DEPARTMENT OF COMMERCE AND LABOR

REPORT OF THE SUPERINTENDENT

OF THE

COAST AND GEODETIC SURVEY

SHOWING

THE PROGRESS OF THE WORK

FROM

JULY 1, 1908, TO JUNE 30, 1909

WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

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 22, 1909.

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, 1909. It is accompanied by maps illustrating the general advance in the operations of the Survey up to that date.

Respectfully,

CHARLES NAGEL,
Secretary.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
COAST AND GEODETIC SURVEY,
Washington, September 20, 1909.

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, 1909. 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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REPORT OF THE SUPERINTENDENT.

WORK OF THE YEAR.

FIELD WORK.

The usual progress has been 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 to the coasts under the jurisdiction of the United States.

The coasts of the United States have been surveyed for all the practical purposes of chart making at the dates on which the work was completed, and the work now consists in perfecting this fundamental basis by such supplemental surveys as are necessary to define all natural changes and to indicate those due to the artificial improvement of the numerous harbors, and also to meet the demands of commerce due to the increased draft of vessels. It is impracticable to make the first survey of any important portion of the coast in such a way that it would meet any and all demands that might be made by the future development of commerce, on account of the usual pressure for quick results and also on account of the prohibitive cost of such work. As a result, only a working basis is attempted at first, and future demands must be met by supplemental surveys. Good progress has been made in charting the unsurveyed coasts of the Philippine Islands, and about 10 per cent of the estimated extent of the coasts was covered during the year, in cooperation with the insular government, which brings the total extent of the coast surveyed in this way to 38 per cent of the whole. Spanish and other surveys are available over an additional 10 per cent of the coast, and this gives a grand total of approximately half the coast for which charts can be published to meet the present demands of commerce.

Slower progress has been made in surveying the vast extent of coast line included within the Territory of Alaska, owing to climatic conditions under which the work must be done which prevent work during a great portion of each year, and to the comparatively small available force of vessels and men engaged on this survey.

The first survey in Porto Rican waters has been completed except for a small amount of offshore hydrographic work.

The extension of the coasts assigned by law to the bureau for charting purposes has been so rapid in recent years that it has been taxed to the limit of physical and financial endurance in order to meet the urgent demands made upon it, and it is gratifying to state that no reasonable complaint in regard to the progress of the work has been made.

The long wire drag, now in use by the Survey, has been considerably modified and improved during the year. The use of this or some similar apparatus is believed to be the only certain way of definitely determining whether any body of water is free from dangers to navigation or of discovering all existing dangers. One form of the drag has been described in an appendix to a previous report, and a report upon the improvements recently made is in preparation for publication.

Details in regard to all 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 demarkation of the Alaska boundary, are given in the following paragraphs and in other portions of this publication.

The inspection and numbering of the monuments erected along the United States and Canada boundary west of the Rocky Mountains was continued and completed up to Point Roberts.

A party began to establish reference monuments on the United States shore along the water boundary west of Point Roberts.

Progress was made in the work of surveying and marking the same boundary east of the Rocky Mountains in the following localities, viz, on the eastern slope of the mountains, along the Pigeon River at the west end of Lake Superior, along the eastern boundary of Maine, and along the St. Croix River. Each portion of the work mentioned above was in progress on June 30 by parties of United States surveyors.

In the demarkation of the Alaska boundary in southeast Alaska monuments were established marking the crossing of the Alsek River, and a vista was opened along the line for a short distance on both sides of the river. Progress was made in opening and marking the line in the vicinity of the Unuk and Leduc rivers.

On the one hundred and forty-first meridian the line was located to a point 195 miles south of the Yukon River, the triangulation was completed to a point 138 miles south, and the topographic survey to a point 90 miles south. In this connection attention is again called to the importance of providing for a triangulation down the Yukon River from the boundary to the mouth, as recommended in my preceding report, to form a connected line of geographic positions down the valley of one of the great rivers of the world as a basis for all future surveys and to correlate detached portions of work already authorized in this region in the economic investigation of the country.

Work at the latitude observatories at Gaithersburg, Md., and at 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 Wicomico and Worcester counties was completed and reports covering the work were prepared and published.

The triangulation of the city of New York by the corporation under the direction of an officer of the Coast and Geodetic Survey was completed and the results have been published by the corporation. As a result of this cooperation between the city authorities and this bureau the much-needed coordination of the geographic positions previously determined from independent bases within the limits of Greater New York

was accomplished at a very small cost to the Government, as the entire expense except the salary of the officer who directed the work was paid by the corporation.

Supplementary work to accomplish the result referred to above would eventually have been done and the request for cooperation was gladly complied with as an economic proposition from our point of view, and the chief engineer of the city in the publication containing the results of the work makes the gratifying statement that "the arrangement under which this work has been carried out has proven most satisfactory and economical to the city of New York." Geographic positions were established and marked at numerous points within the city limits which will be preserved under the protection of the corporation and will serve as a basis of any work which may be needed in this locality for all time to come.

In response to a request from the governors of the States of Louisiana and Mississippi, and under the authority of the Secretary of Commerce and Labor, an officer located and marked the water boundary between these States as established in a decree of the United States Supreme Court. This boundary is the deep-water sailing line emerging from the most eastern mouth of Pearl River into Lake Borgne and extending through the northeast corner of Lake Borgne north of Half Moon or Grand Island; thence east and south through Mississippi Sound, through South Pass between Cat Island and Isle au Pitre to the Gulf of Mexico, as marked on certain charts used by the court.

Astronomic observations to determine latitude, longitude, or azimuth were made in Alaska, British Columbia, Kansas, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Dakota, Pennsylvania, Texas, Washington, and Wisconsin.

Observations to determine the relative force of gravity were made with a half-second pendulum at nine stations distributed as follows: One in the District of Columbia, three in Florida, one in Louisiana, one in Texas, one in Oklahoma, one in Tennessee, and one in South Carolina.

Attention is called to the use of an interferometer, suitably modified, in the determination of the flexure of the pendulum support as described in general terms in connection with the detailed statement of field work in Appendix 2 under the head of "Gravity observations."

