendocino County, Cal., L. A. S., 1873).—Between Pine Grove and Caspar Creek and just inside the north fence of the county road and abreast of the Carleson ranch-house gate. (Note 1, p. 296.)

Beaver Point (Mendocino County, Cal., L. A. S., 1873).—Upon the outer point lying midway between Mitchell Gulch and Hare Creek and very near the edge of the bluff. (Note 1, p. 296.)

Bald Hill (Mendocino County, Cal., A. F. R., 1874; 1878).—About 5 miles northeast of the Noyo mill on the northern end of the clear ridge known as Bald Hill, just below the west brow of the hill. The station was marked by a white earthenware bottle, the top of which was 2.4 feet below the surface mark, which was a sandstone post about 18 inches long, somewhat square, the center of which was marked by a one-half-inch drill hole about 1½ inches deep. The reference marks were three sandstone posts somewhat smaller than the center one, in each of which was a one-half-inch drill hole, one-half inch deep placed each 6 feet from the center, two in line to Laguna Point station and one at right angles to the southward.

Soldier Harbor (Mendocino County, Cal., A. F. R., 1874).—On the bluff at the extremity of the ragged point between Noyo Harbor and the little cove known as Soldiers Harbor, upon the land of the Noyo Mill Company and nearly 1 mile west of the mill. (Note 2, p. 296.)

Pudding Creek (Mendocino County, Cal., L. A. S., 1873; 1874).—Three-fourths of a mile north of the Noyo River, on the south side of the mouth of Pudding Creek, on the edge of the bluff just outside of the western fence of McPherson's grain field. (Note 2, p. 296.)

Laguna Point (Mendocino County, Cal., A. F. R., 1874; 1878).—About 5 miles north of the Noyo River, on the extremity of the low, flat point just south of the entrance to the lagoon, the first prominent rock-bound point south of the mouth of Ten Mile River. The station was marked by a white earthenware bottle; the top is 2.1 feet below the surface mark, which was bluish stone with a one-half inch drill hole 1½ inches deep, marking the center. The reference marks were three bluish stones each with a one-half inch drill hole one-half inch deep set 6 feet from the center, two in line to Bald Hill station and one at right angles to the southward of this line.

Ten Mile River Bluff (Mendocino County, Cal., A. F. R., 1873–74).—About one-fourth mile north of the mouth of Ten Mile River, about 400 yards west of Frazer and Dickinson's house, and 250 yards west of the coast road leading to Kibesillah, on a narrow neck or point, the first south of Belobida gulch, close to the edge of the bluff. (Note 2, p. 296.)

Cunningham Ridge (Mendocino County, Cal., A. F. R., 1873–74).—On the first ridge south of Cunninghams gulch, about 1 mile east of the coast and one-half mile southeast of Cunningham's mill, about 750 feet above tide. (Note 2, p. 296.)

Brushy Point (Mendocino County, Cal., A. F. R., 1873–74).—On the low brushy point on the Whipple ranch, about halfway between Ten Mile River and Kibesillah village, being the north point of the little cove forming Newport Landing; just inside the brush line and about 80 yards northwest of the chute derrick. (Note 2, p. 296.)

Claxton Hill (Mendocino County, Cal., A. F. R., 1874).—On the northern end of the top of a round hill about 1½ miles from the coast and about one-fourth mile south of Ten Mile River, on the ranch of Captain Claxton, about one-fourth mile east of the end of the sand dunes extending from the beach. East of the summit the ground falls off rapidly and is covered with chaparral. The western slope is clear of timber or chaparral and at times is cultivated. (Note 2, p. 296.)

Ten Mile River Beach South Base (Mendocino County, Cal., A. F. R., 1874).—Two miles south of Ten Mile River, on Ten Mile River beach, a few feet above high-water mark. The station was marked by a heavy block of redwood 3 feet in diameter and 4 feet long, the center indicated by a nail driven in and covered with a copper shell.

Ten Mile River Beach North Base (Mendocino County, Cal., A. F. R., 1874).—Nearly due west from Claxton, and 1 mile south of Ten Mile River, upon Ten Mile River beach, a few feet above high-water mark. The station was marked by a heavy block of redwood 3 feet in diameter and 4 feet long, the center indicated by a nail driven in and covered with a copper shell.

Whipple Ridge (Mendocino County, Cal., A. F. R., 1873–74).—Half a mile nearly east of the village of Kibesillah, and 400 yards northeast of the Kibesillah schoolhouse,

on the top of a round knoll on a high ridge running parallel with the coast between Cunningham Gulch and Smith Canyon, and about one-fourth mile from and about 20 feet lower than the top of the ridge. (Note 2, p. 296.)

Mitchell Gulch (Mendocino County, Cal., L. A. S., 1873).—Upon the extreme north point of Mitchell gulch and near the edge of a bluff, on land owned by W. Bromley. (Note 1, p. 296.)

Bloom Knoll (Mendocino County, Cal., A. F. R., 1874).—On the highest knoll (110 feet above tide) in the inclosed fields immediately south of Noyo Harbor. (Note 2, p. 296.)

South Noyo (Mendocino County, Cal., A. F. R., 1874).—On the extreme western point, south of Noyo Harbor on the bluff, 40 feet above tide. (Note 2, p. 296.)

North Noyo (Mendocino County, Cal., A. F. R., 1874).—On the north side of Noyo Harbor, one-half mile west from Noyo mill; on the bluff about 50 feet above tide, close to the west of what is locally known as "The Blowhole." (Note 2, p. 296.)

Ten Mile River Beach (Mendocino County, Cal., A. F. R., 1874).—On a small sand knoll on the Ten Mile River beach about halfway between Laguna Point and Ten Mile River and about 40 yards east of high-water mark, and 20 feet above tide; nearly west of a small fresh-water lagoon from which a rivulet runs westerly toward the station and reaching a point east of the station and 80 yards distant bends to the north. (Note 2, p. 296.)

Sandhill (Mendocino County, Cal., A. F. R., 1874).—On a sand hill about 1½ miles northeast of Laguna Point and one-half mile east from the beach, close to the edge of the timber, and 190 feet above tide, within 200 yards of the coast road from Noyo River to Kibesillah. The eastern edge of the sand dunes at the location of the station is very steep, rising abruptly 60 feet up from the grass and timber land; the slope toward the ocean is gradual and undulating. The sand is loose and shifting and it is probable the underground markings will not remain in place. (Note 2, p. 296.)

Kibesillah Hill (Mendocino County, Cal., A. F. R., 1873–74).—On the top of a high, round-top hill on the summit of the first high ridge north of Kibesillah, marked by its apparent isolation from the adjacent ridges when seen from north or south on the coast trail; about 300 yards east of the small cabin of Captain Claxton and just above the coast road which passes around the west base of the hill. (Note 2, p. 296.)

Bell Mountain (Mendocino County, Cal., A. F. R., 1873–74).—On Bell Mountain, about 2¼ miles north of Kibesillah, and one-half mile east of Bell Point, about midway between Switzer's house and Chadburns gulch, close to the old trail over the top of the ridge; about 200 yards south of and 40 feet below the summit of the mountain. (Note 2, p. 296.)

Bell Point (Mendocino County, Cal., A. F. R., 1873–74).—About one-half mile north of Chadburns gulch and one-half mile south of Switzer's ranch house, three-fourths mile south of Switzers Landing (Westport Landing, 1883), on the outer extremity of the most westerly point between them, 300 yards west of the coast road on a high prominent point, the first prominent one north of what is known as Bruhels Point, on the north projection of the point near the edge of the bluff. (Note 2, p. 296.)

Packard Hill (Mendocino County, Cal., A. F. R., 1873–74).—On the ridge between Gordon and Wager creeks, the first ridge after passing the gulch and stream 1 mile north

of Westport Landing; one-fourth mile east of the nearest point of the coast road which runs around the hill, and a few yards south of the trail from Gordons Creek up the ridge; 200 yards west of and about 30 feet lower than the top of the hill; a few yards from the northwestern fence corner of the field of the Packard ranch on top of ridge. (Note 2, p. 296.)

Abalone Point (Mendocino County, Cal., A. F. R., 1873–74).—On the extremity of the low, flat point halfway between Gordon's and Crusoe's houses, the first prominent point north of Gordons gulch, commonly known as Abalone Point, about 100 yards west of the coast road. (Note 2, p. 296.)

Gordon Hill (Mendocino County, Cal., A. F. R., 1873–74).—On the Gordon ranch, on the side of the high ridge directly back from Abalone Point, midway between Gordon's and Crusoe's houses, near the summit, about 740 feet above tide, just south of a clump of small pines and 40 yards west of the fence that crosses the top of the ridge. (Note 2, p. 296.)

Grave Knoll (Mendocino County, Cal., A. F. R., 1873).—On the summit of the knoll directly south of and about 200 yards from the mouth of Juans Creek, near the southern extremity of the knoll, within 50 yards of the fence on north line of Juan Alviso's field and about 100 yards south of a grave inclosed by a picket fence. (Note 2, p. 296.)

South Cottaneva Ridge (Mendocino County, Cal., A. F. R., 1873).—On the second ridge south of the mouth of Cottaneva Creek, near the summit, about 700 feet above tide, about 300 yards north of Chris' house, and within a few yards of the southwest corner of his fence. (Note 2, p. 296.)

South Cottaneva Point (Mendocino County, Cal., A. F. R., 1873).—Near the lower extremity of the second ridge, south of the mouth of Cottaneva Creek, on a small flat bench about 100 yards from the nearest point of the bench and 340 feet above tide. (Note 2, p. 296.)

Cottaneva Ridge (Mendocino County, Cal., A. F. R., 1873).—On the first ridge south of the mouth of Cottaneva Creek, near the summit, about 830 feet above tide, and within 100 yards of the edge of the timber. This location is known to Mr. Dodge, who lives in Cottaneva Valley. (Note 2, p. 296.)

Cottaneva Point (Mendocino County, Cal., A. F. R., 1873).—On the first ridge south of the mouth of Cottaneva Creek, on a sharp spur, just above the brink of a big slide, about 200 yards from the beach and 500 feet above tide. (Note 2, p. 296.)

Smith Point (Mendocino County, Cal., A. F. R., 1873–74).—On a low flat point on the ranch of Smith of Kibesillah, about 500 yards west of Smith's hotel, on the edge of the bluff in the first grain field north of the hotel and almost in line with and about 200 yards beyond the west end of the north fence of the field. (Note 2, p. 296.)

Bruhel Point (Mendocino County, Cal., A. F. R., 1873–74).—On the outer end of a low flat point, about three-fourths mile north of Kibesillah, and one-fourth mile south of Bruhels Point, where the coast trail leads to the ocean beach; about 40 feet above tide and immediately north of an indentation on the coast line, about 80 yards wide from north to south and 200 yards from east to west. (Note 2, p. 296.)

Harford Hill (Mendocino County, Cal., A. F. R., 1873).—About one-fourth mile south of the inclosures and fences of "Soldier Frank's" ranch, 620 feet above the tide, and about 2 miles north of Cottaneva Valley. (Note 2, p. 296.)

Williams Point (Mendocino County, Cal., A. F. R., 1873).—On a low flat point about 1¼ miles north of the mouth of Cottaneva Creek, on the ranch belonging to Wm. Frank. (Note 2, p. 296.)

Soldier Frank Point (Mendocino County, Cal., A. F. R., 1873).—On the outer extremity of a small flat point directly on the coast about 800 yards southwest of the ranch house belonging to Wm. Frank. (Note 2, p. 296.)

Soldier Frank Hill (Mendocino County, Cal., A. F. R., 1873).—On the high ridge running parallel to the coast and between it and Cottaneva Valley, on the ranch belonging to Wm. Frank (commonly known as "Soldier Frank"), on the brow of the hill, about 80 yards west from the gate at the head of the lane leading from the coast trail to the ranch house. (Note 2, p. 296.)

South Ussal (Mendocino County, Cal., A. F. R., 1873).—On a knoll of the ridge about 1¾ miles south of Ussal Creek, 1 000 feet above tide and 600 feet east of the most prominent point of the coast between Ussal and Cottavena Valley, within 100 yards of the edge of the timber and about 30 yards east of the coast trail. (Note 2, p. 296.)

Timber Point (Mendocino County, Cal., A. F. R., 1873).—On a high ridge covered with timber about 2 miles up the coast from Ussal Valley, on a small bench near the outer extremity of the ridge, within 300 yards of the coast and about 800 feet above tide. (Note 2, p. 296.)

Timber Ridge (Mendocino County, Cal., A. F. R., 1873).—Near the summit of the outer ridge, about 1 200 feet above tide, in the heavy timber. The location of the station of Timber Point was well known to J. A. Davidson, of Ussal Valley. (Note 2, p. 296.)

Little Jackass (Mendocino County, Cal., A. F. R., 1873).—On the outer point of a high sharp ridge, known as the Little Jackass Ridge, about 700 feet above tide and 250 yards from the beach. (Note 2, p. 296.)

Jackass Ridge (Mendocino County, Cal., A. F. R., 1873).—On the summit of the high ridge about 1 mile south of Jackass gulch, within a few yards of the edge of the timber and directly on the trail from Jackass gulch to Ussal Valley, near where it leaves the coast and strikes into the timber eastward. (Note 2, p. 296.)

Jackass South (Mendocino County, Cal., A. F. R., 1873).—On the same ridge as Jackass Ridge station, 400 yards to the south nearly down to the point of the ridge, and about 1 000 feet above tide. (Note 2, p. 296.)

Anderson Cliff (Mendocino County, Cal., A. F. R., 1873).—On the first high cliff south of Jackass gulch, about 700 feet above tide and not more than 150 yards from the beach, on the edge of the bluff which is very abrupt. (Note 2, p. 296.)

Jackson (Mendocino County, Cal., A. F. R., 1873).—On a high ridge running parallel with the coast and about halfway beyween Bear Harbor and Jackass gulch, directly on the trail between the two places and about 200 yards from where the trail first leaves the timber going south, about 1 050 feet above tide. (Note 2, p. 296.)

Bear Harbor (Mendocino County, Cal., A. F. R., 1873).—On the sharp ridge about 200 yards south of the squatters' cabin and about three-fourths mile north of Captain Morgan's house at Bear Harbor, on the summit of the southern knoll, 400 feet above tide and 150 yards from the beach. (Note 2, p. 296.)

Jumper Ridge (Mendocino County, Cal., A. F. R., 1872).—On the main ridge above the old Morgan house at Bear Harbor, owned and occupied in 1882 by Keyser brothers,

about 900 feet above tide, and close to the edge of the redwood timber which densely covers the ridge north and east of the station. (Note 2, p. 296.)

Smoky Ridge (Mendocino County, Cal., A. F. R., 1873).—On the high ridge just north of the cabin kown as the squatters' cabin, on the Bear Harbor ranch, about 900 feet above tide and within 150 yards of the edge of the timber. (Note 2, p. 296.)

Laurie Flat (Mendocino County, Cal., A. F. R., 1873).—On the edge of the bluff about 1 mile south of the dairy house at Upper Bear Harbor, about 100 yards west of the trail from Upper to Lower Bear Harbor, about 300 yards south of a high sharp rock on the beach known as Needle Rock. (Note 2, p. 296.)

Cliff Ridge (Mendocino County, Cal., A. F. R., 1873).—On one of the high ridges running eastward from the coast about 1 mile south of the dairy house at Upper Bear Harbor, about 1 000 feet above tide, and directly on the brow of a small cliff of rock about 200 feet west of edge of timber. (Note 2, p. 296.)

Upper Bear Harbor (Mendocino County, Cal., A. F. R., 1873).—On the summit of the high ridge near edge of timber about three-fourths of a mile from the dairy house at Upper Bear Harbor, and about 500 yards north of the trail leading from Bear Harbor to White Thorn Valley. (Note 2, p. 296.)

Red Hill (Mendocino County, Cal., A. F. R., 1873).—On the summit of a high knoll on the southern ridge of Chemise Mountain, 2 miles north of ranch house at Upper Bear Harbor, and about 50 yards east of the mountain trail leading from Upper Bear Harbor to Shelter Cove, about 1 340 feet above tide and 600 yards from the coast. (Note 2, p. 296.)

Manzanita (Mendocino County, Cal., A. F. R., 1873).—On the backbone of Chemise Mountain, 1½ miles south of the summit and about 20 yards west of the trail, where the ridge is very rocky and covered with small manzanita bushes. (Note 2, p. 296.)

Embarcadero (Humboldt County, Cal., A. F. R., 1871).—On the southwestern extremity of the bluff at Shelter Cove, 200 yards from the western or outside landing. (Note 3, p. 296.)

Big Hill (Humboldt County, Cal., A. F. R., 1873).—About 2 miles east of the ranch house at Shelter Cove and directly on the trail from Shelter Cove to White Thorn Valley, on a bare, conspicuous knoll, about 2 000 feet above the level of the sea. (Note 2, p. 296.)

Harbor (Shelter Cove South Base) (Humboldt County, Cal., A. F. R., 1871).—On the southeast extremity of the point which forms Shelter Cove, the position of which is well known to "French Frank," George Collins, of Petrolia, and the Ray brothers at Shelter Cove. (Note 3, p. 296.)

Colona Cliff (Humboldt County, Cal., A. F. R., 1871).—On the cliff above the wreck of the lumber schooner *Colona*, 1 470 feet above tide and 1 mile north of Shelter Cove, known to the Ray brothers of that place and to "French Frank." (Note 3, p. 296.)

Shelter Cove (Mendocino County, Cal., A. F. R., 1871).—On a prominent round knoll, about 1 000 feet high, north of the bight at Shelter Cove. It is well known to the Ray brothers at Shelter Cove and to "French Frank." (Note 3, p. 296.)

Ray Point (Humboldt County, Cal., A. F. R., 1871).—On the prominent round hill west of the main bight at Shelter Cove, 267 feet above tide. The station is well known to the Ray brothers at Shelter Cove. (Note 3, p. 296, the center stub being 15 inches in diameter, 4 feet long, set with the top level with the surface.)

Alviso Ridge (Mendocino County, Cal., A. F. R., 1873).—On the summit of the first high ridge southeast of and about one-half mile from Juan Alviso's house, within 50 yards of the edge of the timber, about 750 feet above tide. (Note 2, p. 296.)

North Ussal (Mendocino County, Cal., A. F. R., 1883).—On a ridge running parallel with the coast just north of Ussal Valley, on a small knoll on the backbone of the ridge, about 500 feet above tide, about 600 yards north of the mouth of Ussal Creek, and not over 200 yards from the nearest point of the beach. (Note 2, p. 296.)

Devilby (Mendocino County, Cal., A. F. R., 1873).—On a point of the ridge running parallel to the coast, about three-fourths mile north of Henry Devilby's house in Cottaneva Valley, about 100 yards to the westward of the coast trail and within 300 yards of the nearest point of the beach, about 800 feet above tide. (Note 2, p. 296.)

Sheep Ridge (Mendocino County, Cal., A. F. R., 1873).—On the upper part of the same ridge as South Jackass station, about 1 000 feet above tide and about 100 yards from the edge of the timber. As there is no trail leading out to this ridge it would be difficult to give any directions as to how to reach these stations. But the location of this station and of South Jackass triangulation station was well known to Robert Anderson, of Jackass gulch. (Note 2, p. 296.)

Whale Gulch (Mendocino County, Cal., A. F. R., 1873).—About halfway between the mouth of the big ravine known as Whale Gulch and the dairy house at Upper Bear Harbor, on a knoll directly on the coast, the east side of which is covered with timber and chaparral and the west side is a slide which descends very abruptly to the beach; on the southeast end of the top of the knoll. (Note 2, p. 296.)

Kibesillah Rock (Mendocino County, Cal., A. F. R., 1874).—A single lone rock about three-fourths mile northwest of Ten Mile River bluff.

Clear Point (Mendocino County, Cal., A. F. R., 1873).—On a spur of Chemise Mountain, about 1½ miles south of the summit and one-half mile west of the trail; about 1 300 feet above tide, near the upper edge of a clearing, on the lower part of this ridge, just below a small point of rocks. (Note 2, p. 296.)

Big Knoll (Humboldt County, Cal., A. F. R., 1873).—On a knoll about halfway down one of the spurs of Chemise Mountain, about one-half mile west of the Shelter Cove and Bear Harbor trail, and about 1 800 feet above tide, on the second ridge south of the summit of the mountain. (Note 2, p. 296.)

Chemise Flat (Humboldt County, Cal., A. F. R., 1873).—On the first bare flat south of the highest peak of Chemise Mountain, about 50 yards west of the mountain trail from Shelter Cove to Bear Harbor. (Note 2, p. 296.)

McKee Flat (Humboldt County, Cal., A. F. R., 1873).—About one-half mile south of Little Valley and about one-half mile east of and 1 400 feet above the beach, on one of the ridges of Chemise Mountain, on a flat bench covered with chaparral, about 100 yards east of the bare hillside known as the "big opening." (Note 2, p. 296.)

Bight Knoll (Humboldt County, Cal., A. F. R., 1871).—About midway of a bight at Shelter Cove, 200 yards from the beach and about 430 feet above tide. (Note 3, p. 296.)

Crusoe Ridge (Mendocino County, Cal., A. F. R., 1883).—On the first ridge north of Crusoes gulch, 620 feet above tide. The coast trail runs around the base of the ridge at 100 feet elevation. (Note 2, p. 296.)

Switzer Rock (Mendocino County, Cal., A. F. R., 1874).—A lone pinnacle rock three-fourths mile northwest of Switzer's warehouse or Westport chute landing.

Timber Ridge Rock (Mendocino County, Cal., A. F. R., 1883).—Upon a rocky ridge jutting into the ocean from the main ridge running north from Ussal Valley, on the only available point for placing a signal. Marked by a drill hole in the rock. (Note 2, p. 296.)

Big White Rock (Mendocino County, Cal., A. F. R., 1883).—The summit of the first prominent beach islet or rock northwest from Ussal Valley.

Middle Rock (Mendocino County, Cal., A. F. R., 1883).—The apex of a rock halfway between Cluster Cone Rock and a group of four or five rocks, three of which are of equal size and equal distances from each other.

Ussal Rock (Mendocino County, Cal., A. F. R., 1883).—The top of the first prominent rock, 50 feet high, 200 meters offshore, and 2½ miles south of Ussal Valley.

Double Cone, West Rock (Mendocino County, Cal., A. F. R., 1883).—The top of the outer and larger one of two rocks, 250 meters from the beach, directly west of Devilby's house, and southwest from the point where the coast trail forks to go down into Cottaneva Valley.

Cottaneva Needle (Mendocino County, Cal., A. F. R., 1883).—The top of a prominent needle rock, 1 mile northwest of Cottaneva Valley, 200 meters off the beach.

Morgan Rock (Mendocino County, Cal., A. F. R., 1883).—The outer one of two rocks half a mile south of Bear Harbor Cove or landing and halfway from the cove to Cluster Cone Rock.

Cluster Cone (Mendocino County, Cal., A. F. R., 1883).—The summit of the largest rock in a group or cluster about 1 mile south of Bear Harbor and 150 meters seaward from the first ragged, rocky point south of the Bear Harbor beach landing.

Jackson Pinnacle (Mendocino County, Cal., A. F. R., 1883).—A prominent pinnacle rock 1 mile north of Jackass gulch, so close to the rocky beach that from seaward it might be hard to separate it from the bluff behind it, but seen along shore from the coast trail it is quite a marked object.

Needle Rock (Mendocino County, Cal., A. F. R., 1883).—A high-pointed rock, about halfway between Whale Gulch and Bear Harbor, separated from the ocean bluff only at high water.

Jackass Cone (Mendocino County, Cal., A. F. R., 1883).—The largest and highest of the four rocks 250 meters west of Mistake Point, about 1½ miles south of Jackass gulch.

Black Rock (Mendocino County, Cal., A. F. R., 1871).—About 1 mile below the point at Shelter Cove, a few yards from the first point below the cove, which is impassable except at low water; the higher of the two points of a prominent pointed rock close to the beach and connected with it at low water.

White Rock (Mendocino County, Cal., A. F. R., 1871).—About 4½ miles below Shelter Cove, a pointed rock, as seen from Shelter Cove, partly covered with white (bird lime), and apparently within 100 yards of the beach.

Forty-acre Opening (Mendocino County, Cal., C. H. S., 1897).—On the first knoll in an opening or clearing, about 6 miles east of Ukiah, plainly visible from Ukiah, on the farthest ridge visible to the east from Ukiah. The station is marked by a drill hole in a fast rock, the one nearest to the southwest edge of the bare top. The rock rises slightly above the ground surface and is about 1 foot across; it is not very firm, and is slowly disintegrating. There are several of these outcropping or fast rocks to the east and northeast. A few oak trees are on the north of the summit.

Cleland (Mendocino County, Cal., C. H. S., 1897).—On the most southerly of the three ridges that form the mountain mass west of and nearest to Ukiah, to the eastward of another and higher summit covered with bushes and small growth. The best approach is by a farm road 2 miles south of Ukiah and then by trail to the south of the fence that runs to the summit. It can not be ascended along the backbone on account of small scrub oak and manzanita. The station is marked by a drill hole in the only fast rock on top, flush with the surface and near the center of a round knoll, on the part of the mountain bare of trees.

Cole 2 (Mendocino County, Cal., C. H. S., 1897).—On a hill overlooking Ukiah from the westward. The station was marked by a drill hole in a good-sized stone placed in a small mound of earth with stones around it.

Dihel (Mendocino County, Cal., B. A. C., 1878; 1897).—On a hill overlooking Ukiah from the westward. The station was marked by a bottle buried just below the surface, over which was placed, in 1897, a stone with a drill hole in it and over all a mound of stone.

Ukiah South Base (Mendocino County, Cal., C. H. S., 1897).—About 1 100 meters south of the depot at Ukiah on the west side of the track in line with two large circular piles on the north side of a culvert and 13 feet 7 inches west of the center of the west rail, 9 paces southwest of a whistling post. The station was marked by a drain tile 10 inches in diameter and 2 feet long, with the flange down, filled with concrete, with a half-inch steel rod run through its entire length for a center mark. Concrete was also placed around the outside of the tile at top and bottom.

Ukiah North Base (Mendocino County, Cal., C. H. S., 1897).—About 150 meters north of the depot on the west side of the track, the station was marked like Ukiah South Base.

Ukiah Magnetic Station (Mendocino County, Cal., H. P. R., 1897).—On the western side of the level Russian River Valley, one-half mile east of the base of the mountains, and three-fourths of a mile west of the San Francisco and Pacific Coast Railroad, 116 meters true west and 1 786 meters true south of the county court-house, one square west from the county road, in the southeast corner of a square, 49 and 50 feet, respectively, from the southern and eastern street lines of this square, and near a creek which is dry in summer. The station was marked by a smooth, white marble post 4 feet long, set 2 feet in the ground, 8 inches square on top, with a cross marking the center. The south face of this post is lettered U. S. C. & G. S., the east face, MAG. STA., and the north face, 1897. A similar marble post was located on the eastern edge of the street, 250 paces true north. This stone is lettered on its west face MER., on its south face 1897, and its north face U. S. C. & G. S.

Ukiah Longitude Station (Mendocino County, Cal., C. H. S., 1897).—Near the southeast corner of the lumber yard of F. M. Mason in Ukiah, Cal., 12 feet to the street south and 4 feet to the street east, building line.

Ukiah Latitude Station (Mendocino County, Cal., C. H. S., 1897).—Near the southeast corner of Mr. Mason's lumber yard, 105.37 meters south and 39.245 meters west of the court-house, 88½ inches west and 7 inches south of the Ukiah longitude station.

SHELTER COVE TO TRINIDAD HEAD.

Horse Mountain (Humboldt County, Cal., A. F. R., 1871).—On the ridge of that name, a part of the claim of Lieutenant Fraser, 1,920 feet above tide, 1 mile north of the mouth of Horse Mountain Creek.

Fire Hill (Humboldt County, Cal., A. F. R., 1871).—On the chaparral-covered ridge, about halfway between Shelter Cove and Big Flat, at an elevation of about 2 835 feet. The location was known to Wm. Miller, of Big Flat; "French Frank," of Humboldt County, and to Geo. Collins, of Petrolia. The station was marked by a stub 3 feet long, level with the surface of the ground, in the top of which was a nail covered by a cartridge shell. Stones were piled around the stub.

Shubrick Peak (Humboldt County, Cal., A. F. R., 1871).—On the very marked peak north of Big Flat, 2 780 feet above tide. (Note 6, p. 296; nails marking the exact points.)

North Slide (Humboldt County, Cal., A. F. R., 1871).—About 3 miles from the coast, 3 420 feet above tide; the location is known to "French Frank," Wm. Roberts, and Wm. Miller, of Big Flat; it must be approached by way of Hadley Peak or by Telegraph Ridge. The station was marked by a nail in a stub 3 feet long, with the top about 6 inches above ground. Large rocks were piled around the stub.

Hadley Peak (Humboldt County, Cal., A. F. R., 1871).—Three miles north of Big Flat and 12 miles north of Shelter Cove, at an elevation of 2 700 feet above tide; it is 16 miles south of Petrolia, the nearest post-office. The location is well known to "French Frank," Wm. Roberts, Martin Saunders, of Petrolia, and Wm. Miller, of Big Flat. The station was marked by a stub 2 feet long driven about 1 foot in the ground, with large rocks around it.

Chaparral Peak (Humboldt County, Cal., A. F. R., 1871).—On a prominent peak of the H. K. Davis or Point Gorda ridge, about 3 miles from the beach, 2 600 feet above the tide. It is best approached from Point Gorda, and the location was known to "French Frank." The station was marked by a center stub and four witness marks—north, south, east, and west—6 feet from the center.

Gorda (Humboldt County, Cal., A. F. R., 1871).—At an elevation of 2 300 feet on what is known as Davis Ridge, about 4 miles south of the mouth of the Mattole River. The location is known to "French Frank," John Morgan, and H. K. Davis, who live on the western spurs of the ridge, and to John Mackey, who lives 8 miles south of the Marble River. (Note 6, p. 296; exact points marked by nails.)

Uncle Tommy (Humboldt County, Cal., A. F. R., 1871).—On the ridge south of the Mattole River, known as Barksdale Ridge, 2 000 feet above tide and about 2½ miles inland. (Note 6, p. 296.)

Barksdale Table (Humboldt County, Cal., A. F. R., 1871).—On the Barksdale Ridge, about 1 mile from the beach and 1 300 feet above tide. The location is well known to Eli Bagley, who lives near the mouth of the Mattole River. (Note 6, p. 296.)

Moore Hill (Humboldt County, Cal., A. F. R., 1871).—On the summit of the hill on the north bank of the Mattole River, known as Moore's hill, about 1 210 feet above tide and about 1 mile from the beach. (Note 10, p. 297.)

Mussel Knoll (Humboldt County, Cal., A. F. R., 1871).—On the most westerly of the two small knolls at the summit of the Mussel Ridge, 950 feet above tide and about one-half mile from the beach; about 50 yards north of a long board fence running east and west across the hill. (Note 6, p. 296.)

Windy Point (Humboldt County, Cal., A. F. R., 1871).—On the edge of the bluff, 800 feet above tide, about 400 yards from the beach and about the same distance from Reynolds house, which is on the table back of the station. The location is well known to Conrad Schumacher and Edward Saunders, of Petrolia. (Note 6, p. 296.)

McNutt (Humboldt County, Cal., A. F. R., 1871).—On a sharp peak about 300 yards north of where the Mattole road crosses the divide between Domingos Creek and the McNutt Gulch. (Note 6, p. 296.)

South of Cape (Humboldt County, Cal., A. F. R., 1869–1872).—On the western extremity of Brandstetters Ridge overlooking Singleys flat, about one-half mile south of the public house owned by Jos. Russ and kept by Jos. Corbett, 900 feet above tide. (Note 6, p. 296.)

Mount Blank (Humboldt County, Cal., A. F. R., 1869–1872).—Immediately south of Cape Mendocino on what is known as Brandstetters Ridge, separated from the cape by Singleys Creek or gulch, about 2 miles inland and west of Singleys flat, 2 200 feet above tide. (Note 6, p. 296.)

Cape Ridge (Humboldt County, Cal., A. F. R., 1869–1871).—On the main Cape Mendocino Ridge, 2 miles east of Cape Mendocino light-house and 1½ miles south of Bear River, about 1 400 feet above tide. The location was known to Thos. Stewart, of Bear River. (Note 6, p. 296.)

Mendocino (Humboldt County, Cal., A. F. R., 1869–1872).—On the highest point of Cape Mendocino on the main ridge of the cape and three-fourths mile east of the light-house. (Note 6, p. 296.)

Bear River (Humboldt County, Cal., A. F. R., 1869).—On the ridge south of Bear River, sometimes called Widow McGregors Ridge, 940 feet above tide. (Note 7, p. 296.)

Odell (Humboldt County, Cal., A. F. R., 1869).—On the ridge known as Bear River Ridge, about 2 miles north of the house of Cornelius Odell. The location was known to him and to Thomas Stewart, of Bear River. (Note 7, p. 296.)

False Cape (Humboldt County, Cal., A. F. R., 1869).—On the highest part of the bluff of False Cape, 614 feet above tide and 200 meters west of the county road as it winds off the beach coming from Eel River Valley and turns to the eastward up False Cape ridge. (Note 7, p. 296.)

Oil Creek (Humboldt County, Cal., A. F. R., 1869).—On the ridge north of False Cape, known as Little Bald Hill, 1 360 feet above tide. It may be reached by going up the ridge immediately south of where the Eel River and Mattole Valley road leaves the sand beach and rises over False Cape. The location was known to Thomas Stewart, of Bear River, and Smith Fulmore, of Eel River. (Note 7, p. 296.)

Miller Peak (Humboldt County, Cal., A. F. R., 1871).—Ten miles north of Shelter Cove, on the peak south of Miller's house, at Big Flat, about 1 980 feet above tide. (Note 6, p. 296.)

Shipman (Humboldt County, Cal., A. F. R., 1871).—South of the mouth of Shipman Creek, on a spur of Fire Hill Ridge, about 1 600 feet above tide. A clump of fir trees cover the station from seaward view; one of these trees, called Shipman Tree, about 40 feet southwest of the station, was trimmed down to leave a top tuft only. The location was known to "French Frank" and to Wm. Miller, of Big Flat. (Note 3, p. 296.)

Miller Ridge (Humboldt County, Cal., A. F. R., 1871).—On the main ridge of which Millers Peak is a spur, 2 400 feet above tide. The locality is known to Wm. Miller, of Big Flat, and to "French Frank." (Note 6, p. 296; except the center stub was 2 feet long.)

Wyman (Humboldt County, Cal., A. F. R., 1871).—About 3 miles north from Shelter Cove and a few hundred yards from Fraser's cabin, on a little point projecting out into the beach, 34 feet above tide. (Note 3, p. 296; center stub 1 foot in diameter and 3 feet long.)

Midway (Humboldt County, Cal., A. F. R., 1871).—About 6 miles north of Shelter Cove, 1 260 feet above tide. Gitchell's cabin is the nearest; location is known to "French Frank." (Note 6, p. 296.)

Big Flat (Humboldt County, Cal., A. F. R., 1871).—On the low point north of Big Flat Creek and under Shubrick Peak, 5 feet above tide. (Note 6, p. 296.)

Oat Hill (Humboldt County, Cal., A. F. R., 1871).—Near the summit of Oat Ridge, about 2 300 feet above tide. The locality is well known to Martin Saunders, of Petrolia, Wm. Roberts, and "French Frank." (Note 6, p. 296.)

Wild Oat (Humboldt County, Cal., A. F. R., 1871).—On the seaward knob or end of Oat Ridge, 1 870 feet above tide. The location is known to Wm. Roberts, "French Frank," and to Martin Saunders, of Petrolia. (Note 6, p. 296.)

Spanish Hill (Humboldt County, Cal., A. F. R., 1871).—On the western summit of Spanish Ridge, 2 100 feet above tide. The location is well known to Wm. Roberts and "French Frank." (Note 6, p. 296.)

Spanish Creek (Humboldt County, Cal., A. F. R., 1871).—On the southwest spur of Spanish Ridge, 820 feet above tide. (Note 6, p. 296.)

Lake Hill (Humboldt County, Cal., A. F. R., 1871).—On the seaward end of Lake Ridge, about 1 620 feet above the tide. The locality is well known to "French Frank" and to Wm. Roberts. (Note 6, p. 296.)

Reynolds Point (Humboldt County, Cal., A. F. R., 1871).—On the southwest spur of Lake Ridge, 824 feet above tide. Probably marked according to note 6, p. 296.

Cooskie Creek (Humboldt County, Cal., A. F. R., 1871).—A half mile south of Cooskie Creek and one-fourth mile west of the ocean beach, about 1 000 feet above tide. The location is known to Wm. Roberts, "French Frank," and John Mackey, all of Petrolia. (Note 6, p. 296.)

Four Mile Creek (Humboldt County, Cal., A. F. R., 1871).—On the outer edge of a flat table, just south of Four Mile Creek, 800 feet above tide and about 600 yards from the beach, within 150 yards of the trail that leads up the ridge from the mouth of the creek. The location is well known to Conrad Schumacher and Edward Saunders, of Petrolia. (Note 6, p. 296.)

Coyote (Humboldt County, Cal., A. F. R., 1871).—On the ridge south of Four Mile Creek, known as the Davis Ridge, and about 1 760 feet above tide and about a mile from the beach. The location is well known to Edward Saunders and Conrad Schumacher, of Petrolia. (Note 6, p. 296.)

Morgan (Humboldt County, Cal., A. F. R., 1871).—On a high bluff about one and a quarter miles south of Four Mile Creek, 950 feet above tide, and about 400 yards from the beach. The location is well known to Conrad Schumacher and Edward Saunders, of Petrolia. (Note 6, p. 296.)

Mackey Hill (Humboldt County, Cal., A. F. R., 1871).—On the ridge above and northeast of the house of John Mackey, 1 920 feet above tide. The locality is known to John Mackey and "French Frank." (Note 6, p. 296, exact points marked by nails.)

Mackey Ridge (Humboldt County, Cal., A. F. R., 1871).—On the ridge about one-fourth mile southeast of the house of John Mackey, to whom and to "French Frank" and John McCollis this locality is well known. (Note 6, p. 296, nails marking the exact points.)

Mackey Beach (Humboldt County, Cal., A. F. R., 1871).—On the bluff about 50 feet above tide, a few yards from the sand beach southwest from the house of John Mackey, to whom and to "French Frank" the place is well known. (Note 6, p. 296, except the center stub was 4 feet long, and nails in the top of all the stubs marked the exact points.)

Mattole Point (Humboldt County, Cal., A. F. R., 1871).—About one-half mile north of the mouth of Mattole River, on a high bluff 800 feet above tide and about 400 yards from the beach. (Note 6, p. 296.)

Bagley (Humboldt County, Cal., A. F. R., 1871).—About a half mile south of the mouth of Mattole River, on the edge of a high bluff, 800 feet above tide and about 700 yards south of Eli Bagley's house, to whom the location is well known. (Note 6, p. 296.)

Taylor Peak (Humboldt County, Cal., A. F. R., 1871).—On a conical peak 3 350 feet high, well known as Taylors Peak, about 7 miles from the coast at the head or main bend of Mattole River. (Note 7, p. 296.)

Mattole Beach (Humboldt County, Cal., A. F. R., 1871).—On the sand beach at the mouth of the Mattole River, about halfway between the north and south bluffs and about 50 yards from high-water mark. The location is well known to Eli Bagley, who lives at the mouth of the Mattole River. (Note 6, p. 296.)

Chaparral Mountain (Humboldt County, Cal., A. F. R., 1871).—On what is called the Shenanigan Hill, a peak of the Punta Gorda Ridge. The station was marked by a center stub and four witness marks, north, south, east, and west, 6 feet from the center.

Widow Cranks (Humboldt County, Cal., A. F. R., 1871).—On a bald hill known as Widow Cranks Hill, 920 feet above tide and about 1¼ miles from the beach, on the Walker Hunter ranch and 400 yards west of the house occupied by Mr. Titus. (Note 6, p. 296.)

Mussel Ridge (Humboldt County, Cal., A. F. R., 1871).—On the sharp ridge south of a very rough and heavily timbered ravine known as the McNutt gulch, on the Mussel

ranch, about three-fourths mile east of the Mussel Rocks, and 850 feet above tide. (Note 6, p. 296.)

Oil Creek West (Humboldt County, Cal., A. F. R., 1869).—On the western verge of the hill known as "Little Bald Hill," 1 100 feet above tide. It may be reached by the trail leading up just north of where the Eel River and Mattole Valley road leaves the sand beach and rises over False Cape. (Note 7, p. 296.)

Mount Blank 2 (Humboldt County, Cal., A. F. R., 1871).—About 2 miles inland on what is known as Brandstetters Ridge, about 2 160 feet above tide. (Note 6, p. 296.)

Davies Creek (Humboldt County, Cal., A. F. R., 1871).—On the first ridge south of Davies Creek, about one-half mile from the beach and about 725 feet above tide. (Note 6, p. 296.)

Walker Ridge (Humboldt County, Cal., A. F. R., 1871).—On the high ridge south of Davies Creek, known as Walkers Ridge, about one-half mile north of Jessie Walker's house, to whom the location is well known, about 2 miles from the beach, 1 630 feet above tide. (Note 6, p. 296.)

Davies Ridge (Humboldt County, Cal., A. F. R., 1871).—On the first ridge south of Davies Creek, about 1¼ miles from the beach and 1 300 feet above tide, near a number of boulders, the only rocks on the ridge. (Note 6, p. 296.)

Domingo (Humboldt County, Cal., A. F. R., 1871).—On the first ridge south of Domingo Creek, about one-half mile southeast of where the Mattole road leaves the beach and winds up the hill, about 100 yards east of a break in the hill caused by a landslide, 730 feet above tide. (Note 6, p. 296.)

Devils Gate (Humboldt County, Cal., A. F. R., 1871).—On the ridge running back from the place on the beach about 2 miles south of Cape Mendocino, known as the Devils Gate; about 500 yards from the beach and about 460 feet above tide. (Note 6, p. 296.)

Fraser Ridge (Humboldt County, Cal., A. F. R., 1871).—Four miles north of Big Flat or Shubrickville, the site of the wreck of the steamer *Shubrick*, about 1 600 feet above tide. The location is well known to "French Frank," Martin Saunders, of Petrolia, and Wm. Miller, of Big Flat. (Note 6, p. 296, exact points marked by nails.)

Lower Hadley (Humboldt County, Cal., A. F. R., 1871).—Three miles north of Big Flat, 12 miles north of Shelter Cove, about 1 440 feet above tide. The location is known to Wm. Roberts, "French Frank," and Wm. Miller, of Big Flat. The station was marked by a nail in the center of a stub and by four witness marks north, south, east, and west of center.

Rancheria Beach (Humboldt County, Cal., A. F. R., 1871).—About 12 miles north of Shelter Cove, between Frasers Creek and Hadleys Creek, on the sand beach 5 feet above tide. The location is known to Wm. Miller, at Big Flat, 3 miles south, to "French Frank," Martin Saunders, and Geo. Collins, of Petrolia. (Note 6, p. 296, exact points marked by nails.)

Little Spanish (Humboldt County, Cal., A. F. R., 1871).—About 13 miles south of Mattole River, on the southwest spur of Spanish Ridge, about 1 400 feet above tide. The location is known to Wm. Roberts and "French Frank." (Note 6, p. 296.)

Steamboat Rock (Humboldt County, Cal., A. F. R., 1871).—About 1½ miles to the south of Cape Mendocino, about one-third mile offshore, a large flat rock with a sharp

peak at the southern extremity, which rises 46 feet above the tide; from the southward it resembles a steamboat.

Fortunas (Humboldt County, Cal., A. F. R., 1871).—On the western verge of Bear Ridge, 1 000 feet above tide, 1½ miles north of the river, one-half mile west of the county road crossing Bear River Ridge. The location was known to Thos. Steward, of Bear River. (Note 7, p. 296.)

Mussel Rock (Humboldt County, Cal., A. F. R., 1871).—About 1¼ miles south of Domingo Creek and about 3½ miles north of the Mattole River, a large conical rock about 40 feet high, situated on the edge of the beach.

Devils Gate Rock (Humboldt County, Cal., A. F. R., 1871).—The largest of a small group of rocks situated about three-fourths mile offshore and about 3 miles south of Cape Mendocino.

Sealion Rock (Humboldt County, Cal., A. F. R., 1871).—The largest of a small group of rocks about one-half mile offshore and about 2 miles north of the mouth of the Mattole River.

Gorda Rock (Humboldt County, Cal., A. F. R., 1871).—A prominent islet situated about three-fourths mile off Punta Gorda and about 3 miles south of the mouth of the Mattole River.

Reynolds Rock (Humboldt County, Cal., A. F. R., 1871).—The top of a rock about a half mile west of the mouth of Reynolds Creek and about 4 yards distant from the beach at Reynolds Point.