The Standard levels were extended in Arizona, California, Montana, Nebraska, South Dakota, Utah, and Wyoming.

Topographic surveys were made in California, Louisiana, Maryland, New Hampshire, New York, North Carolina, Virginia, and Washington.

Triangulation was done in California, Florida, Louisiana, Maine, Maryland, Massachusetts, New Hampshire, New York, North Carolina, Oregon, Texas, and Washington. In Texas the primary triangulation was extended 325 miles west from the triangulation along the ninety-eighth meridian. Additional connections were made between the primary triangulation along the Coast Range of mountains in Oregon with the tertiary triangulation along the coast, and the geographic positions of all aids to navigation were determined.

The recovery of old triangulation stations, with supplementary triangulation including the determination of the geographic positions of aids to navigation, was continued along the coast of Massachusetts, Connecticut, Maryland, North Carolina, and the west coast of Florida. This work was completed along the east coast of Florida and the

Florida Keys to Key West. The extension of the Florida East Coast Railway is in operation to Knights Key, 45 miles east of Key West, and is being rapidly completed to Key West.

A great many of the tidal channels between the keys have been closed entirely and at others only a narrow channel has been left. In a few places wide spaces have been left open, but even in these spaces the piers for the arches of the Long Key Viaduct and the bridge piers elsewhere have broken the wide tidal openings into 60-foot spaces and the tidal flow is much affected. This wholesale interference with natural conditions must cause material modifications of the existing banks and eventually of the shape and extent of the keys, with more or less radical changes in the tides and tidal currents.

The investigation of the navigable waters on the coast of Maine and in the vicinity of Key West, Fla., with the long wire drag was continued. After a thorough examination of any body of water with this drag it can be positively asserted that no undiscovered danger to navigation exists with less water on it than the depth verified.

Hydrographic work was done in California, Connecticut, Louisiana, Maryland, New York, North Carolina, and Virginia.

An exhaustive examination was made over an extensive area (approximately 300 square miles) in searching for a large bank reported by the steamship *Mongolia* as existing about 17 miles southwest of the Farallon Light off the entrance to San Francisco Bay, California, and it was shown that no such bank exists. A search was also made for a shoal spot reported by the steamer *Alameda* as located about 8 miles southeast of the Farallon light, and no indications of such a spot were found in the vicinity.

In this work a "submarine sentry" set to a depth of 30 fathoms was used by the vessel to make the examination more thorough than would have been possible by sounding.

An examination was made in the vicinity of the main ship channel across the bar off the entrance to San Francisco Bay, and it was shown that no material change has occurred since the previous survey was made in 1900.

The supplemental work on Georges Bank and Shoal in the Atlantic Ocean off the coast of Massachusetts was completed and offshore hydrographic work was done west of the island of Porto Rico.

The collection of information for a revised edition of the two Coast Pilot volumes covering the coast from Point Judith, R. I., to Chesapeake Bay Entrance was completed and a new edition of the volume relating to the coast between Point Judith, R. I., and New York City was prepared and published.

A revised edition of the Coast Pilot volume covering the coasts of California, Oregon, and Washington was prepared and published.

The magnetic survey of the country was continued by making observations at 279 stations distributed over 35 States and Territories 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.; Baldwin, Kans.; Sitka, Alaska; Honolulu, Hawaii; and Vieques, P. R. Continuous records with seismographs were obtained at the magnetic observatories, except at Baldwin, Kans., where there is no seismograph, and meteorological observations were made in connection with the regular work.

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.; Galveston, Tex.; San Diego, Cal.; Presidio of San Francisco, Cal., and Seattle, Wash.

The tide indicator at Fort Hamilton, N. Y.; Reedy Island, Delaware River, Delaware, and Alcatraz Island, San Francisco Bay, Cal., have been continued, and the electric tide indicator in the rooms of the Maritime Association at New York continued to give satisfaction.

ALASKA.

The triangulation across Dixon Entrance was completed and progress was made in the survey of Cordova Bay. Dixon Entrance is important, as it includes one end of the international boundary between Alaska and Canada, and because the terminus of the Grand Trunk Pacific Railway, a transcontinental line, has been located on its shores.

The survey of Controller Bay, begun several years ago and suspended almost immediately in order to use the vessel on work requested without delay by the Navy Department, was resumed, and was in progress at the close of the fiscal year. This bay is in the vicinity of the extensive coal fields discovered in Alaska in recent years, and it is hoped that an important commercial harbor will be developed, as an extensive area of deep water has been reported. Hydrographic work along the coast to the westward is also in progress to determine whether several dangers to navigation exist as reported close to the steamer routes in this region.

In Prince William Sound and vicinity the survey of Orca Bay was completed, and progress was made in the survey of the outer coast of Hinchinbrook Island and of the shores of Knights Island.

In Cook Inlet and vicinity the triangulation was completed from the south end of Kodiak Island northward through Shelikof Strait and Cook Inlet to the vicinity of North Forelands. The surveys of Port Graham and Kupreanof Strait were completed. A survey was made of the greater portion of Uganik and Uyak bays in Kodiak Island and work was done in Marmot Bay, Afogniak Island, and in Nushagak Bay. At the close of the year five surveying steamers were in the field in the localities named and the work was in active progress. The short seasons due to climatic conditions have always retarded the work, but the country is being developed at many points, and with increased facilities for obtaining supplies greater progress will be made.

A revised edition of the Coast Pilot volume covering the coast from Dixon Entrance to Yakutat Bay and sailing directions from Yakutat Bay to Cook Inlet were prepared and published.

The work on the Alaska-Canada boundary was continued and details are given in another portion of this report.

PHILIPPINE ISLANDS.

The important work of chartering the unsurveyed waters of this archipelago was continued in cooperation with the insular government and good progress was made. 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 13 005 square miles and the hydrographic work 6 202 square miles. A topographic survey was made along 748 miles of general coast line.

The Coast and Geodetic Survey steamer *Pathfinder*, and the insular government steamers *Fathomer*, *Romblon*, *Marinduque*, and *Research* 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 of the following areas:

On the east coast of Luzon between Polillo and Jomalig islands and the adjacent coast of the mainland eastward to the junction with former work, with hydrographic work between Jomalig Island and the mainland, thus completing the survey along the east coast of Luzon from San Bernardino Strait to the north end of Jomalig Island; around the south end of Marinduque, and extending from Luzon on the east to Mindoro on the west, completing the survey of the coast southward from Manila Bay to the south end of Tayabas Province, Luzon; along the east coast of Panay and across to Leyte, joining the work north of Negros and Cebu, completing the surveys in this vicinity; around the west, south, and east coast of Bohol, and extending to Cebu and Leyte, completing the survey of the west coast of Leyte; and Dumanquilas Bay and approaches.

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 in the suboffice, and drawings for new charts and new editions of charts are prepared and sent to Washington for completion and publication. New editions of the sailing directions for the islands are prepared and published as often as necessary, and a monthly Notice to Mariners was published.

OFFICE WORK.

Good progress was made in the various branches of the work in the Office, including computation, plotting, and discussion of the results of the work in the field, and in the preparation of data for publication of new charts and new (corrected) editions of charts previously published. As usual a great deal of information compiled from the records in the Office has been furnished in response to requests from official and other sources and the demand for charts was larger than during any previous year.

A new adjustment of the precise leveling results in the United States was made to include all work completed to the end of 1907, and the results were prepared for publication.

The preparation of a publication entitled "The Figure of the Earth and Isostasy from Measurements made in the United States" was completed. This publication includes all results available in 1905. The computation of the results available to the end of 1908 for a similar discussion and publication were nearly completed.

Five volumes containing the results of magnetic observations at the five magnetic observatories maintained by the Survey, made previous to January 1, 1905, were completed for publication. The preparation of the results of Cheltenham, Md., for 1905 and 1906, and at Sitka, Alaska, for 1905 was also completed.

Tide tables containing the predicted tides for numerous ports on the coasts of the United States and in foreign countries for the year 1910 were prepared for publication. New editions, revised to date, of the Coast Pilot volumes covering the coasts from Point

Judith, R. I., to New York, the coasts of California, Oregon, and Washington, and the coast of Alaska from Dixon Entrance to Yakutat Bay were prepared for publication.

A list of these and the other publications during the year is given on page 20.

The annual report of the Survey for 1908 was prepared for transmission to Congress.

The amount appropriated for the Coast and Geodetic Survey for the fiscal year ended June 30, 1909, was $996 290, 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 the parties in the field $325 400, and salaries of field and Office forces $335 890. In addition to the above sums the appropriation for marking the United States and Canada boundary (except a portion of the water boundary) and for locating and marking the Alaska boundary, made to be expended by the Secretary of State, are disbursed under my direction as Commissioner by the Disbursing Agent of the Coast and Geodetic Survey, as special disbursing officer 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 routine work in connection with enlistment of crews for the vessels and the administrative examination of the accounts of the vessels was kept up to date.

Numerous short trips were made by the Inspector in supervising the maintenance of the surveying vessel. The vessels on the Pacific coast were inspected in November, and assignments were made for work during the winter, by direction of the Superintendent.

COAST PILOT.

The proof reading of United States Coast Pilot, Pacific Coast, Alaska, Part I, fifth edition, and of Coast Pilot Notes from Yakutat Bay to Cook Inlet was completed.

The following publications were prepared and the proof was read: United States Coast Pilot, Atlantic Coast, Part IV, fifth edition; United States Coast Pilot, Pacific Coast, California, Oregon, and Washington, second edition; Supplements to United States Coast Pilot, Atlantic Coast, Parts I, II, III, V, VI, VII, and to United States Coast Pilot, Pacific Coast, California, Oregon, and Washington, first edition.

The preparation of United States Coast Pilot, Atlantic Coast, Part V, was begun, and a list of lights and other aids to navigation needed in Alaskan waters was prepared for the use of the Light-House Board.

VESSELS AND THEIR WORK.

STEAMER BACHE.

This vessel was at Baltimore having repairs made July 1 to August 21. Preparations for field work were then made and the vessel sailed for the New England coast on August 31. On September 6 the resurvey of Georges Bank in the Atlantic Ocean off the coast of Massachusetts began where the work was suspended in the previous year, and it was completed on October 22. The work was facilitated by using a whistling buoy, which was placed on the bank by the Light-House Board at the request of the Survey. Soundings were then made to show the present condition of certain features of the Middle Ground in Vineyard Sound, Mass., the Middle Ground Shoal in Fishers Island Sound, and the rocky ground east of Cormorant Island. After completing the work assigned to the party, the vessel returned to Baltimore for repairs on November 20, and remained there until January 17. The *Bache* sailed the next day for Porto Rico, and from January 29 to June 12 was engaged in extending the hydrographic work off the west coast of the island of Porto Rico, and in doing topographic work on Mona and Desecheo islands. An examination was also made of Yabucoa Harbor, east end of Porto Rico Island. The vessel returned to Baltimore on June 21, and minor repairs were in progress at the end of the year.

STEAMER ENDEAVOR.

This vessel was put in commission on November 11, and preparations were made for field work on the coast of North Carolina. Repairs were made to the ship at Norfolk, and she sailed on December 15 for Pamlico Sound. The recovery of stations and supplementary triangulation were completed between Hatteras Inlet and Croatan Light about June 1. During June supplementary topographic work was done on the west side of Croatan Sound and a topographic and hydrographic survey was made of Oregon, New Loggerhead, and Hatteras inlets. Work was in progress in Albemarle Sound on June 30.

SCHOONER MATCHLESS.

The vessel was being repaired at Baltimore July 1 to 15 and June 13 to 30, and was engaged in field work during the remainder of the year. The survey of the lower portion of the Patuxent River was completed and a revisionary survey was made of the upper portion of the river to the head of steamboat navigation. Some supplementary work was done in Smiths Cove and the hydrographic resurvey in the Little Choptank River was completed. The revision of the topographic work between the Patuxent and Potomac rivers was completed, and in May a revision of the survey of the Rappahannock River was begun and continued until May 9, when the vessel sailed for Baltimore to have repairs made.