Shipman Tree (Humboldt County, Cal., A. F. R., 1871).—A tree trimmed down with only a tuft at the top, on a spur of the Fire Hill Ridge, about 40 feet southwest of Shipman triangulation station (p. 387).

Eel River (Humboldt County, Cal., A. F. R., 1869).—On the north sand spit forming the entrance to Eel River. Reported lost in 1870.

Table Ridge (Humboldt County, Cal., A. F. R., 1869).—On the eastern side of the ridge known as Table Bluff, 340 feet above tide, near a Catholic cemetery (not inclosed in 1869). (Note 6, p. 296.)

Table Bluff (Humboldt County, Cal., A. F. R., 1869).—On the southwest point of Table Bluff, south of Humboldt Bay, 160 feet above tide, upon land owned in 1869 by Dr. Jonathan Clark, of Eureka. (Note 6, p. 296.)

Eel River Beach (Humboldt County, Cal., A. F. R., 1869).—On the sand bank about 1¼ miles north of the mouth of Eel River. As the beach was covered with drift logs, the station is probably lost. (Note 7, p. 296.)

Nelson (Humboldt County, Cal., A. F. R., 1869).—On the beach between Table Bluff and the mouth of Eel River. As the beach was covered with drift logs, the station is probably lost. (Note 7, p. 296.)

Sisson (Humboldt County, Cal., J. S. L., 1853; 1869).—On the highest ridge of the bare hill, 60 meters long and 15 meters wide, and nearly level, back of Red Bluff, 200 meters from the point of woods formerly used as a pilot range, and on the far side of the road to Eel River; 300 meters 91° 45′ from Sisson's house; a little west of the crest of the hill, about 600 feet above tide. (Note 6, p. 296.)

Red Bluff Latitude Station (Humboldt County, Cal., G. D., 1854; 1869).—On the highest part of the bluff known as Red Bluff, about 100 feet high, on the western side

and opposite the entrance of Humboldt Bay, 9 meters from the west edge of the bluff and 19 meters from the north edge. The station was marked by a granite block, 9 inches square, 5½ feet long, set even with the surface of the ground, having a copper bolt leaded in the upper end, marked with a cross, which is 0.85 inch east of the center of the station. A stub with a nail in top was set in line to Humboldt Bay Light-house.

Bucksport (Humboldt County, Cal., A. F. R., 1869).—On the eastern shore of Humboldt Bay, on salt marsh ground, about 1 mile south of the South Park race track and between the east shore of the bay and the county road leading to Eureka. (Note 6, p. 296.)

Sandhill (*R*) (Humboldt County, Cal., A. F. R., 1869).—On one of the highest of the small sandhills on the south part of the small peninsula, one-fourth mile from the ocean. (Note 6, p. 296.)

Humboldt Bay North Base (Humboldt County, Cal., A. F. R., 1869).—On the eastern shore of Humboldt Bay, near the outer edge of the salt marsh and about west from the South Park race track. The station was marked in a manner similar to Humboldt Bay Middle Base. (See following description.)

Humboldt Bay Middle Base (Humboldt County, Cal., A. F. R., 1870).—On the east side of Humboldt Bay, 400 yards west of the county road leading south from Eureka and the bay shore, and 120 yards east of the bay beach, on a very small, hard-land island, slightly above the level of the salt marsh, in the inclosure belonging to and nearly west of the slaughterhouse. The station was marked by a cement block, on top of which was a copper plate marked with the letters U. S. C. S. M. BASE, through a hole in the plate a tube of copper one-half inch in diameter by 1 foot long was thrust down into the cement, and the upper end of the tube level with the surface of the copper plate marked the center of the station. The witness marks were four redwood stubs placed to the north, east, south, and west, each 6 feet distant from the center.

Curlew (Humboldt County, Cal., J. S. L., 1853; 1869).—On the western shore of Humboldt Bay, on a prominent sand hill on the north peninsula, at the extreme edge of a pine barren, about 150 yards west of the bay beach and half a mile north of Fay's mill. (Note 6, p. 296.)

Peninsula (Humboldt County, Cal., A. F. R., 1869).—On the sand dune between the west shore of Humboldt Bay and the ocean beach. (Note 6, p. 296.)

Sand Bluff (Humboldt County, Cal., A. F. R., 1870).—On the western shore of Humboldt Bay, on the first prominent point north of Worth's house and wharf, on a sand bluff. (Note 6, p. 296.)

West Point (Humboldt County, Cal., A. F. R., 1870).—On a point of land to the north of a small indentation and west of a large island. (Note 6, p. 296.)

East Point (Humboldt County, Cal., A. F. R., 1870).—On the end of a prominent point north of Carson Mill. (Note 6, p. 296.)

Eureka Azimuth Station (Humboldt County, Cal., G. D., 1869; 1871.)—On the west side of the plaza or public square in Eureka (between Fourth, Fifth, I, and J streets), 28 feet 2 inches from the west fence of the plaza. From the point where the measure touches the fence to the southwest corner of the plaza is 98 feet 3 inches, and to the northwest corner 139 feet 4 inches. The true meridian of the station was marked on the north and south fences by saw cuts in the upper rail, the south mark being 10 feet 6

inches from the west fence and the north mark 54 feet 5½ inches from the west fence. The station was marked by a block of wood. It was reported in 1886 that large public buildings had been erected on the plaza and the station probably lost.

Wheeler (Humboldt County, Cal., A. F. R., 1870).—On the first prominent point on the west shore of Humboldt Bay, south of the mouth of Mad River slough, about 100 yards northeast of Wheeler's house, on the edge of the timber, 40 yards from the bay shore, and about 20 feet above tide. (Note 6, p. 296.)

Green Bluff (Humboldt County, Cal., A. F. R., 1870).—On the north shore of Humboldt Bay, on Brainards Point, the first prominent hard point north of Eureka, about 20 feet above tide. (Note 6, p. 296.)

Morgan (Humboldt County, Cal., A. F. R., 1870).—On the highest sand dune north of Worth triangulation station, upon the edge of the pine timber which forms an almost complete barrier to observation from the western sand dunes of Humboldt Peninsula toward the east. The location was known to Simon Morgan, of Eureka. (Note 6, p. 296.)

Cut Hill (Humboldt County, Cal., A. F. R., 1870).—On the North Peninsula west of Humboldt Bay, on top of a sand dune, 60 feet above tide. (Note 6, p. 296, nails in each stub.)

Slough (Humboldt County, Cal., A. F. R., 1870).—On the marsh bank of slough north of Eureka. The location was known to Wm. Tomlinson, Simon Morgan, and Wm. Johnson, of Eureka. (Note 6, p. 296, nails in each stub.)

Slough Fork (Humboldt County, Cal., A. F. R., 1870).—On the marsh about 1 mile east of Slough triangulation station. The location was known to Simon Morgan and Wm. Johnson, of Eureka. (Note 6, p. 296, nails in each stub.)

Marsh Point (Humboldt County, Cal., A. F. R., 1870).—On a point of the marsh about halfway between the Arcata wharf and the mouth of Mad River slough, on the north shore of Humboldt Bay. (Note 6, p. 296.)

John Brown (Humboldt County, Cal., A. F. R., 1870).—On the first point of hard land inside the entrance to the Mad River slough on the west bank of the slough, about 50 yards north of John Brown's house. (Note 6, p. 296.)

Mosquito Point (Humboldt County, Cal., A. F. R., 1870).—On the marsh on the west bank of Mad River slough, about a mile above John Brown's house. (Note 6, p. 296.)

Northerner (Humboldt County, Cal., A. F. R., 1870).—On the bluff 240 feet above tide, one-half mile south of Centerville, east of the wreck of the steamer *Northerner*, a little southeast of and nearly over the graves of the persons drowned at the wreck, which are marked by the boom and gaff of one of the steamer's fore and aft sails, planted in the sand, with a cross on top. (Note 7, p. 296.)

Eccentric (Humboldt County, Cal., A. F. R., 1869).—On one of the sloughs south of the mouth of Eel River and reached by going through Salt River; the location was known to Smith Fulmore, of Eel River. (Note 7, p. 296.)

Centerville (Humboldt County, Cal., A. F. R., 1869).—One mile and a half south of the mouth of Eel River and about 300 yards south of where the sand hillock rises above the surface of the beach, on a sand hillock of the spit on the beach between the mouth of Eel River and the collection of shanties on the southern extremity of Eel River beach, known as Centerville. Station is about 40 feet above the tide. (Note 7, p. 296.)

Centerville South (Humboldt County, Cal., A. F. R., 1869).—Nearly 3 miles south of the mouth of Eel River, on the sand spit between the ocean and the marshes of Eel River. The location was known to Smith Fulmore, of Eel River. (Note 7, p. 296.)

Russ Cut-Off (Humboldt County, Cal., A. F. R., 1869).—On the salt marsh about 2 miles south of the mouth of Eel River, on the branch known as Salt River. The location was known to Smith Fulmore, of Eel River. (Note 7, p. 296.)

Picket Pile (Humboldt County, Cal., A. F. R., 1869).—About a mile and a half south of the mouth of Eel River, on the marsh or tule land between Salt River and the sand spit south of the mouth of Eel River, about 100 yards west of the bank of Salt River. The location was known to Smith Fulmore, of Eel River. (Note 7, 296.)

East Point (Humboldt County, Cal., A. F. R., 1869).—On the end of the beach opposite the mouth of Eel River. Reported lost in 1870.

Flag Tree (Humboldt County, Cal., A. F. R., 1869–1883).—The outer or northern tree of a small clump of redwoods on the south bank of Eel River between Morgan slough and Eastlake slough, trimmed down to leave a tuft at the top.

South Beach (Humboldt County, Cal., A. F. R., 1869).—About 2 miles south of the entrance to Humboldt Bay, on the sand spit running north from Table Bluff, and forming the southwest boundary of the bay. (Note 6, p. 296.)

South Spit (Humboldt County, Cal., A. F. R., 1869).—About one-fourth mile south of the entrance to Humboldt Bay, on the sand spit south of the entrance. (Note 6, p. 296.)

Round Top (Humboldt County, Cal., A. F. R., 1870).—On the north peninsula west of Humboldt Bay, on top of a sand dune 80 feet above tide, at a very narrow part of the sand dune. (Note 6, p. 296, nails in each stub.)

Ocean (Humboldt County, Cal., A. F. R., 1870).—About a mile south of the mouth of Mad River, about one-fourth mile west of the mouth of the canal which connects Mad River with the waters of Humboldt Bay, on a sand dune about 20 feet above tide and about 100 yards east of the ocean beach. (Note 6, p. 296.)

Trinidad Head (Humboldt County, Cal., A. F. R., 1870).—On the summit of Trinidad Head, 380 feet above tide. The station was marked by a stub 3 feet long, the top level with the surface of the ground, directly under which was a bottle; four bottles were buried in the ground 3 feet from the surface, each 6 feet distant and with the mouths pointing toward the center.

Laguna (Humboldt County, Cal., A. F. R., 1870).—On the northern end of a small marsh island lying in the northern part of that portion of Mad River slough where it widens out into what is called the Laguna. (Note 6, p. 296.)

Onsley (Humboldt County, Cal., A. F. R., 1870).—On the marsh about one-half mile northwest of Onsleys Landing. (Note 6, p. 296.)

Canal (Humboldt County, Cal., A. F. R., 1870.)—On the marsh at the head of Mad River slough, about 100 yards east of the mouth of the canal which connects the slough with Mad River and about 200 yards south of the timber which comes down close to the edge of the marsh. (Note 6, p. 296.)

Mad River (Humboldt County, Cal., A. F. R., 1870).—On the first sand dune north of Mad River, about 1 mile therefrom and about 100 yards east of the ocean beach. The station was marked by a round stub 4 feet long and about 1 foot in diameter, the top level with the surface of the ground, and by 4 witness marks north, south, east, and west and 6 feet distant.

Dows Prairie (Humboldt County, Cal., A. F. R., 1870).—On the edge of a bluff about 180 feet above the ocean beach, on what is known as Dows Prairie, about 450 yards west of the house of David Worth. (Note 6, p. 296.)

Little River (Humboldt County, Cal., A. F. R., 1870).—On the summit of the knoll on the north of the mouth of Little River, about 90 feet above tide. (Note 6, p. 296.)

Underwood Creek (Humboldt County, Cal., A. F. R., 1870).—On a sand dune about 300 yards north of the mouth of Underwood Creek and about 100 yards east of the ocean beach. (Note 6, p. 296.)

Worth (Humboldt County, Cal., A. F. R., 1870).—On the highest sand dune west of the house of Thomas Worth. (Note 6, p. 296.)

Fay's mill (Humboldt County, Cal., A. F. R., 1869; 1883).—About 2 miles north of Humboldt Bay Light-house, on the west shore of Humboldt Bay, the smokestack of Fay's mill.

Worth's house, chimney (Humboldt County, Cal., A. F. R., 1869; 1883).—About 4 miles north of Humboldt Bay Light-house, the chimney of Worth's house, on the west shore of Humboldt Bay, and back of a small wharf known as Worth's wharf.

Jones' mill (Humboldt County, Cal., A. F. R., 1870).—On the east side of Indian Island, west of the town of Eureka, on the opposite side of the main channel, the smokestack of Jones' mill.

Cousin's mill (Humboldt County, Cal., A. F. R., 1870).—On the eastern shore of Indian Island in Humboldt Bay, west of the town of Eureka, on the opposite side of the main channel, the smokestack of Cousin's mill.

Little River Beach (Humboldt County, Cal., A. F. R., 1870).—About 1 mile south of the mouth of Little River and about 100 yards east of the Ocean beach, on a sand dune about 20 feet above tide, about 400 yards south of the cabin of Chas. Beach. The station was marked by a round center stub about 1 foot in diameter and by 4 witness marks to the north, south, east, and west and each 6 feet from the center.

Little River Rock (Humboldt County, Cal., A. F. R., 1870).—About 1 mile northwest of Little River and about 400 yards west of the shore, the summit of a prominent rocky islet 120 feet above tide.

Shelton (Humboldt County, Cal., A. F. R., 1870).—In the town of Trinidad, in the inclosure of a man named Shelton and near his house. (Note 6, p. 296.)

Timber Ridge (Humboldt County, Cal., A. F. R., 1870).—On the first prominent ridge on the east side of the upcoast trail and about three-fourths mile north of Trinidad. (Note 6, p. 296.)

Off Trinidad Rock (Humboldt County, Cal., A. F. R., 1870).—On the large rock lying about one-half mile west of Trinidad Head and about 80 feet above the sea level. A center stub 1 foot long, surrounded by small rocks, marked the station.

North Trinidad (Humboldt County, Cal., A. F. R., 1870).—On a large level table about 160 feet above the level of the sea and about 1 mile north of Trinidad on the west-coast trail. (Note 6, p. 296.)

Scottys Point (Humboldt County, Cal., A. F. R., 1870).—On Scottys Point, about 3½ miles north of the coast trail from Trinidad. The station was marked by a center stub 2 feet long, the top level with the surface of the ground.

Cone Rock (Humboldt County, Cal., A. F. R., 1870).—About 1½ miles west of Scottys Point and 2 miles south of Turtle Rocks; the top of a conical rock, 40 feet above tide.

Patricks Point South (Humboldt County, Cal., A. F. R., 1870).—About 7 miles north of Trinidad by the coast trail. (Note 7, p. 296, nail in stub.)

Inner Turtle Rock (Humboldt County, Cal., A. F. R., 1870).—On top of the smaller of the two Turtle rocks, the last prominent offlying rocks north of Trinidad.

Auxiliary Dow (Humboldt County, Cal., A. F. R., 1869; 1883).—Three-quarters of a mile south of where the coast trail leaves Dows Prairie and enters the ocean beach and 2 miles south of Little River, under the high bluff in front of Dows Prairie, and about 20 feet above tide. (Note 6, p. 296.)

Pilot Rock (Humboldt County, Cal., A. F. R., 1870).—The top of a prominent rock in the roadstead at Trinidad.

Trinidad flagstaff (Humboldt County, Cal., A. F. R., 1869; 1883).—The town flagstaff of Trinidad, opposite the main street through which the coast road enters and leaves the town, about one-half mile east of the summit of Trinidad Head, on the bluff overlooking Trinidad Bay, 160 feet above tide.

Blank Rock (Humboldt County, Cal., A. F. R., 1869; 1883).—The top of a large rock 100 feet high, the nearest rock west of Trinidad Head and the first prominent rock north of what is well known in Trinidad Bay as "pilot rock."

In Line (Humboldt County, Cal., A. F. R., 1870).—On the sand ridge south of Mad River, which separates the ocean from the marsh lands of Humboldt Bay.

Mad River Bluff (Humboldt County, Cal., A. F. R., 1870).—About 500 yards to the north of the mouth of Mad River, on a bluff about 40 feet above tide.

Island (Humboldt County, Cal., A. F. R., 1870).—On the larger of the two small marsh islets known as the Bird Islands. (Note 6, p. 296.)

Carson's mill (Humboldt County, Cal., A. F. R., 1869; 1883).—In the northwestern part of the town of Eureka, close to the bay shore, the smokestack of Carson's mill.

Arcata wharf (Humboldt County, Cal., A. F. R., 1870).—On the southern extremity of Arcata wharf, in the northern part of Humboldt Bay. It was reported in 1883 that the wharf had been extended and the station probably lost.

Signal House (Humboldt County, Cal., A. F. R., 1870).—A scantling nailed on a small shanty on the west shore of Humboldt Bay; it is about 1 mile northwest of the little islands known as Bird Islands.

McNulty's barn, south gable (Humboldt County, Cal., A. F. R., 1869).—The south gable of McNulty's barn, the base of which is about 30 feet above tide, on the south side of what is known as Table Bluff. It is 1½ miles from Ocean Beach and one-fourth mile east of McNulty's warehouse.

Guthrie's house, west gable (Humboldt County, Cal., A. F. R., 1869).—On the third ridge south of Centerville, 480 feet above tide, and 1½ miles south of the point at which the coast road leaves the hard ground and strikes the beach, which is at the point where there is a cross erected over some graves.

Guthrie's Tree (Humboldt County, Cal., A. F. R., 1869).—On the same ridge as and 550 meters from Guthrie's house. It is on the extremity of the ridge overlooking the ocean beach. In 1883 the tree could not be identified.

Red Bluff (Humboldt County, Cal., G. D., 1854).—On the southwest and highest point of the bluff known as Red Bluff, opposite the entrance of Humboldt Bay. The bluff is about 96 feet high, and there is a tall flagstaff used as a pilot range standing at the extreme end of the bluff near the station. Station is about 22 paces from Red Bluff Latitude Station. (See p. 390, also note 10, p. 297.)

Martin (Humboldt County, Cal., G. D., 1854).—On the steep face of the point of table-land east-southeast from the mouth of Elk River and 46 meters north of the road leading to Mr. Martin's house. (Note 10, p. 297.)

North Base (Humboldt County, Cal., G. D., 1854).—On a sand hillock bearing north ¾° east from the light-house, distant 625 meters. (Note 10, p. 297.)

Bucksport (Humboldt County, Cal., G. D., 1854).—In the town of Bucksport, on a small ridge above high-water mark. (Note 10, p. 297.) The station was reported in 1869 as being probably lost.

Sandhill (Humboldt County, Cal., G. D., 1854).—Near Sandhill (R) triangulation station. (See p. 391.) Lost, 1869.

South Base (Humboldt County, Cal., G. D., 1854).—On the north point of the entrance to Humboldt Bay, 20 meters from high-water mark, and so placed that the base runs nearly through the middle of the peninsula. (Note 10, p. 297.)

Road (Humboldt County, Cal., G. D., 1854).—On the Bucksport and Eureka road, 136 meters north of the first house out from Bucksport, and about 1 mile from Eureka. At this place the road divides for 100 meters, one part passing through the woods, the other between the edge of the woods and the marsh; the station is on the latter road. (Note 10, p. 297.)

Indian Island (Humboldt County, Cal., G. D., 1854).—On Indian Island, 23 paces from the edge of the marsh on the point of fast land projecting farthest into the marsh from the south face of the wooded mound. About 35 paces east of the station is an Indian village where an arm of the slough running through the island approaches within a few paces of the fast land. (Note 10, p. 297.)

Point (Humboldt County, Cal., G. D., 1854).—On the bay shore of the north peninsula of Humboldt Bay, opposite Indian Island, and 12 feet above high-water mark. About 60 meters inshore the ridge is wooded. (Note 10, p. 297.)

Bother (Humboldt County, Cal., G. D., 1854).—On the southern point of the low and drifting sand hills on the bay shore of the north peninsula of Humboldt Bay, opposite the slough below Eureka. These sand hills rise abruptly from a small patch of prairie and continue along the shore for 500 meters, where another small patch of prairie, partly wooded, commences. The station is about 25 feet above high-water mark. (Note 10, p. 297.)

Paddle (Humboldt County, Cal., G. D., 1854).—On top of a small grass-covered sand knoll, 10 feet high, on the ocean beach of the north peninsula of Humboldt Bay, directly west of station Curlew. (See p. 391; also note 10, p. 297.)

Hammon (Humboldt County, Cal., G. D., 1854).—On a sand knoll on the north peninsula of Humboldt Bay, directly opposite the Bucksport sawmill; 140 meters from the shore line, and 50 meters southeast of Hammond and Marvels house. The line to south base passes on the west side of three or four pine trees situated in a depression about 50 meters from the station. (Note 10, p. 297.)

Meridian Mark (Humboldt County, Cal., G. D., 1854).—On the north peninsula of Humboldt Bay, on a sand hill 18 feet high, rising directly from the shore line of the bay, and due east of the light-house. At the foot of this hill, on the eastern side, is a clump of willows and a few Indian huts. (Note 10, p. 297.)

Elk (Humboldt County, Cal., G. D., 1854).—On the peninsula forming the south point of the mouth of Elk River, 160 meters from the extreme point, and 50 meters east-northeast from the nearest hut of the Indian village. (Note 10, p. 297.)

South Spit (Humboldt County, Cal., G. D., 1854).—On the south point of the entrance to Humboldt Bay, 33 meters from the shore in the direction of North Base. (See p. 391; also note 10, p. 297.)

Rudder (Humboldt County, Cal., G. D., 1854).—On the southern peninsula of Humboldt Bay, 1 900 meters from the entrance and 50 meters from the ocean beach. (Note 10, p. 297.)

A (Humboldt County, Cal., G. D., 1854).—On the third ridge of the bare hill back of Red Bluff. (Note 10, p. 297.)

ELEVATIONS.

In order to have for each point the final United States Standard Datum position and the final elevation published together, it has been necessary to repeat in this publication the elevations of a number of points, published in "The Transcontinental Triangulation" and in "Triangulation in California, Part I." For the same reason the positions are reproduced here, from "Triangulation in California, Part I," of the following stations: Mount Lassic, King Peak, Mad River, and Bear Ridge.

The plane of reference is mean sea level. The elevations are divided into three classes, viz: (1) Those determined by spirit leveling in which the probable error varies from ±0.03 meter to ±0.25 meter; (2) those determined by reciprocal zenith distance measures, in which the probable error varies from ±0.3 meter to ±1.5 meters; (3) those determined by nonreciprocal zenith distance measures, in which the probable error may be as much, in some cases, as ±10 meters.

Table of elevations.

Station	Point to which elevation refers	Elevation	Station	Point to which elevation refers	Elevation
Class 1		*Meters*	*Class 2*—Continued.		
Point Avisadero	Ground	52.09	Strawberry Hill	Ground	57.2
Guano Island	Ground	8.67	Yerba Buena Island	Ground	105.3
North West Straits	Ground	2.79	Angel Island Peak	Ground	238.2
Pulgas East Base	Ground	5.87	Rocky Island	Ground	47.7
Pulgas West Base	Ground	39.43	Point San Quentin	Ground	52.6
Santa Cruz	Ground	109.48	High Hill	Ground	149.4
Santa Cruz Point	Ground	9.68	Point San Pedro	Ground	108.4
Red Hill	Ground	57.12	Richardson	Ground	340.2
Ross Mountain	Ground	672.23	High Bluff	Ground	162.5
Bodega Head	Ground	73.49	Coyote Ridge	Ground	315.2
Sonoma Mountain	Ground	698.56	Read	Ground	144.4
Tomales Bay	Ground	205.13	Mount Tamalpais	Ground	790.74
Benicia B. M.	Bench mark	1.777	Jackson Butte	Ground	704.8
Martinez East	Bench mark	57.01	Sierra Morena	Ground	735.9
			Loma Prieta	Ground	1157.5
Class 2			Rocky Mound	Ground	429.4
			Mount Toro	Ground	1081.2
King Peak	Ground	1246.8	Gavilan	Ground	858.2
Mount Lassic	Ground	1791.9	Sanel Mountain	Ground	1022.0
Point Bonita	Ground	86.2	Walalla	Ground	673.5
Angel I. North West	Ground	48.5	Sulphur Peak	Ground	1054.5
Peninsula Hill	Ground	111.9	Redwood	Ground	340.7

Table of elevations—Continued.

Station	Point to which elevation refers	Elevation	Station	Point to which elevation refers	Elevation
Class 3		*Meters.*	*Class 3*—Continued		*Meters*
Bear Ridge	Ground	753.2	Green Bluff *	Ground	148
Mad River	Ground	1557.0	Abbey Hill	Ground	375.4
Dicks Peak	Summit	3039	Black Mountain *	Ground	857
Downieville Butte *	Summit	2619	Murphy	Ground	823.9
Carys Peak *	Summit	3057	Masters Hill	Ground	745.2
Silver Mt., S. Peak *	Summit	3323	Clayton, Mt. Diablo Azimuth Mark *	Copper bolt	438.5
Point Diablo *	Ground	61	Lick Observatory	Top of small dome	1298.9
Contra Costa (1) *	Ground	29	Peaked Hill *	Ground	115
Red Rock *	Ground	51	Bodega Hill	Ground	264.0
San Rafael Creek *	Ground	34	Chaparral *	Ground	393
California Point *	Ground	23	Dry Creek *	Ground	194
Petaluma Creek	Ground	33.8	Russian River *	Ground	175
Mare Island SE.	Ground	86.2	Benitz *	Ground	480
Mare Island NW.*	Ground	31	Dunn *	Ground	587
Vallejo (1)*	Ground	27	Clark *	Ground	624
Vallejo (3)	Ground	113.0	Bodega	Ground	183.0
Abbott	Ground	114.3	Inlet *	Ground	78
Bush Hill	Ground	146.8	Estero *	Ground	97
Duxbury *	Ground	243	Sugarloaf Hill *	Ground	69
Sand Knoll	Ground	69.3	Teton *	Ground	145
Black Ridge	Ground	230.4	Point Reyes Hill *	Ground	429
Black Bluff *	Ground	63			

* No check on this elevation.

Index to positions, descriptions, sketches, and elevations.

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Belvedere Rock	226	332	13	.....
Belvedere telegraph pole	221	330	13	.....
Benicia B. M.	247	348	21	397
Benitz	265	367	23	398
Benjamin's yellow house flagstaff	226	.....	13	.....
Berkeley:				
Capworks wharf	234	338	13	.....
California University Building	234	338	13	.....
California University flagstaff	234	.....	13	.....
Corder tannery chimney	234	338	13	.....
Lumber wharf	234	338	13	.....
Pipeworks chimney	234	338	13	.....
Powder wharf	234	338	13	.....
Reductionworks chimney	234	338	14	.....
Shellmound flagstaff	234	338	14	.....
State Deaf and Dumb Asylum	234	.....	13	.....
University Avenue wharf	234	.....	13	.....
Bernal	215	327	11	.....
Beutro	256	.....	18	.....
Big barn, south gable	249	.....	21	.....
Big flat	280	387	30	.....
Bigelow flagstaff	252	.....	21	.....
Big Hill	274	381	29	.....
Big Knoll	275	382	29	.....
Big White Rock	276	383	29	.....
Bight	269	374	26	.....
Bight Knoll	275	382	29	.....
Bight Shore Rock	223	.....	12	.....
Bihler Point	264	366	24	.....
Bill	222	.....	13	.....
Bird Lime Point	228	334	12	.....
Birds Landing warehouse, south gable	249	.....	21	.....
Bird Point	227	333	12	.....
Black	265	367	26	.....
Black Bluff	196	304	7, 11	398
Black Diamond Catholic Church cross	253	.....	21	.....
Black Diamond engine house flagstaff	253	.....	21	.....
Black house chimney	254	.....	21	.....
Black Marsh	239	343	19	.....
Black Mountain	195	302	6, 35	398
Black Point wharfhouse, west gable	223	.....	12	.....
Black Ridge	204	317	11, 12	398
Black Ridge 2	196	303	7, 11, 12	.....
Black Rock	277	383	29	.....
Black-roof house	221	330	13	.....
Black shanty, north gable	254	355	21	.....
Blackhead rock	225	332	12	.....
Blakes (T.) house, southeast gable	268	.....	22	.....
Blank Rock	288	395	33	.....
Bloom Knoll	272	378	27	.....
Blue Mountain, San Francisco	232	336	12	.....
Bluff Point 2	207	321	11, 13	.....
Bluff Point:				
North Base	221	330	13	.....
North Range, east	236	339	13	.....
North Range, west	236	340	13	.....
South Base	221	330	13	.....
South Range, east	236	339	13	.....
South Range, west	236	339	13	.....
Blunts Reef, North Rock	282	.....	31	.....
Blunts Reef, South Rock	283	.....	31	.....
Boardinghouse flagstaff	214	326	15	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Boathouse, east gable	243	.....	19	.....
Boathouse, Sausalito	235	339	13	.....
Bodega	194	301	3, 6, 8, 23	398
Bodega Head	198	308	6, 8, 9, 23	397
Bodega Head 2	197	305	8	.....
Bodega Head, highest part of rock	267	.....	23	.....
Bodega Hill	262	363	23	398
Bodega Latitude Station	266	370	23	.....
Bodega Rock	266	370	23	.....
Bodwell	243	346	20	.....
Bolsa	256	.....	18	.....
Bonita Bight	223	331	12	.....
Bonita Bluff	219	329	12	.....
Bonita Bluff 2	227	333	12	.....
Bonita Outer Rock	229	335	12	.....
Bonita Point Light-house	197	.....	7, 11, 12	.....
Bonita Point Light-house, end wharf fence	223	.....	12	.....
Bonita Rock	227	333	12	.....
Bonita Wash Rock	225	.....	12	.....
Boot and shoe factory, West Berkeley	235	.....	13	.....
Borax-works, Alameda	236	340	14	.....
Bother [a]	290	396	33	.....
Bourns Landing	264	366	25	.....
Bowman, north gable	253	.....	21	.....
Brant	254	355	21	.....
Brick Co. stack, California Pressed, San Francisco	230	.....	12	.....
Brickworks, tall chimney	222	.....	13	.....
Brick warehouse, southeast ventilator	218	.....	16	.....
Bridge Point	221	330	13	.....
Bridgeport	247	351	21	.....
Broderick Monument, San Francisco	231	336	12	.....
Brooks Island	207	321	13	.....
Brooks Island 2	220	330	.....	.....
Brooks Island, south tip	225	.....	13	.....
Brooks Rock	225	332	13	.....
Brown	243	.....	20	.....
Brown's house	252	.....	21	.....
Bruhel Point	273	379	28	.....
Brush	239	343	19	.....
Brushy Point	272	377	28	.....
Buck Peak	261	.....	34	.....
Buckler 2	247	350	21	.....
Bucksport	290	396	32	.....
Bucksport (69)	284	391	32	.....
Building, south gable	244	.....	19, 20	.....
Bull 2	250	353	21	.....
Burdell, red railroad tank	244	.....	19, 20	.....
Bush Hill	239	343	21	398
Bushy top tree	268	.....	25	.....
Butchertown smokestack, San Francisco	230	335	12	.....
"Butchertown" windmill, West Berkeley	235	338	13	.....
Butler	255	356	17	.....
C plot	278	.....	29	.....
Cabrillo	270	375	27	.....
Calaveras Point	257	.....	16	.....
California Point	207	320	.....	398
California Point 2	207	320	11, 13	.....
California Powderworks, large stack	241	.....	19	.....
California Powderworks, outside lower stack	241	.....	19	.....
California Sugar-refinery	215	.....	12	.....
Calistoga Church, north corner	261	.....	34, 38	.....
Calistoga, mark on depot	261	.....	34, 38	.....

[a] Position given on sketch, but no name.

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Canal	287	393	33	
Candlestick Point	210	323	15	
Cape Knob	284		31	
Cape Mendocino Latitude Station	282		31	
Cape Mendocino Light-house	282		31	
Cape Ridge	279	386	31	
Cape Rock	284		31	
Capworks, Berkeley	234	338	13	
Carleson	271	376	27	
Carquinez Point	246	347	21	
Carson's mill[a]	289	395	33	
Carson, telegraph pole	223	331	13	
Carys Peak cairn	261		34	398
Caspar flag	278		27	
Caspar Point	271	376	27	
Castle Peak summit	261		34	
Castro Slough warehouse, west gable	223		13	
Catholic Church:				
Black Diamond	253		21	
Centerville	217		35	
Marysville	260	361	37	
Oakland	235		14	
Point Arena	202		10, 25	
Tiburon	236	339	13	
Vallejo	246		19	
Catholic Orphan Asylum, San Francisco	232		15	
Cattle Hill	204	317	11	
Cavanagh	269	373	26	
Cement	204	317	11, 12	
Cemetery	207	319	12	
Centerville	286	392	32	
Centerville Catholic Church spire cross	217		35	
Centerville City	289		32	
Centerville, South	286	393	32	
Chamisal	200	310	9	
Chaparral (1856–1906)	200	309	9, 23	398
Chaparral (1871)	271	375	27	
Chaparral Mountain	281	388	30	
Chaparral Peak	278	385	30	
Chemise Flat	275	382	29	
Chemise Mountain (see Part I)			29, 34	
Cheney's house, flagstaff	267		23	
Chicken house, east gable	244		19	
Children's playhouse, San Francisco	230	336	12	
Chinahouse, east gable	213	325	16	
Chinahouse, east gable	240		19	
Chinahouse, east gable	241		19	
Chris house, south gable	276		28	
Chris Rock	276		28	
Chronicle tower, San Francisco	231	336	12	
City Hall dome, San Francisco	232		12	
Clam Point telegraph pole	216		15	
Clark	201	312	10, 25	398
Claxton Hill	272	377	28	
Clayton, Mount Diablo azimuth mark	247	348		398
Clear Point	275	382	29	
Cleland	277	384	36	
Cliff House tower	197		7, 12	
Cliff House turret, highest finial	197		7, 12	
Cliff Ridge	274	381	29	
Clubhouse, Corinthian	221	330	13	
Clubhouse flagstaff	244		19, 20	

[a] Position given on sketch, but no name.

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Cluster Cone	276	383	29	
Cluster Rock	228	334	12	
Coalhouse	253		21	
Cogswell Monument, San Francisco	230	336	12	
Cole 2	277	384	36	
Collinsville	247	349	21	
Collinsville depot flagstaff	253		21	
Collinsville Point, east house	253		21	
Collinsville schoolhouse, chimney	253		21	
Colma	205	317	11	
Colma vicinity, 1906-7	196	303	7	
Colma 2	196	304	7	
Colma Schoolhouse tower finial	197		7	
Colona Cliff	274	381	29, 30	
Commission Rock Beacon	242	345	19	
Cone Rock (Sail Rock)	225	332	13	
Cone Rock	288	395	33	
Congregational Church:				
Antioch	254		21	
Eureka	285		33	
Oakland	235		14	
Conical Rock	284		30	
Conservatory, San Francisco	230		12	
Conte's barn, west gable	199		8	
Contra Costa (1)	203	314	11, 15	
Contra Costa (2)	211		15	
Contra Costa (3)	220	329	13	398
Cook	255	356	17	
Coon 2	247	350	21	
Cooskie Creek	280	387	30	
Corder tannery, Berkeley	234	338	13	
Corinthian Clubhouse flagstaff	221	330	13	
Cornwall Railroad depot, north chimney	252		21	
Cornwall Railroad tankhouse	252		21	
Corte Madera	207	320	13	
Cottaneva Cone	277		29	
Cottaneva Needle	276	383	29	
Cottaneva Point	273	379	28, 29	
Cottaneva Ridge	273	379	28, 29	
Cottaneva Rock	276		28	
Court-house:				
Marysville	259	360	34, 37	
Oakland	235	338	14	
Ukiah	277		36	
Cousin's mill stack	287	394	33	
Cove	223	331	13, 19	
Coyote	280	388	30	
Coyote Creek, south draw lantern box	217		16	
Coyote Hill Creek	210	323	16	
Coyote house stovepipe	214	326	16	
Coyote oysterhouse, north gable	214		16	
Coyote Ridge	205		11	397
Coyote warehouse, south gable	213	326	16	
Crag Hazel boathouse, Sausalito	235	339	13	
Craven's transit pier, Mare Island	242	345		
Creek	266	369	22	
Creek 2	198	308	8	
Crocker's house, San Francisco	231		12	
Crusoe Ridge	275	382	28	
Crusoe's barn, west gable	276		28	
Cuffey Cove	269	372	26	
Cunningham Ridge	272	377	28	
Cupola	252	355	21	

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Cupola, Alameda	237	340	14	.....
Cupola flagstaff, Alameda	237	340	14	.....
Cupola on house	252	.....	21	.....
Curlew	285	391	32, 33	.....
Cuthbertson's house chimney	202	.....	10	.....
Cut Hill	285	392	33	.....
Cutts No. 1	257	358	17	.....
Cutts No. 2	256	357	17	.....
Cypress Grove flagstaff	199	.....	8	.....
Dark house ventilator	253	355	21	.....
Davies Creek	281	389	31	.....
Davies Ridge	282	389	31	.....
Dead tree	289	.....	33	.....
Deaf and Dumb Asylum, Berkeley	234	.....	13	.....
Delta 2	248	352	21	.....
Denniston	205	.....	11	.....
Depot chimney, South San Francisco	234	.....	15	.....
Depot flagstaff, Tiburon	236	339	13	.....
Depot chimney, Warmsprings	237	.....	16	.....
Derrick	267	.....	25	.....
Devilby	275	382	29	.....
Devils Gate	282	389	31	.....
Devils Gate rock	283	390	31	.....
Diablo Diamond	228	334	12	.....
Diablo Hill	206	319	11, 12	.....
Diamond	247	349	21	.....
Dicks Peak or Red Peak	261	.....	34	398
Dihel	277	384	36	.....
Distillery, Antioch	254	.....	21	.....
Distillery smokestack	218	.....	15	.....
Ditch (Cutts)	211	325	15	.....
Ditch (Rodgers)	212	.....	15	.....
Dixon	200	309	9, 23	.....
Dock-bell, Tiburon	236	339	13	.....
Dock, southwest corner	242	.....	19	.....
Domingo	282	389	31	.....
Domingo's house chimney	283	.....	31	.....
Don	244	.....	20	.....
Double barn, north west gable	244	.....	19	.....
Double Cone West Rock	276	383	29	.....
Double Rock, east peak	214	327	15	.....
Double White	226	333	12	.....
Dougherty's house, southwest gable	268	372	23	.....
Downieville Butte, north, highest peak	261	.....	34	398
Dows Prairie	287	394	33	.....
Drawbridge flagstaff	251	.....	21	.....
Dry Creek	265	367	23	398
Duff's mill stack	287	.....	33	.....
Dumbarton flumehouse chimney	210	.....	16	.....
Dumbarton oysterhouse flagstaff	211	324	16	.....
Dumbarton Point	212	325	16	.....
Dunlop's house chimney	257	.....	17	.....
Dunn	201	311	10, 25	398
Dutton's flagstaff	249	.....	21	.....
Dutton's tank	249	.....	21	.....
Duxbury	205	.....	11	398
Dynamo stack, San Francisco	231	336	12	.....
Dyke	211	324	16	.....
Dyke 2	243	.....	19	.....
East Base, Mount Conness	259	.....	40	.....
East Brother Island Light-house	208	.....	13	.....
East Diablo	206	318	11, 12	.....
East Diablo, east tip	228	334	12	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
East Diablo, west tip	228	334	12	
East end ferry-slip, Vallejo Junction	242		19	
East Peak Observatory, Mount Tamalpais	195		6	
East Point (1869)	286	393	32	
East Point (1870)	285	391	33	
East Sister	238		11, 13, 19	
East Stack, Point Pinole	246		19	
East Summit, Mount Helena	259		38	
East Twin	283		31	
Eccentric	286	392	32	
Eden Staff	213		15	
Edith	248	351	21	
Eel River	284	390	32	
Eel River Beach	284	390	32	
El Cerrito	207	320	11, 13	
Electric stack, San Francisco	232	336	12	
Elk	290	397	32	
Elk Creek	269	373	26	
Ellis Landing, barn, inner gable	221	331	13	
Ellis Landing, window	222		13	
Elmer, Marysville	259	360	37	
Embarcadero	274	381	29	
End house, north gable	253		21	
End of wharf	225		13	
End of wharf fence, Bonita Point Light-house	223		12	
Engine house:				
Black Diamond	253		21	
San Francisco	233		12	
Engineer's warehouse, San Francisco	230	335	14	
Episcopal Church, West Berkeley	234		13	
Estero (1860)	268	372	23	398
Estero (1859)	266	368	22	
Eucalyptus tree:				
San Leandro	214	326	15	
San Mateo	214	326	15	
Eureka:				
Azimuth Station	285	391	33	
Congregational Church	285		33	
Methodist Church	285		33	
Plaza flagstaff	285		33	
Ewell's XL Dairy smokestack	218	329	15	
False Cape	279	386	31	
False Cape Rock	283		31	
False Cattle Hill (2)	196	305	7, 11	
False Ford	264	366	25	
Farallon Light-house	194		3, 4, 6, 35	
Farthest house on creek	252		21	
Fay's mill	287	394	32, 33	
Fence	221	330	13	
Fence signal	220	330	13	
Ferndale	289		32	
Ferris	240	344	19	
Ferris chimney	240	344	19	
Ferry flagstaff	254		21	
Ferry-house chimney	245		20	
Ferry-slip, Tiburon	236		13	
Ferry-slip, Vallejo Junction	242		19	
Ferry tower, San Francisco	232		12	
Fertilizer Co.'s stack, Pacific Bone	218		15	
Fields, Marysville	259	360	37	
Fir tree	287		33	
Fire Hill	278	385	30	
First tank, Point Pinole	246		19	

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Fish flagstaff	252	.....	21	.....
Fishhouse, north gable	286	.....	32	.....
Fisk tree	264	366	24	.....
Flagstaff, Presidio	233	.....	12	.....
Flag tree	286	393	32	.....
Flat (Sonoma County)	243	346	20	.....
Flat (San Mateo County)	196	304	7, 11	.....
Flat Rock	223	331	12	.....
Flys Hill	245	.....	20	.....
Fly's house chimney	245	.....	20	.....
Fog Cap	205	317	11	.....
Fog Cap 2	196	304	7	.....
Fog-bell:				
Alcatraz	219	.....	12	.....
Angel Island	220	.....	13	.....
Fog-siren, Point Bonita	219	.....	12	.....
Foley	248	352	21	.....
Fork tree	268	.....	24	.....
Fort Humboldt	290	.....	32	.....
Fort Humboldt flagstaff	289	.....	32	.....
Fort Point	204	316	12	.....
Fort Point Light-house	206	.....	12	.....
Fort Point old light-house	206	.....	12	.....
Fort Point Life-Saving Station	219	329	12	.....
Fort Point Rock	225	332	12	.....
Fort Point wharf, San Francisco	230	335	12	.....
Fort Rock	225	332	12	.....
Fort Ross	200	309	9, 23, 24	.....
Fort Ross vicinity, 1906	199	309	9	.....
Fortunas	282	390	31	.....
Forty-acre opening	277	384	36	.....
Foster	198	306	8, 22	.....
Foundry chimney, navy-yard, Mare Island	242	346	19	.....
Four Mile Creek	280	387	30	.....
Four-window barn	216	.....	15	.....
Fox	265	367	25	.....
Franklin schoolhouse flagstaff	199	.....	8	.....
Franks Lagoon	205	.....	11	.....
Frank's tannery, Redwood City	237	340	16	.....
Fraser Ridge	282	389	30	.....
Freeman	251	354	21	.....
Freight wharf, Tiburon	236	.....	13	.....
Frink	266	369	22	.....
Frink 2	198	307	8	.....
Frost's house, east chimney	267	.....	25	.....
Funcke	200	310	9, 24	.....
Garnett	248	351	21	.....
Garnett 2	251	354	21	.....
Gas tank, San Francisco	231	336	12	.....
Gavilan	193	298	2, 5, 6, 35	397
Gilbert	256	.....	18	.....
Gilroy Presbyterian Church, white spire	257	.....	35	.....
Glassell	255	356	17	.....
Glueworks, California, San Francisco	230	.....	12	.....
Good Luck Point	245	.....	20	.....
Goodyear	246	347	21	.....
Goodyear Railroad station tank	250	.....	21	.....
Golden Gate Park:				
Azimuth mark	230	.....	12	.....
Children's playhouse	230	.....	12	.....
Conservatory	230	.....	12	.....
North base	230	.....	12	.....
Golden Gate to Point Arena	262	363	.....	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Gorda	279	385	30	.....
Gorda Rock	283	390	30	.....
Gordon	271	376	27	.....
Gordon Hill	273	379	28	.....
Gordon's barn, west gable	278	.....	28	.....
Goucher	211	324	35	.....
Grace Church, San Francisco	232	336	12	.....
Grant	248	.....	21	.....
Grasier	268	371	22	.....
Grave	271	376	27	.....
Grave Knoll	273	379	28	.....
Gray	270	375	27	.....
Grayback	228	334	12	.....
Grayback double end	223	.....	12	.....
Grayback white tip	227	333	12	.....
Gray house chimney	222	.....	13	.....
Greek Jo's house, east gable	252	.....	21	.....
Green 2	251	354	21	.....
Green Bluff (Humboldt County)	285	392	33	.....
Green Bluff (San Mateo County)	204	317	11	398
Green Hill	245	.....	20	.....
Green's house chimney	245	.....	20	.....
Green Island	245	.....	20	.....
Green Point, 1887	243	347	19	.....
Green Point, 1899	244	.....	.....	.....
Green Top	257	.....	18	.....
Greenwood	269	373	26	.....
Griffith Hill	283	.....	31	.....
Grove Point 2	239	344	19	.....
Guadalupe warehouse	218	.....	15	.....
Guano Island	195	303	4, 6, 11, 16	397
Gushee	256	357	17	.....
Gushee's house chimney	257	.....	17	.....
Guthrie's house, west gable	289	395	32	.....
Guthrie's tree	289	395	32	.....
H	229	334	12	.....
Hadley Peak	278	385	30	.....
Half	215	327	11, 15	.....
Halfmoon Bay	255	357	11	.....
Half Pile	218	.....	12	.....
Halfway	209	322	13	.....
Hall	263	364	25	.....
Halleck Schoolhouse, cupola	199	.....	8	.....
Hamilton	255	.....	18	.....
Hammon	290	396	32	.....
Hammond	248	.....	21	.....
Hammond (Marin County)	198	308	8, 22	.....
Handley	270	375	27	.....
Hans	198	307	8, 22	.....
Harbeck	264	365	24	.....
Harbor (Shelter Cove, South Base)	274	381	29	.....
Hardy Rock	276	.....	28	.....
Hardy's house, south gable	276	.....	28	.....
Hare farmhouse, cupola flagstaff	244	.....	19	.....
Harford Hill	273	379	29	.....
Hargrave	271	376	27	.....
Hastings	247	.....	21	.....
Hastings warehouse, west gable	251	.....	21	.....
Havens Neck	263	365	25	.....
Haydon	243	346	20	.....
Hay warehouse, south gable	216	.....	15	.....
Heights	206	318	12	.....
Helena Eccentric, Mount Helena	258	.....	38	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Helena Flank, Mount Helena	258	.....	38	.....
Helmet Rock	226	332	12	.....
Helmke Ridge	263	365	24	.....
Henry Hill	200	310	9, 23, 24	.....
Henry Tree	200	311	9	.....
Herrick	269	374	26	.....
Hewston	252	.....	21	.....
Hewston 2	247	349	21	.....
High	221	.....	13	.....
High Bluff (Mendocino County)	202	313	10, 25	.....
High Bluff	205	.....	11	397
High Bluff (Golden Gate)	219	329	12	.....
High Hill	207	319	11, 13	397
High lone tree	213	.....	11	.....
High sharp peak	199	.....	8	.....
High tank, Point Pinole	246	.....	19	.....
High Top	257	.....	18	.....
Highest part of rock, Bodega Head	267	.....	23	.....
Highland	207	319	11, 13	.....
Highschool, Redwood City	237	.....	16	.....
Hill	248	351	21	.....
Hilltop with single tree	257	.....	17	.....
Hip-roof house flagstaff, Warmsprings	237	.....	16	.....
Hitchcock ranch, barn cupola	199	.....	8	.....
Hog Island	267	370	22	.....
Hog Island 2	198	309	8	.....
Hogle	205	.....	11	.....
Home Hill	245	.....	20	.....
Honker	251	354	21	.....
Hopkins Art Institute tower, flagstaff	229	335	12	.....
Horse Mountain	278	385	30	.....
Horeshoe Point	200	310	9, 24	.....
House chimney near big barn	270	.....	26	.....
House door	289	.....	33	.....
House east of Brown's	252	.....	21	.....
House flagstaff	220	.....	13	.....
House in tules, south gable	240	.....	19	.....
Howard ranch, barn cupola	199	.....	8	.....
Huff's house, west gable	199	.....	8	.....
Hulls Mountain, summit	261	.....	34	.....
Humboldt Bay, Middle Base	285	391	32, 33	.....
Humboldt Bay, North Base	284	391	32, 33	.....
Humboldt Light-house	284	.....	32	.....
Hunters Point, chimney 2	215	328	15	.....
In Line	288	395	33	.....
In Line Base	278	.....	28	.....
Indian Island	290	396	33	.....
Ingleside race-course building, flagstaff	197	.....	7	.....
Inlet	268	372	23	398
Inner Turtle Rock	288	395	33	.....
Interior flumehouse, chimney	211	.....	16	.....
Inverness post-office, flagstaff	199	.....	8	.....
Irvington wine vaults, cupola	217	.....	35	.....
Iron Rod (U. S. E.), Lone Tree Point	239	343	19	.....
Isabel Pile	221	330	13	.....
Island (Contra Costa County)	246	347	21	.....
Island (Sonoma County)	264	366	25	.....
Island (Humboldt County)	288	395	33	.....
Island house red chimney	254	.....	21	.....
Island Hydrographic	238	.....	19	.....
Island Peak	283	.....	30	.....
Italian	243	346	20	.....
Iversen Point	263	365	25	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Jack	257	.....	18	.....
Jackass Cone	277	383	29	.....
Jackass Ridge	273	380	29	.....
Jackass, South	273	380	29	.....
Jackass Tree	276	.....	29	.....
Jackson	274	380	29	.....
Jackson Butte	261	361	34	397
Jackson Pinnacle	277	383	29	.....
Jewish Synagogue, San Francisco	233	337	12	.....
Jobs Sister summit	261	.....	34	.....
Joel Flat	284	.....	31	.....
John Brown	286	392	33	.....
Johnson	269	374	27	.....
Johnston	255	357	11	.....
Jones's mill stack	287	394	33	.....
Joyce	267	371	.....	.....
Judson Chemical Works chimney	220	.....	13	.....
Judson Point	208	321	13	.....
Jumper Ridge	274	380	29	.....
Junction	265	366	25	.....
Kammer house, San Leandro Point	216	.....	15	.....
Keeper's house chimney	284	.....	31	.....
Keeper's house, Point Bonita	219	.....	12	.....
Kendall's (A. B.) house, east chimney	202	.....	10	.....
Kennedy	270	374	26	.....
Kenney's house chimney	202	.....	10	.....
Kent	270	375	27	.....
Kerr	212	.....	15	.....
Kibesillah Hill	272	378	28	.....
Kibesillah Rock	275	382	28	.....
King	249	353	21	.....
King Peak	262	362	30, 34	397
Knipp	263	365	24	.....
Knipp & Stengel's ranch chimney	264	.....	24	.....
Knoll	271	376	27	.....
Knox	263	364	25	.....
Kohler's house stovepipe	252	.....	21	.....
Ladies Pavilion, San Francisco	229	335	12	.....
Lafayette Park	205	318	12	.....
Lafayette Park Latitude Station	258	359	12, 35	.....
Lagoon (Sonoma County)	267	370	23	.....
Lagoon (Santa Cruz County)	255	356	17	.....
Laguna	287	393	33	.....
Laguna Point	271	377	28	.....
Lake Hill	280	387	30	.....
Lakeville	243	346	20	.....
Lancaster	201	311	9, 24	.....
Lancaster 2	200	310	9	.....
Landing north tower, Oakland	235	.....	14	.....
Lane	201	312	10, 26	.....
Large Boulder	224	.....	13	.....
Large gray house chimney	253	.....	21	.....
Large red warehouse, north gable	217	.....	16	.....
Lark	264	366	24	.....
Last	256	.....	18	.....
Latitude Station:				
Arena	201	.....	10, 25	.....
Lafayette Park	258	359	12, 35	.....
Marysville	260	.....	37	.....
Mount Conness	259	360	40	.....
Mount Hamilton	260	361	39	.....
Mount Helena	259	359	38	.....
Mount Tamalpais	258	359	.....	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Latitude Station—Continued.				
Presidio, 1852	258	359	12, 35	.....
Presidio, 1896	258	359	12	.....
Ukiah	278	385	36	.....
Laurie Flat	274	381	29	.....
Lick Observatory, Mount Hamilton	195	.....	6, 35, 39	398
Light-house No. 1	282	.....	31	.....
Light-house No. 2	282	.....	31	.....
Light-house site, Pigeon Point	256	.....	18	.....
Light-house wharf, Mare Island	242	.....	19	.....
Lime Point Bluff	203	315	11, 12	.....
Lime Point foghorn	220	.....	12	.....
Lime Point fog-station	224	332	12	.....
Lime Point Rock (cross)	229	335	12	.....
Linden House, South San Francisco	233	338	15	.....
Little Jackass	273	380	29	.....
Little Mile Rock	226	333	12	.....
Little River (Mendocino County)	270	375	27	.....
Little River (Humboldt County)	287	394	33	.....
Little River Beach	287	394	33	.....
Little River Rock	287	394	33	.....
Little Spanish	282	389	30	.....
Lobos Rock	226	333	12	.....
Loma Prieta	193	298	2, 5, 6, 35	397
Lone house, south gable	267	.....	22	.....
Lone Mountain, cross	204	317	12	.....
Lone tree	244	.....	20	.....
Lone tree on hill	199	.....	8	.....
Lone Tree Point	238	341	19	.....
Lone Tree Point 2	240	.....	.....	.....
Lone Tree Point, iron rod (U. S. E.)	239	343	19	.....
Lone Tree Point, plasterworks chimney	241	.....	19	.....
Lone Tree Point, plasterworks, northwest gable	242	.....	19	.....
Long Point 2	238	341	19	.....
Long Pond	238	341	19	.....
Longitude Station:				
Marysville	260	361	37	.....
Mount Hamilton	260	361	39	.....
Point Arena	263	365	25	.....
Presidio	233	337	12	.....
Ukiah	277	385	36	.....
Lower Hadley	282	389	30	.....
Lower Jagged, Mount Conness	259	.....	40	.....
Lower Sierra Point	210	323	15	.....
Lower stack, California Powderworks	241	.....	19	.....
Lucky Tree	262	363	24	.....
Lumber wharf, Berkeley	234	338	13	.....
Mackey Beach	281	388	30	.....
Mackey Hill	280	388	30	.....
Mackey Ridge	281	388	30	.....
Mackey's house chimney	283	.....	30	.....
Mad River	262	363	34	398
Mad River	287	393	33	.....
Mad River Bluff	288	395	33	.....
Mad River Tree	288	.....	33	.....
Magnetic Station:				
Mount Conness	259	360	40	.....
Mount Hamilton	260	.....	39	.....
Presidio	233	337	12	.....
Ukiah	277	384	36	.....
Mallard	248	352	21	.....
Mal Paso	278	.....	.....	.....
Mal Paso 2	269	374	26	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Manchester Methodist Church, center of tower	202		10	
Manchester Presbyterian Church spire	202		10	
Manzanita (Santa Cruz County)	255	356	17	
Manzanita (Mendocino County)	274	381	29	
Mare Island:				
Craven's transit pier	242	345	19	
Light-house wharf, southwest corner	242		19	
Mare Island Light-house	242		19	
Naval Observatory transit	242		19	
Navy-yard foundry chimney	242	346	19	
Navy-yard tall chimney	242	345	19	
Smokestack back of marine barracks	242		19	
Mare Island Northwest	239	342	19	398
Mare Island Southeast	238	342	19	398
Marin Island	223	331	13	
Marin Island East	208	321	11, 13	
Marine Hospital, San Francisco	233		12	
Mariners Church, San Francisco	231	336	12	
Marked tree	249	353	21	
Marr	263	364	25	
Marsh	247		21	
Marsh Island	238		13	
Marsh Point (Marin County)	220	330	13	
Marsh Point (Humboldt County)	286	392	33	
Marsh Pole	239	344	19	
Marshal	248		21	
Martin	289	396	32	
Martinez	246		21	
Martinez East	247	348	21	397
Marysville:				
Catholic Church	260	361	37	
Courthouse flagstaff	259	360	34, 37	
Elmer	259	360	37	
Fields	259	360	37	
Latitude Station	260		37	
Longitude Station	260	361	37	
Middle Meridian	260		37	
North Base	259	360	37	
North Butte, summit pole	260		34, 37	
North Meridian	260		37	
Presbyterian Church	260	361	37	
Roll	259	360	37	
South Base	260	360	37	
South Meridian	260		37	
Stone	259	360	37	
Walton	259	360	37	
Mass	249	353	21	
Masters Hill	255	357	35	398
Mattole Beach	281	388	30	
Mattole Mountain tree	284		30	
Mattole Peak tree	284		30	
Mattole Point	281	388	30, 31	
McCartney's tank, San Leandro Point	216	328	15	
McDonald's house, south chimney	199		8	
McDuff	248	352	21	
McKee Flat	275	382	29	
McLain water tank, San Francisco	229	335	12	
McNears Landing wharfhouse, front gable	241		19	
McNulty's barn, south gable	289	395	32	
McNutt	279	386	31	
McPherson	269	374	27	
McPherson's flagstaff	272		27	
Meierkoff	271	376	27	

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Morse's house, chimney	202		10	
Mosquito Point	286	392	33	
Mound	207	320	11, 13	
Mountain Peaks	258	358		
Mount Blank	279	386	31	
Mount Blank 2	281	389	31	
Mount Blank 3	282		31	
Mount Conness:				
East Base	259		40	
Latitude Station	259	360	40	
Lower Jagged	259		40	
Magnetic Station	259	360	40	
Slope	259		40	
Vertical Circle Station	259	359	40	
West Base	259		40	
Mount Diablo Latitude Station	258	359	2	
Mount Hamilton:				
Astronomic Eccentric	260		39	
Latitude Station	260	361	39	
Lick Observatory	195		6, 35, 39	
Longitude Station	260	361	39	
Magnetic Station	260		39	
North Base	260		39	
Residence flagstaff	260		39	
South Base	260		39	
Tycho	260		39	
Mount Helena:				
A	259		38	
East Summit	259		38	
Helena Eccentric	258		38	
Helena Flank	258		38	
Latitude Station	259	359	38	
South Flat	259		38	
Spur, green tree	259		38	
Vertical Circle Station	259	359	38	
Mount Lassic	262	362	34	397
Mount Lola Latitude Station	258	358		
Mount Pierce	283		31	
Mount Tamalpais	193	299	3, 4, 6, 11, 35	397
East Peak Observatory	195		6	
Latitude Station	258	359		
Wireless house	196		6	
Wireless tower	222			
Mount Toro	193	298	2, 6, 35	397
Mowrys Creek	211	325	16	
Mowry's oysterhouse	211	324	16	
Mud Creek, north draw lantern box	217		16	
Mulford Landing	214	326	15	
Murphy	255	357	35	398
Mussel Knoll	279	386	31	
Mussel Ridge	281	388	31	
Mussel Rock	289		31	
Mussel Rock	283	390	31	
Nailworks, Oakland	235		14	
Napa Branch	245		20	
Napa City, Court-house spire	246		20	
Napa Creek	245		20	
Napa Hill	245		20	
Narrow-gauge landing, Alameda	237	340	14	
Naval Observatory transit, Mare Island	242		19	
Navarro Head	269	373	26, 27	
Navarro Point	270	374	26	
Navarro Ridge, East Base	269	373	26, 27	

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Oakland--Continued.				
Mole, outer switch-house	235	338	14	.....
Nailworks stack	235	.....	14	.....
Nev. Smith wharfhouse gable	235	338	14	.....
Oakland Harbor light-house	235	.....	14	.....
Presbyterian Church spire	235	338	14	.....
Oakland Point	209	322	14	.....
Oakland Point Congregational Church spire	220	.....	14	.....
Oakland Point railroad depot flagstaff	220	329	14	.....
Oat Hill	280	387	30	.....
Observatory	239	344	19	.....
Ocean	287	393	33	.....
Ocean Beach	266	370	23	.....
Ocean House, San Francisco	230	.....	11	.....
Odell	279	386	31	.....
Odell 2	282	.....	31	.....
Off Trinidad Rock	288	394	33	.....
Oil Creek	279	386	31, 32	.....
Oil Creek West	281	389	31, 32	.....
Oilworks east chimney	241	.....	19	.....
Oilworks west chimney	241	.....	19	.....
Oil wharf outer west corner	241	.....	19	.....
Old barn southwest gable	240	.....	19	.....
Old hut southeast gable	217	328	16	.....
Old shed southeast gable	217	328	16	.....
Onsley	287	393	33	.....
Orphan Asylum, Vallejo	246	.....	19	.....
Outer Break	283	.....	31	.....
Outer gable small whitewashed house	224	.....	13	.....
Outer tank, Point Pinole	246	.....	19	.....
Outer Twin Rock	284	.....	31	.....
Oysterhouse, San Mateo	213	326	16	.....
Oyster Point	210	323	15	.....
Pacheco	240	344	19	.....
Pacific Bone Fertilizer Co., smokestack	218	.....	15	.....
Pacific Mail dock, San Francisco	232	.....	12	.....
Pacific Oilworks, Alameda	237	340	14	.....
Packard Hill	273	378	28	.....
Packinghouse, South San Francisco	233	338	15	.....
Paddle	290	396	33	.....
Pajaro Mouth 2	193	299	5, 6	.....
Parker Monument, San Francisco	231	336	12	.....
Parsons	255	356	17	.....
Patricks Point South	288	395	33	.....
Peak	269	372	26	.....
Peak	255	.....	18	.....
Peak flag	212	325	16	.....
Peak Mountain	205	.....	11	.....
Peaked Hill	199	309	9, 23	398
Peninsula	285	391	33	.....
Peninsula Hill	205	318	11	397
Peninsula Hill 2	209	322	13	.....
Perrot	268	371	22	.....
Pescadero	256	.....	18	.....
Pescada Landing fishhouse flagstaff	226	.....	13	.....
Petaluma Baptist Church spire	243	.....	20	.....
Petaluma Creek	238	340	19	398
Peter Tree	264	366	24	.....
Petrolia	279	.....	31	.....
Petrolia flagstaff	283	.....	31	.....
Picket Pile	286	393	32	.....
Piedra	205	.....	11	.....
Pier No. 2, San Francisco	231	.....	12	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Pier No. 3, San Francisco	231	.....	12	.....
Pier No. 5, San Francisco	231	.....	12	.....
Pier No. 7, San Francisco	233	.....	12	.....
Pier No. 9, San Francisco	233	.....	12	.....
Pier No. 12, San Francisco	231	.....	12	.....
Pier No. 24, San Francisco	232	.....	12	.....
Pier No. 27, San Francisco	231	.....	12	.....
Pierce	247	350	21	.....
Pigeon Point (center light-house site)	256	.....	18	.....
Pigott's (Doctor) house, southwest gable	267	.....	23	.....
Pillar Point	205	318	11	.....
Pilot Rock	288	395	33	.....
Pine	255	356	17	.....
Pine Grove	271	376	27	.....
Pinnacle Rock (San Mateo County)	217	328	15	.....
Pinnacle Rock (Sonoma County)	201	311	9, 23	.....
Pinole Landing, outside end	241	.....	19	.....
Pipeworks:				
Alameda	237	340	14	.....
Berkeley	234	338	13	.....
Pise Hill	203	314	11	.....
Pise Hill 2	195	302	4, 6	.....
Pittsburg	248	.....	21	.....
Plasterworks chimney, Lone Tree Point	241	.....	19	.....
Plasterworks gable, Lone Tree Point	242	.....	19	.....
Plaza flagstaff, Eureka	285	.....	33	.....
Point (Santa Cruz County)	255	356	17	.....
Point (Mendocino County)	270	375	27	.....
Point (Humboldt County)	290	396	33	.....
Point 2	229	334	12	.....
Point 3	228	334	12	.....
Point Ano Nuevo	255	357	17	.....
Point Arena vicinity, 1906	201	311	10	.....
Point Arena:				
Catholic Church spire	202	.....	10, 25	.....
Longitude Station	263	365	25	.....
Methodist Church, south gable	267	.....	25	.....
Northwest Base	263	364	25, 26	.....
Point Arena Light-house	201	.....	10, 25, 26	.....
Southeast Base	263	364	25	.....
Pont Arena to Shelter Cove	269	372	.....	.....
Point Avisadero	203	314	11, 15	397
Point Avisadero 2	209	323	.....	.....
Point Avisadero hog-ranch, white tank	215	.....	15	.....
Point Avisadero (Potrero), North Range	215	.....	12	.....
Point Blunt Knob	220	.....	13	.....
Point Blunt Rock	220	329	13	.....
Point Bonita	205	318	12	397
Point Bonita fog-siren	219	.....	12	.....
Point Bonita, keeper's house	219	.....	12	.....
Point Cavallo	205	318	11, 12	.....
Point Cavallo 2	204	316	11, 12	.....
Point Cavallo tip	223	331	12	.....
Point Diablo	219	329	12	398
Point Diablo tip	227	333	12	.....
Point Lobos	204	317	12	.....
Point Lobos 2	204	316	11, 12	.....
Point Lobos 3	206	319	12	.....
Point Lobos windmill	219	329	12	.....
Point Pinole	238	340	.....	.....
Point Pinole 2	238	341	.....	.....
Point Pinole 2, 1896	239	.....	.....	.....
Point Pinole 2 ⊙	239	.....	.....	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Point Pinole 3	238	341	19	.....
Point Pinole:				
East stack	246	.....	19	.....
First tank	246	.....	19	.....
High tank	246	.....	19	.....
Outer tank	246	.....	19	.....
West tall brick chimney	246	.....	19	.....
Point Pinos Latitude Station	193	299	6	.....
Point Pinos Light-house	193	.....	5, 6	.....
Point Reyes Beach	267	370	22	.....
Point Reyes East	266	368	22	.....
Point Reyes Head	262	363	6, 22	.....
Point Reyes Head 2	195	.....	.....	.....
Point Reyes Hill	194	301	3, 6, 8, 22, 35	398
Point Reyes Latitude Station	268	371	22	.....
Point Reyes Light-house	194–5	.....	6, 22	.....
Point Reyes Light-house site	268	.....	22	.....
Point Reyes Station Schoolhouse cupola	199	.....	8	.....
Point Richmond 2	207	320	11, 13	.....
Point Richmond tip	225	332	13	.....
Point San Bruno 2	210	.....	15	.....
Point San Jose	203	315	11, 12	.....
Point San Mateo	211	325	15	.....
Point San Mateo extremity	210	323	15	.....
Point San Mateo Rock	218	.....	15	.....
Point San Pablo 2	208	321	13, 19	.....
Point San Pablo Hydrographic	222	.....	13, 19	.....
Point San Pedro	208	321	11, 13, 19	397
Point San Pedro House, southeast gable	222	.....	13, 19	.....
Point San Quentin	207	319	11, 13	397
Polite Man	212	.....	15	.....
Powderhouse, San Francisco	232	.....	15	.....
Powder wharf, Berkeley	234	338	13	.....
Powderworks, California	241	.....	19	.....
Powell's barn, north gable	278	.....	28	.....
Powerhouse:				
Market street, San Francisco	232	336	12	.....
Union street, San Francisco	231	.....	12	.....
Prayer Book Cross, San Francisco	230	.....	12	.....
Presbyterian church:				
Marysville	260	361	37	.....
Oakland	235	338	14	.....
Potrero, San Francisco	232	337	12	.....
Union City	217	.....	15	.....
Vallejo	246	.....	19	.....
West Berkeley	235	.....	13	.....
Presidio:				
Flagstaff	233	.....	12	.....
Latitude Station, 1852	258	359	12, 35	.....
Latitude Station, 1896, east pier	258	359	12	.....
Longitude Station, 1896-97; 1903	233	337	12	.....
Magnetic Station	233	337	12	.....
Wharf, northeast corner	233	.....	12	.....
Wharfhouse	233	337	12	.....
Presidio Hill	203	315	11, 12	.....
Pressed Brick Co. stack, San Francisco	230	.....	12	.....
Preston (Solano County)	249	353	21	.....
Preston (Marin County)	266	369	22	.....
Preston 2	198	306	8	.....
Preston's house stovepipe	267	.....	22	.....
Preston ranch barn, north gable	199	.....	8	.....
Primaries and Secondaries, 1906–7	193	297	.....	.....
Prison searchlight	222	.....	13	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Projection south Point Richmond	225	.....	13	.....
Pudding Creek	271	377	27, 28	.....
Pulgas East Base	195	303	4, 6, 11, 16	397
Pulgas West Base	195	303	4, 6, 11, 16	397
Punta Potrero	211	.....	16	.....
Purcell's flagstaff	256	.....	11, 18	.....
Pyramid Peak	261	.....	34	.....
Pyramid Rock	226	333	12	.....
Quarantine Station flagstaff	220	.....	13	.....
Quarantine wharf flagstaff	220	.....	13	.....
Quarry	208	321	13	.....
Quarry hyd	220	330	13	.....
Quarter	215	327	11, 12	.....
Quarter Pile	218	.....	12	.....
Raccoon Point	221	331	13	.....
Railroad curve telegraph pole	221	331	13	.....
Railroad depot flagstaff, Sausalito	236	339	13	.....
Railroad Point	219	.....	12	.....
Railroad tank	223	331	13	.....
Railroad telegraph pole	223	.....	13	.....
Rainbow Peak	283	.....	31	.....
Ranch	256	.....	18	.....
Rancheria Beach	282	389	30	.....
Randlett	270	375	27	.....
Ravenswood old wharf flagstaff	212	325	16	.....
Ravenswood warehouse flagstaff	212	.....	16	.....
Ray Point	274	381	29, 30	.....
Ray's barn, south gable	277	.....	29	.....
Ray's dairyhouse, south gable	277	.....	29	.....
Read	205	.....	11, 13	397
Red barn cupola weathervane	245	.....	19	.....
Red Bluff (Mendocino County)	269	372	26	.....
Red Bluff (Humboldt County)	289	396	32	.....
Red Bluff (Marin County)	223	.....	13	.....
Red Bluff Latitude Station	284	390	32	.....
Red brick chimney	213	.....	15	.....
Red brick chimney	249	.....	21	.....
Red chimney	289	.....	32	.....
Red cupola	218	329	15	.....
Red Hill (Alameda County)	194	300	3, 4, 6, 11, 16, 35	397
Red Hill (Mendocino County)	274	381	29	.....
Red house chimney	223	.....	13	.....
Red house cupola	214	326	15	.....
Red house, north gable	289	.....	33	.....
Red Hyd., 1899	243	.....	.....	.....
Red Marsh	239	343	19	.....
Red Rock	207	320	11, 13	398
Red Rock, southernmost rock	224	.....	13	.....
Red warehouse, Warmsprings	237	.....	16	.....
Reduction works, Berkeley	234	338	14	.....
Redwood (Santa Cruz County)	255	356	17	.....
Redwood (Sonoma County)	262	363	23	397
Redwood little oysterhouse, east gable	213	.....	16	.....
Redwood City Creek	213	326	16	.....
Redwood City:				
Frank's tannery stack	237	340	16	.....
High-school tower	237	.....	16	.....
Waterworks tank	237	340	16	.....
Rees	270	375	27	.....
Refugio wharf-end	241	.....	19	.....
Reservoir (San Francisco County)	204	316	12	.....
Reservoir (Marin County)	221	330	13	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Residence flagstaff, Mount Hamilton	260	.....	39	.....
Reynolds	266	369	22	.....
Reynolds 2	198	306	8	.....
Reynolds Point	280	387	30	.....
Reynolds Rock	283	390	30	.....
Rice	255	356	17	.....
Rice's house chimney	257	.....	17	.....
Richards	265	368	22	.....
Richardson	205	.....	11, 13	397
Richardson East	209	322	13	.....
Richardson Schoolhouse tower	223	.....	13	.....
Richmond Rock	224	.....	.....	.....
Ridge	203	313	11, 35	.....
Ridge 2 Eccentric	195	302	4, 6	.....
Ridge Rock	209	322	13	.....
Road (Humboldt County)	290	396	32	.....
Road (San Mateo County)	196	304	7, 11	.....
Rob	206	319	12	.....
Rob 2	206	319	12	.....
Rob 3	206	319	12	.....
Roberts Landing	214	327	15	.....
Roberts's warehouse	216	328	15	.....
Robinson Point	263	365	25	.....
Robinson's large windmill	253	355	21	.....
Rock awash	284	.....	31	.....
Rock Point	223	331	13	.....
Rocky Island	203	315	11, 13	397
Rocky Mound	194	300	3, 4, 6, 35	397
Rocky Peak	263	365	11, 25	.....
Rocky Point	263	365	24	.....
Rocky Point	267	370	23	.....
Roll, Marysville	259	360	37	.....
Ross Mountain	194	301	3, 6, 9, 23, 34	397
Ross Mountain Latitude Station	258	359	.....	.....
Ross Tree	264	366	24	.....
Round	269	372	26	.....
Round Rock	278	.....	29	.....
Round Top	287	393	33	.....
Round Top Latitude Station	258	358	.....	.....
Round Valley Mountain summit	262	.....	34	.....
Rudder	290	397	32	.....
Russ Cut Off	286	393	32	.....
Russ house north chimney	286	.....	32	.....
Russian Gulch	270	375	27	.....
Russian Hill	204	316	11, 12	.....
Russian River	265	367	23	398
Rutherford Tree	263	365	24, 25	.....
Ryer's house cupola	249	.....	21	.....
Sacramento ball on capitol dome	260	.....	34	.....
Sacramento Longitude Station	260	361	34	.....
Sacramento Packing Co. cannery smokestack	252	.....	21	.....
Saddle Point	269	373	26	.....
Sail Rock	265	367	25	.....
Sailors' Home, San Francisco	231	.....	12	.....
St. Brendans Church, San Francisco	232	.....	12	.....
St. Johns Hill	254	355	17	.....
St. Josephs spire, Alameda	237	.....	14	.....
St. Marys Hospital, San Francisco	231	.....	12	.....
St. Patricks Church, San Francisco	233	337	12	.....
Salmon Creek	268	372	23	.....
Salmon Point	269	374	27	.....
Salt Point	200	310	9, 24	.....
San	240	.....	19, 20	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
San	243	.....	19	.....
San Antonio	243	346	20	.....
San Antonio 2	244	.....	20	.....
San Antonio Creek	203	314	11, 14	.....
San Antonio Point	211	325	14	.....
San Bruno Mountain	195	302	4, 6, 7, 11	.....
San Bruno house minaret	218	328	15	.....
San Bruno oysterhouse west window north front	216	.....	15	.....
San Bruno Range north end rocky peak	218	.....	15	.....
San Bruno Range south end low peak	218	.....	11	.....
San Francisco:				
Azimuth mark, Golden Gate Park	230	.....	12	.....
Baker Beach windmill	230	335	12	.....
Blue Mountain	232	336	12	.....
Broderick Monument	231	336	12	.....
Butchertown smokestack	230	335	12	.....
California Glueworks flagstaff	230	.....	12	.....
California Pressed Brick Co. stack	230	.....	12	.....
Catholic Orphan Asylum flagstaff	232	.....	15	.....
Children's playhouse, Golden Gate Park	230	336	12	.....
Chronicle tower flagstaff	231	336	12	.....
City Hall dome	232	.....	12	.....
Cliff House tower	197	.....	7, 12	.....
Cliff House turret highest finial	197	.....	7, 12	.....
Cogswell Monument	230	336	12	.....
Conservatory, Golden Gate Park	230	.....	12	.....
Crocker's house flagstaff	231	.....	12	.....
Edison Light and Power Co. dynamo stack	231	336	12	.....
Edison Light and Power Co. electric stack	232	336	12	.....
Engine house	233	.....	12	.....
Engineer's warehouse	230	335	14	.....
Ferry tower flagstaff	232	.....	12	.....
First Baptist Mission cupola	232	.....	15	.....
Fort Point wharf	230	335	12	.....
Gas tank	231	336	12	.....
Grace Church cross	232	336	12	.....
Hopkins Art Institute	229	335	12	.....
Jewish Synagogue east spire	233	337	12	.....
Ladies Pavilion flagstaff	229	335	12	.....
McLain watertank tower	229	335	12	.....
Market Street powerhouse stack	232	336	12	.....
Marine Hospital flagstaff	233	.....	12	.....
Mariners Church spire	231	336	12	.....
North Base, Golden Gate Park	230	.....	12	.....
Ocean House flagstaff	230	.....	11	.....
Pacific Mail dock outer gable	232	.....	12	.....
Parker Monument	231	336	12	.....
Pier No. 2 outer gable	231	.....	12	.....
Pier No. 3 outer gable	231	.....	12	.....
Pier No. 5 outer gable	231	.....	12	.....
Pier No. 7 outer gable	233	.....	12	.....
Pier No. 9 outer gable	233	.....	12	.....
Pier No. 12 outer gable	231	.....	12	.....
Pier No. 24 outer gable	232	.....	12	.....
Pier No. 27 outer gable	231	.....	12	.....
Potrero Presbyterian Church spire	232	337	12	.....
Powderhouse windmill	232	.....	15	.....
Prayer Book Cross	230	.....	12	.....
Presidio. (*See* Presidio.)				
Pressed Brick Co. stack	230	.....	12	.....
Sailors' Home flagstaff	231	.....	12	.....
St. Brendans Church cross	232	.....	12	.....
St. Marys Hospital tank	231	.....	12	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
San Francisco—Continued.				
St. Patricks Church spire	233	337	12	.....
Selby shot-tower	229	335	12	.....
Selby smelting-works chimney	229	335	12	.....
Spreckels Building dome	232	.....	12	.....
Sutro's Observatory tower	230	335	12	.....
Sutro's Olympus	232	.....	12	.....
Sutro's stable red spire	230	.....	12	.....
Tannery ventilator flagstaff	232	337	15	.....
Telegraph Hill, United States time-ball flagstaff	229	335	12	.....
Tetlow's southeast chimney	231	.....	12	.....
Union Street	233	.....	12	.....
Union Street powerhouse stack	231	.....	12	.....
United States barge office flagstaff	231	.....	12	.....
Washington Square	233	337	12	.....
San Francisco Bay	203	313	.....	.....
San Francisquito Creek 2	211	324	16	.....
San Jose Catholic Institute spire	257	.....	35	.....
San Jose Court-house dome flagstaff	196	.....	6	.....
San Jose Mission Church	258	.....	35	.....
San Leandro eucalyptus tree	214	326	15	.....
San Leandro Point 2	203	314	11, 15	.....
San Leandro Point, Kammer house, north window, west front	216	.....	15	.....
San Leandro Point, McCartney's white tank	216	328	15	.....
San Lorenzo	212	.....	15	.....
San Mateo eucalyptus tree	214	326	15	.....
San Mateo oysterhouse, north gable	213	326	16	.....
San Pablo Bay	238	340	.....	.....
San Pablo flagstaff	221	331	13	.....
San Pablo Ridge	208	321	11, 13, 19	.....
San Pablo Road flagstaff	222	.....	13	.....
San Pedro Rock	196	.....	7, 11	.....
San Quentin wharfhouse, southeast gable	222	.....	13	.....
San Rafael Court-house flagstaff	222	.....	11, 13, 19	.....
San Rafael Creek	222	331	13, 19	398
San Rafael Rock	222	.....	13	.....
Sand (Contra Costa County)	247	350	21	.....
Sand (Mendocino County)	263	364	25	.....
Sand	218	.....	12	.....
Sand Bluff	285	391	33	.....
Sand Knoll	204	317	11, 12	398
Sandhill (Sonoma County)	268	372	23	.....
Sandhill (Mendocino County)	272	378	28	.....
Sandhill (Humboldt County)	290	396	32	.....
Sandhill (R.)	284	391	32, 33	.....
Sandstone	263	365	24, 25	.....
Sandy Point	264	366	24	.....
Sanel Mountain	262	361	34	397
Santa Clara Catholic Church spire	257	.....	35	.....
Santa Cruz	193	299	5, 17, 35	397
Santa Cruz light-house	193	.....	6	.....
Santa Cruz Magnetic Station	193	299	6	.....
Santa Cruz Point	254	355	17	397
Santa Cruz warehouse flagstaff	258	.....	17	.....
Santa Rosa Court-house dome	261	.....	34	.....
Saunders Hill	265	367	25	.....
Sausalito:				
Baron wharf	236	339	13	.....
Crag Hazel boathouse flagstaff	235	339	13	.....
North Dock-light	235	339	13	.....
Railroad depot, inner flagstaff	236	339	13	.....
Railroad depot, outer flagstaff	236	339	13	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Sausalito—Continued.				
South Dock-light	235	339	13	.....
Tide station wharf	236	339	13	.....
Sausalito Point	205	318	11, 13	.....
Scaffold Tree	271	376	27	.....
School cupola, Vallejo	246	.....	19	.....
Schoolhouse chimney	254	.....	21	.....
Schoolhouse, east gable	250	.....	21	.....
Schoolhouse on hill	199	.....	8	.....
Schoolhouse, Warmsprings	237	.....	16	.....
Scott's house, peak of roof	202	.....	10	.....
Scottys Point	288	394	33	.....
Seal	256	.....	18	.....
Seal Bluff	248	351	21	.....
Seal Bluff, east warehouse, north gable	250	.....	21	.....
Seal Bluff, west warehouse, north gable	250	.....	21	.....
Sealion Rock (Mendocino County)	276	.....	29	.....
Sealion Rock (Humboldt County)	283	390	31	.....
Sears	242	346	20	.....
Sears Point	238	341	19	.....
Second interior flumehouse flagstaff	212	.....	16	.....
Second Under Rock	228	334	12	.....
Sellick	255	.....	11, 18	.....
Sentry-box, Alcatraz	223	.....	12	.....
Shag Rock	229	335	12	.....
Shanty on end small wharf	224	.....	13	.....
Shebang	289	.....	33	.....
Sheep Ridge	275	382	29	.....
Shellmound flagstaff, Berkeley	234	338	14	.....
Shelter Cove	274	381	29	.....
Shelter Cove to Trinidad Head	278	385	.....	.....
Shelter Cove North Base	274	.....	29	.....
Shelter Cove South Base	274	381	29	.....
Shelton	288	394	33	.....
Shepherd's chimney	268	.....	25	.....
Sherman Island house	252	.....	21	.....
Sherman Island house	252	.....	21	.....
Sherwood Mountain, highest knoll	261	.....	34	.....
Shipman	279	387	30	.....
Shipman Tree	283	390	30	.....
Shoe-factory smokestack	216	.....	15	.....
Shoemake	202	313	10, 25, 26	.....
Shoemake 2	202	313	10	.....
Shore Cone	225	.....	12	.....
Shore Cone Rock	227	333	12	.....
Shoreline Rock	276	.....	29	.....
Shot-tower, San Francisco	229	.....	12	.....
Shubrick Peak	278	385	30	.....
Sierra barn, east gable	218	.....	15	.....
Sierra Morena	193	297	2, 3, 6, 35	397
Sierra Point	203	315	11, 15	.....
Signal House	289	395	33	.....
Sigvart	266	369	22	.....
Sigvart 2	198	307	8	.....
Silver Mountain, North Peak cairn	261	.....	34	.....
Silver Mountain, South Peak cairn	261	.....	34	398
Silvers Tree	265	367	24	.....
Simmons	248	351	21	.....
Sinclair	202	313	10, 25	.....
Sisson	284	390	32	.....
Skeleton Stump	289	.....	33	.....
Slaten's windmill	243	347	19	.....
Slaughterhouse	245	.....	19, 20	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Slaughterhouse Point 2	239	343	19, 20	.....
Slope, Mount Conness	259	.....	40	.....
Slough	285	392	33	.....
Slough Fork	286	392	33	.....
Smelting-works, San Francisco	229	335	12	.....
Smith (Marin County)	197	305	8, 22	.....
Smith (Mendocino County)	262	363	10, 25	.....
Smith 2	202	312	10	.....
Smith Point	273	379	28	.....
Smith's Chute	288	.....	33	.....
Smokestack back Marine Barracks, Mare Island	242	.....	19	.....
Smoky Ridge	274	381	29	.....
Soldati milkhouse cupola	253	.....	21	.....
Soldier Frank Hill	273	380	29	.....
Soldier Frank Point	273	380	29	.....
Soldier Harbor	271	377	27	.....
Sonoma Creek	238	.....	19	.....
Sonoma Creek 2	240	345	19	.....
Sonoma Landing flagstaff	240	345	19	.....
Sonoma Mountain	194	300	3, 6, 35	397
Sonoma Pole	240	345	19	.....
South	203	315	11, 14	.....
South Base	290	396	32	.....
Bluff Point	221	330	13	.....
Marysville	260	360	37	.....
Mount Hamilton	260	.....	39	.....
Ukiah	277	384	36	.....
South Beach	286	393	32	.....
South Belmont oysterhouse red tank	213	.....	16	.....
South Cottaneva Point	273	379	28	.....
South Cottaneva Ridge	273	379	28	.....
South Cottaneva Rock	276	.....	28	.....
South Dock-light, Sausalito	235	339	13	.....
Southeast Base, Point Arena	263	364	25	.....
South Flat, Mount Helena	259	.....	38	.....
South Grass	240	345	19	.....
South Meridian, Marysville	260	.....	37	.....
South Noyo	272	378	27	.....
South of Cape	279	386	31	.....
South Peak	205	.....	11	.....
South Point	216	328	15	.....
South Range East, Bluff Point	236	339	13	.....
South Range West, Bluff Point	236	339	13	.....
South Red Hill	210	324	16	.....
South San Francisco:				
Armour Hotel flagstaff	233	338	15	.....
Artesian well tower	233	337	15	.....
Depot chimney	234	.....	15	.....
Linden House cupola	233	338	15	.....
Merriam Block, east cupola	234	.....	15	.....
Merriam Block, west cupola	234	.....	15	.....
Packinghouse smokestack	233	338	15	.....
South Seal Rock	225	.....	12	.....
South Shag Rock	216	328	15	.....
South South Tree	212	325	35	.....
South Spit	286	393	32	.....
South Spit	290	397	32	.....
South Tree	212	.....	35	.....
South Trestle	221	.....	13	.....
South Twin Peak	218	.....	12	.....
South Ussal	273	380	29	.....
South Windmill	240	.....	19	.....
Southampton Shoal Light-house	220	.....	13	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Triple warehouse, northeast gable	214	326	15	.....
Triplet Hill	263	365	25	.....
Tubb's windmill	240	345	19	.....
Tuft	217	328	16	.....
Tunitas	256	.....	18	.....
Two-Mile	215	327	15	.....
Two Tree Hill	257	.....	35	.....
Tycho, Mount Hamilton	260	.....	39	.....
Ukiah:				
Court-house cupola flagstaff	277	.....	36	.....
Latitude Station	278	385	36	.....
Longitude Station	277	385	36	.....
Magnetic Station	277	384	36	.....
North Base	277	384	36	.....
South Base	277	384	36	.....
Uncle Edward	211	.....	16	.....
Uncle Tommy	279	385	30	.....
Under Cavallo	209	322	12	.....
Under Cement	207	319	12	.....
Under High tip	228	334	12	.....
Under Rock	227	333	12	.....
Underwood Creek	287	394	33	.....
Union City Creek	210	323	15	.....
Union City Mills	211	.....	15	.....
Union City Presbyterian Church spire	217	.....	15	.....
Union House, south chimney	289	.....	32	.....
Union Island	211	325	16	.....
Union street, San Francisco	233	.....	12	.....
Union street powerhouse, San Francisco	231	.....	12	.....
Union Island Rock	211	.....	.....	.....
United States flagstaff, Angel Island	220	329	13	.....
University Building, Berkeley	234	338	13	.....
University flagstaff, Berkeley	234	.....	13	.....
University Avenue wharf, Berkeley	234	.....	13	.....
Upham	249	.....	21	.....
Upper 2	251	354	21	.....
Upper Bear Harbor	274	381	29	.....
Upper Bear Harbor barn west gable	277	.....	29	.....
Ussal Rock	276	383	29	.....
Vaca Latitude Station	258	359	.....	.....
Vallejo:				
Catholic Church northwest pinnacle	246	.....	19	.....
Orphan Asylum cupola flagstaff	246	.....	19	.....
Presbyterian Church spire	246	.....	19	.....
School cupola	246	.....	19	.....
Vallejo Hill	245	.....	19	.....
Vallejo Hill 2	239	343	19	.....
Vallejo Junction east end ferry-slip	242	.....	19	.....
Vallejo Junction west end ferry-slip	242	.....	19	.....
Vallejo (1)	239	342	19, 21	398
Vallejo (2) 1896	239	.....	19, 21	.....
Vallejo (3)	238	342	19, 21	398
Vance's mill stack	289	.....	33	.....
Ventilator	250	.....	21	.....
Vertical Circle Station:				
Mount Conness	259	359	40	.....
Mount Helena	259	359	38	.....
Visitation Knob	210	323	11, 15	.....
Waddell's wharf, east pier	257	.....	17	.....
Walalla	262	362	34	397
Walalla Tree	264	366	25	.....
Walker's house chimney	283	.....	31	.....
Walker Ridge	281	389	31	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Walton, Marysville	259	360	37	.....
Warehouse, Castro Slough	223	.....	13	.....
Warehouse southeast gable	217	328	16	.....
Warehouse west gable	244	.....	19	.....
Warmsprings:				
Depot chimney	237	.....	16	.....
Hip-roof house flagstaff	237	.....	16	.....
Red warehouse west gable	237	.....	16	.....
Schoolhouse flagstaff	237	.....	16	.....
Washington Square, San Francisco	233	337	12	.....
Waterworks, Redwood City	237	340	16	.....
Welch	270	374	26	.....
Wells Fargo wharfhouse chimney	222	.....	13	.....
West Base, Mount Conness	259	.....	40	.....
West Berkeley:				
Boot and shoe factory cupola	235	.....	13	.....
"Butchertown" windmill	235	338	13	.....
Episcopal Church spire	234	.....	13	.....
Presbyterian Church	235	.....	13	.....
Standard Soap Co. flagstaff	235	.....	13	.....
West chimney, Point Pinole	246	.....	19	.....
West Diablo	206	319	11, 12	.....
West Diablo Under Rock	223	.....	12	.....
West end ferry-slip, Vallejo Junction	242	.....	19	.....
West gable barn	257	.....	17	.....
West Point (San Mateo County)	210	323	16	.....
West Point (Humboldt County)	285	391	33	.....
West Point flumehouse east gable	212	.....	16	.....
Wetner	258	.....	18	.....
Wetner 2	255	.....	18	.....
Whale Gulch	275	382	29	.....
Whale Point	227	334	12	.....
Wharf, Presidio	233	.....	12	.....
Wharfhouse, Angel Island	226	332	13	.....
Wharfhouse, Black Point	223	.....	12	.....
Wharfhouse, Presidio	233	337	12	.....
Wheeler	285	392	33	.....
Whipple Ridge	272	377	28	.....
White Barn	286	.....	33	.....
White Barn, Avisadero Bight	217	.....	15	.....
White Barn southeast gable	245	.....	19	.....
White house east gable	253	.....	21	.....
White house south gable	243	.....	19	.....
White house south gable	250	.....	21	.....
White house stovepipe	254	355	21	.....
White Rock	270	.....	26	.....
White Rock	277	383	29	.....
Whites Landing	258	358	35	.....
White shanty west gable	254	.....	21	.....
White spire cross	271	.....	27	.....
White tank	245	.....	19	.....
White tank, Angel Island	221	330	13	.....
White Top Rock	227	333	12	.....
Whitewashed rock on point	224	.....	13	.....
Widow Cranks	281	388	31	.....
Wild Oat	280	387	30	.....
Wildcat	267	371	22	.....
Williams Point	273	380	29	.....
Willow Point	266	369	22	.....
Willow Point 2	198	308	8	.....
Wilson	238	342	19	.....
Wilson 2	239	.....	19	.....
Windmill	250	.....	21	.....