SCHOONER TRANSIT.

Repairs were made to this vessel and she was placed in commission on January 25 for work on the coast of Louisiana. A survey, including triangulation, topography, and hydrography, was made of Four League Bay from Atchafalaya Bay to the Gulf of Mexico, and a hydrographic survey was made of Wax Lake and some of its tributaries. Soundings were also made in the dredged channels in Atchafalaya Bay. The work was suspended on May 27, and the vessel was placed out of commission.

STEAMER HYDROGRAPHER.

The Coast Pilot party on this vessel was at work collecting information in the field for the revision of United States Coast Pilot, Atlantic Coast, Parts IV and V, on July 1, and the work continued until September 16, when the vessel was placed out of commission at Curtis Bay, Maryland.

STEAMER EXPLORER.

The survey of Shelikof Strait, Alaska, was in progress on July 1, and was continued until October 15, when work was suspended for the season. The vessel reached Seattle on November 1, and San Francisco on November 9. A search was made for the large bank reported by the steamer *Mongolia* off the entrance to San Francisco Bay, and for another shoal reported southeast of the Farallones, but no trace of them was found. Soundings were made on San Francisco bar, and a revisionary survey was made of the San Francisco, Alameda, Oakland, and Port Richmond water fronts. A resurvey was made of the lower portion of Suisun Bay and a topographic survey showing all details was made of an addition to the grounds of the immigration station on Angel Island, at the request of the bureau concerned.

Repairs were made to the vessel, and on April 21 she sailed for Seattle en route to Alaska. She reached Bristol Bay on May 26, and the survey of the bay was in progress on June 30.

STEAMER GEDNEY.

The triangulation of Dixon Entrance was in progress on July 1, and was completed on August 10. A topographic survey was then made at Cape Chacon, Cape Muzon, Point Nunez, and Nichols Bay. The survey of a bay in Cholmondeley Sound and of Kasaan Bay was completed and triangulation was done in Cordova Bay. The work was suspended for the season on October 26, and the vessel reached Seattle on November 25. On the return voyage a boathouse was built at Metlakatla for storing the launch and other outfit.

Current observations were made in Admiralty Inlet between December 10 and February 20. Supplementary work along the water front of Tacoma was done in February and March, and the vessel was partially repaired.

In April the repairs were completed at Seattle, and the vessel sailed for Alaska on April 30.

The survey of Cordova Bay was resumed on May 19 and was in progress on June 30.

STEAMER PATTERSON.

The survey of Shelikof Strait, Alaska, was in progress on July 1, and work in this vicinity was continued until October 17, when work was suspended and the vessel reached Seattle on October 30.

Supplementary surveys were made along the water front of Seattle, and the topographic survey of Port Orchard was revised. Current observations were made in Admiralty Inlet, near West Point, and near Everett. This work was discontinued on January 23. During the occupation of the current station near West Point the launch *Vixen* was swamped and lost.

Supplementary work was done along the water front of Everett, and in Quartermaster Harbor.

Repairs were then made to the ship, and she sailed from Seattle for Alaska on April 15.

The vessel reached Controller Bay on May 24, and the survey of the bay was in progress at the close of the year.

STEAMER M'ARTHUR.

Triangulation in Cook Inlet, Alaska, was in progress on July 1. This work was extended northward as far as the Forelands and a survey of Port Graham was made. The work was suspended on October 7, and the vessel reached Seattle on the 24th. Supplies were taken on board, and the vessel proceeded to Juan de Fuca Strait and completed a topographic survey from Port Crescent to Neah Bay on February 23. Supplementary work was then done along the water front of Bellingham, Wash., and on March 6 the vessel went to Seattle to have repairs made.

The *McArthur* sailed from Seattle on April 28, and reached Port Graham on May 16.

At the close of the year the work between the Forelands and the head of Cook Inlet was in progress.

STEAMER YUKON.

On July 1 the party on this vessel was cooperating with the party on the steamer *Patterson* in making a survey of Shelikof Strait and of the adajcent waters. The work was suspended for the season on September 23, and the *Yukon* was taken to Kodiak and hauled out for the winter on October 11.

The *Yukon* was put in commission on May 3, and the extension of the survey northward from Kodiak, Alaska, began on the 17th. This work was in progress on June 30.

STEAMER TAKU.

The topographic and hydrographic survey along the southeast coast of Hinchinbrook Island, Alaska, was in progress on July 1, and was completed to a junction with previous work near Cape Hinchinbrook on the 31st. The party then proceeded to Knights Island, Prince William Sound, and continued the survey in the vicinity until September 24, when the work was suspended for the winter.

The reefs reported by the United States revenue cutter *Manning*, off Knights Island, and by the steamship *Pennsylvania*, north of Seal Island, were examined.

The *Taku* was then taken to Orca and laid up for the winter and the party reached Seattle on October 21.

On April 20 the *Taku* was placed in commission and repairs were made. The survey of the head of Orca Inlet, Prince William Sound, Alaska, as requested by the Department of the Interior and by the War Department, was begun on May 12, and was completed on June 26.

On June 30 the *Taku* was at Orca preparing for work in the vicinity of Knights Island.

OFFICE OF INSPECTOR OF GEODETIC WORK.

J. F. HAYFORD, *Inspector.*

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 most important events of the year in connection with the geodetic work were the completion of the astronomic observations necessary for the 1909 determination of the figure and size of the earth from measurements made in the United States, the completion of two long lines of precise leveling, and the beginning of the triangulation from the ninety-eighth meridian triangulation in Texas to the western oblique arc in California.

A series of astronomic observations to determine latitude, longitude, and azimuth, for use in connection with a new determination of the figure and size of the earth from measurements in the United States, was begun in August, 1905, and was completed in November, 1908. This series, together with certain old astronomic observations which became available during this interval, added about 50 per cent to the astronomic observations used in connection with the 1906 determination of the figure and size of the earth from measurements in the United States.

The connection of mean sea level at San Diego, Cal., by precise leveling with an elevation previously determined by the Survey at Ogden, Utah, was completed, and also the connection of elevations previously determined in Pocatella, Idaho, and in Crawford, Nebr. These two lines furnish two large circuits in the precise level net of the United States and a second connection with sea level in the Pacific Ocean.

In the Texas-California triangulation mentioned above observations were made at 51 primary stations, azimuths being determined at 7 of these, and the measurement of a primary base line 12 kilometers long in 5.1 months. The progress of the work along the axis of the triangulation was approximately 520 kilometers (325 miles).

OFFICE OF INSPECTOR OF MAGNETIC WORK.

R. L. FARIS, *Inspector.*

The instructions for magnetic work and the information required by the parties in the field were prepared by the Inspector. He made two trips of inspection during the year, one to Sitka, Alaska, to relieve the observer in charge of the observatory and start the work under his successor, and the other to Arizona, to decide on a proper site for the location of a magnetic observatory to take the place of the one at Baldwin, Kans., which will be discontinued. Several places were examined, and a suitable place was selected near Tucson, Ariz. In connection with this work magnetic observations were made at six stations in Arizona.

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

OBSERVATORY WORK.

The magnetic observatories at Cheltenham, Md.; Baldwin, Kans.; Honolulu, Hawaii; Sitka, Alaska, and Vieques, P. R., were kept in continuous operation, and

observations were obtained with a self-registering magnetograph and a seismograph at each observatory except at Baldwin, Kans., where there was no seismograph.

Magnetic storms of unusual severity were recorded at Cheltenham in September and in May, and the seismograph records show the effect of 33 earthquakes. A record was obtained of 145 earthquakes at Honolulu and of 24 at Vieques. Meteorological observations were made at all the observatories.

MAGNETIC WORK ON LAND.

The values of the magnetic elements, declination, dip, and intensity, were determined at 279 stations, distributed over 35 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.
Alaska	45	47	5	47	34	34
Arizona	6	6	5	6	6	6
Arkansas	5	5	1	5	5	5
California	1	1	1	1	1	1
Connecticut	1	1	0	1	1	1
District of Columbia	2	2	2	2	1	2
Florida	3	3	3	3	3	3
Hawaii	1	1	1	1	1	1
Illinois	39	39	2	39	39	39
Indiana	7	7	1	7	7	7
Iowa	17	17	3	17	17	17
Kansas	2	2	2	3	3	3
Kentucky	10	10	1	10	10	10
Louisiana	1	1	1	1	1	1
Maryland	5	5	1	13	4	10
Massachusetts	2	2	1	2	2	2
Michigan	8	8	1	8	8	8
Minnesota	11	11	1	11	10	11
Mississippi	2	2	1	2	2	2
Missouri	22	22	2	22	22	22
New York	4	4	2	4	4	4
North Carolina	4	3	3	4	4	4
Ohio	3	3	1	4	4	4
Oklahoma	1	1	1	1	1	1
Oregon	2	2	1	2	2	2
Pennsylvania	1	2	1	4	4	4
Philippine Islands		13				
Porto Rico	4	5	3	5	5	5
South Carolina	1	1	0	1	1	1
Tennessee	28	28	5	28	28	28
Texas	1	1	1	1	1	1
Virginia	2	1	1	2	2	2
Washington	3	3	3	3	3	3
West Virginia	3	3	1	3	3	3
Wisconsin	27	27	3	27	27	27
Foreign countries	5	4	1	5	4	4
Total	278	279	61	298	273	281

MAGNETIC WORK AT SEA.

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

Vessel.	General region.	Results from swings.			Results from course observations.		
		Declination.	Dip.	Intensity.	Declination.	Dip.	Intensity.
Bache	Atlantic Ocean	25	23	23	7	0	0
Patterson	Pacific Ocean	4	4	4	0	0	0
Explorer	do	18	20	20	12	0	0
Gedney	do	15	0	0	0	0	0
McArthur	do	4	0	0	0	0	0
Total		66	47	47	19	0	0

The *Bache* on her cruise to Porto Rico kept well inside the usual track on the outward voyage and well outside the usual track in returning in order to obtain observations in new localities in the Atlantic Ocean. The Survey vessels on the Pacific coast obtained observations on their voyages to and from Alaska and in the inland waters whenever the weather and other conditions permitted.

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 party 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 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 party are bonded in the sums of from $2 000 to $10 000 each, and, while acting as chiefs of party, 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. 1–165), covering the progress of the work of the Survey during the fiscal year 1908, was completed and sent to the Public Printer through the Secretary of Commerce and Labor on September 11, 1908, and the last proof was read and returned to the printer on December 26. Copies of the report were received for distribution on February 3, 1909.

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, 1907, to June 30, 1908, 169 pages, with following appendix also published separately:

No. 3. Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1907, and June 30, 1908. Reprint. 97 pp.

Tide Tables for the year 1909. 524 pp.

Tide Tables for the Atlantic Coast of the United States, including Canada and the West Indies, for the year 1909.* Reprint from Tide Tables for 1909. 173 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 1909. 160 pp.

Tide Tables for the year 1910. 530 pp.

Tide Tables for the Atlantic Coast of the United States, including Canada and the West Indies, for the year 1910. Reprint from the Tide Tables for 1910. 151 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 1910. 165 pp.

United States Coast Pilot, Pacific Coast. California, Oregon, and Washington. Second edition. 251 pp.

United States Coast Pilot, Pacific Coast. Alaska, Part I, Dixon Entrance to Yakutat Bay. Fifth edition. 233 pp.

United States Coast Pilot, Atlantic Coast. Parts I–II: From the St. Croix River to Cape Ann. Supplement to Second edition. 15 pp.

United States Coast Pilot, Atlantic Coast. Part III: From Cape Ann to Point Judith. Supplement to second edition. 12 pp.

United States Coast Pilot, Atlantic Coast. Part V: New York to Chesapeake Bay Entrance. Supplement to third edition. 10 pp.

* This publication was received in June, 1908, and should have been noted in the annual report for the previous year.