Index to positions, descriptions, sketches, and elevations—Continued.

Station.	Position.	Description.	Sketch.	Elevation.
Windmill	289	.....	33	.....
Windmill, Point Lobos	219	329	12	.....
Windy Point	279	386	30	.....
Wireless house, Mount Tamalpais	196	.....	6	.....
Wireless tower, Mount Tamalpais	222	.....	.....	.....
Wood's house	252	.....	21	.....
Worth	287	394	33	.....
Worth's house chimney	287	394	33	.....
Wyman	280	387	30	.....
Yellow Bluff tip	224	332	12	.....
Yerba Buena Island	203	314	11, 14	397
Yerba Buena Island 2	209	.....	.....	.....
Yerba Buena Light-house	215	.....	14	.....
Yolo Northwest Base Latitude Station	258	358	.....	.....
Yolo Southeast Base Latitude Station	258	358	.....	.....
Young	266	369	22	.....
Young	256	.....	18	.....

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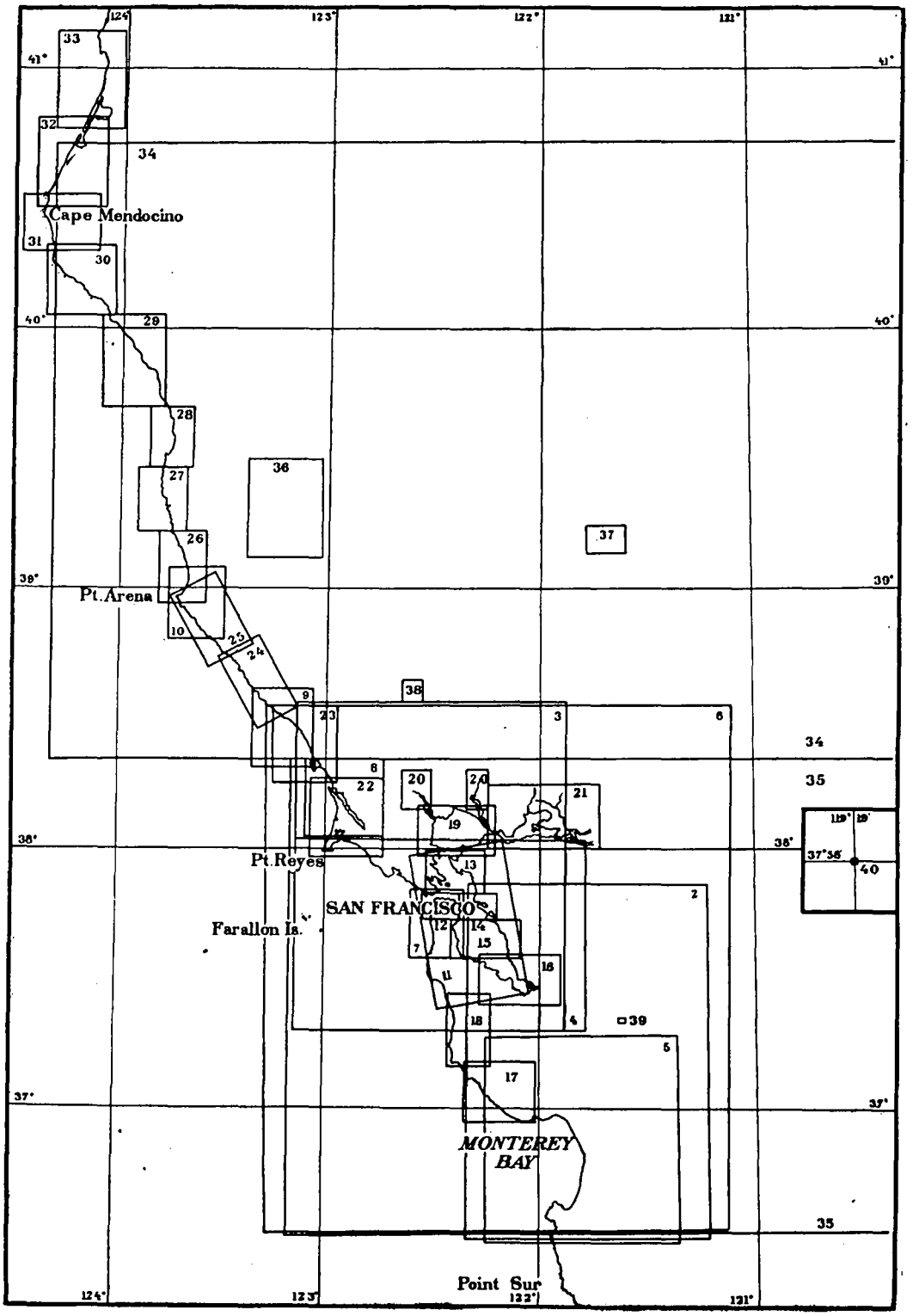

INDEX MAP TO SKETCHES.

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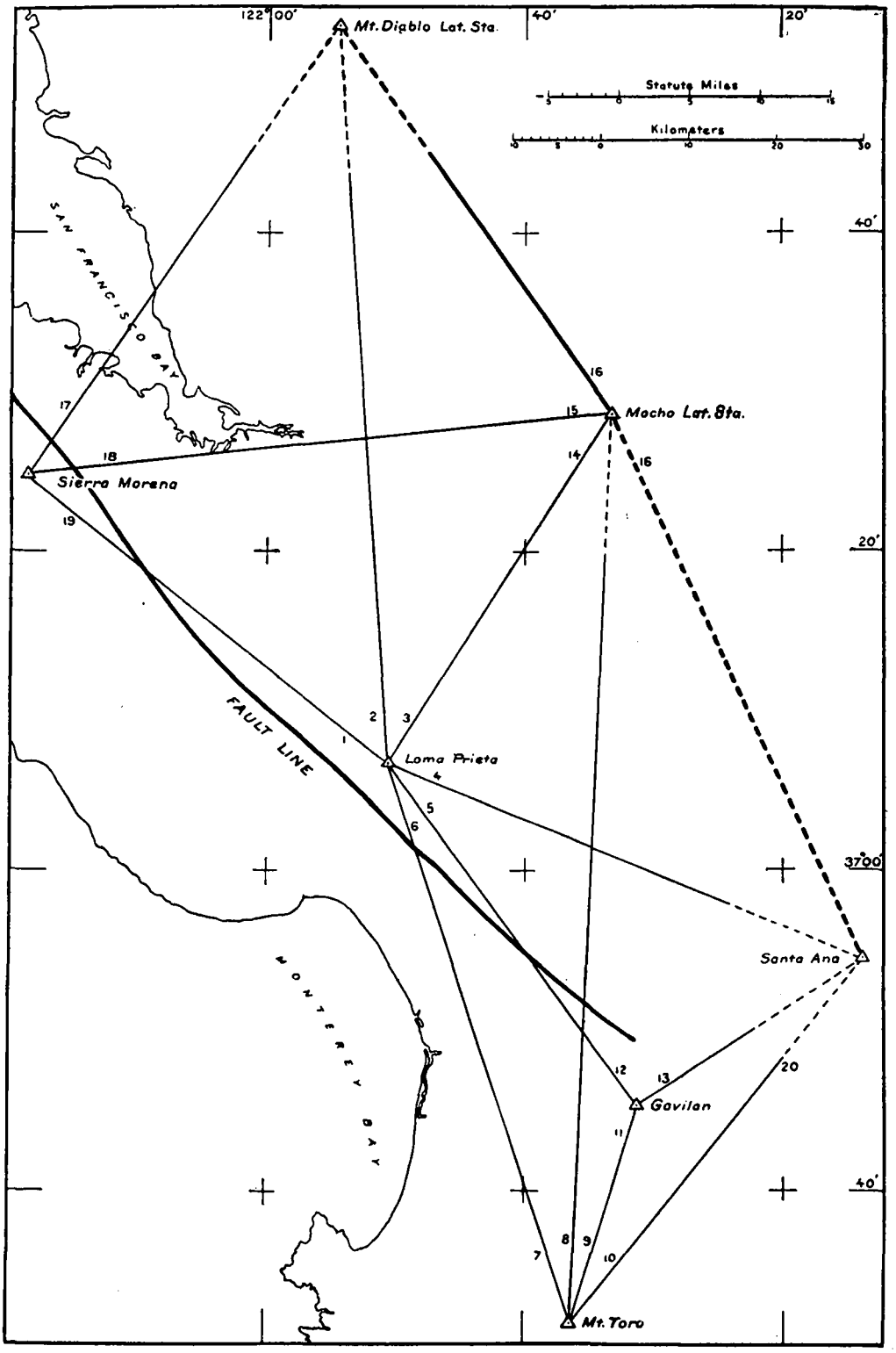

PRIMARY TRIANGULATION, 1906-7, FIRST FIGURE ADJUSTMENT.

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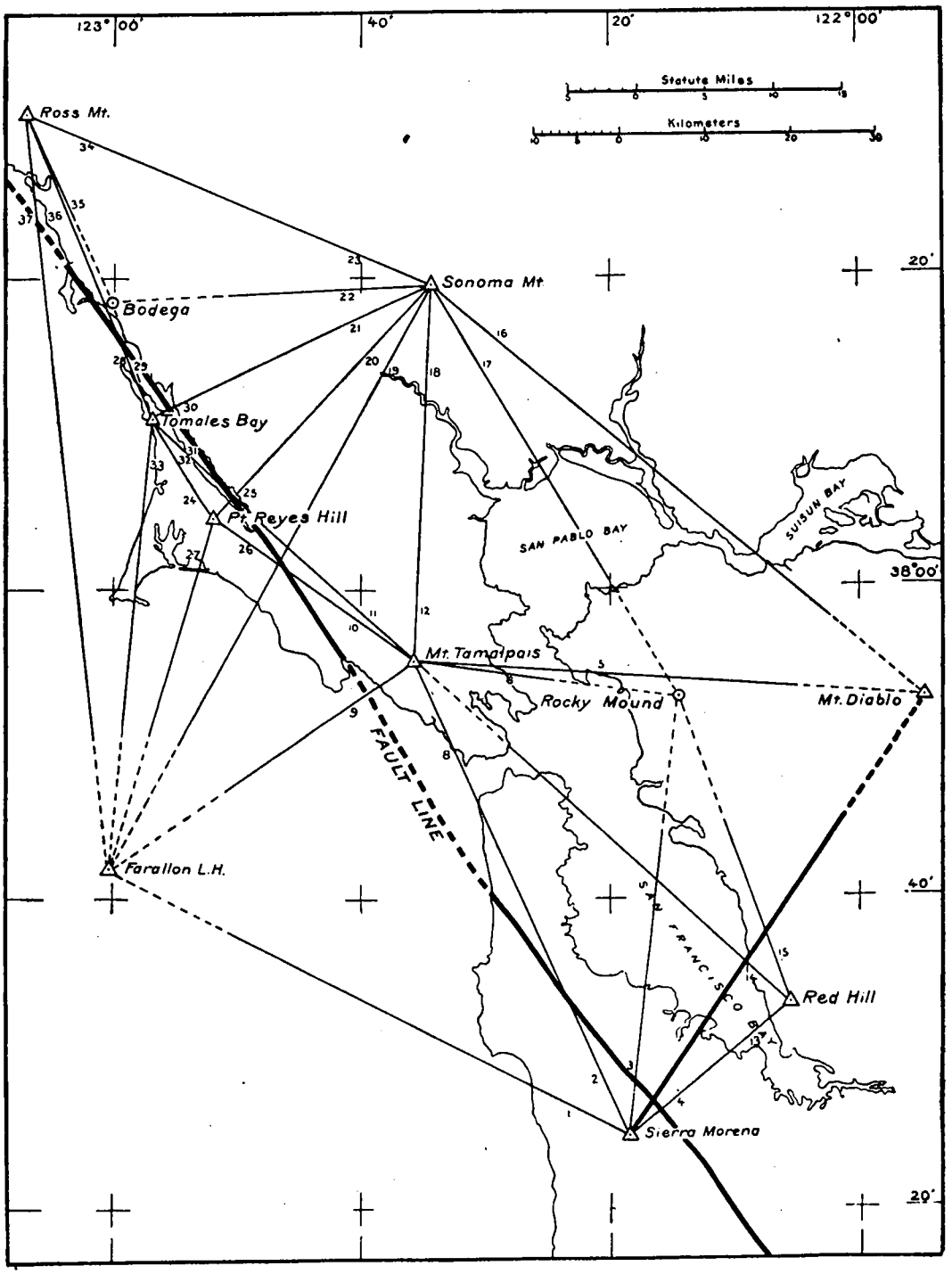

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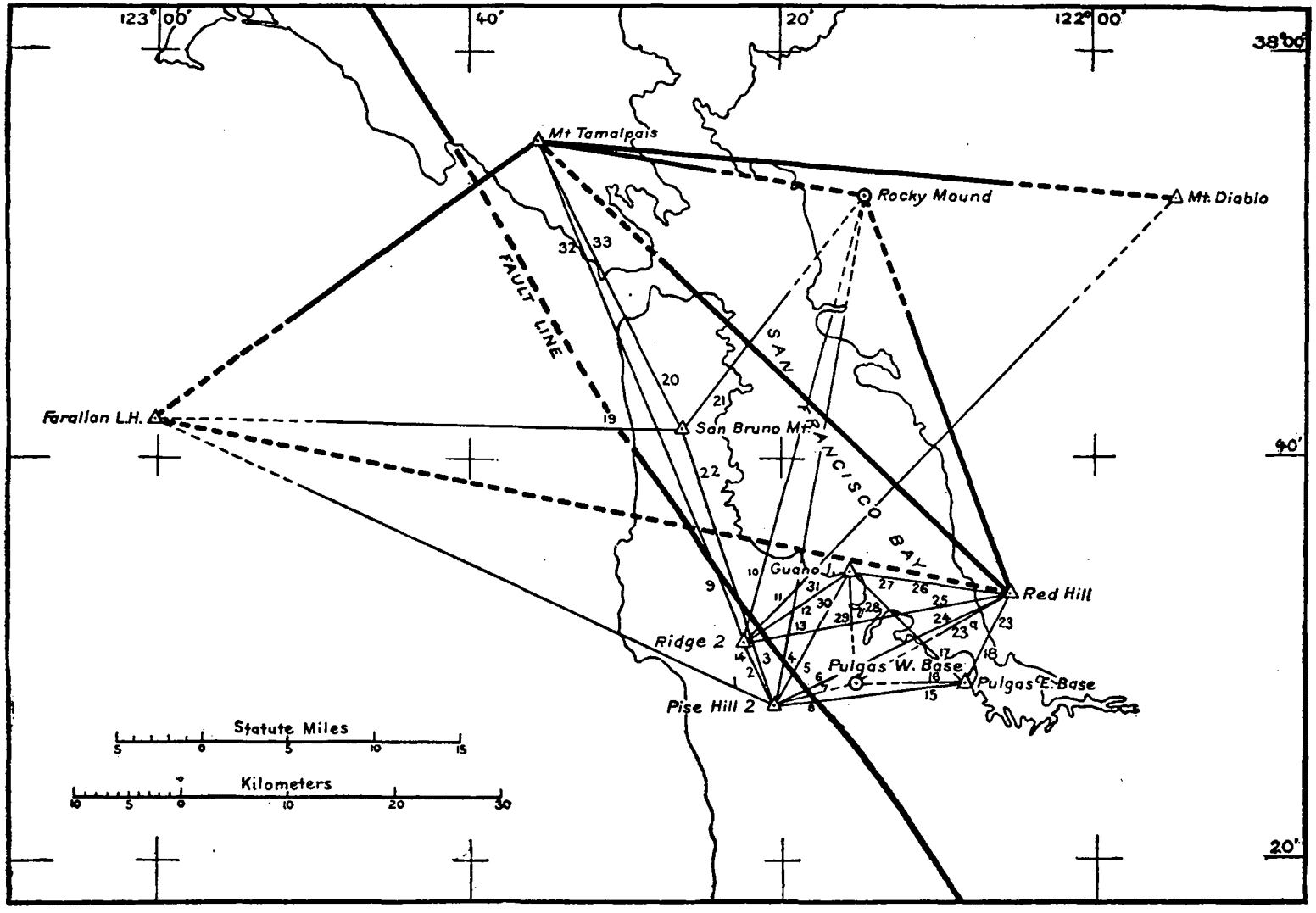

SECONDARY TRIANGULATION, 1906-7, FIRST FIGURE ADJUSTMENT.

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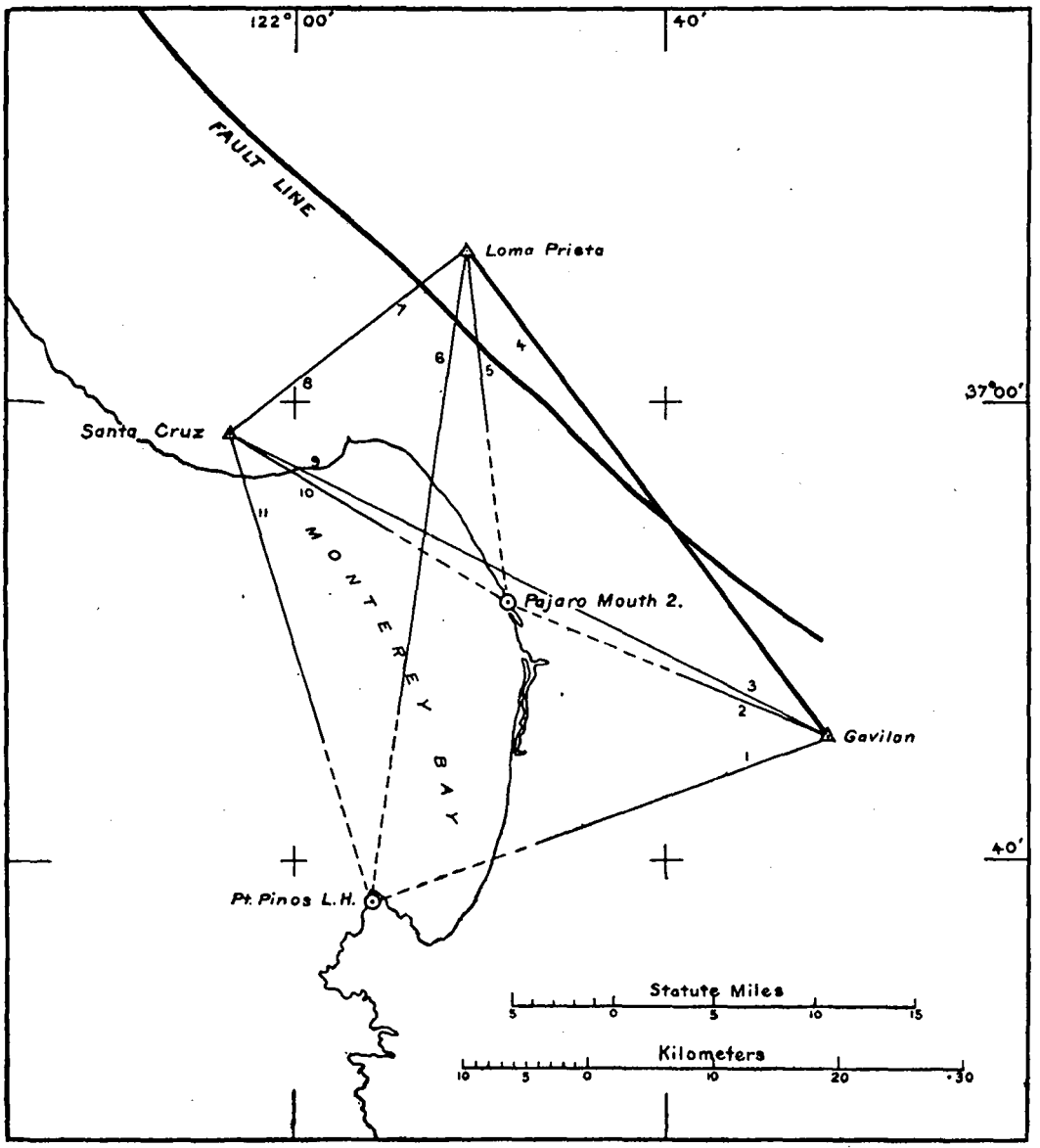
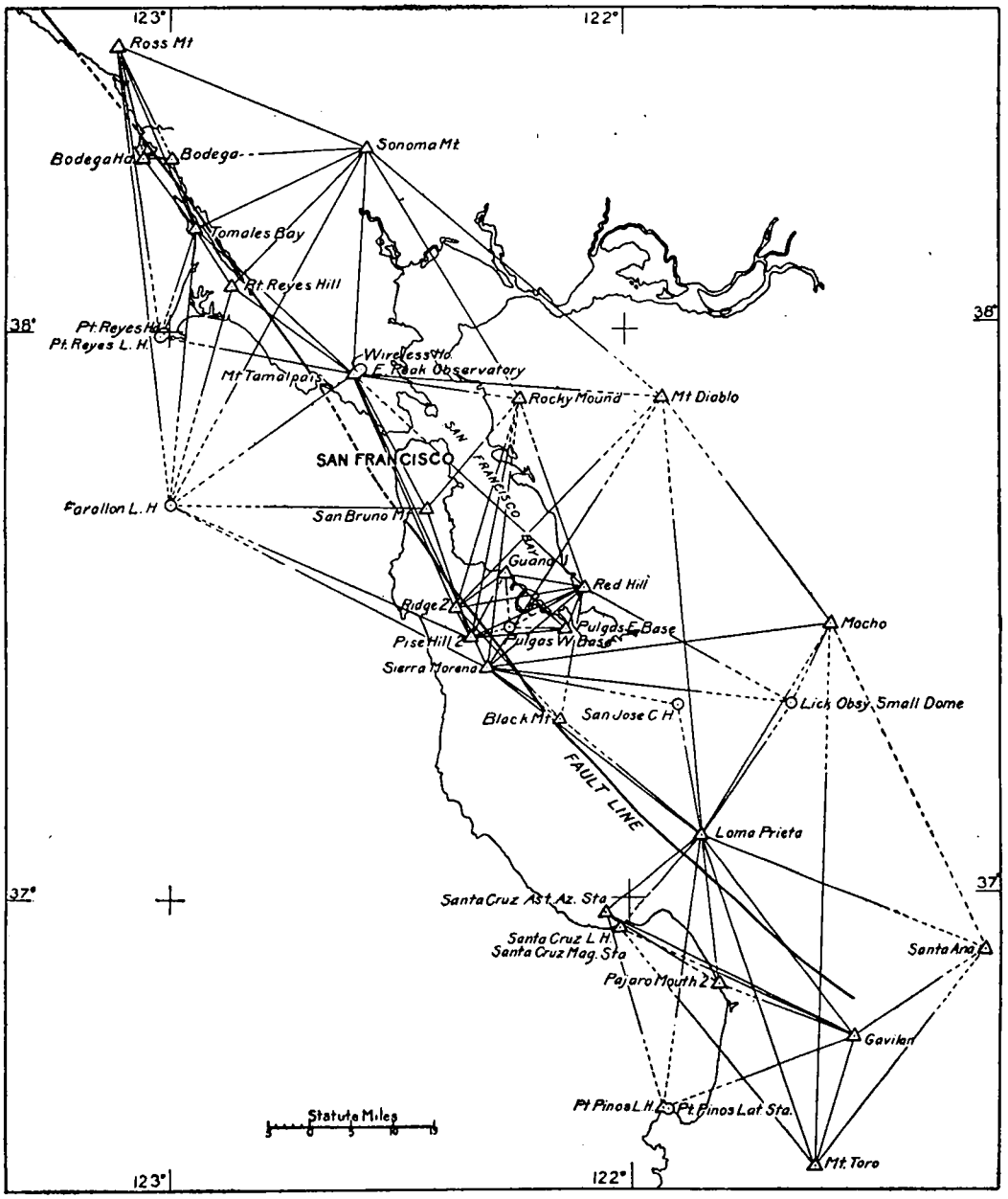
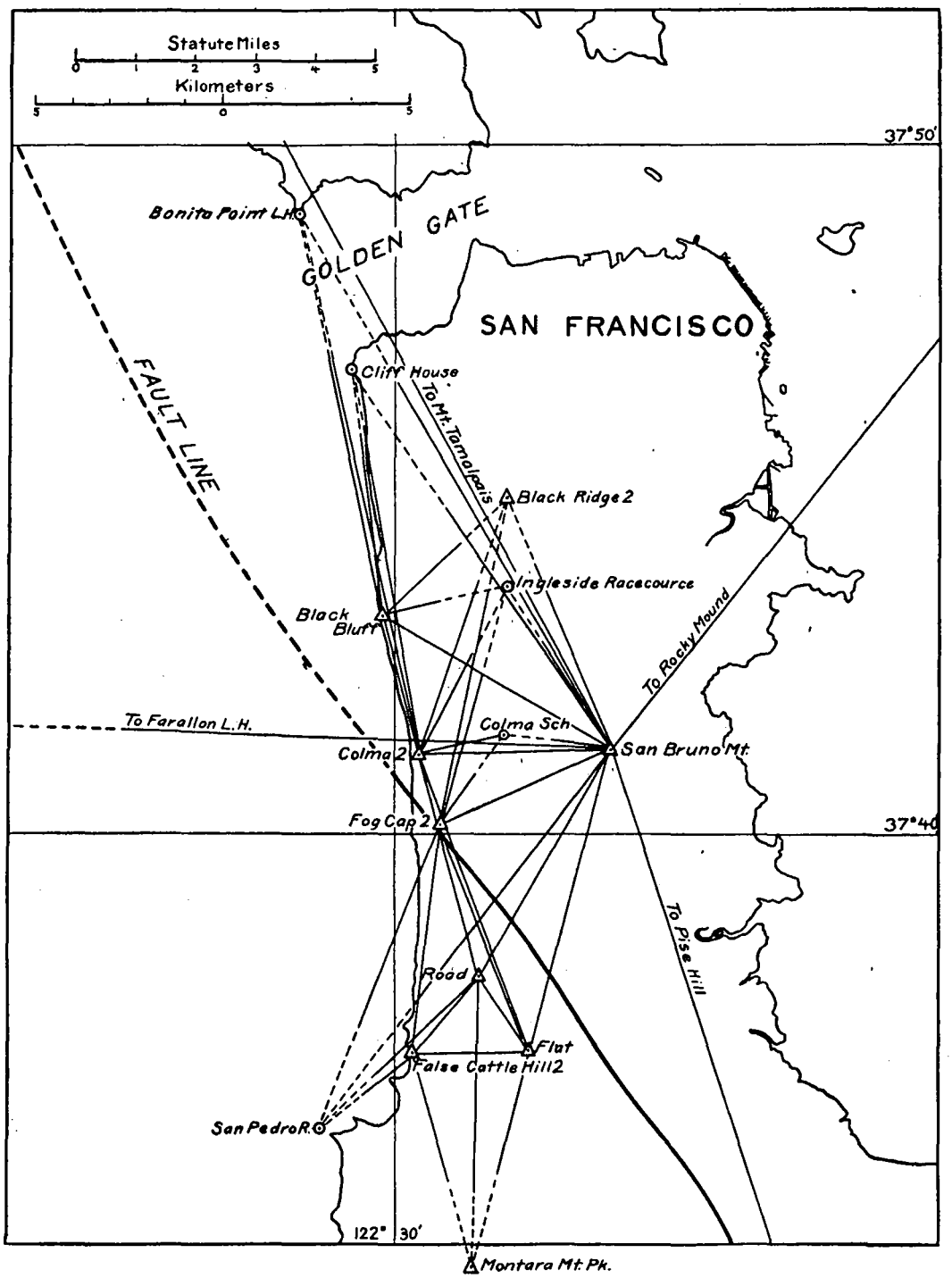


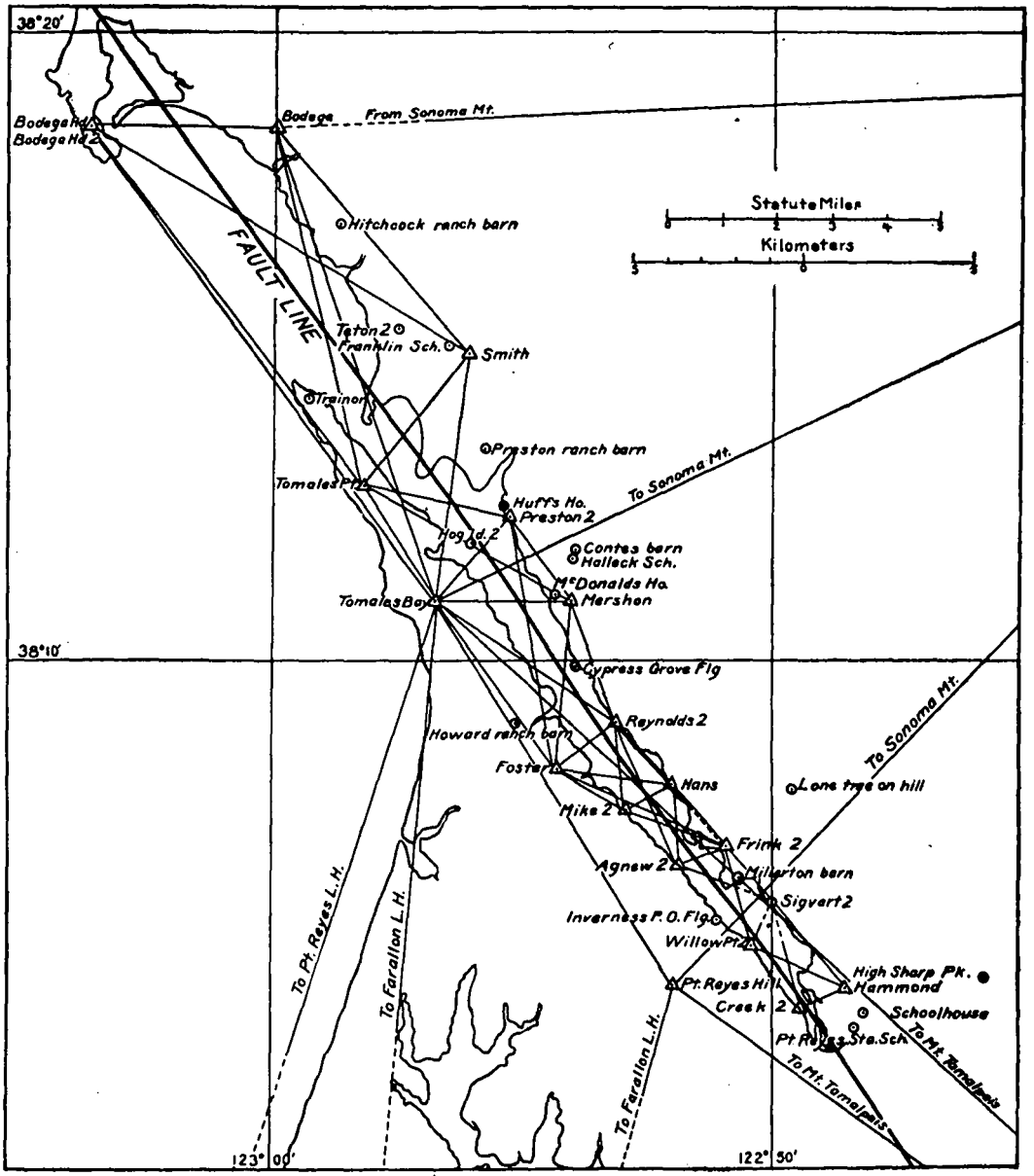
SECONDARY TRIANGULATION, 1906-7, SECOND FIGURE ADJUSTMENT.



TRIANGULATION OF 1906-7, GENERAL SKETCH.



VICINITY OF COLMA, 1907.



VICINITY OF TOMALES BAY, 1906.

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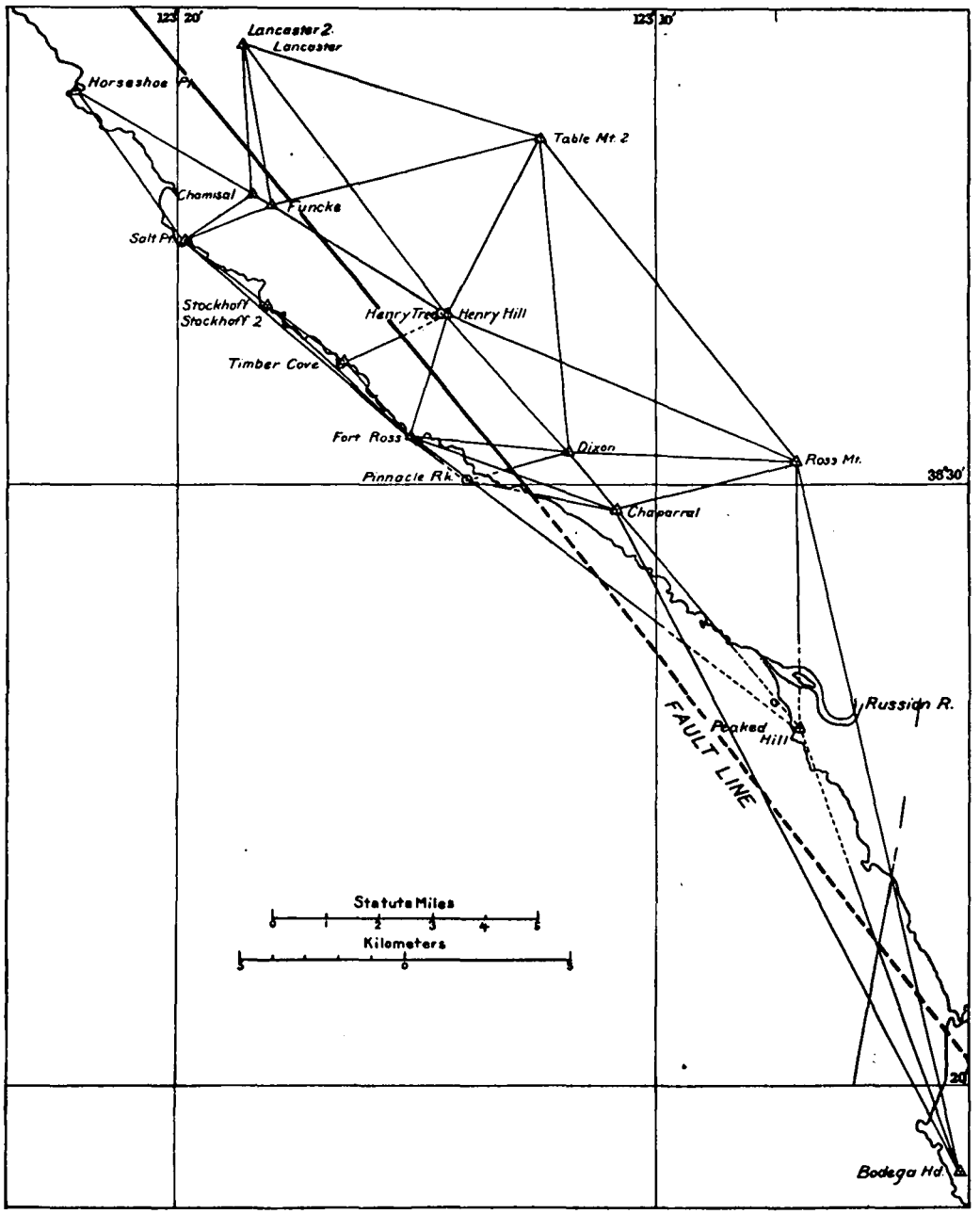
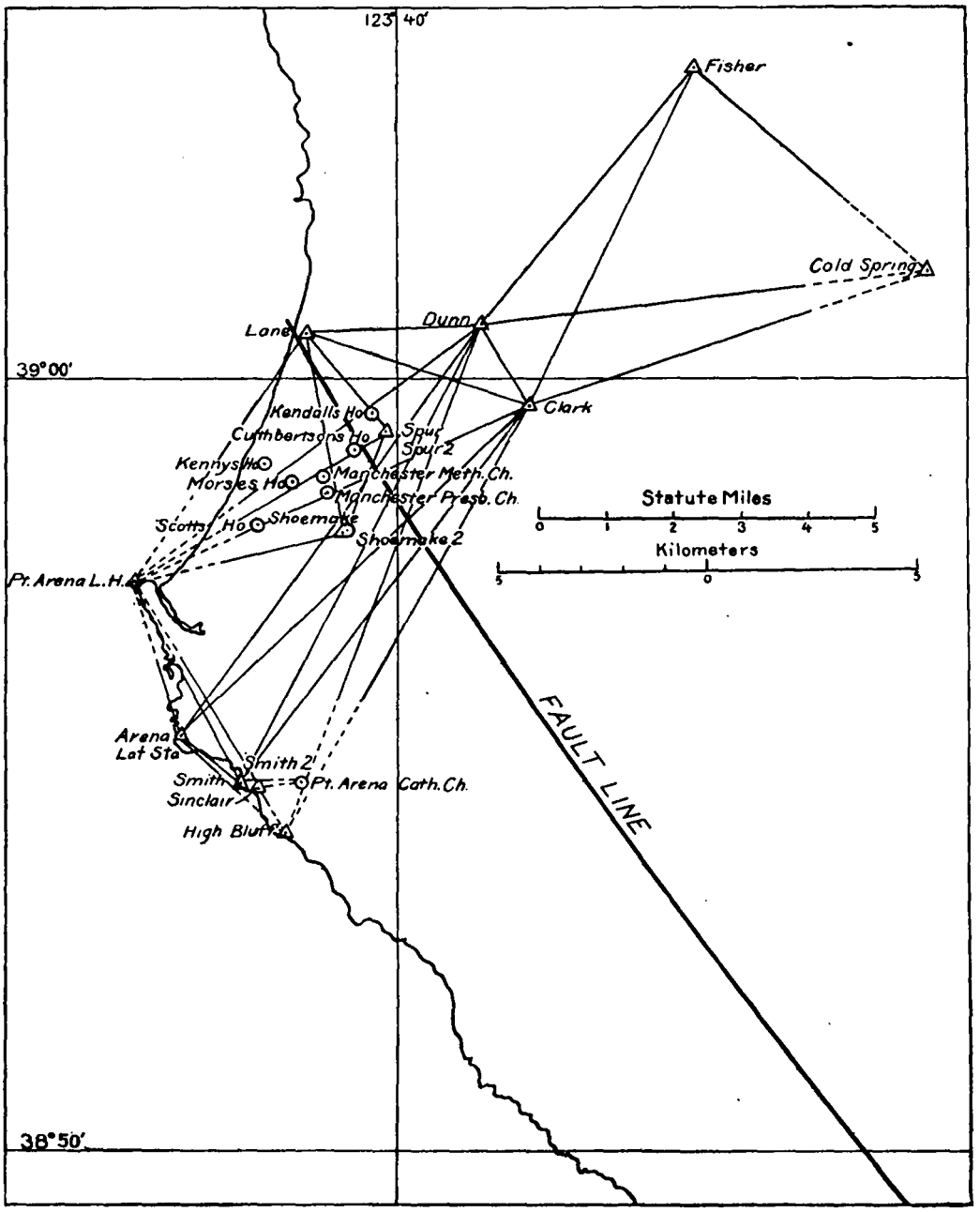
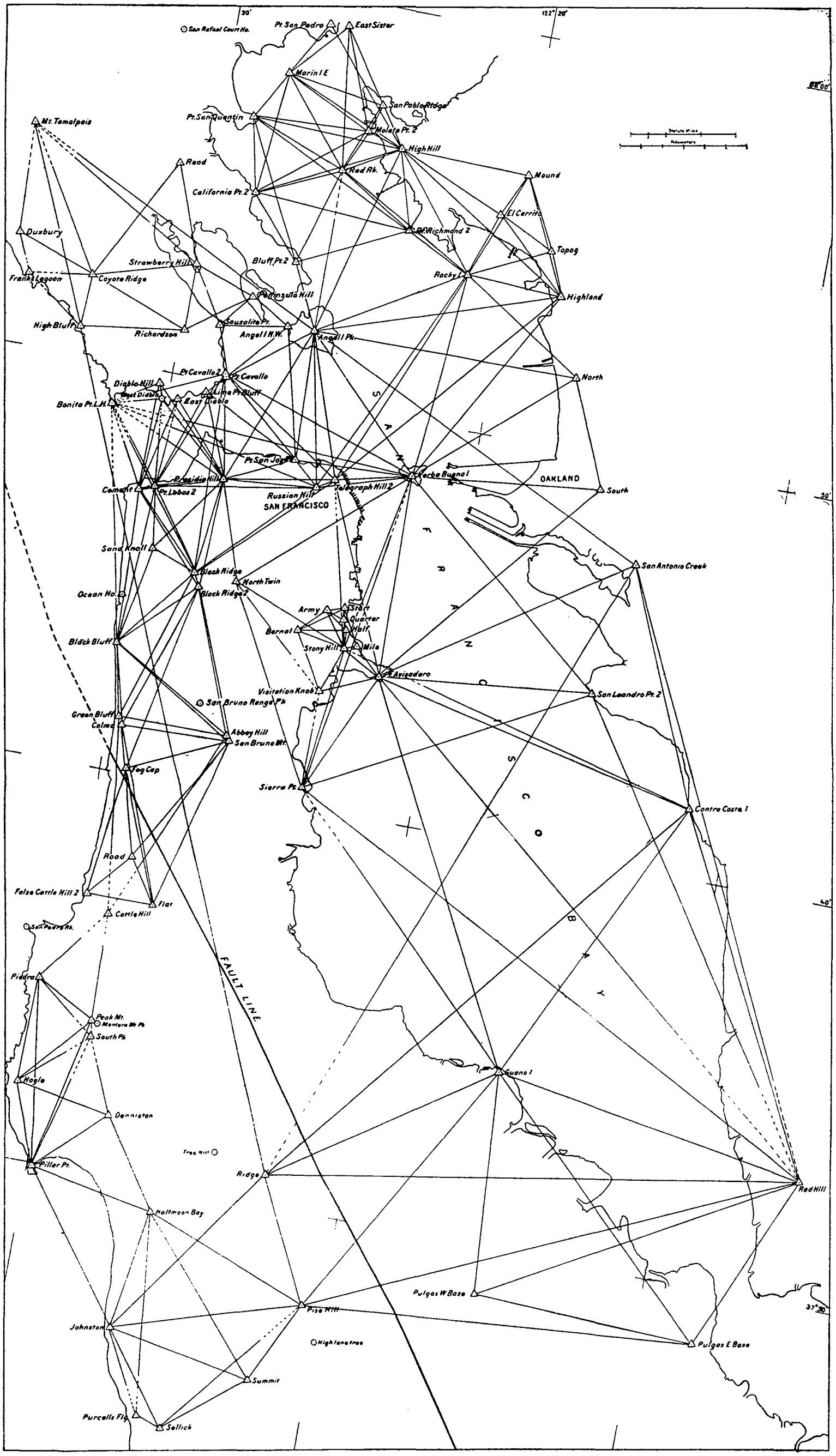


VICINITY OF FORT ROSS, 1906.

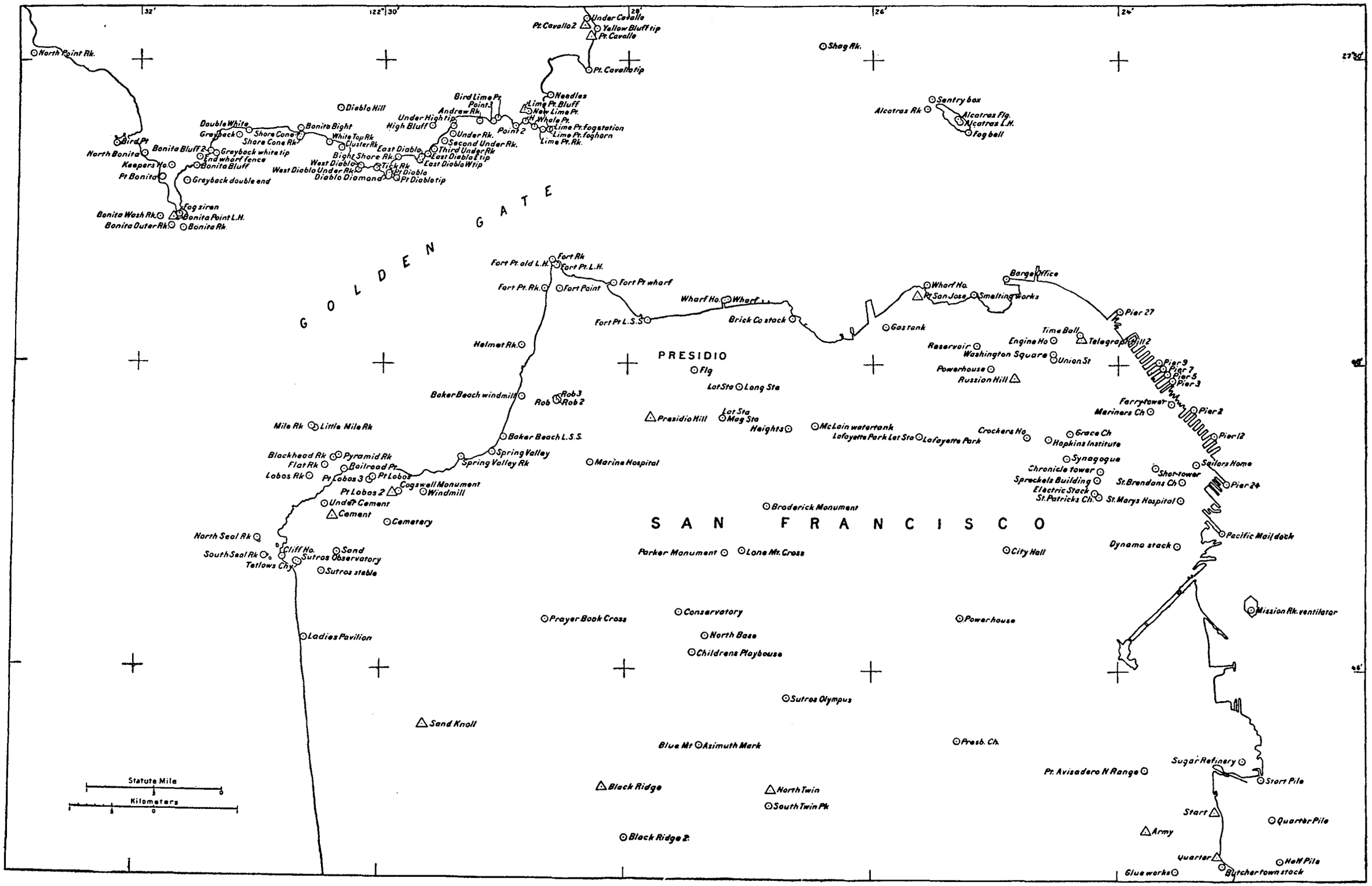


VICINITY OF POINT ARENA, 1906.

63481°—11——29

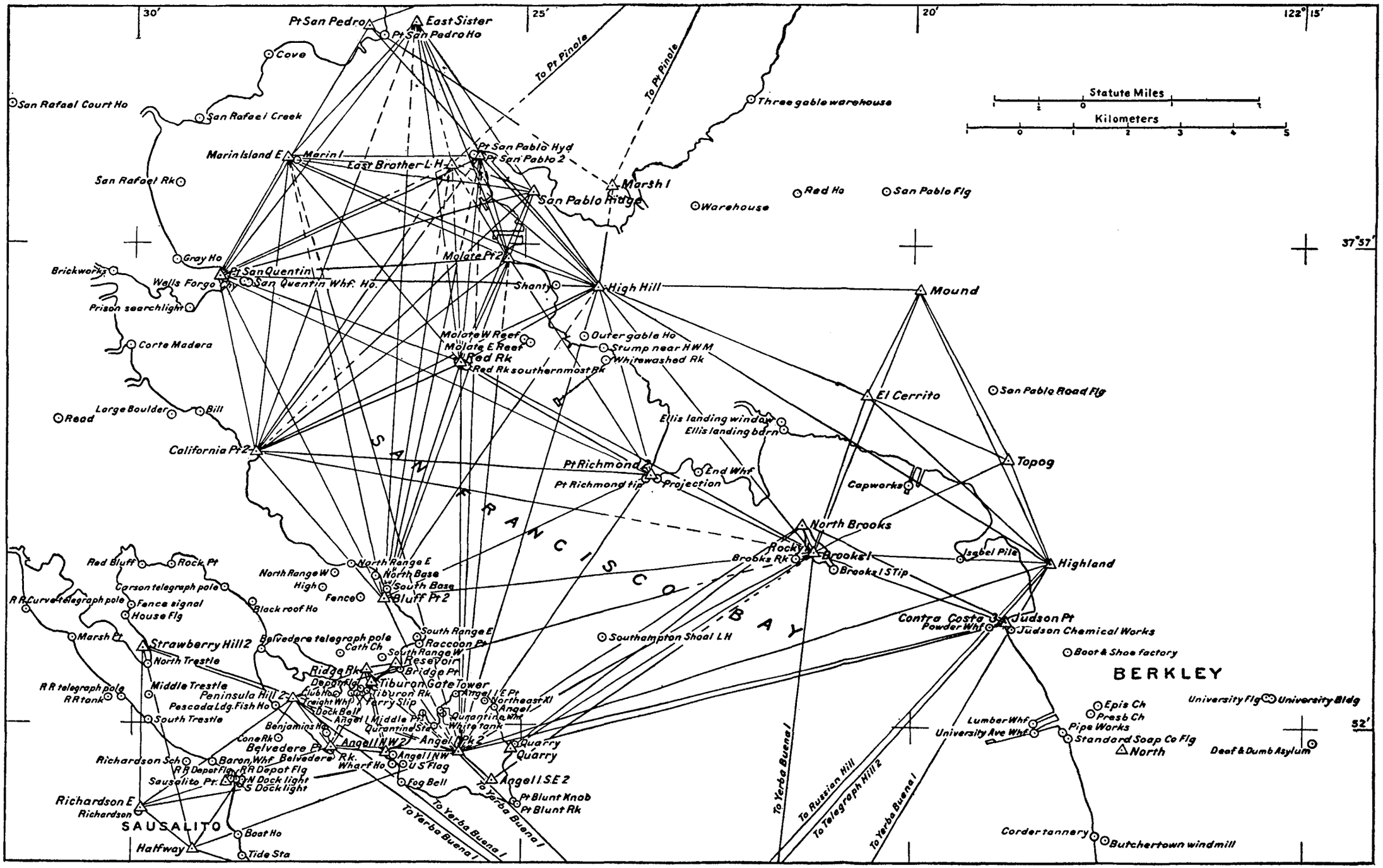


SAN FRANCISCO BAY, GENERAL SKETCH.

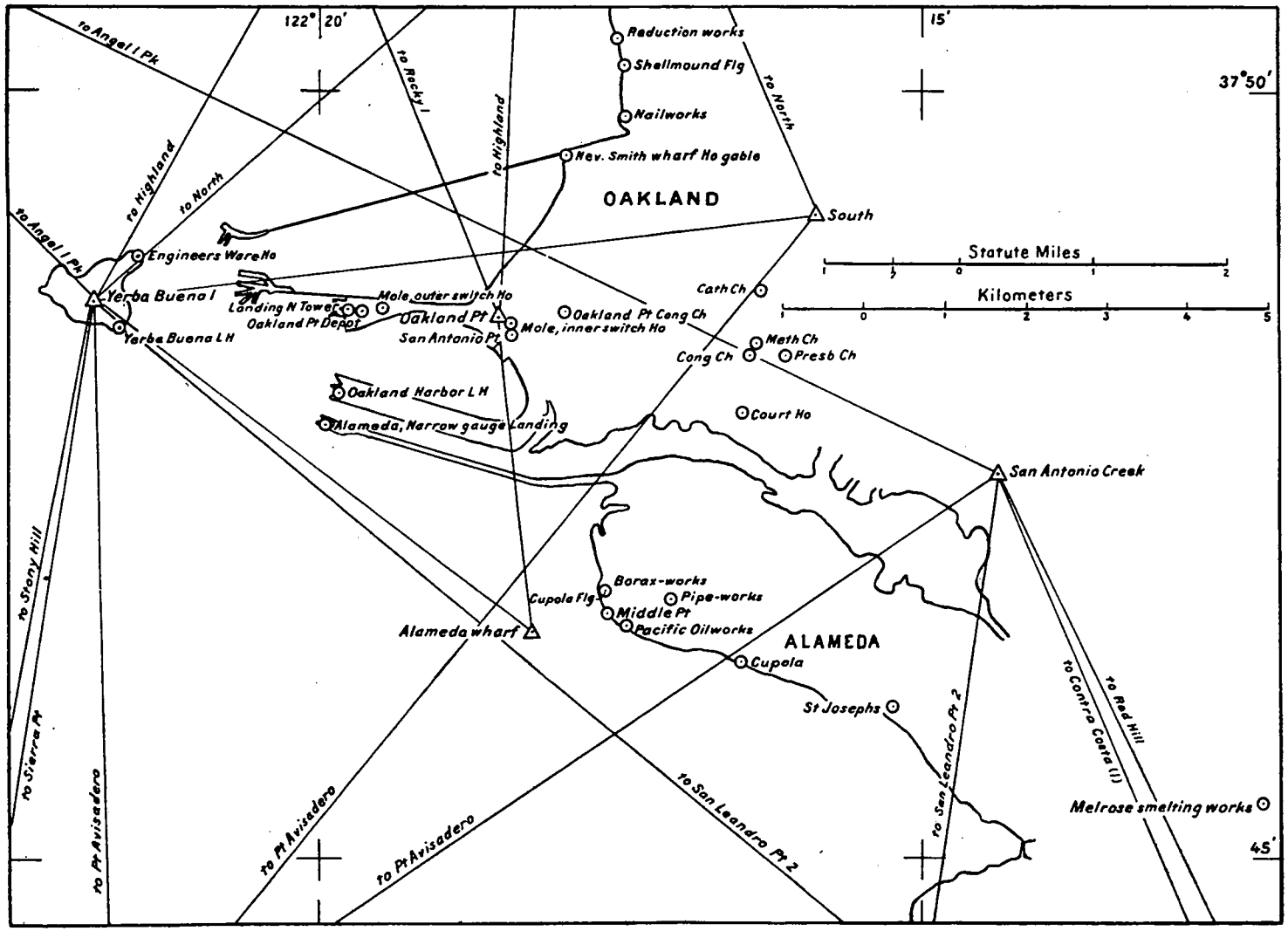


63481°—11

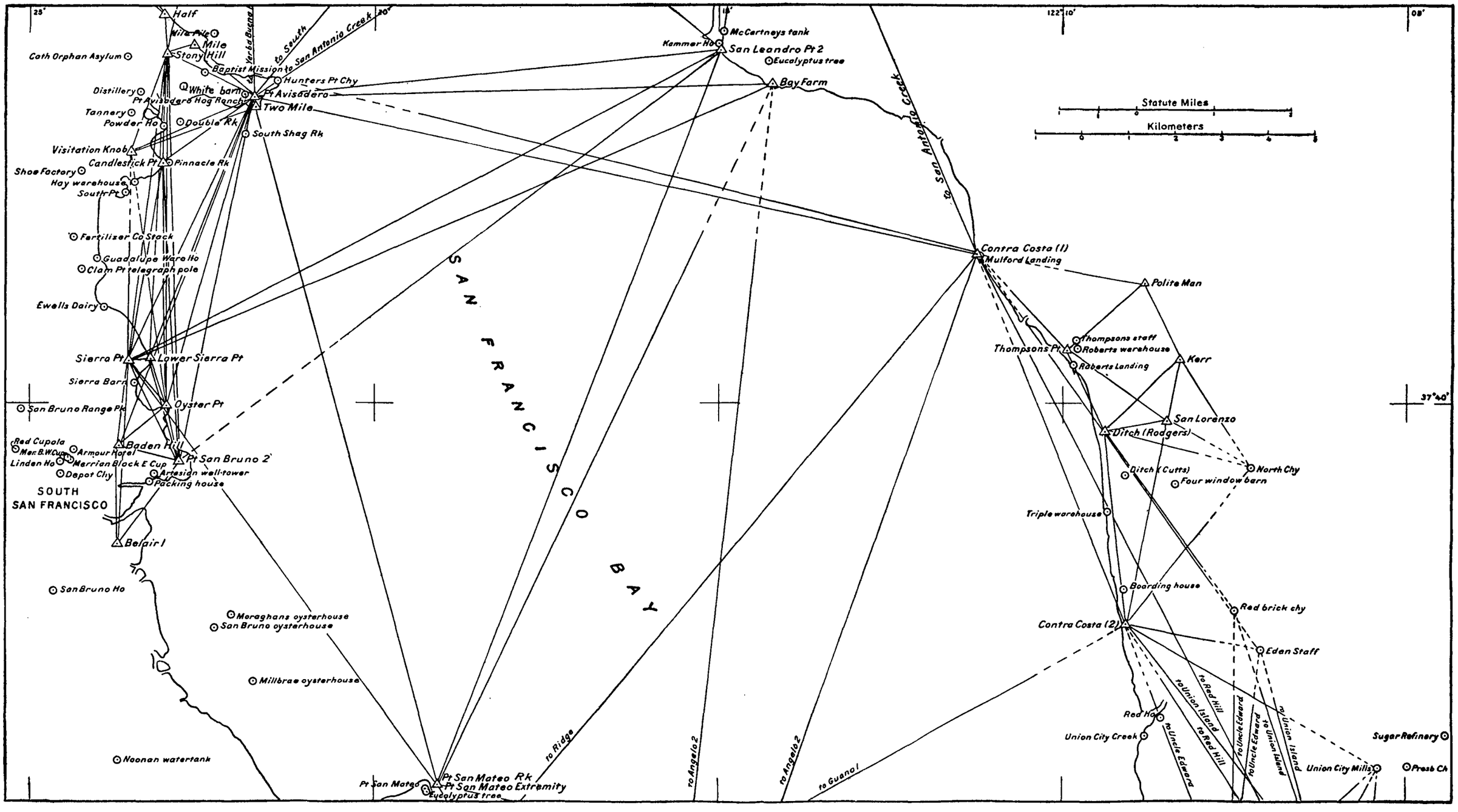
SAN FRANCISCO BAY, GOLDEN GATE.



SAN FRANCISCO BAY, NORTHERN PART

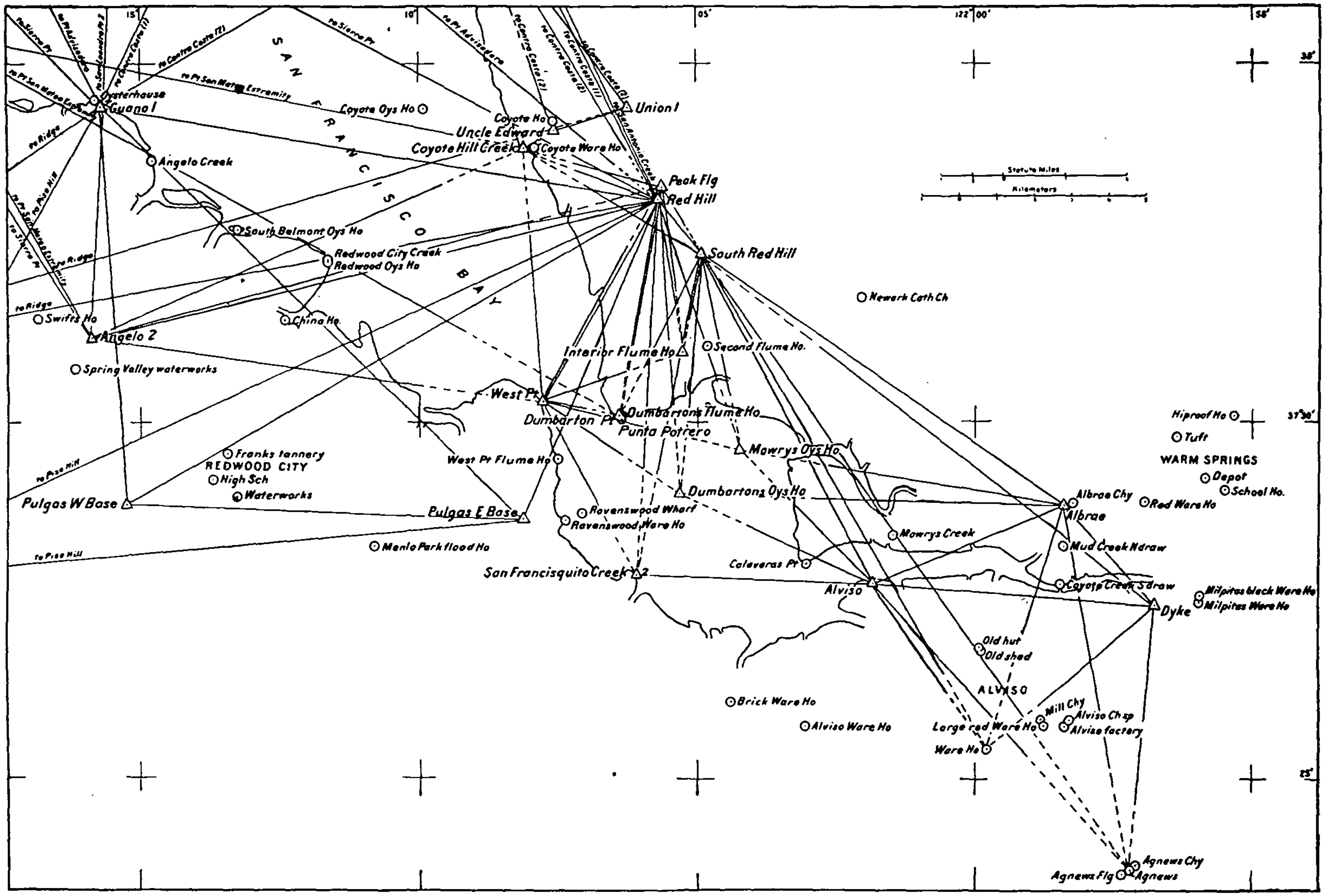


SAN FRANCISCO BAY, NORTH CENTRAL PART.

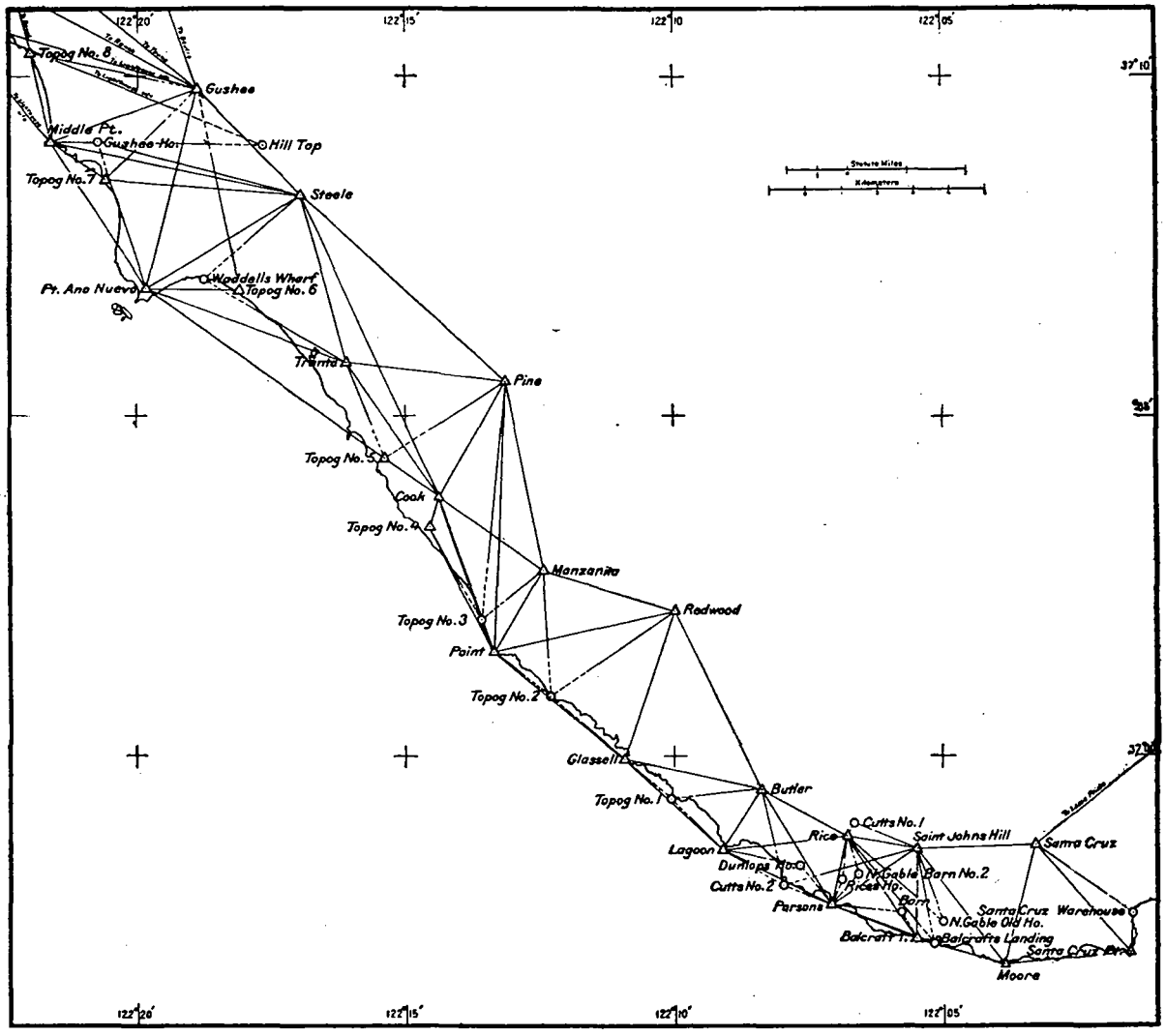


SAN FRANCISCO BAY, SOUTH CENTRAL PART.

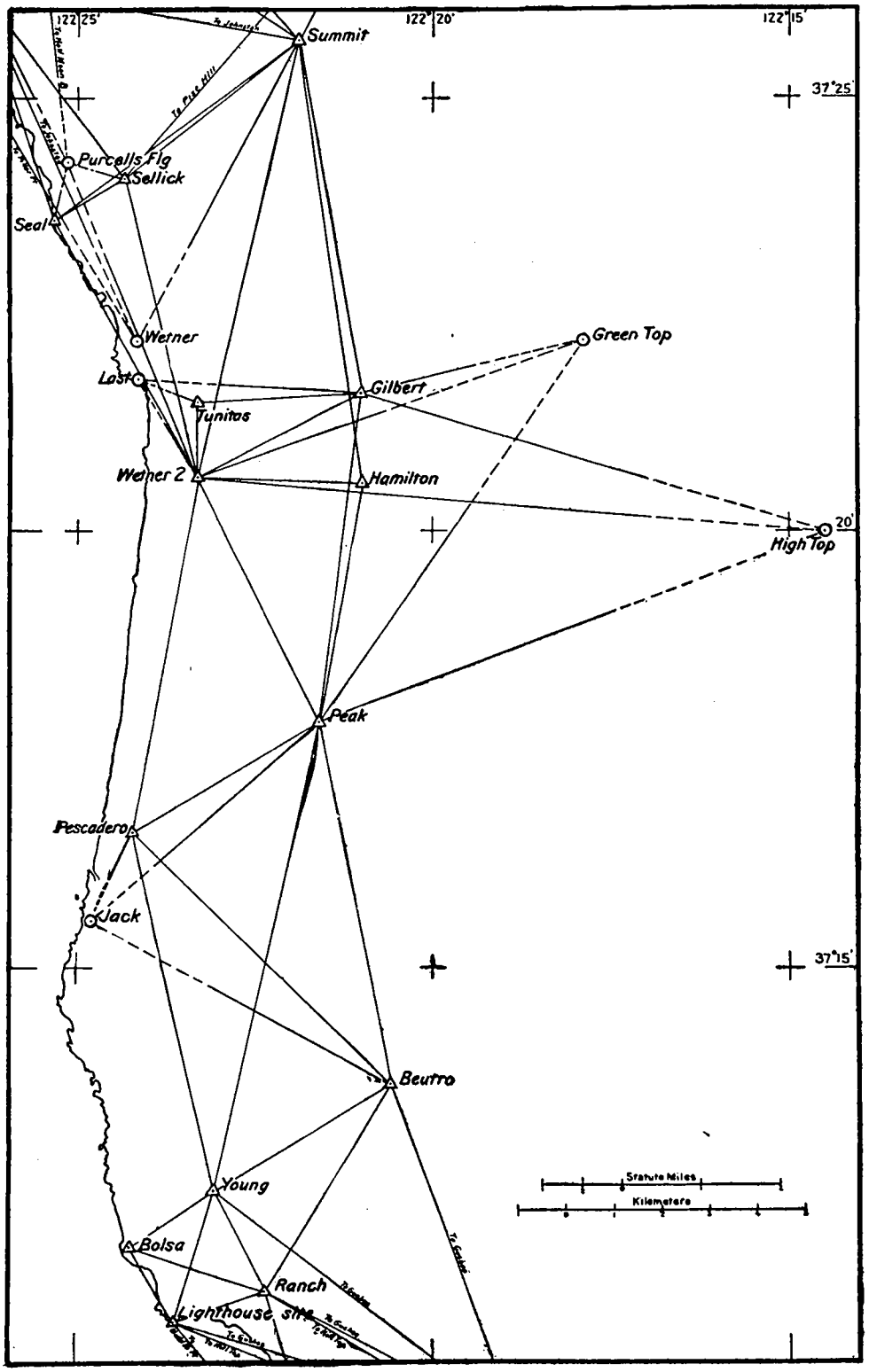
63481°—11



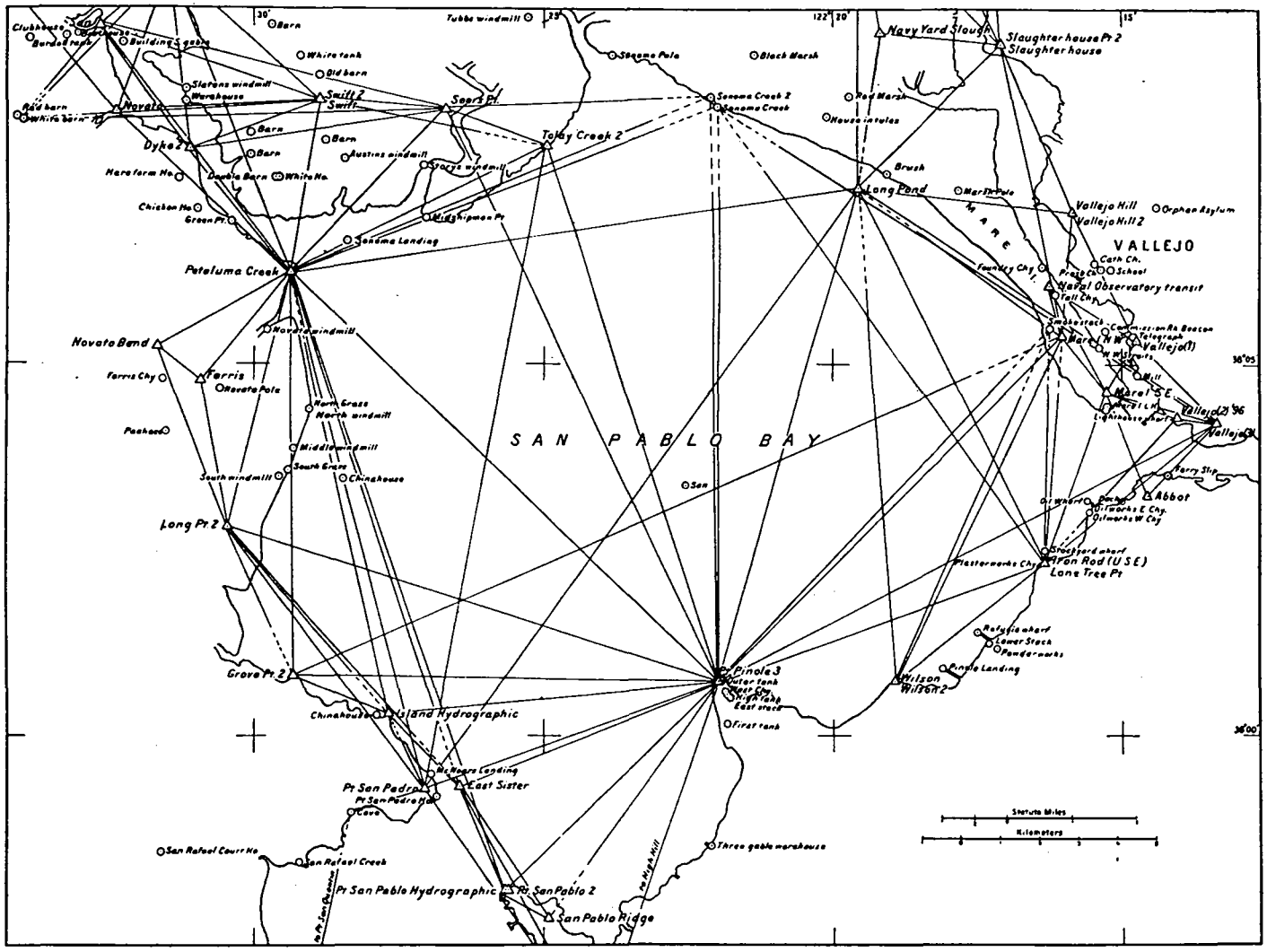
SAN FRANCISCO BAY, SOUTHERN EXTREMITY.



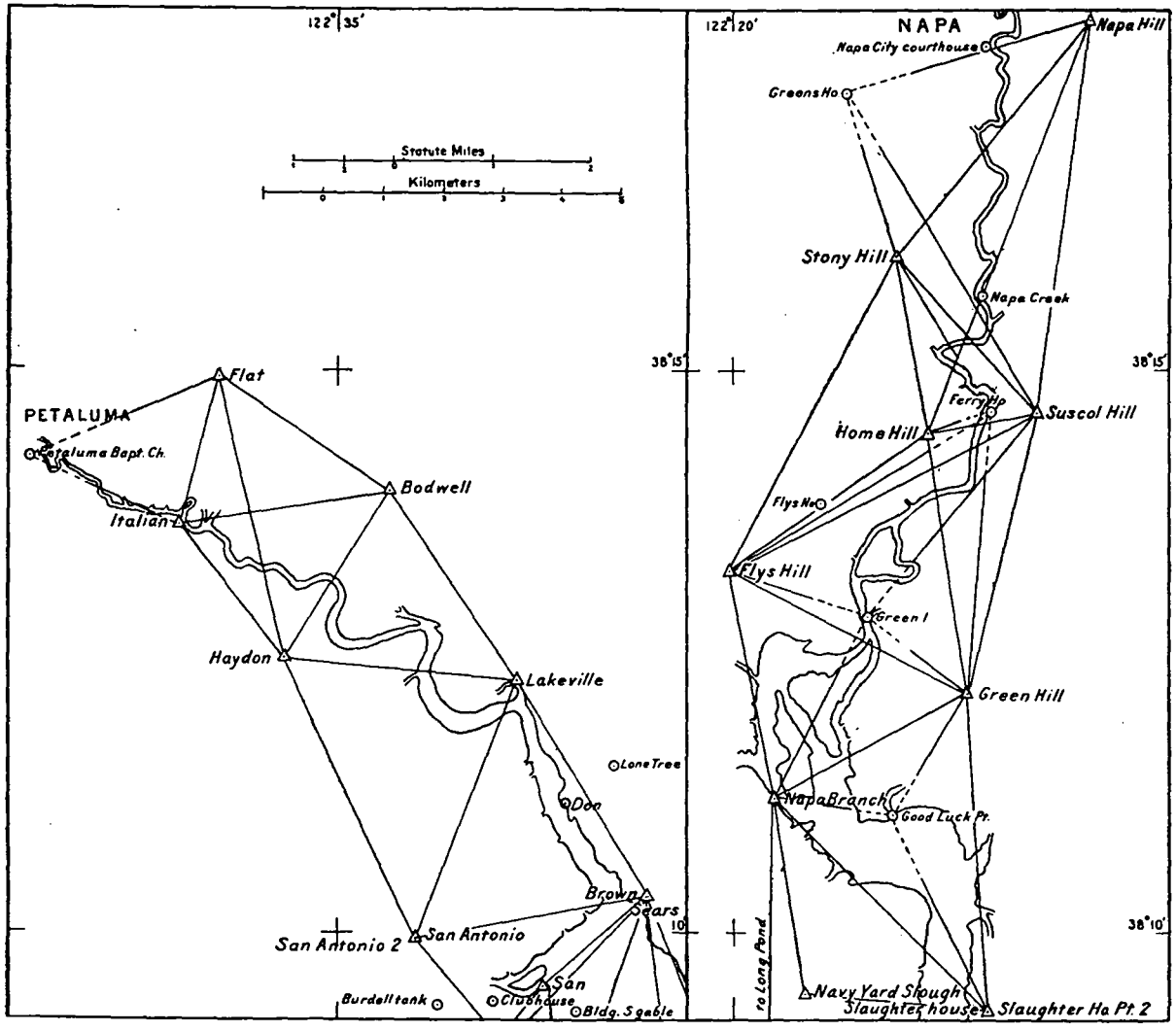
MONTEREY BAY TO SAN FRANCISCO BAY, 1 (SOUTHERN PART).



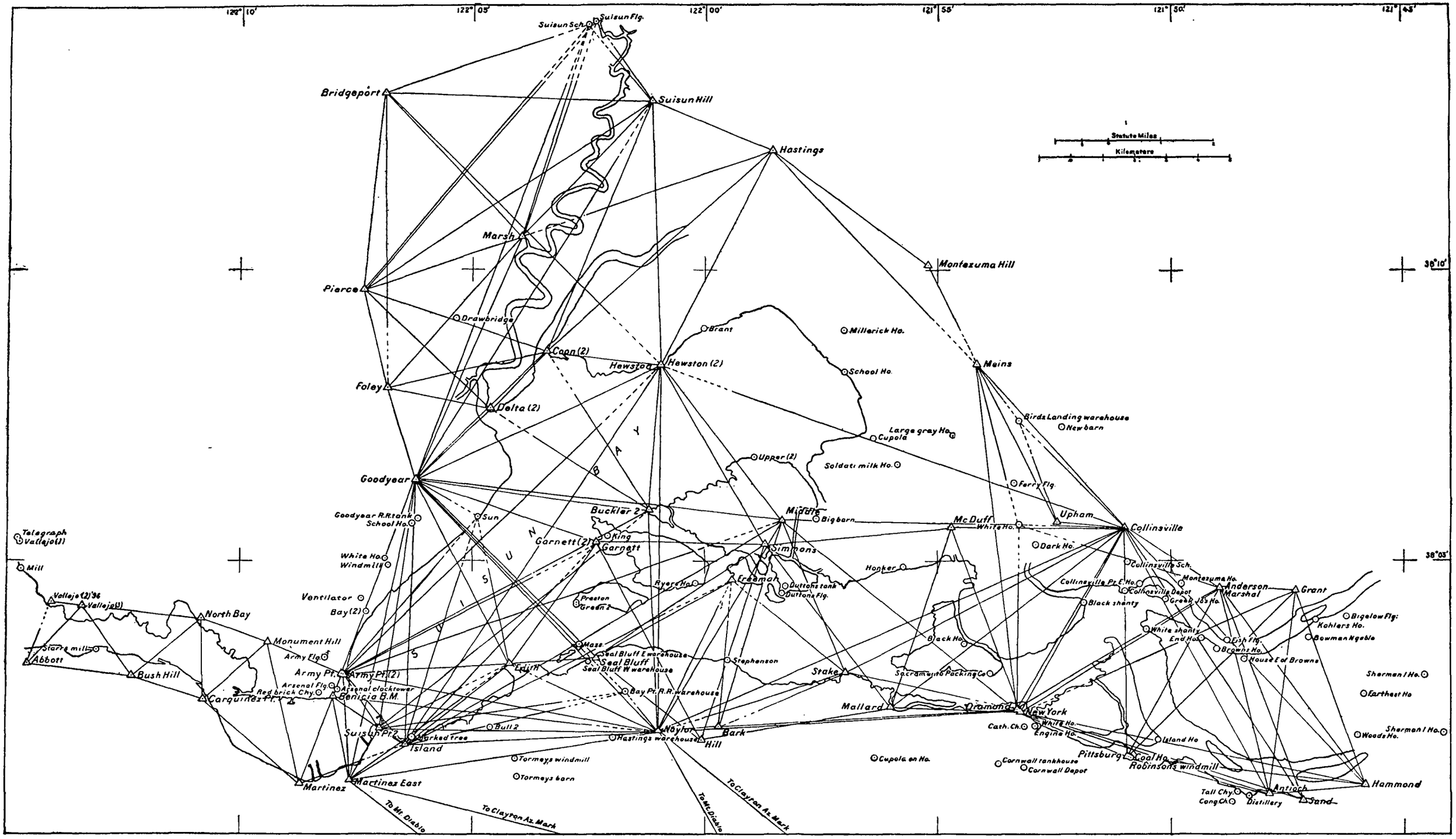
MONTEREY BAY TO SAN FRANCISCO BAY, 2 (NORTHERN PART).



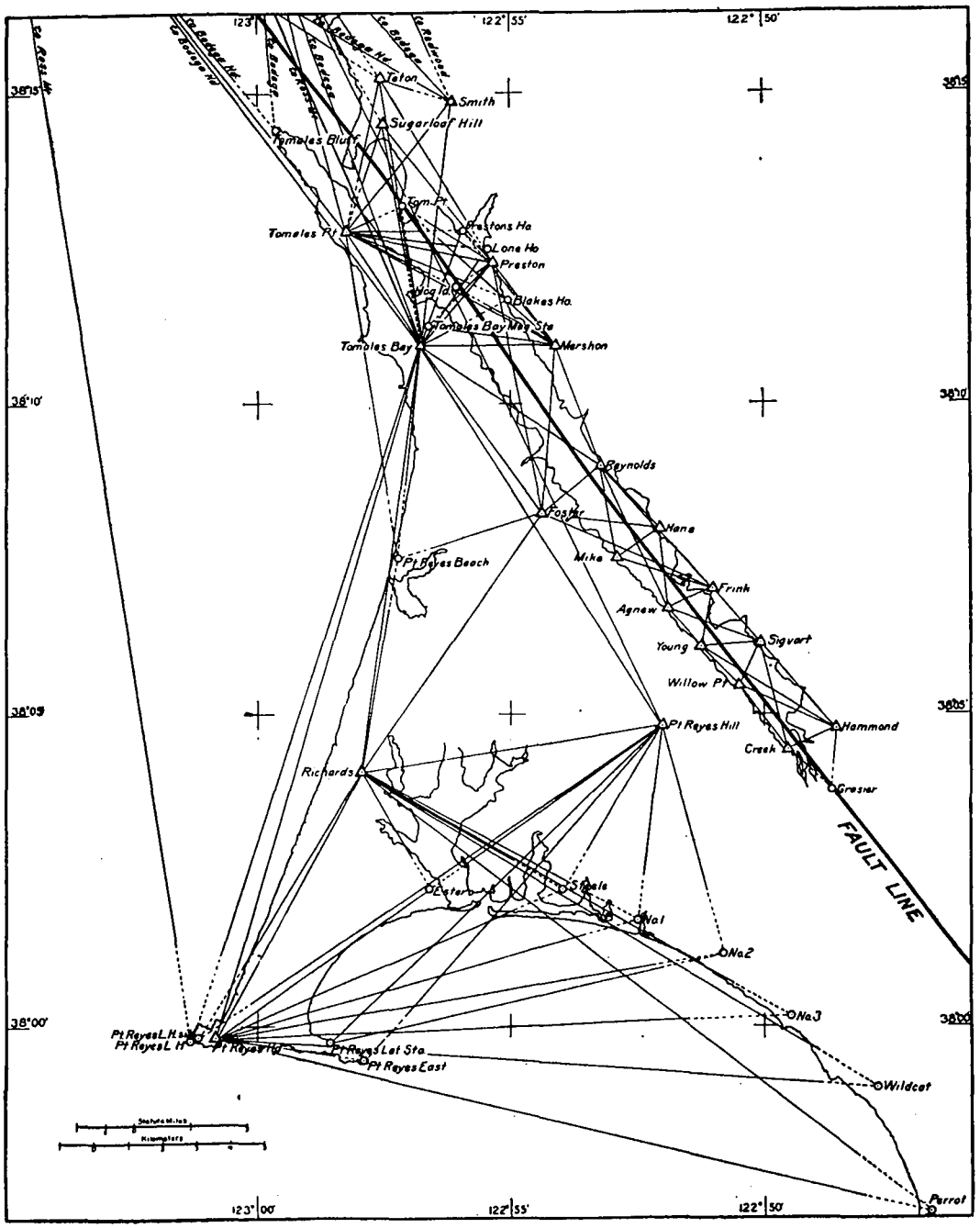
SAN PABLO BAY.



PETALUMA CREEK AND NAPA CREEK.