United States Coast Pilot, Atlantic Coast. Part VI: Chesapeake Bay and Tributaries. Supplement to third edition. 6 pp.
United States Coast Pilot, Atlantic Coast. Part VII: From Chesapeake Bay Entrance to Key West. Supplement to third edition. 19 pp.
United States Coast Pilot, Pacific Coast. California, Oregon, and Washington. Supplement to first edition. 15 pp.
Alaska. Coast Pilot Notes on Bering Sea and the Arctic Ocean. 65 pp.
Alaska. Coast Pilot Notes from Yakutat Bay to Cook Inlet. 36 pp.
Catalogue of Charts, Coast Pilots, and Tide Tables, 1908. 231 pp.
Catalogue of Charts, Coast Pilots, and Tide Tables, 1908. Supplement. 2 pp.
List and Catalogue of the Publications issued by the Coast and Geodetic Survey, 1816–1902. Reprint. 237 pp., with supplement,* 1903–1908, 44 pp.
General Instructions for the Field Work of the Coast and Geodetic Survey. 127 pp.
United States Magnetic Tables and Magnetic Charts for 1905. 154 pp.
Principal Facts of the Earths Magnetism, and methods of determining the True Meridian and the Magnetic Declination. Reprint with additions. 100 pp.
Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Cheltenham, Md., 1901–1904. 206 pp.
Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Vieques, Porto Rico, 1903–4. 70 pp.
Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Baldwin, Kans., 1901–1904. 138 pp.
Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Sitka, Alaska, 1902–1904. 129 pp.
Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory near Honolulu, Hawaii, 1902–1904. 130 pp.
Precise Leveling in the United States, 1903–1907, with a readjustment of the level net and resulting elevations. 280 pp.
Survey of Oyster Bars, Somerset County, Md. 118 pp.
Survey of Oyster Bars, Wicomico County, Md. 54 pp.
Survey of Oyster Bars, Worcester County, Md. 67 pp.
The Work of the Coast and Geodetic Survey. Second edition. 47 pp.
Coast and Geodetic Survey in Alaska. Leaflet. 8 pp.

The publication named below was prepared and published in Manila, P. I., and is issued from the suboffice at that place. A small number of this publication is kept at the office in Washington.

Philippine Islands Notices to Mariners Nos. 7 to 13 of 1908 and 1 to 3 of 1909.

* This supplement was also issued separately.

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APPENDIX 1

REPORT 1909

DETAILS OF FIELD OPERATIONS

CONTENTS.

DETAILS OF FIELD OPERATIONS.

UNITED STATES.

LOUISIANA.

[H. L. BECK, Commanding the Schooner *Transit*.]

SUMMARY OF RESULTS.—Hydrography: 66 square miles of area covered, 433 miles of lines sounded, 10 045 soundings made, 5 tide stations established, 5 hydrographic sheets completed. Topography: 47 miles of shore line of bayous surveyed, 9 miles of shore line of lakes surveyed, 4 topographic sheets completed. Triangulation: 211 square miles of area covered, 16 stations occupied, 59 geographic positions determined.

In January a party was organized to complete unfinished surveys on the coast of Louisiana in Atchafalaya Bay and vicinity. The work began on February 2 and continued until June 4, when the party was disbanded. A power boat (gasoline launch) was hired and used during the season. Three old triangulation stations were recovered on Atchafalaya Bay, and one on Four League Bay, near the Gulf Coast, and connected by a new scheme of triangulation. A topographic survey was made of Four League Bay from the entrance on Atchafalaya Bay through to the Gulf of Mexico, and the hydrographic work covered the same region. Soundings were made in the dredged channels in Atchafalaya Bay, and a survey was made of Wax Lake and the passes leading into it. A plane table survey was made of Little Wax Bayou and of Big Wax Bayou from the vicinity of Belle Isle to Adams Cross. Soundings were made in the bayous. The region covered by the work is all marsh, divided by numerous channels and covered with high grass. At a number of points it was necessary to erect observing platforms in order to see over the grass.

IOWA.

[J. R. BENTON.]

STATIONS OCCUPIED.—Albia and Bloomfield.

Observations to determine the value of the three elements of terrestrial magnetism were made at the stations named above, June 25 to 30, and work was suspended on the latter date on account of the illness of the observer.

MARYLAND.

[J. B. BOUTELLE.]

SUMMARY OF RESULTS.—Topography: 20 square miles area covered, 36 miles of shore line surveyed, 53 miles of roads surveyed, and 51 miles of shore line of creeks surveyed.

The topographic resurvey of the shores of Chesapeake Bay in the vicinity of Port Republic was in progress on July 1, and the work was continued until December 15.

During this period the survey was completed to the vicinity of Cove Point, where it joined work previously completed by another party.

The western limit of the work is the main county road, which is on the dividing ridge between Chesapeake Bay and the Patuxent River. The country is very rough and hilly, with many small streams running through deep ravines.

Twenty-foot contours were extended over the area surveyed.

The party proceeded to Nottingham, on the upper Patuxent River, on October 24, and began work on the extension of the topographic survey of both banks of the river from Jones Point to Hills Bridge, and up the Western Branch to Upper Marlboro.

The work was completed on December 14.

MICHIGAN, OKLAHOMA, TEXAS, AND WISCONSIN.

[WILLIAM BOWIE, July 1 to December 31, and J. S. HILL, January 1 to April 20.]

SUMMARY OF RESULTS.—Astronomic observations: 12 azimuths measured and 3 latitudes determined. Base measurement: 1 base line measured. Magnetic observations: 3 stations occupied. Triangulation: 5 425 square miles of area covered, 51 stations occupied, 91 geographic positions determined.

On July 1 a party was at work in Wisconsin making astronomic observations and determining the value of the three elements of terrestrial magnetism at certain stations in the vicinity of the Great Lakes. Azimuth observations were made at one station in Michigan and at two in Wisconsin; latitude observations at one station in Wisconsin, and magnetic observations at one station in Michigan and two in Wisconsin. This completed the work assigned to the party and it was disbanded on August 2.

All of the observations for azimuth and latitude were made at stations in the triangulation of the Great Lakes by the United States Lake Survey, and the azimuth of a line of this triangulation was determined in each case.

Astronomic work was resumed on October 5 in Oklahoma, and latitude and azimuth observations were made at two triangulation stations in that State. The work was completed on October 25.

A signal-building party began operations in Texas on September 17 on the extension of the primary triangulation from the triangulation along the ninety-eighth meridian toward the Pacific coast.

A number of tripods and scaffolds were ready for the observing party as the result of work done during the previous fiscal year, and 10 additional structures were completed before October 29. An observing party was then organized and observations began on November 6. The necessary work was completed at 19 stations before December 31, including the determination of an azimuth at 3 of the stations. After that date, Decmeber 31, the work was continued in the same manner until April 20. During this period observations were made at 32 stations and 4 azimuths and 1 base line were measured.

The total progress for the season is 325 miles, measured along the axis of the triangulation.

The Stanton base line, 13 kilometers long, was prepared and measured in twelve days, an unusual performance in work of this character.

ILLINOIS, INDIANA, IOWA, MARYLAND, MICHIGAN, MINNESOTA, NEW YORK, PENNSYLVANIA, WEST VIRGINIA, AND WISCONSIN.

[J. E. BURBANK.]

STATIONS OCCUPIED.—*Illinois:* Aledo, Bloomington, Carlinville, Carmi, Carrollton, Carthage, Charleston, Clinton, Effingham, Fairfield, Greenville, Jerseyville, Lawrenceville, Lewiston, Louisville, Macomb, Marshall, Monticello, Mount Carmel, Mount Sterling, Oguawka, Paris, Petersburg, Pittsfield, Robinson, Sullivan, Toledo, Toulon, Waukegan, and Winchester. *Indiana:* Danville, Greenfield, and Liberty. *Iowa:* Allison, Charles City, Clinton, Dubuque, Grundy Center, Iowa City, Marion, Mount Pleasant, Muscatine, New Hampton, Oscaloosa, Sigourney, Tipton, Wapello, and Waverly. *Maryland:* Cheltenham. *Michigan:* Sidnaw and Watersmeet. *Minnesota:* Anoka, Cambridge, Elk River, Foley, Hastings, Henderson, Le Seuer Center, Little Falls, Mankato, Princeton, and Shacopee. *New York:* Albion, Buffalo, and Lockport. *Pennsylvania:* Meadville. *West Virginia:* New Martinsville, Parkersburg, and St. Marys. *Wisconsin:* Antigo, Appleton, Black River Falls, Chilton, Crandon, Darlington, Eagle River, Eau Claire, Florence, Green Bay, Green Lake, Hermansville, Hudson, Juneau, Kewaunee, Lancaster, Menomonie, Milwaukee, Manistique, Marquette, Merrill, Munising, Oconto, Oskosh, Port Washington, Portage, Stevens Point, Waupaca, and West End.

The work at the magnetic observatory at Cheltenham, Md., was continued without interruption during the year. A 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. The year was notable for the number and severity of the magnetic storms, six of which may be classed as large disturbances.

The seismograph afforded good results and 33 earthquakes were recorded, most of which were earthquakes of moderate intensity. A record was obtained of one of the destructive shocks in Italy.

During the year observations were made to determine the value of the three elements of terrestrial magnetism at the stations named above by observers detailed to work under Mr. Burbank's direction.

BRITISH COLUMBIA, DISTRICT OF COLUMBIA, FLORIDA, KANSAS, LOUISIANA, OKLAHOMA, OREGON, SOUTH CAROLINA, TENNESSEE, TEXAS, AND WASHINGTON.

[W. H. BURGER.]

SUMMARY OF RESULTS.—Astronomic observations: 4 azimuths measured and 1 latitude determined. Gravity observations: 9 stations occupied. Magnetic observations: 16 stations occupied. Triangulation: 80 square miles of area covered, 10 stations occupied, 17 geographic positions determined.

Astronomic observations were in progress in Oregon on July 1, and this work was continued until October 16, except that work was suspended for thirteen days (September 21 to October 3). During this period observations to determine an azimuth were made at 1 station in British Columbia, 1 in Kansas, and 2 in Washington. Latitude was determined at 1 station in Oregon. Advantage was taken of the presence of the observer in the various localities mentioned to have magnetic observations made at 6 stations, distributed as follows: 1 in British Columbia, 1 in Kansas, 2 in Oregon, and 2 in Washington.

In February a party was organized to make pendulum observations to determine the force of gravity at various stations in the United States. Observations were made at the following stations: 1 in the District of Columbia, 3 in Florida, 1 in Louisiana, 1 in Texas, 1 in Oklahoma, 1 in Tennessee, and 1 in South Carolina. The field work began on February 13,

and was in progress on June 30. These observations were made with the half-second pendulum apparatus for the determination of the relative value of the force gravity, using the Coast and Geodetic Survey office at Washington as a base station. One new feature of importance has been introduced into the method of observation. Formerly the correction for flexure of the pendulum support was determined by measuring under a microscope the displacement of the support caused by a horizontal force of 1 500 grams applied to the pendulum case at the elevation of the knife edge. In this work the flexure of the support was measured at each station in terms of the wave length of light by the use of an interferometer. The flexure measured is simply that due to the action of the pendulum while swinging through an amplitude of 28 to 114 minutes of arc on each side of the vertical.* Under these conditions, the maximum value of the horizontal component of the force which the swinging pendulum brings to bear upon its support is only 40 grams. It is believed that the resulting corrections to the observed periods of the pendulum to take account of the effect of flexure are of greater accuracy than those derived by the old method. The principal difficulty encountered is due to irregular tremors in that support of the interferometer, which is independent of the pendulum support. This change of practice substitutes a dynamic method of measuring a dynamic phenomenon for a static method, and it substitutes for a measurement under exaggerated conditions (with the applied forces 50 or more times as large as they are under ordinary conditions) a measurement with the forces exaggerated but little, if any.

KANSAS.

[S. A. DEEL, July 1–31; S. G. TOWNSHEND, August 1 to September 30; W. B. KEELING, October 1 to May 7; S. G. TOWNSHEND, May 8 to June 30.]