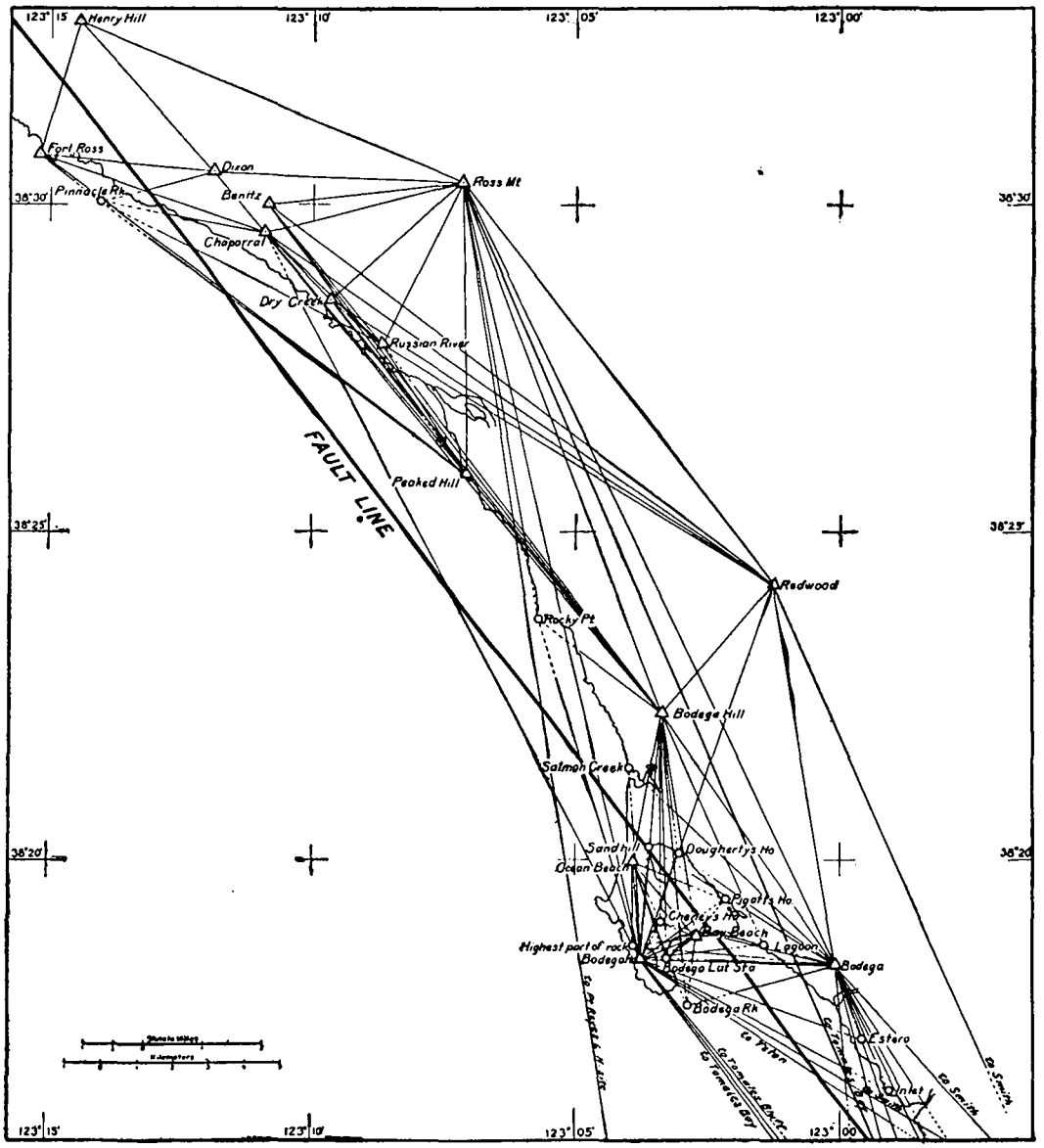

122° 10'
122° 05'
122° 00'
121° 55'
121° 50'
121° 45'
38° 10'
38° 05'
Statute Miles
Kilometers
Suisun Sch.
Suisun Flg.
Bridgeport
Suisun Hill
Hastings
Marsh
Pierce
Montezuma Hill
Drawbridge
Brant
Millerick Ho.
Coon (2)
Hewston
Hewston (2)
School Ho.
Foley
Delta (2)
Mains
Birds Landing warehouse
Newbarn
Large gray Ho.
Cupola
Upper (2)
Soldati milk Ho.
Ferry Flg.
Goodyear
Goodyear R.R.tank
School Ho.
Sun
Buckler 2
Middle
Big barn
McDuff
White Ho.
Upham
Collinsville
Telegraph
Vallejo(1)
Garnett (2)
King
Garnett
Simmons
Dark Ho.
White Ho
Windmill
Honker
Collinsville Sch.
Mill
Freeman
Ryers Ho.
Buttons tank
Buttons Flg.
Collinsville Pt.E.Ho.
Montezuma Ho.
Anderson
Marshal
Grant
Vallejo (2)'36
Vallejo(1)
Ventilator
Bay (2)
Preston
Green 2
Collinsville Depot
Green 3 Ho.
Black shanty
North Bay
Bigelow Flg:
Kohlers Ho.
Bowman Ngeble
Monument Hill
Army Flg.
Mass
Seal Bluff E warehouse
Seal Bluff
Seal Bluff W warehouse
Stephenson
Black Ho.
White shanty
End Ho.
Fish Flg.
Browns Ho.
House E of Browne
Starr's mill
Abbott
Bush Hill
Army Pt.
Army Pt.(2)
Arsenal Flg.
Arsenal clocktower
Red brick Chy.
Benicia B.M.
Carquinez Pt.
Stake
Sacramento Packing Co
Sherman I Ho.
Farthest Ho
Bay Pt. R.R. warehouse
Mallard
Diamond
New York
Suisun Pt.2
Marked tree
Bull 2
Island
Naylor
Bark
Hill
Hastings warehouse
Cath. Ch.
White Ho.
Engine Ho.
Island Ho
Woods Ho.
Sherman I Ho.
Tormeys windmill
Tormeys barn
Cupola on Ho.
Cornwall tankhouse
Cornwall Depot
Pittsburg
Coal Ho.
Robinsons windmill
Martinez
Martinez East
Antioch
Hammond
Tall Chy.
Cong Ch.
Distillery
Sand
To Mt. Diablo
To Clayton Az. Mark
To Mt. Diablo
To Clayton Az. Mark
SUISUN BAY

SUISUN BAY.



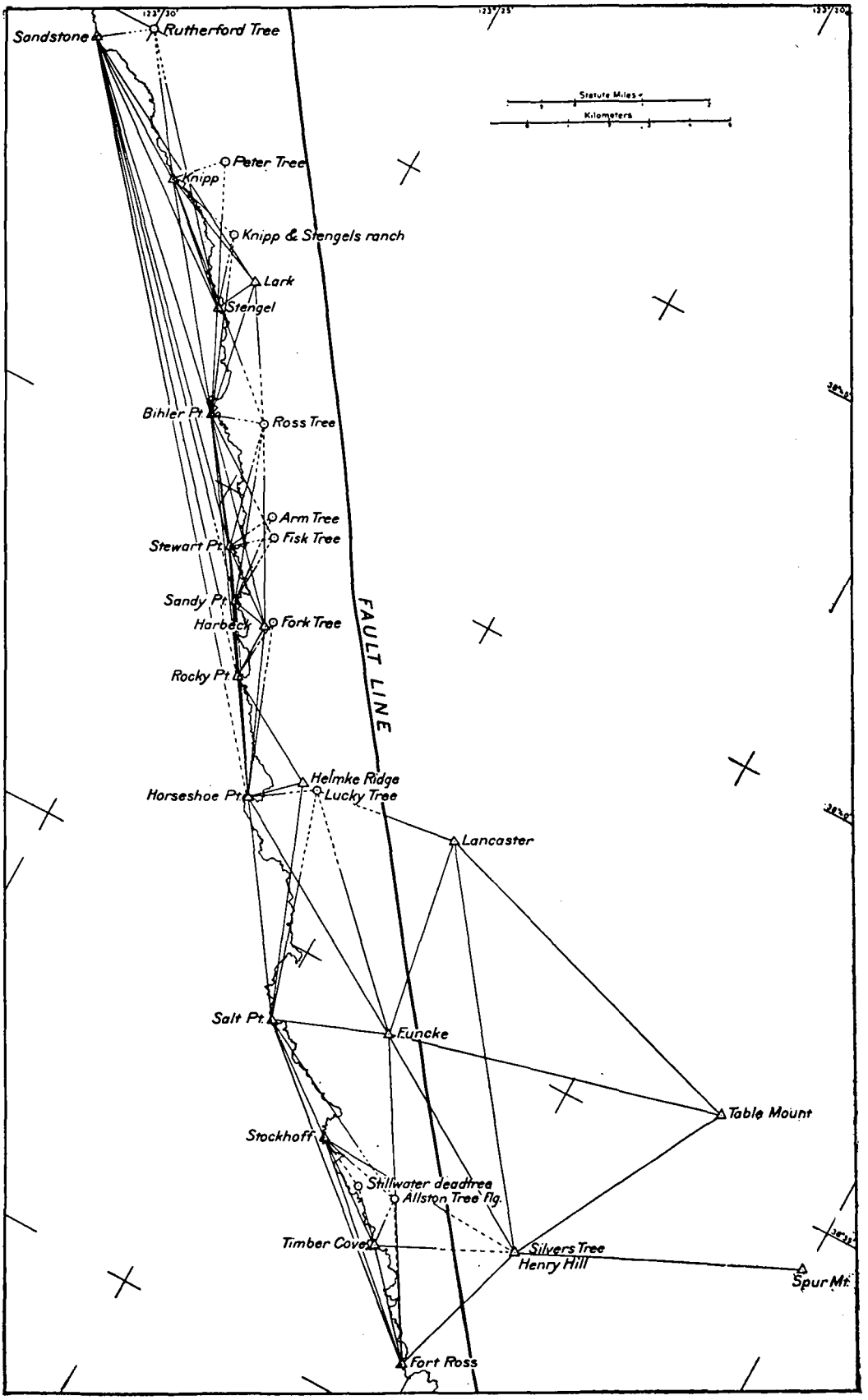
GOLDEN GATE TO POINT ARENA, 1.

No. 23.

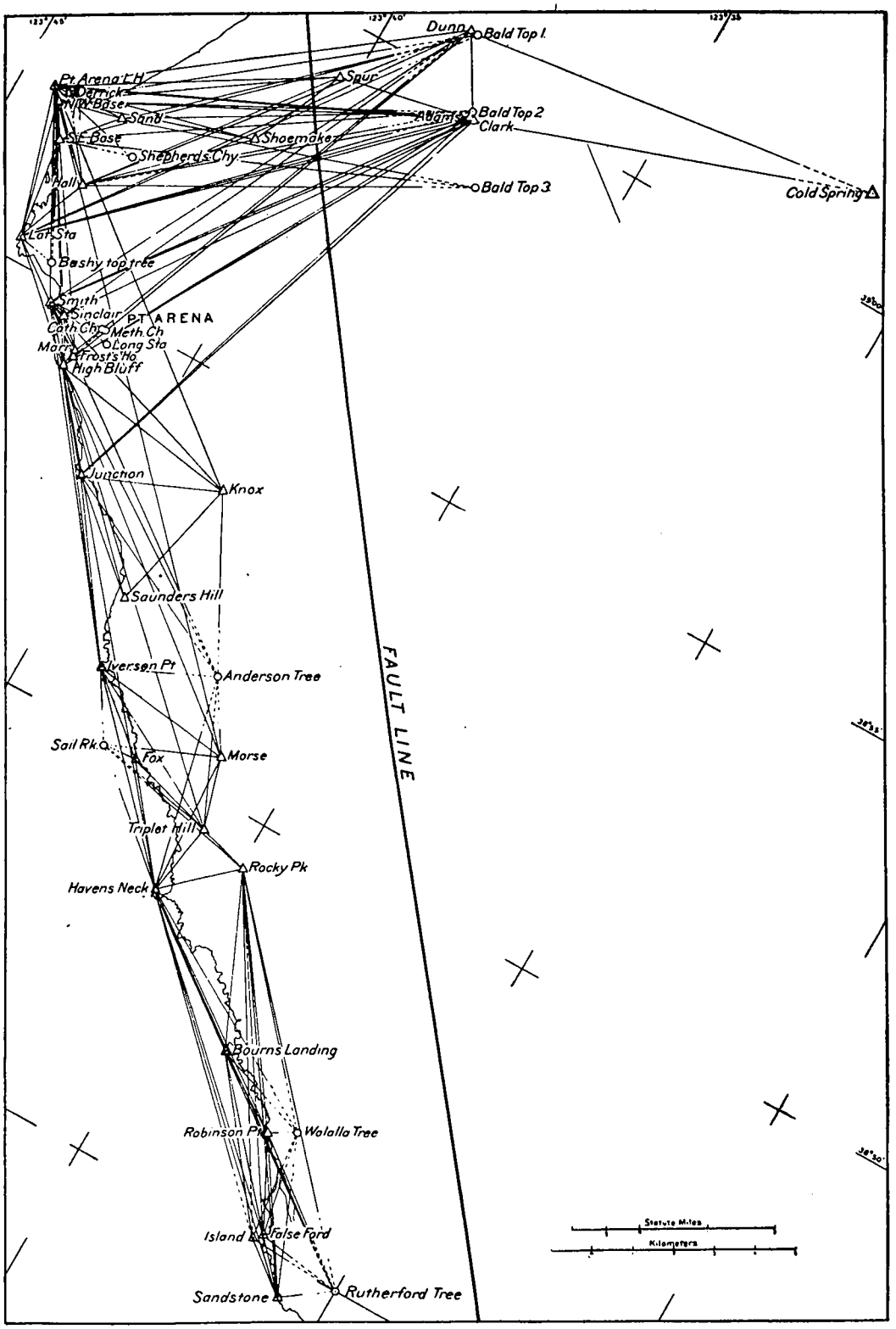


GOLDEN GATE TO POINT ARENA, 2.

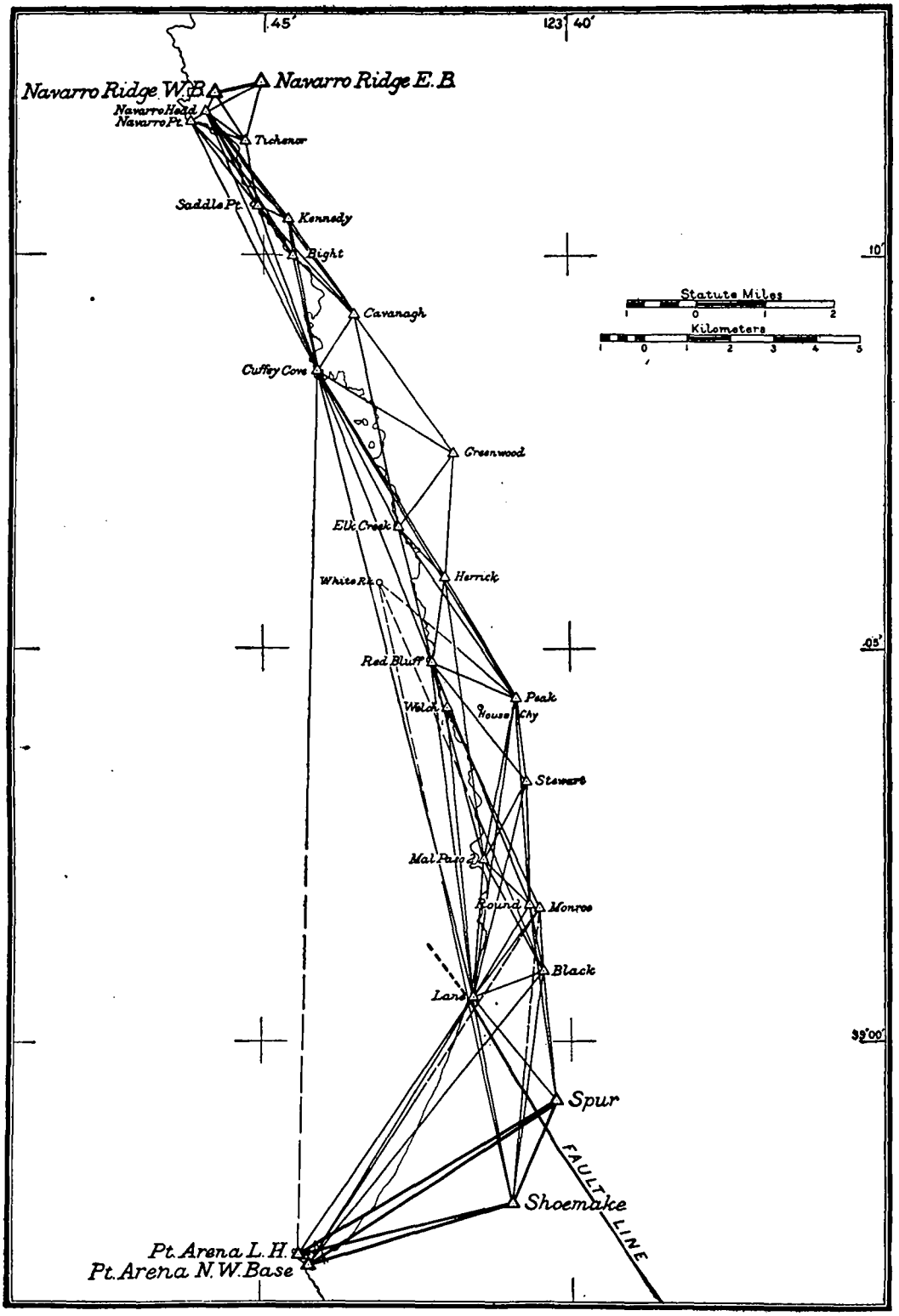
63481°—11——30



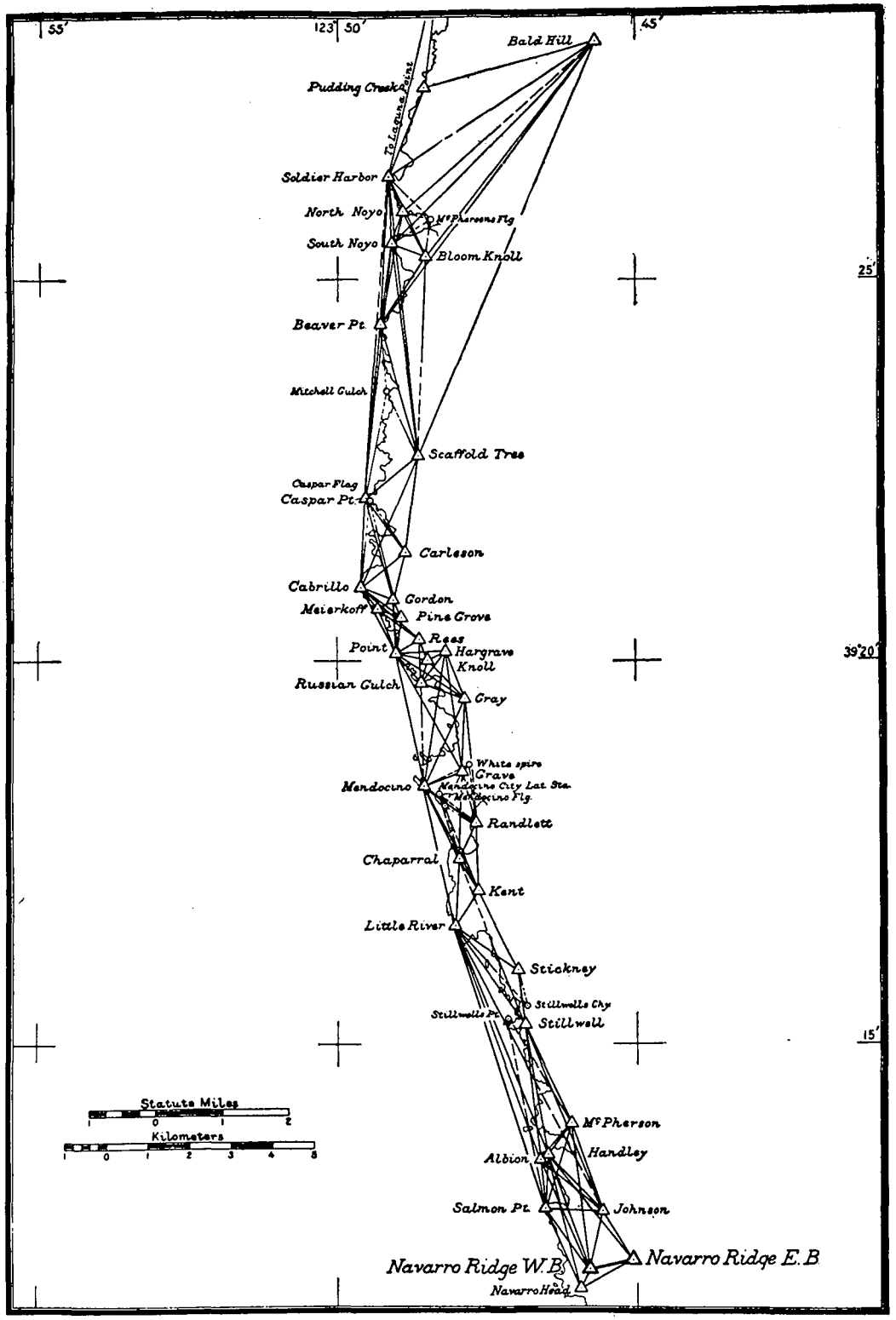
GOLDEN GATE TO POINT ARENA, 3.



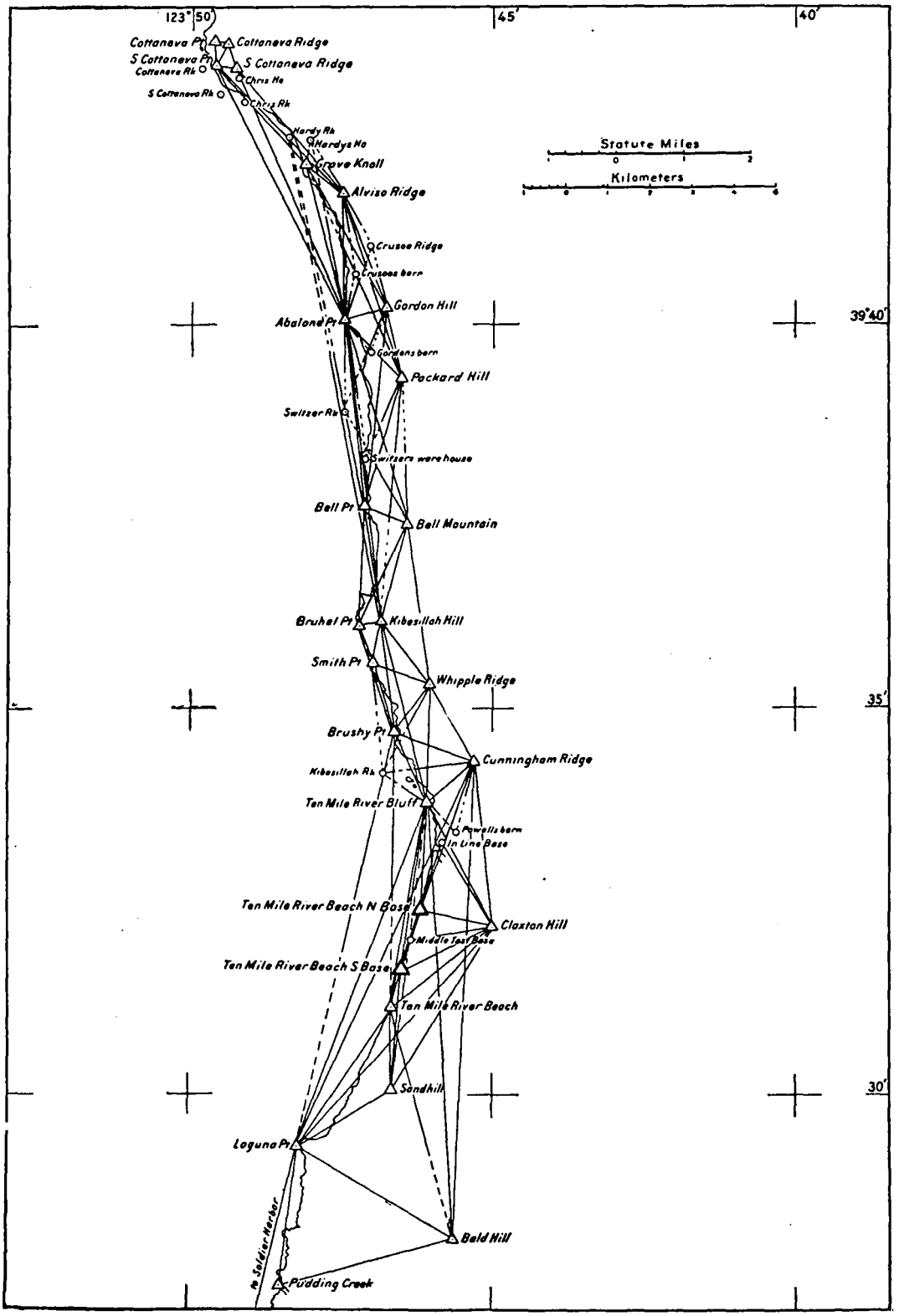
GOLDEN GATE TO POINT ARENA, 4.



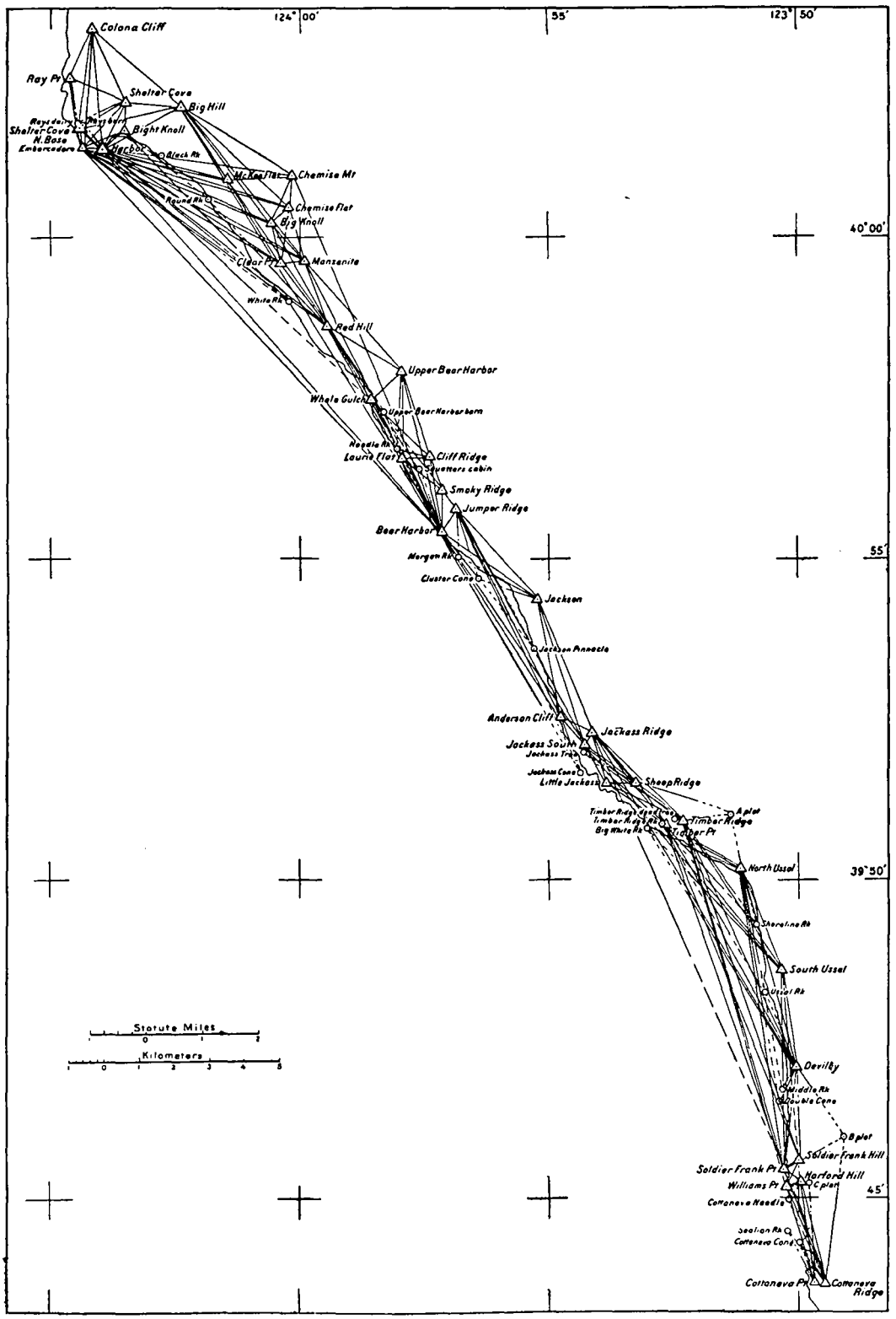
POINT ARENA TO NAVARRO RIDGE.



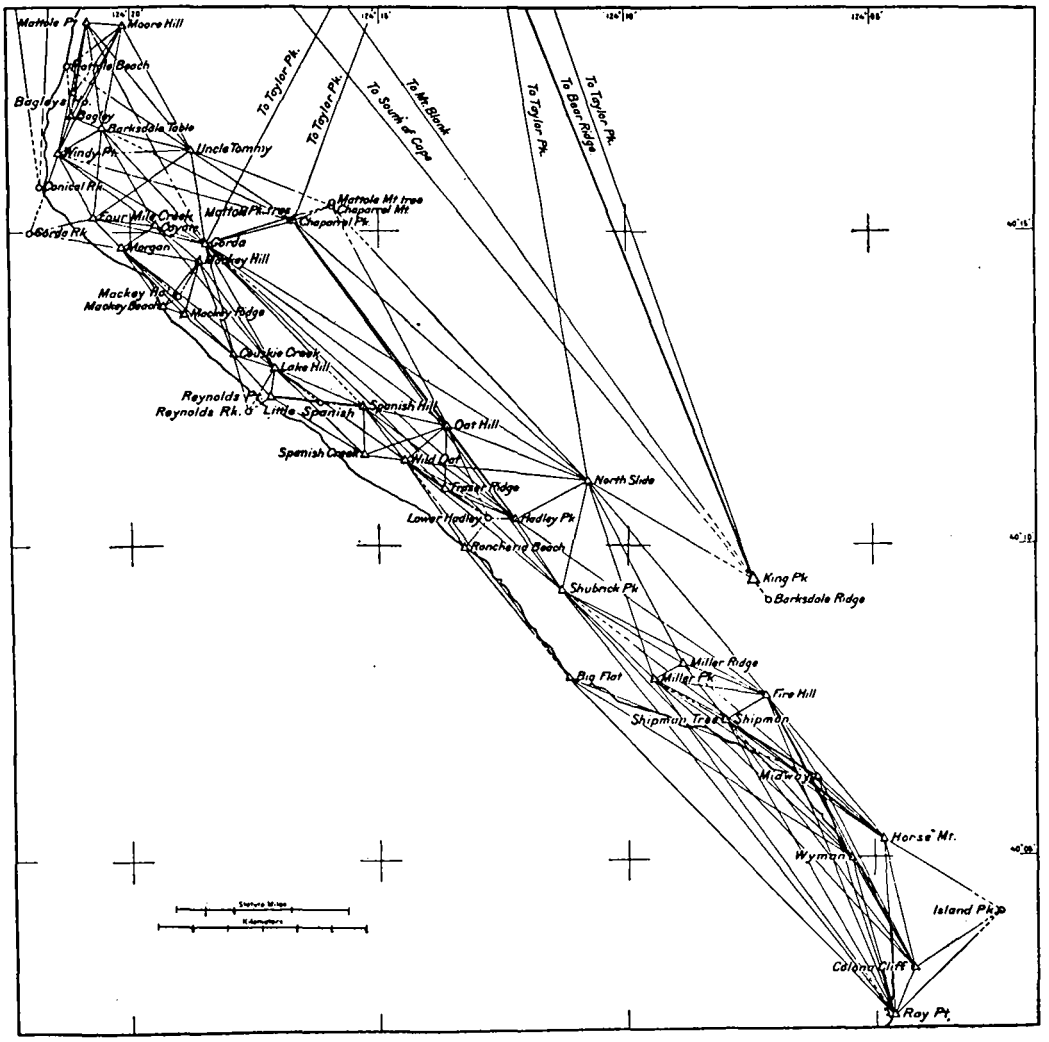
NAVARRO RIDGE TO PUDDING CREEK.



PUDDING CREEK TO COTTANEVA POINT.

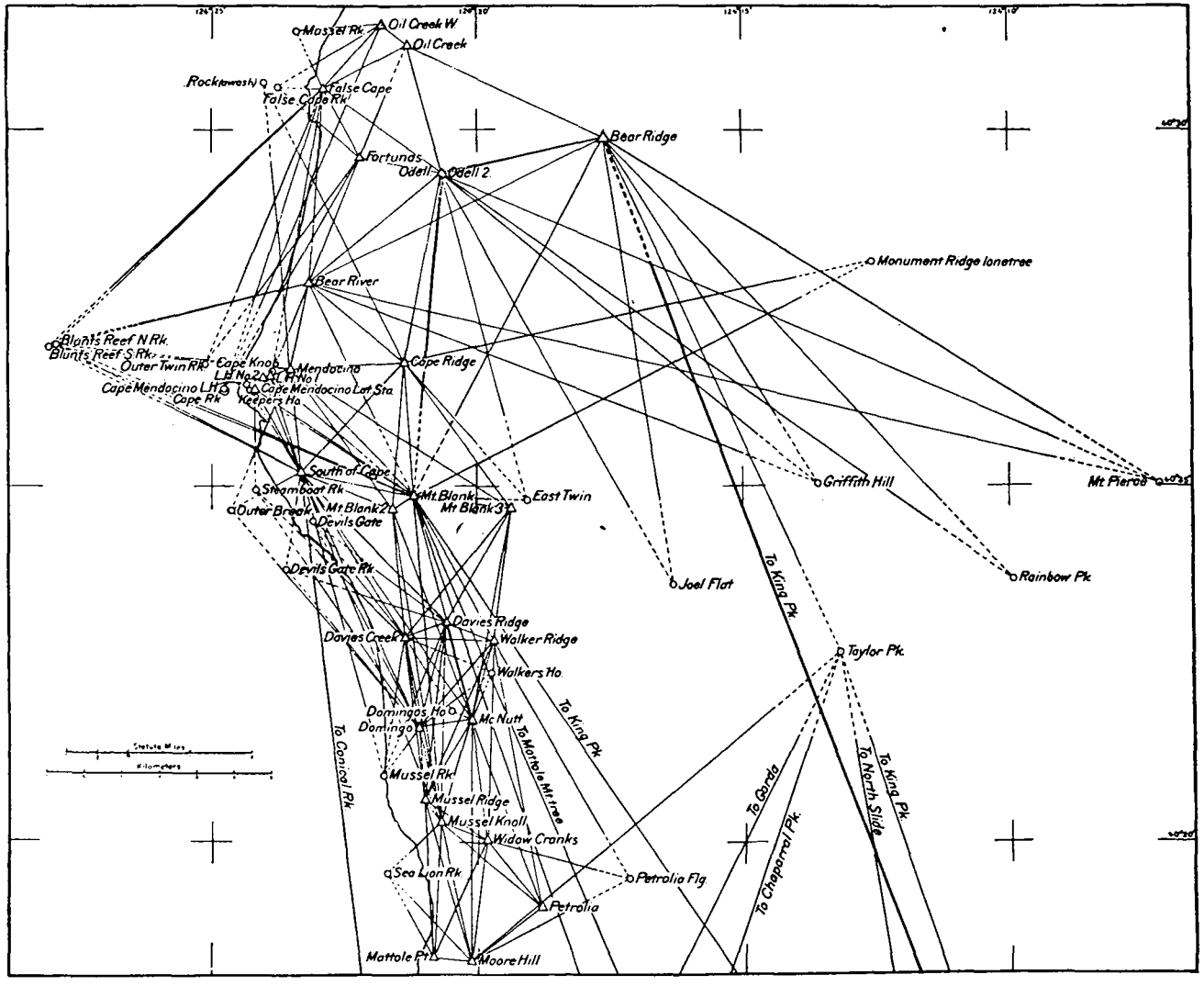


COTTANEVA POINT TO SHELTER COVE.

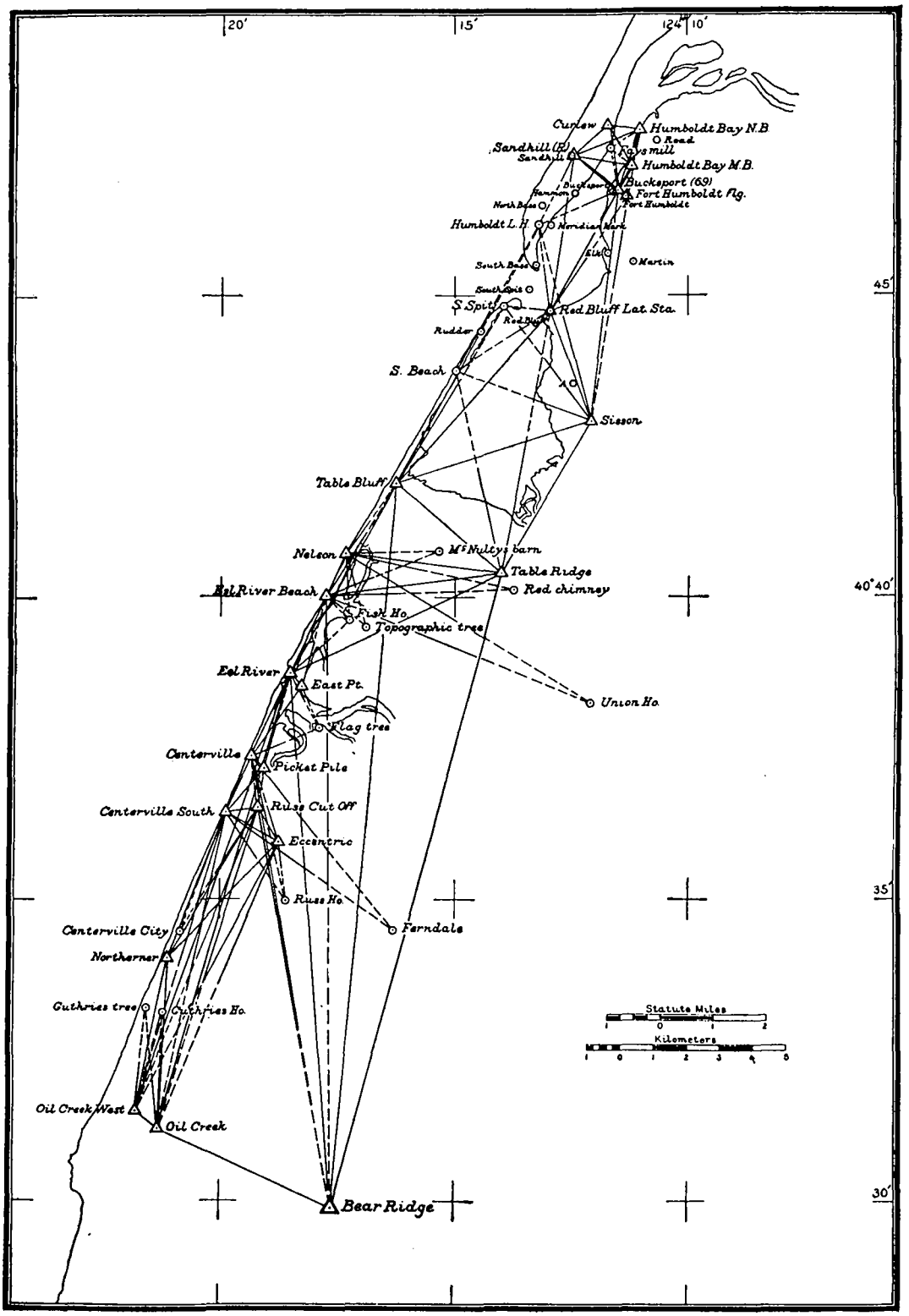


SHELTER COVE TO MATTOLE POINT.

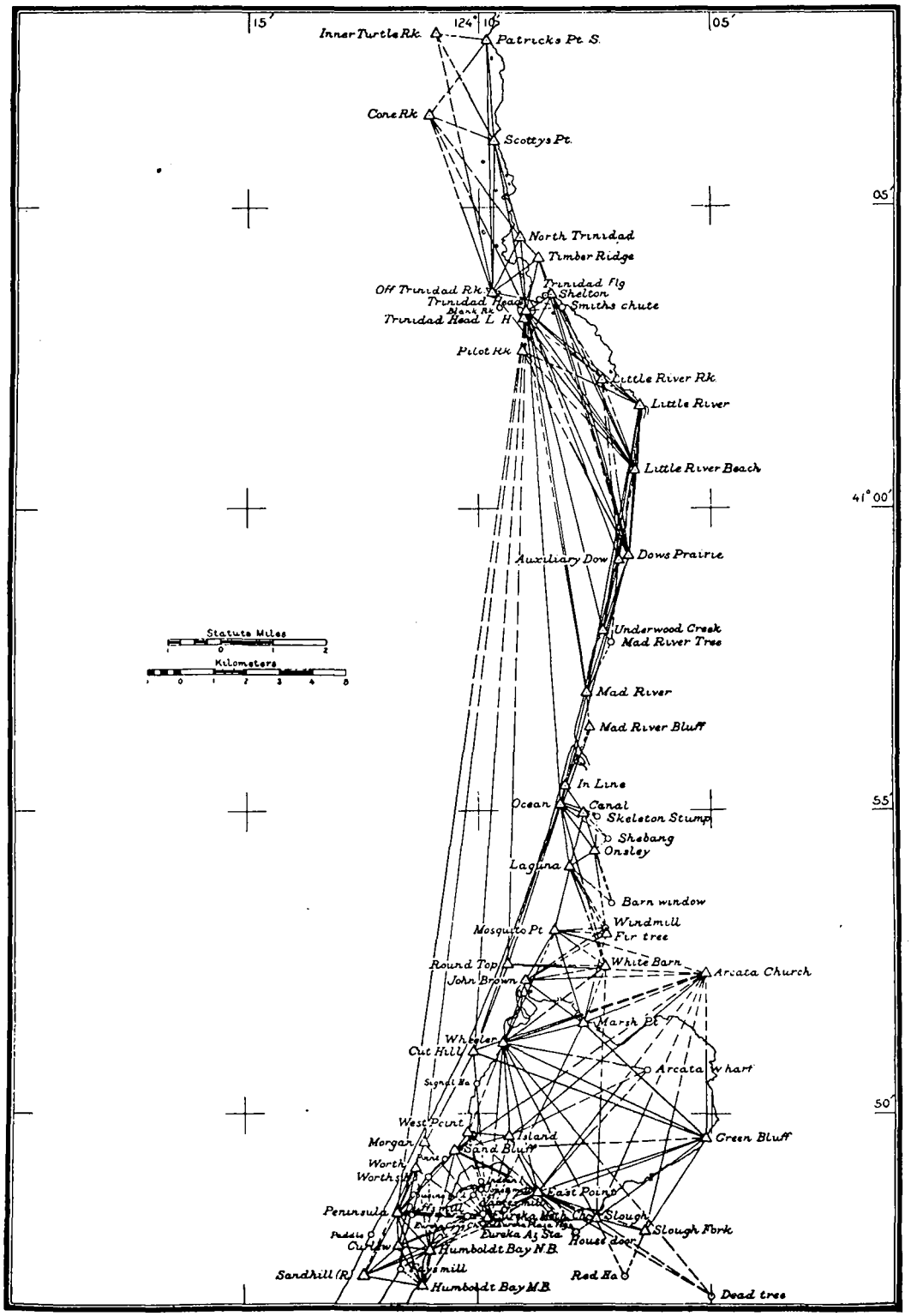
6348 1°—11——31



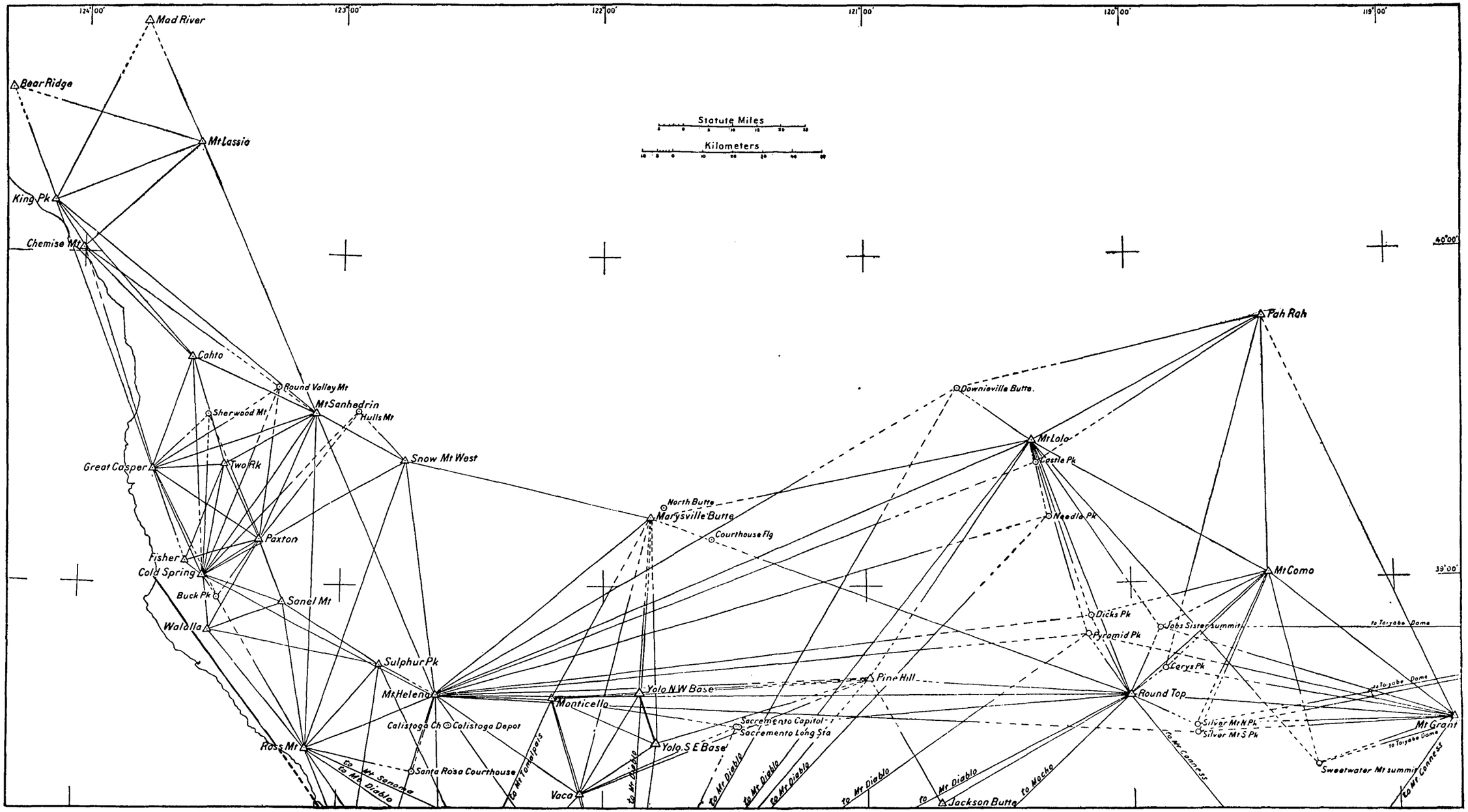
MATTOLE POINT TO OIL CREEK.



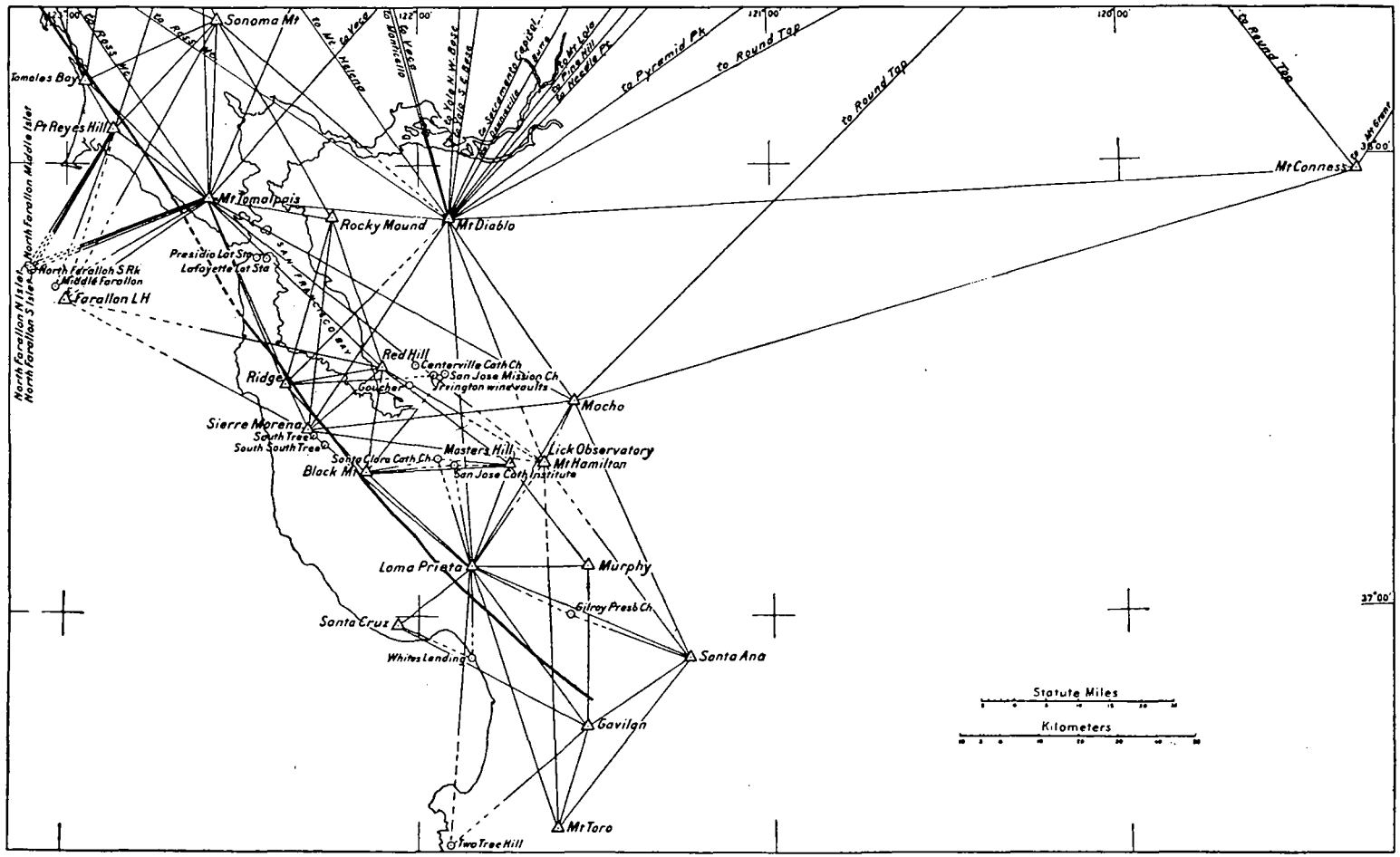
OIL CREEK TO HUMBOLDT BAY.



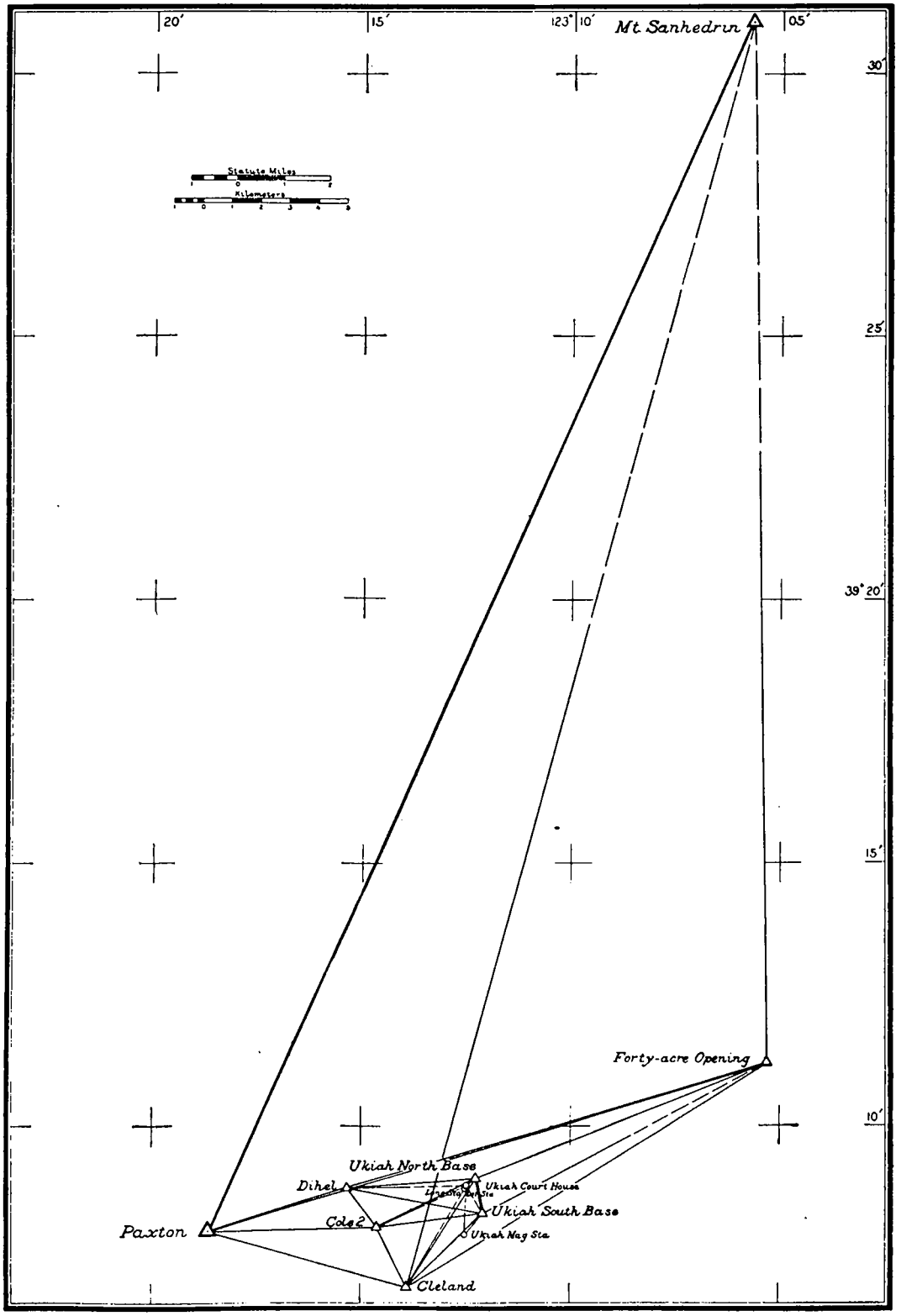
HUMBOLDT BAY TO TRINIDAD HEAD.



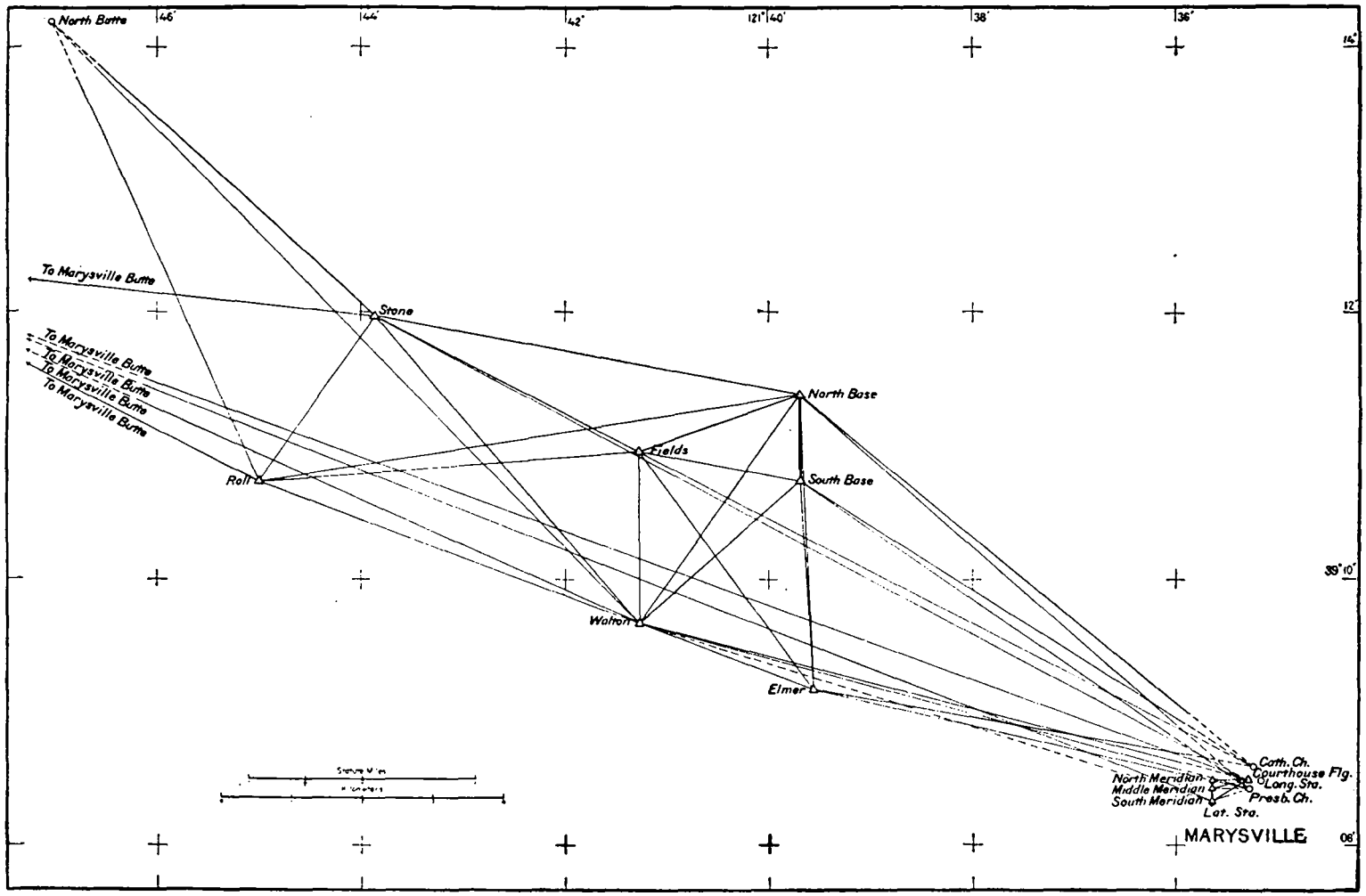
GENERAL SKETCH OF CALIFORNIA (NORTHERN PART).



GENERAL SKETCH OF CALIFORNIA (SOUTHERN PART).

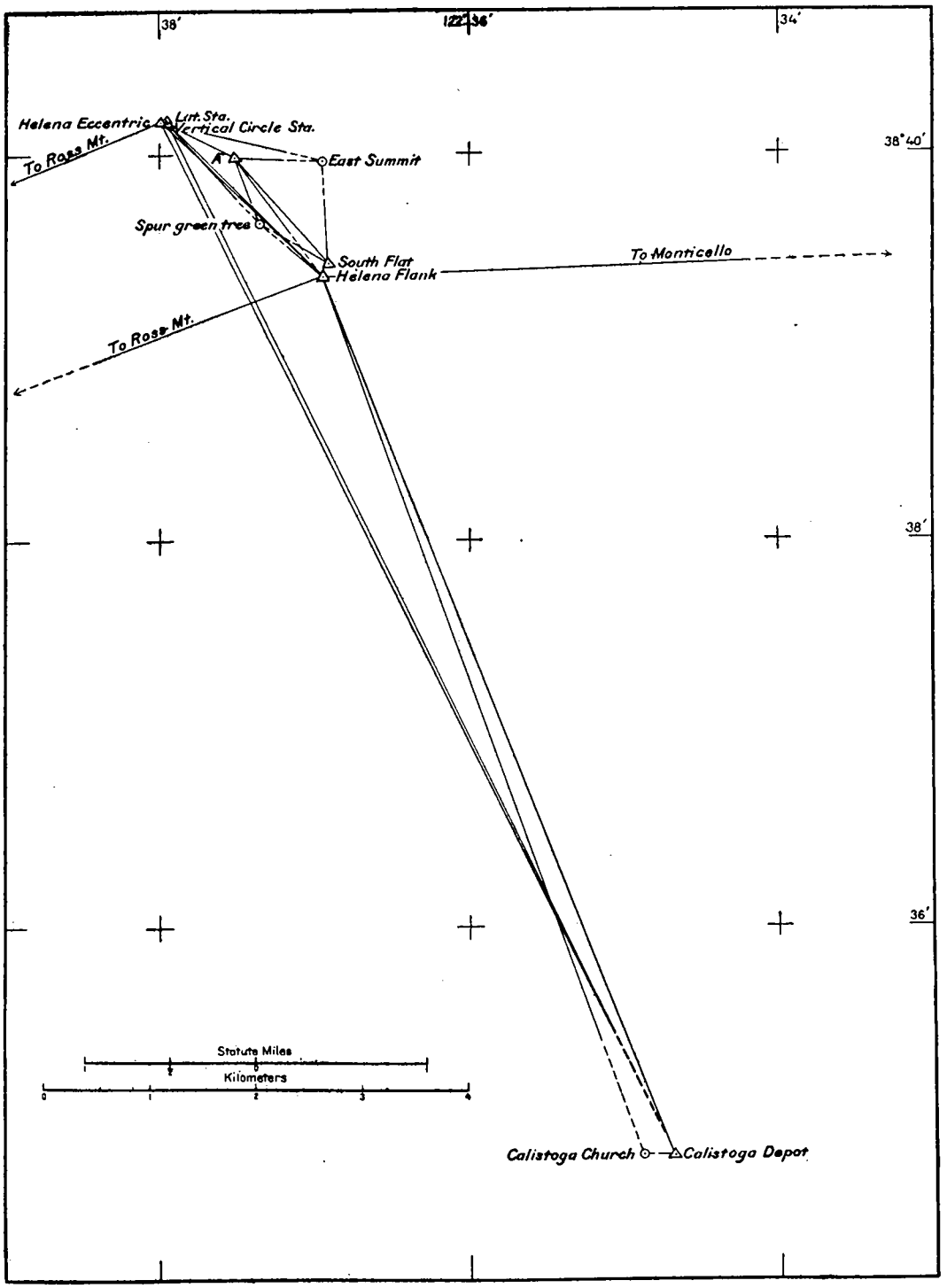

20′
15′
123° 10′
05′
Mt Sanhedrin
30′
25′
39° 20′
15′
10′
Statute Miles
Kilometers
Forty-acre Opening
Ukiah North Base
Dihel
Ukiah Court House
Ukiah South Base
Cole 2
Ukiah Mag Sta
Paxton
Cleland

UKIAH.

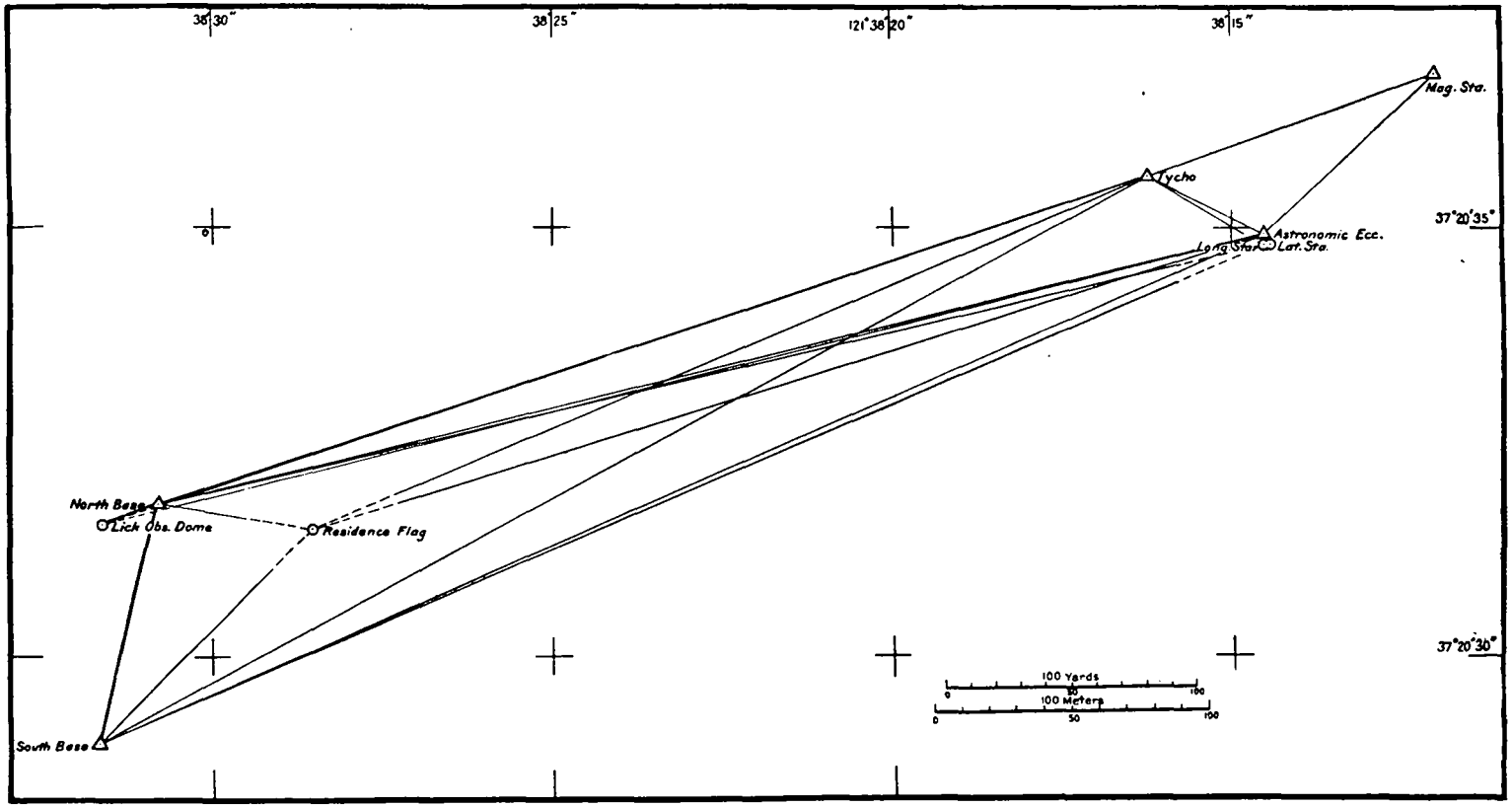

North Butte
46'
44'
42'
121°40'
38'
36'
14'
12'
39°10'
08'
To Marysville Butte
To Marysville Butte
To Marysville Butte
To Marysville Butte
To Marysville Butte
Stone
North Base
Fields
South Base
Roll
Walton
Elmer
Cath. Ch.
Courthouse Flg.
Long. Sta.
Presb. Ch.
North Meridian
Middle Meridian
South Meridian
Lat. Sta.
MARYSVILLE

MARYSVILLE.

No. 38.

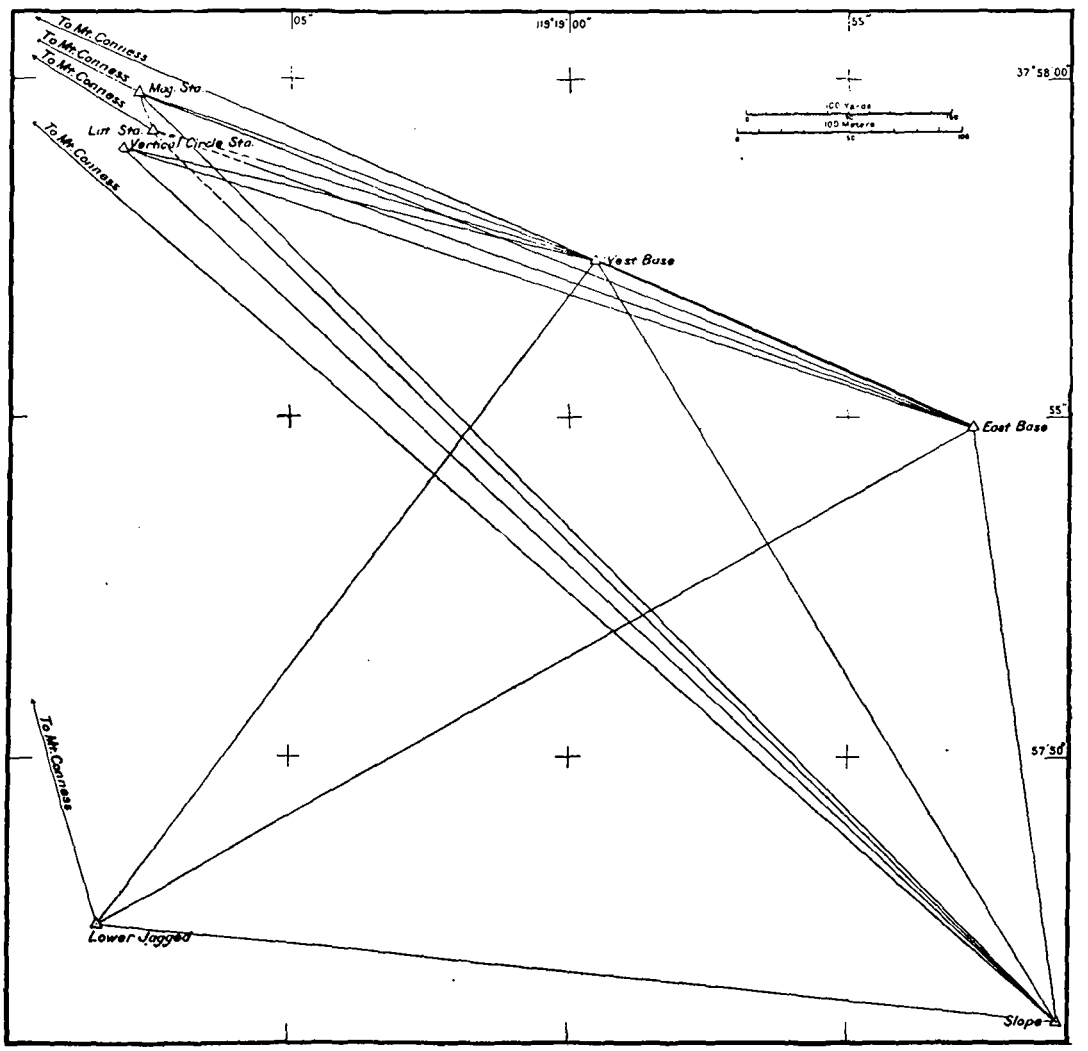


MOUNT HELENA.



MOUNT HAMILTON.

No. 40.



MOUNT CONNESS.

63481°—11——32

APPENDIX 6

REPORT 1910

THE MEASUREMENT OF THE FLEXURE OF PENDULUM SUPPORTS WITH THE INTERFEROMETER

By

W. H. BURGER

Assistant, Coast and Geodetic Survey

CONTENTS.

ILLUSTRATIONS.

THE MEASUREMENT OF THE FLEXURE OF PENDULUM SUPPORTS WITH THE INTERFEROMETER.*

By W. H. BURGER,

Assistant, Coast and Geodetic Survey.

The horizontal component of the force acting on the knife-edge through the swinging pendulum causes the support to move in unison with the pendulum, and thereby affects the period of the oscillation. This movement is the so-called flexure of the pendulum support.

This movement or displacement of the pendulum support is an exceedingly minute quantity, the measurement of which has been the subject of much investigation. Its effect upon the period of the pendulum has been more or less satisfactorily determined by various methods, such as by using an auxiliary pendulum which is set in motion by the oscillation of the support under the influence of the standard pendulum; by Hardy's Noddy, and by the static method used in recent years by the Coast and Geodetic Survey.

In the static method used for measuring the flexure of the support a horizontal pull of 1.5 kilograms was applied at the height of the knife-edge, and the resulting displacement was measured by means of a scale and microscope. In none of these methods was the measurement made of the actual displacement of the pendulum support due to the swinging pendulum. The correction for flexure was obtained through methods involving doubtful assumptions, as, for example, in the case of the static method heretofore used by the Coast and Geodetic Survey, it was assumed that the flexure correction was always proportional to the measured displacement, whereas this is not true when the 1.5 kilogram pull applied is sufficient to force the support beyond its limit of elasticity.

In general the apparatus used in the other methods is inferior to the apparatus used in the interferometer method, for with none of them can the measurements be made with such accuracy as with the interferometer.

To avoid the inaccuracies of the static method, Mr. John F. Hayford, Inspector of Geodetic Work of the Coast and Geodetic Survey, proposed the plan of using the interferometer to measure the absolute displacement of the support due to the oscillating

* After the investigations were made and the interferometer actually used at many gravity stations in the measurement of the flexure of the pendulum support, it was learned that practically the same method had already been used by another investigator. (See "Eine optische Methods zur direkten Messung des Mitschwingens bei Pendelbeebachtungen" von K. R. Koch, Leipzig, 1905. As far as can be learned, however, no observer or investigator has used the interferometer method in determining the flexure of the pendulum support at field stations, where observations must be made under widely different conditions and where speed in observing and simplicity of apparatus are important factors.

pendulum and to determine the effect of the displacement upon the period of the pendulum. To the writer was assigned the investigation and experimental work and the elaboration of plans for the use of the interferometer. In this, along both the theoretical and practical lines, much assistance was received from Mr. Hayford and from Mr. E. G. Fischer, Chief of the Instrument Division, and to them is largely due the success of the work.

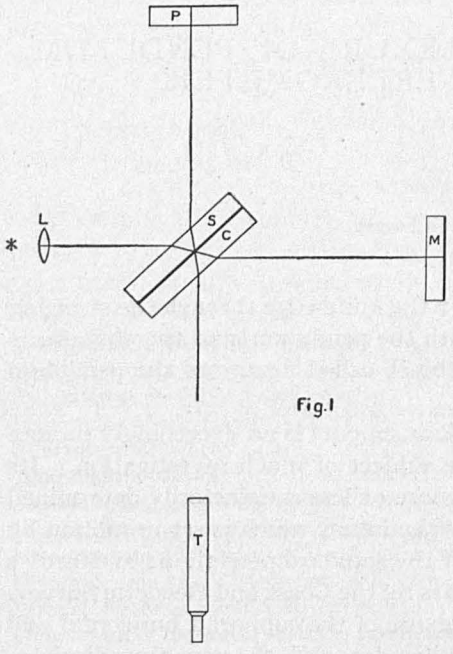
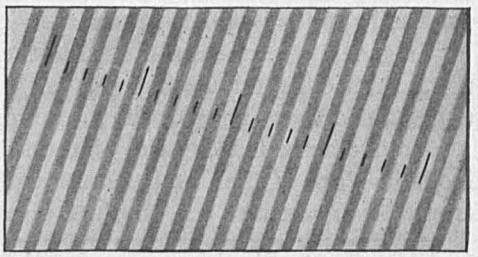


Fig. 1

The preliminary investigation was made in the fall of 1907 and was only carried far enough to prove that the proposed plan was feasible. Work was then suspended till the fall of 1908, when the final investigations and experiments were taken up. In the interval an interferometer to suit the requirements of the work was designed and constructed.

DESCRIPTION OF THE INTERFEROMETER.†

The principle of the interferometer is graphically shown in fig. 1. The beam from the source of light,* with its rays made practically parallel by a lens L, strikes the rear or second surface of the plate S, and separates, part of it being reflected to the plane mirror P, returning exactly on its path through S and then through C to T, where it is examined by a telescope. The other part of the ray goes through the glass plate S, passes through the glass plate C, and is reflected by the plane mirror M, returns on its path through C to the plate S, where it is reflected so as to unite with the first ray under conditions which produce interference. The resulting phenomenon is observed as a series of bands in the form of a grating, the dark band being produced when the two wave trains differ in phase by one-half wave length and the light bands when they meet in the same phase. The plane parallel glass C is introduced to compensate for the extra thickness of glass which the first portion of the ray has traversed in passing through the plate S. Without it the two paths would not be optically identical, because the first would contain more glass than the second.



Fringes and scale.

Some light is reflected from the front surface of the plate S, but its effect is rendered insignificant if the coating of silver covering the rear surface of that plate is of such thickness that nearly equal portions of incident light are reflected and transmitted.

† Adapted from description on page 40, "Light Waves and their Uses," by A. A. Michelson, University of Chicago Press, 1903.

The plane-parallel plates S and C are worked originally in a single piece, which is afterwards cut in two. The two pieces are placed parallel to each other, thus insuring exact equality in the two optical paths SP and SM.

The interferometer used by the Coast and Geodetic Survey in measuring the flexure of pendulum supports is a modified form of the interferometer described in "Light Waves and their Uses," by A. A. Michelson (pp. 40–41). A detailed description will not be given here, only the modifications and changes being noted. The instrument was designed by Mr. E. G. Fischer, Chief of the Instrument Division, and two instruments were constructed in the shops of the Survey under his direction. The optical parts were furnished by Dr. J. A. Brashear, of Pittsburg, Pa. In figs. 2 and 3 are shown the pendulum receiver and interferometer with accessories used in observing.

The separator plate and the compensator plate are not mounted in separate frames as in the form of interferometer described by Michelson, but are held together in the same metal frame (k, fig. 2), with the silvered surface of the separator plate within, and separated from the inner surface of the compensator plate by a narrow border of tin foil. Great care is taken in the preparation and mounting of this tin foil border in order to make sure the two plates are truly parallel. It also serves to seal the space between the two plates and thus furnish protection from moisture, gases, or other agents which might injure the delicate silvering of the separator plate.

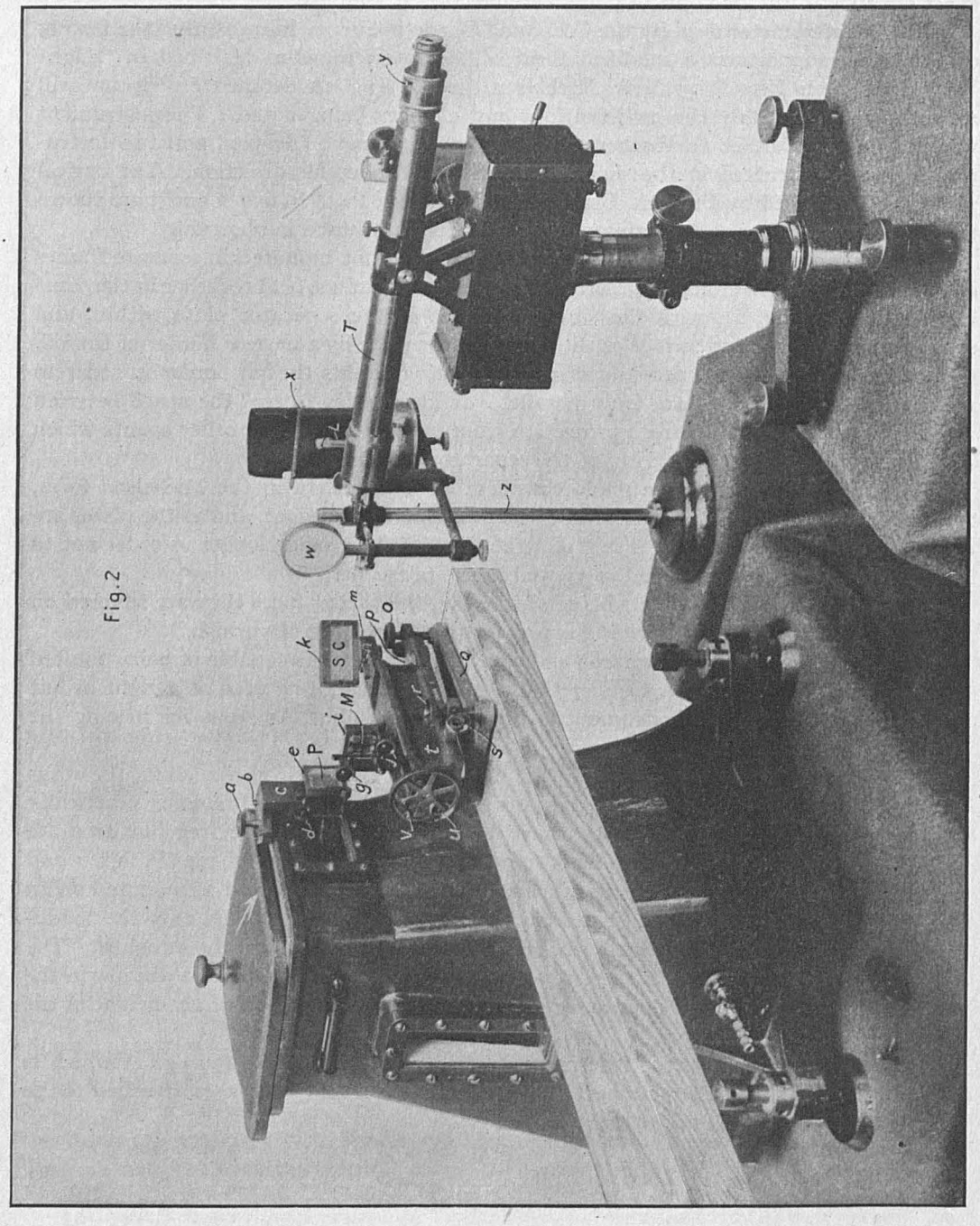
The frame and plates are made considerably longer than in the Michelson form, for, both plates being in the same frame, the frame must be deeper, and as the plates are at an angle of 45 degrees to the line of sight they must be made longer in order not to lessen the area of the fringe field as viewed in the telescope.

Instead of the plane mirrors being silvered on their front faces they are silvered on their back surfaces and the silvering is protected by a coating of varnish.

The frame holding the separator and compensator plates is capable of being rotated on its vertical axis in such a manner that the apparatus can be used as a right or left handed instrument. The instrument is furnished with abutting stops for placing the frame quickly in either position.

The carriage of the fixed mirror (M, figs. 1 and 2), which moves along the ways (c, fig. 3) and by means of which the two paths are made equal, remains practically unchanged, although special devices have been added for insuring free but accurate motion on the long screw controlling its motion. The other fixed mirror (P, figs. 1 and 2) is separated entirely from the metal base of the interferometer and is mounted on an arm (c, fig. 2) which is fastened by dowel pins and thumbscrew (a, b, fig. 2) to the pendulum receiver. The top of the receiver is removed before this arm can be attached. The arm when in place supports the mirror in a position directly in front of the window in the receiver through which coincidences or slit images are observed and at the height of the knife-edge.

The 3 foot-screws of the interferometer rest on a base plate (Q, fig. 2) which is fastened to the independent support. A small circular level (p, fig. 2) is attached to the interferometer for quick adjustment.



Pendulum case and observing apparatus with interferometer in position.

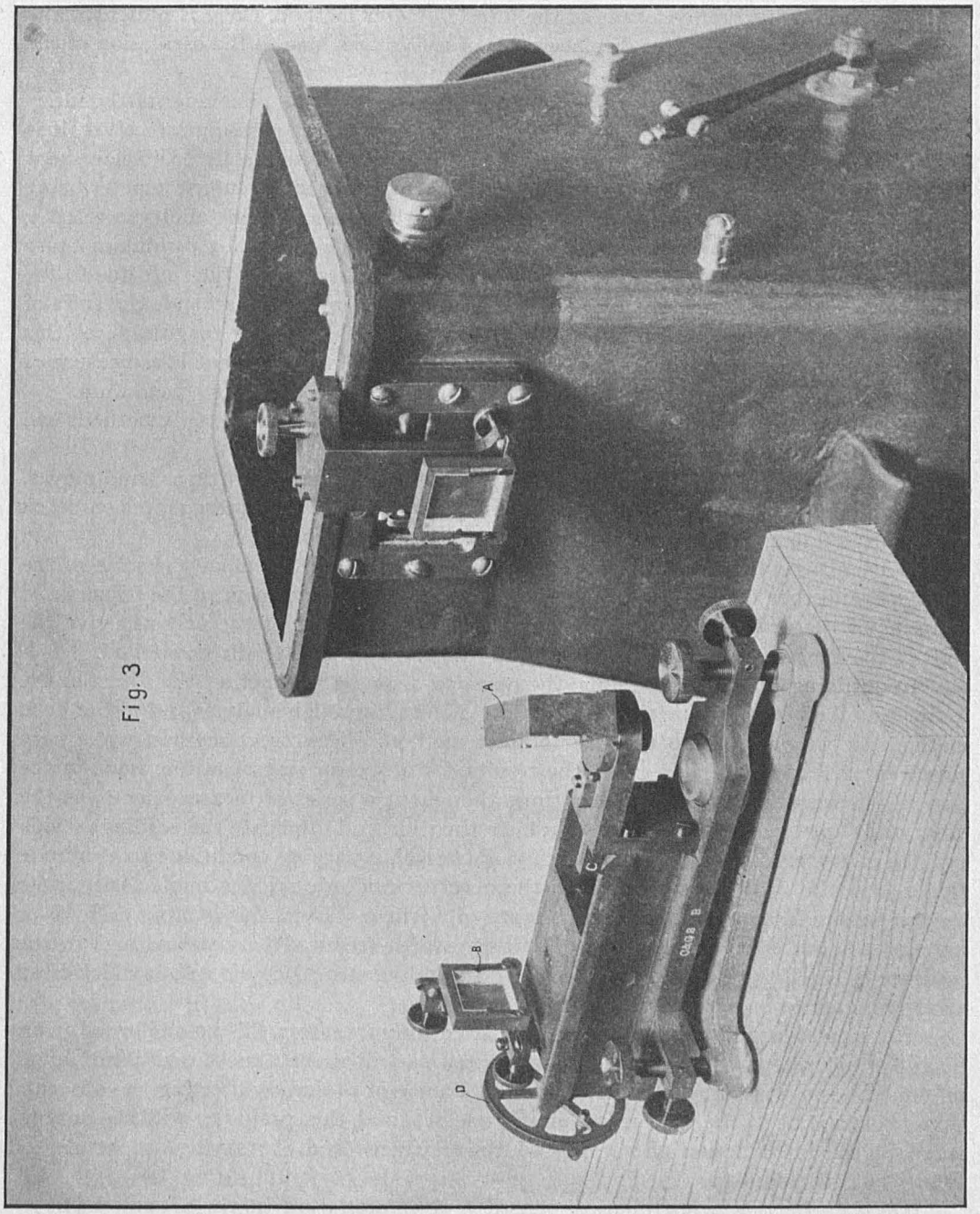


Fig. 3

The interferometer.

METHOD OF OBSERVING.

In observing flexure by means of the interferometer method, there is presented the problem of finding the shift, or displacement, of the fringes, due to the oscillation of the pendulum support, in terms of the width of one fringe.

As one mirror is attached to the pendulum receiver and the remainder of the interferometer is mounted on a support entirely independent of the pendulum receiver, it is easily seen that any movement in the pendulum case will cause a shift or displacement of the fringes in the interferometer. Owing to the two parts of the interferometer being mounted on separate and independent supports, and the consequent instability in relative position of its parts, vibrations from sources other than the oscillating pendulum cause shifting of fringes, but these are erratic and are seldom mistaken for the shift due to the pendulum. Since the pendulum makes one complete swing in 0.5 second, the shift of fringes will occur as a half-second shift across the field. It is the magnitude of this half-second movement which it is desired to measure. This movement is a measure of the amount of flexure in the pendulum case caused by the oscillating pendulum.

To find the amount of the shift, in terms of the width of a fringe, two methods can be used:

1. By observing the fraction of the fringe width over which any fringe band moves, using as a pointing line any line of the scale in the eyepiece of the observing telescope, as seen projected upon the fringe field. This is the direct method.

2. By observing the width of a fringe in terms of the divisions of the scale in the telescope, and then observing the amount of the shift or displacement of the fringe band in terms of the scale divisions. The second quantity divided by the first will give the shift of the fringes in terms of the width of a fringe. This is the indirect method.

In outlining a plan of observing, the question arose as to whether the direct or the indirect method of observing should be used. After a thorough analysis and test of both methods, it was decided to use the indirect method. The direct method while very simple, may lead to large errors in the results, for any error in estimation made in the first few observations is likely to continue thoughout a series of measurements, as the observer is apt to become prejudiced in his estimation and duplicate the readings which may be in error. There is little chance of introducing varying conditions to eliminate this. Also, the smallest reading which the observer can ordinarily estimate easily while the fringes are in motion is about one-tenth of a fringe. Even this is often difficult or impossible. An error of one-tenth of a fringe width (reduced to standard arc) in the measure of the flexure causes an error of 17 in the seventh place of period, which is an error too large to be allowed.

The second, or indirect method, is almost entirely free from this possibility of error. Such a variety of conditions can be introduced as will make almost every individual measure an independent one. There is little chance of prejudice affecting the observations, unless it be in the 5 measures of any one set, and this prejudice will be counteracted by the introduction of varying widths of fringes and of varying amplitudes of swings of the pendulum.

The following is a specimen of record and computation in the measurement of flexure as used in the field (station, Kerrville, Tex.; date, January 24, 1910):

Semiarcs		Total arc	Width of fringe			Movement of fringe			F=displacement per 5^{mm} arc	Result for flexure
			A	B	Diff.	A	A	Diff.		
mm	*mm*	*mm*	Scale divisions			Scale divisions				
9.8	9.7	19.5	2.2	5.6	3.4	3.0	3.6	.6	$\frac{.58}{3.18}+19.25\times 5$	.05
			1.0	4.2	3.2	1.0	1.5	.5	$=.05$	.05
			5.2	8.2	3.0	5.2	5.8	.6		.05
			2.3	5.3	3.0	1.0	1.6	.6		.08
		19.0	2.0	5.3	3.5	4.3	3.7	.6		.058 fringe per 5^{mm} arc
		19.25			3.18			.58		
		18.9	4.8	7.3	2.5	1.2	1.6	.4	$\frac{.44}{2.24}+18.65\times 5$	Correction = $5.8\times 1.73=10$ in seventh place of period of half-second pendulum
			3.5	5.7	2.2	3.8	4.2	.4	$=.05$	
			4.8	7.0	2.2	5.3	4.9	.4		
			6.2	8.3	2.1	4.8	4.3	.5		
9.2	9.2	18.4	5.0	7.2	2.2	5.0	5.5	.5		
		18.65			2.24			.44		
3.2	3.2	6.4	6.0	8.2	2.2	6.0	6.2	.2	$\frac{.14}{2.22}+6.30\times 5$	
			4.9	7.0	2.1	5.1	5.2	.1	$=.05$	
			4.6	7.0	2.4	3.0	3.1	.1		
			6.0	8.2	2.2	3.0	3.2	.2		
		6.2	5.6	7.8	2.2	1.1	1.2	.1		
		6.30			2.22			.14		
		6.2	2.2	6.0	3.8	1.8	2.2	.4	$\frac{.38}{3.70}+6.10\times 5$	
			1.2	4.8	3.6	1.3	1.0	.3	$=.08$	
			1.0	4.8	3.8	2.0	1.6	.4		
			0.8	4.5	3.7	3.1	3.5	.4		
3.0	3.0	6.0	2.1	5.7	3.6	3.0	3.4	.4		
		6.10			3.70			.38		

PROGRAMME OF OBSERVING.

The programme of observing flexure, by means of the indirect method of using the interferometer, is as follows:

Having adjusted the interferometer in position, and obtained fringes of maximum brightness, the fringe-width is made rather broad, say, 3 to 4 scale divisions, the adjustment for fringe-width being made with the fine adjusting screws (*d*, *g*, *j*, fig. 2) attached to the mounting of each mirror. The width of fringe depends upon the angle at which the two rays meet. This angle is changed by changing the position of the reflecting mirrors. The arc of oscillation of the pendulum is made rather large, say, from 6 to 9 millimeters for the semiarc. The reason for making both fringe-width and arc large will be explained further on.

The semiarcs are read and recorded as above.

The reading scale in the eye end of the observing telescope is set so that it is approximately at right angles to the fringe bands. (See p. 434.) The shift or displacement of the fringes will thus be in the direction of the length of the scale.

The fringe motion is watched for a short period to recognize the half-second shift of the fringes, due to the half-second beat of the pendulum and to accustom the eye to the wavering field. Similarly placed points or lines on any two adjacent black (or yellow) bands are selected for use in measuring the fringe width. The writer's experience has shown the best part of the bands to be the line or edge of the black band, for the observer can easily select this line or edge and keep it in sight.

Before reading, care should be taken that the observer does not touch the flash apparatus or its support, for any motion of it will cause an apparent motion of the fringes and thus not only make observing more difficult, but cause errors in the readings.

Having selected the two fringe lines, their positions are read on the scale at the instant they reach the one limit of their motion as they shift under the action of the oscillating pendulum. The difference between the scale readings of the two lines will give the fringe-width in scale divisions. With practice the positions of both of these lines can be read at the same time, provided the fringe-width is not too great. In case the observer has difficulty in reading the scale for both lines at the same instant as they reach the extreme limit of their shift, a good plan is to read for one line, and then when the next half-second shift in the same direction comes read for the second line. (See *A* and *B*, column 2, p. 439.) The first line is read again, and if this reading is very close to the first reading the first and second readings are recorded as being the scale divisions reached by the two lines. The third reading is only a check upon the stability in position of the various parts of the interferometer for the period between the readings.

It should be noted that the divisions of the scale are in sets of five, but without any figures. In reading, it is convenient to consider any fifth, or long line, as the zero line. This will usually make all readings less than 10.

Immediately after the above readings have been made the reading should be made of the positions reached by one of the chosen fringe lines, in the two extreme positions of its shift under the action of the swinging pendulum. (See A and A, column 3, p. 439.). Their difference will give the amount of shift or displacement of the fringe in terms of the scale divisions.

These two differences are the quantities sought and constitute one measure. Four others, or five measures in all, are made as quickly as possible, then the width of fringe is made narrow (about 2 divisions of scale), and five more measures are made and the semiarcs read. Each five measures constitute a set, and the mean of a set is used in computing one value for the flexure of the support.

When the fringe-width is small, any error in estimating tenths of scale divisions causes large errors in the flexure value, for, assuming the shift to be only two-tenths of a scale division, an error of one-tenth in estimation will cause the resulting value of flexure to be in error by 50 per cent. When the fringe-width is large, an error of one-tenth of a scale division will cause a proportionally smaller error. For this reason it was suggested to begin with a "rather broad" fringe-width. However, if the fringes are made too broad, it is difficult to observe, for their shading from dark to bright bands is so gradual that no definite points can be chosen for observing. When the observer reaches the set where the fringe-width is small, he is better fitted to read them more accurately.

Having obtained two sets as described, two more sets are taken, beginning with a small arc (preferably about 5 mm. total arc) and small fringe-width, and changing the fringe-width back to the large width between the third and fourth sets. The fringe-width, when beginning the third set, may be left as it was at the end of the second set, if desired.

The arcs are read at the beginning of the first and third sets, and at the ends of the second and fourth sets. An interpolation is made between the readings of the first and second sets, and between the third and fourth sets, in order to find the mean total arc for each set. The interpolation is made under the assumption that the observations are made with uniform speed and that the decrease in arc is proportional to the elapsed time.

In the reduction of observations it is necessary to reduce the flexure value for each set to what it would have been had the standard arc been used in each case. With a change of arc there is a proportional change in the horizontal force applied to the knife edge, and therefore a proportional change in the flexure of the support. In the actual observations it is not advisable to use an arc of only one magnitude, hence when measures are made with various arcs they must all be reduced to the same standard arc. An arc of 5.0 millimeters was chosen as a standard when the coefficient of flexure was determined, and consequently all measures in the field should be reduced to that standard.

In case the four sets do not give the required accuracy, additional sets with other arcs and fringe-widths should be obtained. Unless the conditions are very poor, there is no difficulty in obtaining the desired accuracy with four sets, the accuracy required being such that the resulting value obtained should not be in error by more than the one-twentieth of one fringe width. Throughout nearly twenty months of work by the writer, in no case was it found necessary to make more than the four sets, providing observing was possible at all.

The observer is not forced to follow exactly the method of observing outlined above. It is the result of observations for a considerable period, and is one which combines in a minimum of operations nearly a maximum of conditions. Whatever system is employed, the endeavor should be made to introduce many conditions as to widths of fringes and amplitude of arcs.

In making the different measures of any set it is well to use fringes in different parts of the fringe field. By doing so different readings of the scale are obtained and advantage is taken of the slight variation which may exist in the several fringe-widths of a fringe field.

The time necessary in making a complete measurement of the flexure value, such as is given above, will vary for different observers, different conditions of mounting the pendulum case and interferometer, and the influence of vibrations from causes outside the interferometer and pendulum case. The observer should accustom himself to make the readings of the fringe-width and fringe movement, in terms of the scale divisions, as rapidly as possible, the one to follow the other with little loss of time. If much time elaspes the fringe-width may change and the ratio of the fringe-width to the fringe motion will not indicate the true flexure existing in the support.

During the observations the observer and the recorder, if there is one, should remain as quiet as possible in order not to cause any erratic movements of the fringes. Should there be any marked erratic vibrations the observer must keep close watch and make the observations in the lulls which occur. These lulls may occur for only a second or two, and therefore the observer must accustom himself to read at a glance and not to hesitate much. It is better to have an error of a tenth of a division than to lose readings, providing the error is of the accidental class.

If the fringe field is fairly stable, the observations can be made with great ease and rapidity, and it is not difficult to make the observations almost as fast as one can record.

Sometimes the wind pressure on the buildings, traffic in near-by streets, or people walking in the building may cause such intense vibrations that the half-second oscillation can not be detected, and, indeed, they may sometimes be so strong as to cause the fringes to disappear entirely or cause them to shift so rapidly that no observations are possible. In order to fully comprehend the foregoing and to gain some idea of the sensitiveness of the instrument and the minuteness of the quantity to be measured, it is noted that the flexure when using a good mounting of the pendulum support varies from about 0.06 to 0.10 fringe, corresponding to an actual displacement of the pendulum support of from 0.017 to 0.029 microns. If it is not possible to remedy the conditions by changes in the independent support it will be necessary to delay observations to a time when the wind dies down, when traffic in the street is at a minimum, or when people are quiet or out of the building.

Much annoyance can be saved if the alcohol flame is protected from drafts, for when it flares very much the fringe field may be blurred too much for observing.

In changing the fringe-width between sets only the very slightest touch should be given to the adjusting screws, in order not to cause the fringes to disappear entirely, and thus cause delay in finding them again.

In using the flash apparatus in pendulum observations it is placed about 2 meters from the receiver. In using the telescope of the flash apparatus for flexure measurements it may be necessary to increase the distance from the receiver in order to focus accurately upon the fringe field, for in viewing the slit image the telescope is focused upon an object which is nearly twice as distant as is the fringe field.

Also, when observing coincidence of images the scale in the eye end of tne telescope is thrown out of focus in order not to interfere with distinct vision of the slit images. When observing flexure this scale is made clear and distinct by means of the sliding eyepiece tube of the telescope.

It will be found necessary to lower the telescope of the flash apparatus for flexure observing. A higher mounting of the telescope in necessary in pendulum work than is necessary in interferometer work, for in observing coincidence the telescope is pointed at the image of the slit, the slit itself being below the telescope and in the face of the box of the flash apparatus, while in observing the shift of fringe the telescope is pointed horizontally at the compensator and separator glasses, at which point the fringe field is formed.

As the fringes may appear at any angle with the vertical through the instrument, the scale in the eye end of the observing telescope is mounted so that it can easily and quickly be rotated about the optical axis of the telescope. To make this rotation, it is only necessary to turn, by means of a projecting pin, the movable collar which is located between the eye piece and the focusing screw of the telescope.

ADJUSTMENT OF FRINGES.

When hunting for fringes—that is, when manipulating the fine adjustment screws so that fringes will be formed in the interferometer—it may happen that a very fine set of fringes will make its appearance. This is a secondary set of fringes, probably caused by the very thin film of air between the separator and the compensator glasses. These secondary fringes will be very straight unless distortion or optical defect exists in the two plates.

The fringes which are sought will seldom be straight on first appearance, but will be found in the form of parts of concentric rings and may occur with almost any width and of varying intensity. In adjusting for observation the fringes should be made straight and have the maximum brightness. This adjustment is made by turning the long screw by means of the small wheel with handle and milled edge which is placed at the opposite end of the interferometer from the separator and compensator plates (*D*, Fig. 3). The delicate motion necessary to complete this adjustment should not be made with the handle, but by using the rim of the milled wheel, and after each fraction of a turn the hand should be taken from the wheel to permit the instrument to come to rest. The wheel should be turned while close watch is kept of the movement of the fringes and it should be turned so that the shift of fringes is in the direction in which lies the center of the series of concentric fringe bands. As the wheel is turned in this direction the fringes become straight, and, finally, if the motion is continued, the curvature of the fringes will be in the opposite direction, showing that the desired position of straight fringes has been passed. When this occurs the motion should be reversed until the desired position is obtained and the fringes are straight. In seeking this position it will be noted that the fringes alternately become brighter and dimmer as the wheel is turned. The position of maximum brightness occurs when the paths of the two rays providing interference are equal. This is also the position for straight fringes. This position should always be sought, for observations are more easily made with bright and straight than with dim and curved fringes.

TEMPERATURE CONTROL.

In the determination of the intensity of the force of gravity it is very desirable and essential that the observer select a location having a small range of temperature; therefore, in general, the temperature control of the various parts of the interferometer and support will be very good and few stresses, etc., will be set up which might cause undue shift of fringes. However, the wood or other material from which the interferometer independent stand is to be constructed should be placed inside the building some time before it will be needed, in order that it may attain the approximate temperature of the pendulum room. Wood which is moist should be avoided. Any changes in the independent stand due to absorption or evaporation of moisture will cause a slow but constant shift of the fringes, and generally in one direction. This makes observing very difficult, and without using special caution may cause errors in the results.

SODIUM LIGHT, WAVE LENGTH, ETC.

In the use of the interferometer it is essential that a monochromatic light be used, for it is necessary to know the wave length. In selecting a monochromatic light to use with the interferometer the sodium light was chosen, for it could very easily be obtained by the use of sodium chloride and an alcohol flame.

If the fringes shift or are displaced by one fringe-width due to the motion of the pendulum, it is easily seen that the pendulum case has moved through a distance equal to one-half the wave length of the light used, for a change of distance between the thinly silvered plate and the mirror on the pendulum case causes a change in the total path of the ray to and from that mirror by double the amount, so that if the length of

the wave of light used is known we have a means of computing the movement of the case.

The wave length of the sodium light is practically 0.58 micron, and therefore a shift or displacement of the fringes by an amount equal to one fringe-width means a displacement of the pendulum case of 0.29 micron.

There is furnished with each interferometer an alcohol lamp and stand with lens and glass tube, asbestos fiber (L, z, w, x, Fig. 2), and sodium chloride to produce the sodium flame, for the value of the flexure coefficient is based upon the value of the wave length of sodium light.

INDEPENDENT SUPPORT FOR THE INTERFEROMETER.

By means of the rotating frame holding the half-silvered mirror or separator and the compensator glass the interferometer can be used as a right or left handed instrument; that is, it can be used with flame to the right or the left of the interferometer. This permits of a wide range in form of support for the interferometer, which is of great importance in fieldwork, for the pendulum receiver is mounted in various places, and were the interferometer not capable of being used in both positions its mounting would often be attended with great difficulty.

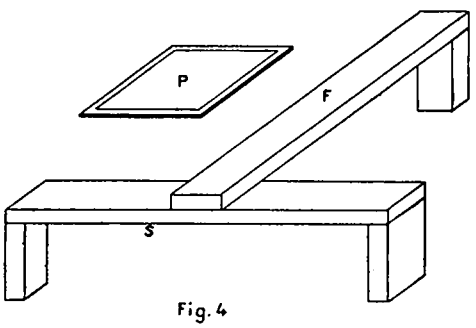


Fig. 4

P = Pendulum case
F = Position of glass plates and mirrors of interferometer
S = Position of sodium flame

As the conditions existing at each gravity station may be such as to demand a special form of interferometer support, no description can be given for a form which will suit every station. In general, however, a modification of one of the typical forms described below can be used.

Type 1.—Best fitted for flexure measures when the pendulum pier is rather high, when the pier is at some distance from the walls of the room, and when the pier is so constructed that vibrations are not communicated to the ground close to the pier. This form of support consists, essentially, of three legs in the form of a tripod, with a head large enough to hold the interferometer. The legs can be sunk into the ground near the pier or else fastened by plaster of Paris to the floor in front of the pier. In all forms avoid resting the stand on wooden flooring, if the observer is compelled to work on this same flooring.

Type 2.—To be used when the pendulum receiver rests upon a concrete floor or low pier and conditions are such that the vibrations may be communicated from the pendulum support to the independent support of the interferometer. This form (see fig. 4) consists of a beam supported by uprights close to the manometer window and parallel to the plane of oscillation of the pendulum. A second beam, at right angles to this, has one end supported by an upright and the other end resting on the first beam. This second beam is the one upon which the interferometer is mounted. The interferometer should be placed far enough from the receiver so that the distance from the center of the separator and comparator frame to the mirror on the receiver will fall within the variable distance between the movable mirror and the center of the separator and compensator frame. If needed to make the stand more rigid, braces may be nailed to

the beam and upright at each point of support. It will often be found advisable to weight the stand with bricks, pails of sand, etc., to increase its stability. Care must be taken that the supports rest far enough away from the receiver so that there is no chance of vibration being communicated to it by the pendulum. In case the receiver is near to a wall the beam may be attached to the wall, but wind pressure against the side of the building may be great enough to make observing difficult when this is done, for the wind pressure may make the wall vibrate, but not the floor. This form of stand may be modified as shown in fig. 5. Other conditions being equal, however, that type of stand should be used which will permit the observer to have room to start the pendulum swinging and to read the arc.

Whatever type of stand is constructed the top of the support at the position where the interferometer is to be mounted should be about 4¾ inches below the top of the receiver when the cover is off and so placed that, when the interferometer is resting upon it, the distance from the mirror on the receiver to the center of the frame holding the thinly silvered mirror and the compensator fall within the variable distance between the movable mirror and the center of that frame.

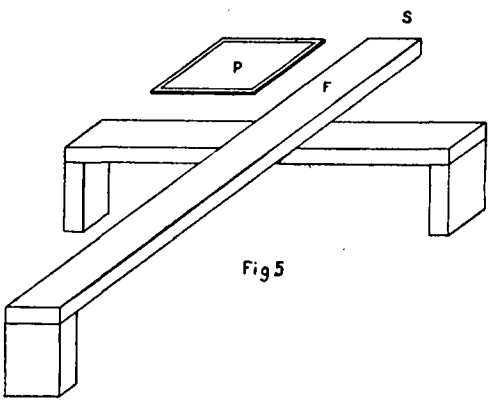


Fig 5

MOUNTING AND ADJUSTMENT OF THE INTERFEROMETER.

The base plate of the interferometer can be affixed to the support by plaster of Paris, beeswax, or screws, or it may simply rest on the support. Plaster of Paris should not be used if the base plate is to be fastened to wood, for moisture should be avoided. By means of the leveling screws the instrument is adjusted to the right height, which can be quickly determined by sighting along the top of the separator frame and the top of the mirror on the receiver; these should be at the same height. The center of the separator frame should be directly in front of the center of the mirror on the receiver and the long axis of the interferometer approximately parallel to the face of the mirror on the receiver. By means of the long screw the movable mirror should be placed the same distance from the center of the separator frame as is the mirror on the receiver, in order to make the two paths from the separator to the two reflecting mirrors equal, a condition essential in using the interferometer. This is easily done by placing one leg of a pair of dividers in the small hole (*A*, fig. 3) on top of the frame and the other leg alternately to the two small mirrors whose distances are to be made equal.

The sodium flame and the lens should be adjusted for elevation and direction so that, when looking through the thinly silvered glass into the mirror on the receiver, the field is a uniform sodium flame color, or at least that part of it bounded by the circular image of the lens. Two distinct images and one faint image of this lens will be seen. By shifting the interferometer and its base and by using the leveling screws the two brighter images should be made to overlap approximately; then the leveling screws should be clamped. In the field there will be found images of the small ink spot which is on the center of the face of the thinly silvered mirror. The two images of this spot

should be used in the final adjustment of the coincidence of the images, which adjustment should be made by means of the fine motion screws controlling the motion of the two reflecting mirrors. When the two images are made to coincide exactly, it is well to check the distance of the two mirrors from the center of the separator glass, making corrections if necessary.

Then comes the problem of causing the fringes to appear in the field, and this requires care and patience. If the above adjustments have been made accurately, the fringes may quickly be found. No set rules can be given for the production of the fringe field, as it is largely a matter of experiment in each individual case. With the two images overlapping, as described above, by using first one and then the other of the two fine adjustment screws on the interferometer mirror the spots are made to separate slightly in various directions from the coincident position. If great difficulty is had in finding the fringes, the cause may be in the lack of stability in position of the support or in the incorrect adjustment of the movable mirror. The stability of the support can often be tested by a slight tapping with the finger. If satisfactory, it should show no vibration. The adjustment of the movable mirror may be changed a trifle, but not more than a small fraction of a turn.

When the fringes have been found, they should be made bright and straight and of the desired width as described on pages 439 and 443; the telescope and scale should be adjusted as described on page 442, the pendulum set to swinging, and observations made in accordance with the plan previously outlined.

The lid should be on and close up to the arm of the receiver mirror, as this was the position when the flexure coefficient was determined, and it is desirable that observation for flexure be made in the field under the same conditions as when the coefficient was determined.

It is to be noted that the measurements of flexure are made with case not exhausted, while pendulum observations are made with receiver exhausted to 60 mm. pressure. However, it is believed that there is no error introduced into the results, for it is difficult to see how flexure could be changed by exhausting the case.

DETERMINATION OF THE COEFFICIENT OF FLEXURE.

The method used to determine the coefficient for flexure correction to the pendulum period was the method first used by Airy and employed since by most observers.

In determining the coefficient for flexure of the supports in terms of the period of the pendulum by this method, simultaneous swings of two different pendulums were observed, the periods of each being determined by using the same two chronometers to operate both flash apparatus. The pendulums were swung on separate piers, and under nearly identical conditions except for flexure. One was kept swinging as a standard with no change of conditions, while the other was swung under constant conditions except for varying flexibility of the support, suitable conditions having been determined by a preliminary investigation with the interferometer. The work was divided into "runs," each run being independent as far as observations were concerned. The pendulums were swung in nominally eight-hour periods, with no renewal of pendulums, each run with not less than six swings and each beginning and ending with a time set. When all corrections had been applied to the period of the standard pendulum, the flexure being constant throughout the run, the variation from the mean period of the run shown by the individual swings was assumed to be due to the variation in rate of the chronometer

for the periods covered by the individual swings and to whatever small observational errors might be present. As the period of the other pendulum was approximately the period of the standard pendulum, it was assumed that its individual periods had the same corrections due to rate as the corresponding period of the standard pendulum.

When these corrections had been applied to the swings of the pendulum having varying flexures, it was found that the periods obtained for the various swings differed. It was assumed that this variation was caused by the variation in flexure conditions and that the change in period was proportional to the displacement of the support and therefore proportional to the flexure as expressed in terms of the fringe width. (See table of results below.)

In determining the coefficient for flexure correction the following programme of observation was used, observations being made in manner described:

Run A.—Pendulum A_4, under standard conditions, and B_4, under standard conditions except with changes in flexure conditions, as follows: Swings 1 and 2, small flexure; 3 and 4, large flexure;. 5 and 6, medium flexure.

Run B.—Same as Run A, except B_4 under standard conditions and A_4 under varying changes of flexure.

Run C.—Like Run A, with A_5 in place of A_4 and B_5 in place of B_4.

Endeavor was made to vary flexure conditions enough to obtain many points at various places on the flexure curve.

The following table shows the results obtained:

Pendulum B_4.

Small flexure		Large flexure		Difference		Result
Flexure	(Period corrected except for flexure)	Flexure	(Period corrected except for flexure)	Flexure	Period	
Fringe		*Fringe*		*Fringe*		
0. 10	0ˢ.5008099	0. 37	0ˢ.5008166	.....	.....	0. 01 F=2.13*
.08	8117	.....	.....	.....	.....	
.07	8099	.....	.....	.....	.....	7th place of period
Mean 0. 083	0. 5008105	0. 370	0. 5008166	0. 287	0ˢ.0000061	
Pendulum A_4.						
0. 06	0. 5008409	0. 322	0. 5008438	.....	.....	0. 01 F=1.32
.12	8400	.....	.....	.....	.....	7th place of period
.06	8411	.....	.....	.....	.....	
Mean 0. 080	0. 5008406	0. 322	0. 5008438	0. 242	0. 0000032	
Pendulum A_5.						
0. 09	0. 5006635	0. 26	0. 5006649	.....	.....	0. 01 F=1.50
.....	.....	.28	6674	.....	.....	7th place of period
Mean 0. 09	0. 5006635	0. 27	0. 5006662	0. 18	0. 5000027	

*$\frac{\text{Difference in period}}{\text{Difference in flexure}}$ or $\frac{61}{28.7}$

Results weighted according to the differences in flexure give for a final mean 0.01 F = 1.73.

The value 0.01 F = 1.73 for correction to period in seventh place was adopted as the flexure coefficient for the two sets of pendulums. As the range of period is small, it is sufficiently accurate to consider this coefficient a constant quantity and the correction proportional to the flexure of the support as obtained in fringes.

INTERFEROMETER AS A FIELD INSTRUMENT.

Although the interferometer was used in the measurement of the flexure of pendulum supports for about twenty months under the varying conditions found in field work, there were exceedingly few cases where measures could not be taken on account of excessive erratic vibrations. Traffic on the streets and wind pressure on the buildings were the principal agents causing a delay. Observing for flexure was mostly done at night, immediately after the close of the pendulum observations. Usually there was little, if any, traffic to hinder work at that time, and the fringes were generally stable enough for the observations to be made without difficulty.

COMPARISON OF THE STATIC WITH THE INTERFEROMETER METHOD.

In regard to the relative value of the interferometer method as compared with the static method of determining flexure, which had been previously employed in gravity work by the Survey, it is believed the former has enough advantage over the latter to warrant its continued use. The following statements are based mostly on a comparative test of the two methods made at Washington and at various stations in the field.

While the static method is a little more simple, there is but little gain in time over the interferometer method. The interferometer can always be used under conditions where the static method can be used, except in cases of extreme flexibility of support; but this condition is seldom met in actual gravity work.

The static method, due to the limit of power of the microscope, may easily give results which may be in error by as much as .1 micron (if not more), corresponding to an error of 6.5 in the seventh place of period. The interferometer method gives results far more accurate, the results, it is believed, rarely being in error by more than 2 in the seventh place of period.

The use of the dynamic method is preferred to the static method, as the theory connecting the static measurements and the actual dynamic conditions under which gravity observations are made is not considered satisfactory.

Prejudice in observing is practically eliminated by the interferometer method, for by changing arc and fringe-width many conditions are introduced, and the method of observing in terms of scale divisions and on various parts of the scale tend to protect the observer against such error. This is not the case with the static method, where the observer may easily duplicate erroneous readings.

PECULIAR FEATURES OF THE FLEXURE OF THE PENDULUM SUPPORT.

In the preliminary work, when making tests with the interferometer, some very interesting facts were discovered in regard to flexure of the pendulum supports. The details of these experiments are not given, but can be found in the archives of the Survey. Only the results are given here.

(*a*) The flexure of the concrete pier at the Coast and Geodetic Survey Office produced by the pendulum swinging through an arc of 5 mm. is less than the limit of measure by the interferometer, and therefore it can be said that no correction for it is necessary.

(*b*) When mounted in the best possible manner on this pier, the center of rocking of the pendulum case was found to be 3.75 inches above the capstone of the pier for an arc of 5 mm.

(*c*) It was found that the displacement of the pendulum support, when the pendulum was swinging through an arc of 5 mm., was one-ninety-fifth of the displacement produced by the 1 500-gram weight used in the static method, both measurements of displacements being made with the interferometer. The computed theoretical result obtained was 1:91 as the ratio existing between the displacement caused by the two forces, showing a marked agreement with the value found by experiment.

(*d*) The measures by the old, or static, method may be in error by as much as 1 micron, corresponding to an error of 6 in the seventh place of period, for 1 micron is the smallest reading possible with the apparatus.

(*e*) In addition to the rocking or rotary motion about a horizontal axis in the support due to the swinging pendulum, there occurs also a very small rotary motion about a vertical axis, for the pendulum is supported at a point slightly eccentric to the center of the case. This movement is too small to be appreciable under working conditions.

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ALPHABETICAL INDEX.

(Exclusive of Appendices 3–6.)

Y.

Distribution of the principal astronomic stations occupied by the U.S. Coast and Geodetic Survey for Latitude, Longitude and Azimuth to June 30, 1910

U. S. Coast and Geodetic Survey

O. H. Tittmann, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

Statute Miles 100 50 0 100 200 300 400

Kilometers 100 50 0 100 200 300 400 500 600 700 800

Explanation of Signs:
- Latitude Stations
- Longitude "
- Azimuth "
- Combination Stations

125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65°

45° 40° 35° 30° 25° 20°

115° 110° 105° 100° 95° West from Greenwich 90° 85° 80° 75°

Positions and Connections of Telegraphic Longitude Stations from 1846 to June 30 1910

U. S. Coast and Geodetic Survey.

O. H. Tittmann, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

Statute Miles

Kilometers

Station connection without change of observers and without the use of the transit micrometer

West from Greenwich

Routes of Geodetic Spirit Leveling
and
Positions of Gravity and Tide Stations
to June 1910

D O M I N I O N O F C A N A D A

W A S H I N G T O N

O R E G O N

C A L I F O R N I A

N E V A D A

I D A H O

M O N T A N A

W Y O M I N G

U T A H

C O L O R A D O

A R I Z O N A

N E W M E X I C O

N O R T H D A K O T A

S O U T H D A K O T A

N E B R A S K A

K A N S A S

O K L A H O M A

T E X A S

M I N N E S O T A

I O W A

M I S S O U R I

A R K A N S A S

L O U I S I A N A

W I S C O N S I N

I L L I N O I S

M I C H I G A N

I N D I A N A

O H I O

K E N T U C K Y

T E N N E S S E E

M I S S I S S I P P I

A L A B A M A

G E O R G I A

F L O R I D A

S O U T H C A R O L I N A

N O R T H C A R O L I N A

V I R G I N I A

W E S T V I R G I N I A

P E N N S Y L V A N I A

N E W Y O R K

M A I N E

V E R M O N T

N E W H A M P S H I R E

M A S S A C H U S E T T S

C O N N E C T I C U T

R H O D E I S L A N D

L A K E S U P E R I O R

L A K E M I C H I G A N

L A K E H U R O N

L A K E E R I E

L A K E O N T A R I O

P A C I F I C O C E A N

A T L A N T I C O C E A N

G U L F O F M E X I C O

C U B A

B A H A M A I S L A N D S

Olympia
Portland
Sacramento
Carson City
Gold
Prescott
Santa Fe
Albuquerque
Helena
Butte
Boise City
Pocatello
Salt Lake City
Cheyenne
Denver
Crawford
Bismarck
Huntley
Pierre
St. Paul
Madison
Lincoln
Des Moines
Topeka
Jefferson City
Springfield
Lansing
Indianapolis
Columbus
Frankfort
Nashville
Charleston
Harrisburg
Washington
Richmond
Raleigh
Columbia
Atlanta
Montgomery
Tallahassee
Jackson
Baton Rouge
Little Rock
Guthrie
El Reno
Jerico
Fort Worth
Baird
Austin
Albany
Boston
Providence
Hartford
Augusta
Montpelier
Concord
Nassau
Habana
Kingston
Mexicos

U. S. Coast and Geodetic Survey

O. H. Tittmann, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

Statute Miles 100 50 0 100 200 300 400

Kilometers 100 50 0 100 200 300 400 500 600 700 800

Gravity stations

The location of Tide Stations are shown thus;
Where series of Observations of 1 to 3 years
" " " " 3 to 9 "
" " " " 9 and more years
The letter d affixed to the symbol indicates that daily predictions for that station are given in the Tide Tables.

120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65°

West from Greenwich

45° 40° 35° 30° 25° 20°

Positions of Magnetic Stations
occupied to June 30 1910

D O M I N I O N O F C A N A D A

W A S H I N G T O N
O R E G O N
C A L I F O R N I A
N E V A D A
I D A H O
M O N T A N A
W Y O M I N G
U T A H
C O L O R A D O
A R I Z O N A
N E W M E X I C O
N O R T H D A K O T A
S O U T H D A K O T A
N E B R A S K A
K A N S A S
O K L A H O M A
T E X A S
M I N N E S O T A
I O W A
M I S S O U R I
A R K A N S A S
L O U I S I A N A
W I S C O N S I N
I L L I N O I S
M I C H I G A N
I N D I A N A
O H I O
K E N T U C K Y
T E N N E S S E E
M I S S I S S I P P I
A L A B A M A
G E O R G I A
F L O R I D A
S O U T H C A R O L I N A
N O R T H C A R O L I N A
V I R G I N I A
W E S T V I R G I N I A
P E N N S Y L V A N I A
N E W Y O R K
M A I N E
V E R M O N T
N E W H A M P S H I R E
M A S S A C H U S E T T S
C O N N E C T I C U T
R H O D E I S L A N D

L A K E S U P E R I O R
L A K E M I C H I G A N
L A K E H U R O N
L A K E E R I E
L A K E O N T A R I O

P A C I F I C O C E A N
A T L A N T I C O C E A N
G U L F O F M E X I C O
M E X I C O
L O W E R C A L I F O R N I A
B A H A M A I S L A N D S
C U B A

Olympia
Portland
Helena
Butte
Bismarck
Huntley
Boise City
Pocatello
Salt Lake City
Carson City
Sacramento
Cheyenne
Crawford
Denver
Pierre
Sioux Falls
Madison
Des Moines
Lincoln
Topeka
Springfield
Jefferson City
Lansing
Indianapolis
Columbus
Frankfort
Nashville
Harrisburg
Albany
Augusta
Montpelier
Concord
Boston
Providence
Hartford
Trenton
Washington
Richmond
Charleston
Raleigh
Columbia
Atlanta
Montgomery
Tallahassee
Jackson
Baton Rouge
Little Rock
Fort Worth
Baird
Austin
El Reno
Guthrie
Jerico
Santa Fe
Albuquerque
Prescott
Gila
Nassau
Habana
Kingston
Mexico

U. S. Coast and Geodetic Survey

O.H.Tittmann, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

Statute Miles 100 50 0 100 200 300 400

Kilometers 100 50 0 100 200 300 400 500 600 700 800

125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65°

45° 40° 35° 30° 25° 20°

95° West from Greenwich

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UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
JUNE 30 1910
Western Sheet
Scale 1/5,000,000
Statute Miles
50 40 30 20 10 0 50 100 150 200
EXPLANATION OF SYMBOLS
Primary Triangulation
Secondary / Tertiary Triangulation
Reconnaissance
Surveyed Topography
do. In-shore Hydrography
do. Off-shore do.
Lines of Deep Sea Soundings
do. Geodetic Levelling
125°
120°
115°
110°
105°
100°
45°
40°
35°
30°
25°
20°
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
LOWER CALIFORNIA
MEXICO
PACIFIC OCEAN
Cape Flattery
Vancouver
Victoria
Port Townshend
Everett
Seattle
Tacoma
South Bend
Astoria
Portland
Dalles
Salem
Empire
Roseburg
Grants Pass
Cape Mendocino
Eureka
Sacramento
San Francisco
Carson City
Pt. Conception
Santa Barbara
Guadalupe I.
Cerros I.
Cape San Lazaro
La Paz
Cape San Lucas
Guaymas
Coolee City
Spokane
North Yakima
Pasco
Umatilla
Walla Walla
Lewiston
Baker City
Boise
Shoshone
Pocatello
Logan
Ogden
Salt Lake City
Provo City
Panguitch
Kingman
Coffs
Flagstaff
Prescott
Holbrook
Missoula
Helena
Virginia City
Shelby
Great Falls
Glascow
Lewistown
Miles City
Buford
Bismarck
Aberdeen
Watertown
Pierre
Chamberlain
Yankton
Bellefourche
Deadwood
Sheridan
Lander
Douglas
Crawford
Alliance
Rawlins
Green River
Cheyenne
Julesburg
North Platte
Columbus
Denver
Grand Junction
Leadville
Colorado Springs
Pueblo
Monticello
Durango
Conejos
Trinidad
Colby
Scott
Dodge City
Salina
Wichita
Guthrie
El Reno
Santa Fe
Albuquerque
Socorro
Roswell
Amarillo
Jericho
Juarez
El Paso
Baird
Fort Worth
Dallas
Waco
Lampasas
Austin
San Antonio
Port Lavaca
Rockport
Corpus Christi
Eagle Pass
Laredo
Presidio del Norte
Chihuahua
Matamoras
Rio Grande
Monterey
Tampico
Mazatlan
San Blas
Cape Corrientes
Manzanilla
MEXICO
Vera Cruz

115° 110° 105° 100° 95° 90°

50° 45° 40° 35° 30° 25° 20°

Spokane
Lewiston
Walla
Missoula
Shelby
Great Falls
Helena
Glascow
Butte
Lewistown
MONTANA
Miles City
Bismarck
NORTH DAKOTA
Grand Forks
Fargo
Duluth
LAKE SUPERIOR
MINNESOTA
Aberdeen
Watertown
St. Paul
St. Peters
WISCONSIN
Fond du Lac
Madison
Milwaukee
Prairie du Chien
Dubuque
Boise
Shoshone
Pocatello
IDAHO
Sheridan
Bellefourche
Deadwood
Pierre
SOUTH DAKOTA
Chamberlain
Sioux Falls
Yankton
Sioux City
Lander
WYOMING
Douglas
Crawford
Logan
Rawlins
Green River
Alliance
Salt Lake City
Provo City
Cheyenne
North Platte
Julesburg
NEBRASKA
Columbus
Omaha
Lincoln
Des Moines
Davenport
Rock Island
Peoria
ILLINOIS
Keokuk
Quincy
Springfield
Denver
Grand Junction
Colorado Springs
Pueblo
Canyon
Colby
Atchison
Topeka
KANSAS CITY
Junction City
Salina
Jefferson City
MISSOURI
Panguitch
Monticello
Durango
Conejos
Trinidad
Scott
KANSAS
Dodge City
Wichita
Cairo
Kingman
Flagstaff
Prescott
Holbrook
Santa Fe
Albuquerque
Socorro
ARIZONA
NEW MEXICO
Amarillo
Jericho
El Reno
Guthrie
OKLAHOMA
INDIAN TERR.
Memphis
ARKANSAS
Little Rock
Helena
MISSISSIPPI
Texarkana
Greenville
Dallas
Fort Worth
Baird
Shreveport
Vicksburg
Jackson
Natchez
Waco
Lampasas
TEXAS
Austin
Baton Rouge
NEW ORLEANS
Port Arthur
Houston
Galveston
Port Lavaca
Rockport
Corpus Christi
Laredo
Brownsville
Rio Grande
Matamoras
Monterey
Eagle Pass
Presidio del Norte
Juarez
El Paso
Chihuahua
Guaymas
Lazaro
La Paz
Cape San Lucas
Mazatlan
San Blas
Cape Corrientes
Manzanilla
MEXICO
GULF OF MEXICO
Tampico
Vera Cruz
Coatzacoalcos
Campeche
Frontera

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UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
JUNE 30 1910
Eastern Sheet
Scale 1/5,000,000
Statute Miles
50 40 30 20 10 0 50 100 150 200
EXPLANATION OF SYMBOLS
Primary Triangulation
Secondary Tertiary } Triangulation
Reconnaissance
Surveyed Topography
do. In-shore Hydrography
do. Off-shore do.
Lines of Deep Sea Soundings
do. Geodetic Levelling
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
INDIAN TER.
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S. CAROLINA
NORTH CAROLINA
VIRGINIA
W. VIRGINIA
PENNSYLVANIA
NEW YORK
MARYLAND
VERMONT
NEW HAMP.
MASS.
CONN.
R.I.
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
GULF OF MEXICO
MEXICO
YUCATAN
CUBA
BAHAMA
ATLANTIC
Axis of the Gulf Stream - Warmest Water
Bismarck
Pierre
Aberdeen
Chamberlain
Sioux Falls
Yankton
Sioux City
Omaha
Lincoln
Columbus
North Platte
Julesburg
Alliance
Crawford
Deadwood
Bellefourche
Buford
Grand Forks
Duluth
St. Paul
St. Peters
Madison
Milwaukee
Fond du Lac
Dubuque
Prairie du Chien
CHICAGO
Des Moines
Davenport
Rock Island
Peoria
Keokuk
Quincy
Springfield
Atchison
Topeka
KANSAS CITY
Jefferson City
Colby
Scott
Dodge City
Wichita
Guthrie
El Reno
Amarillo
Jericho
Greenville
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Fort Worth
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Lampasas
Austin
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Galveston
Port Arthur
Port Lavaca
Rockport
Corpus Christi
Eagle Pass
Laredo
Rio Grande
Matamoras
Monterey
Tampico
MEXICO
Vera Cruz
Coatzacoalcos
Frontera
Campeche
Progreso
Cape Catoche
Belize
Texarkana
Shreveport
Little Rock
Helena
Memphis
Corinth
Cairo
Vicksburg
Jackson
Natchez
Baton Rouge
NEW ORLEANS
Mouths of the Mississippi
Mobile
Pensacola
Apalachicola
Tallahassee
Montgomery
Birmingham
Atlanta
Macon
Augusta
Savannah
Brunswick
Fernandina
Jacksonville
St. Augustine
Keys
Cape Canaveral
Tampa
Punta Gorda
Miami
Tortugas
Key West
HAVANA
Cienfuegos
C. San Antonio
Santiago
Nassau
Charleston
Georgetown
Columbia
Wilmington
Newberne
Cape Hatteras
Raleigh
Norfolk
Richmond
Lynchburg
Fredericksburg
Charleston
Nashville
Chattanooga
Huntsville
Louisville
Frankfort
Lexington
Madison
Evansville
Terre Haute
Indianapolis
Logansport
Fort Wayne
CINCINNATI
Columbus
Zanesville
Wheeling
Cumberland
WASHINGTON
BALTIMORE
Annapolis
Pittsburg
Harrisburg
Reading
PHILADELPHIA
Trenton
Atlantic City
NEW YORK
Williamsport
Erie
Cleveland
Toledo
Detroit
Lansing
Grand Rapids
Saginaw
Buffalo
Rochester
Oswego
Toronto
Ogdensburg
Ottawa
MONTREAL
QUEBEC
Albany
Poughkeepsie
Springfield
Hartford
New London
Providence
BOSTON
Concord
Portland
Augusta
Rockland
Bangor
Montpelier

UNITED STATES

COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1910

Eastern Sheet

Scale 5.000000

Statute Miles

50 40 30 20 10 0 50 100 150 200

EXPLANATION OF SYMBOLS

Primary Triangulation

Secondary } Triangulation
Tertiary }

Reconnaissance

Surveyed Topography

.....do.....In-shore Hydrography

.....do.....Off-shore.....do.....

Lines of Deep Sea Soundings

.....do.....Geodetic Levelling

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ETCHED PLATE No. 2388

UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
ALASKA
JUNE 30, 1910

Gravity stations	⊙
Latitude determinations	●
Longitude "	⊕
Azimuth "	↘
Tidal observations	∩∩∩
Magnetic observations	⊛
Triangulation	△△△
Topography	▒▒▒
Hydrography	▒▒▒
Deep-sea soundings	5 5 5 5

Scale 5,000000

Statute Miles
100 50 0 100 150 200

Nautical Miles
100 50 0 50 100 150 200

East from Greenwich | West from Greenwich

148° 152° 156° 160° 164° 168° 172° 176° 180° 176° 172° 168° 164° 160° 156° 152° 148° 144° 140° 136° 132° 128° 124° 120° 116°

64° 60° 56° 52°

ARCTIC OCEAN
SIBERIA
BERING STRAIT
C. Prince of Wales
Pt. Barrow
C. Lisburne
C. Hope
Kotzebue Sd.
Norton Sound
St. Lawrence I.
St. Michael
St. Matthew I.
Nunivak I.
Kuskokwim Bay
BERING SEA
Pribilof Islands
ALEUTIAN ISLANDS
BRISTOL BAY
Kodiak I.
ALASKA
YUKON R.
Porcupine R.
Ft. Egbert
Dawson
YUKON DIST.
BRITISH COLUMBIA
Mt. St. Elias
Alexander Archipelago
DIXON ENTRANCE
Queen Charlotte Is.
GULF OF ALASKA
NORTH PACIFIC OCEAN

GENERAL PROGRESS SKETCH

D.

HAWAIIAN ISLANDS

(Hawaiian Government Surveys also shown)

Triangulation
Topography
Hydrography
Deep Sea Sdgs. ++++
Longitude determination (telegraphic)

JUNE 30, 1910

PORTO RICO

Primary triangulation
Secondary and tertiary triangulation
Topography
Hydrography

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UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS

PHILIPPINE ISLANDS

JUNE 30, 1910

Latitude determinations
Longitude " (telegraphic)
Azimuth "
Tidal observations
Magnetic observations
Triangulation
Topography
Hydrography
Deep sea soundings ××××

Formosa
Batan Islands
CHINA SEA
PACIFIC OCEAN
SULU SEA
PALAWAN
BORNEO
MINDANAO
Panay
Negros
Cebu
Bohol
Leyte
Samar
Mindoro
LUZON
Aparri
Laoag
Tuguegarao
Vigan
Candon
S. Fernando
Baguio
Bolinao
Dagupan
Casiguran
Cruz
Tarlac
Baler
Iba
Subic
Manila
Mariveles
Lucena
Batangas
Boac
Calapan
Paluan
Romblon
Masbate
Calbayog
Catbalogan
Borongan
Tacloban
Ormoc
Guiuan
Cuyo
San Jose
Iloilo
Cuion
Puerto Princesa
Cagayan Sulu
Sandakan
Jolo
Siasi
Bongao
SULU ARCHIPELAGO
Zamboanga
Cotabato
Davao
Mati
Cagayan
Misamis
Iligan
Dumaguete
Tagbilaran
Lianga
Hinatuan
Virac
Tabaco
Legaspi
Sorsogon
Lucena
Atimonan
Infanta
Mariveles
Cuyo
Tayabas
Na Caceras
Laoang
Taft
Borongan
Guiuan
Ormoc
Cebu
Tagbilaran
Dapitan
Malabang
Jolo
Siasi
Bongao

117° 118° 119° 120° 121° 122° 123° 124° 125° 126° 127°
22° 21° 20° 19° 18° 17° 16° 15° 14° 13° 12° 11° 10° 9° 8° 7° 6° 5°

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Mercator projection $5\frac{1}{000000}$ *in lat. 13° N.*