The work at the magnetic observatory at Baldwin, Kans., was continued during the year. A record of the relative force of the three elements of terrestrial magnetism was obtained with self-registering instruments and observations were made once each week to determine the absolute value of these elements.

Daily meteorological observations were also made during the year.

WASHINGTON.

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

During the period November 29 to January 21 current observations were made at various points in Puget Sound, and one station was occupied in each of the following localities: Elliott Bay off Seattle, off West Point light, Port Madison, in Agate Passage, Possession Sound near Muckilteo Point light, north end of Colvos Passage, off east entrance to Richs Passage, and at west end of Richs Passage. A comparatively long series of observations were made off West Point and Muckilteo Point lights, and a short series at the other stations.

After the current observations were discontinued, supplementary surveys were made in Seattle and Quartermaster harbors, in the vicinity of Everett, and in Sinclair Inlet. The information necessary for a revision of the charts in these localities was obtained.

* In the regular gravity observations the pendulum is started with an amplitude of about 29 minutes of arc on each side of the vertical.

The *Patterson* returned to Seattle on February 27 to have repairs made, and the field work in this locality was continued and completed on March 19.

WASHINGTON.

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

SUMMARY OF RESULTS.—Hydrography: 57 miles of lines sounded, 3 878 soundings made, 1 tide station established, 8 current stations occupied, 2 hydrographic sheets completed. Topography: 2 square miles of area covered, 8 miles of shore line surveyed, 22 miles of roads surveyed, 2 topographic sheets completed.

Current observations were made in Admiralty Inlet and Hood Canal between December 10 and January 23, and on January 25 supplementary work to show the present condition of the water front of Tacoma, Wash., was begun. The hydrographic work commenced on March 10, and a thorough survey was made of the waterways from the vicinity of Browns Point to Point Defiance.

Information was obtained for the revision of the chart of the locality covered by the survey, and the work was completed on April 10.

CALIFORNIA.

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

SUMMARY OF RESULTS.—Hydrography: 411 square miles of area covered, 847 miles of lines sounded, 7 906 soundings made, 1 tide station established, 4 hydrographic sheets completed. Magnetic observations: 2 stations occupied on land and 5 at sea. Topography: 4 square miles of area covered, 59 miles of shore line surveyed, 30 miles of roads surveyed, 4 topographic sheets completed. Triangulation: 6 stations occupied and 1 geographic position determined.

The *Explorer* reached San Francisco on November 9, and continued work in the vicinity until April 21, when the vessel sailed for Seattle en route to Alaska. During this period the work mentioned below was done.

Magnetic observations were made at sea and on shore at San Francisco. A large area (approximately 300 square miles) was covered by sounding south of the Farallon Islands, off the entrance to San Francisco Bay, in searching for banks reported in this vicinity, and no indications of such banks were found. In this work a "submarine sentry" set to a depth of 30 fathoms was used by the vessel to make the examination more thorough than would have been possible by sounding. A resurvey of a portion of San Francisco Bay, near Mission Rock, was made. Soundings were made across San Francisco bar in the main ship channel, and it was shown that no material change has occurred since the previous survey was made in 1900. A resurvey was made of the western end of Suisun Bay. A supplementary survey was made along the water front of San Francisco, Oakland, Alameda, and Point Richmond to secure data for a revision of the charts, and a topographic survey was made of an addition to the reservation at the immigrant station on Angel Island at the request of the immigration authorities.

FLORIDA.

[W. B. FAIRFIELD.]

The recovery of old triangulation stations on the west coast of Florida, including supplementary triangulation to determine the location of aids to navigation was

resumed on January 1, and the work was continued until June 7. During this period a search was made for 127 old stations, and 36 of these were recovered. New marks were established at nearly all of the stations recovered.

In Tampa Bay the positions of the buoys marking a dredged channel were determined. The search for old stations covered the coast from Little Sarasota Bay south to Little Hickory Pass, and included the shores of Lemon Bay, Charlotte Harbor, Mattacha Sound, Peace River, and San Carlos Bay. Twenty-five new stations were established and 91 geographic positions were determined, including 20 aids to navigation (3 light-houses, 5 beacons, and 12 buoys). One old tide bench mark was recovered.

The new triangulation was extended from the head of Peace River to its mouth, in Charlotte Harbor, and in San Carlos Bay.

MARYLAND AND VIRGINIA.

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

SUMMARY OF RESULTS.—Hydrography: 191 square miles of area covered, 1 100 miles of lines sounded, 40 661 soundings made, 7 tide stations established, 10 hydrographic sheets completed. Magnetic observations: 6 stations occupied. Topography: 28 square miles of area covered, 94 miles of shore line surveyed, 57 miles of shore line of creeks surveyed, 4 miles shore line of ponds surveyed, 33 miles of roads surveyed, 8 topographic sheets completed.

The completion of the topographic and hydrographic work in the Patuxent River, Maryland, was assigned to the party on the schooner *Matchless*, and the work began at the mouth of the river on July 30, and was completed on August 20. Supplemental topography and hydrography were then extended up the river to Nottingham, 37 miles above the mouth, and the work was completed on September 11.

From September 19 to November 19 the party was engaged in completing the hydrographic survey of the Little Choptank River. On November 27 topographic and hydrographic work began in the vicinity of Point No Point, and the work between Cedar Point and the Potomac River was completed May 6.

During the period May 11 to June 8 the party was engaged in revising the topography and hydrography along the Rappahannock River, Virginia, between Windmill Point and Urbana.

The work was suspended on June 9 in order to have repairs made to the vessel at Baltimore.

VIRGINIA.

[S. FORNEY.]

SUMMARY OF RESULTS.—Topography: 94 square miles of area covered, 24 miles of shore line surveyed, 91 miles of shore line of rivers surveyed, 213 miles of shore line of creeks and ponds surveyed, 249 miles of roads surveyed, 2 topographic sheets completed.

The topographic resurvey of the shores of Chesapeake Bay and its tributaries was continued during the fiscal year and was in progress at its close.

The survey of the Rappahannock River to Rogues Point and the western shore of Corottoman River and the adjacent territory, including the vicinity of Irvington, Whitestone, and Kilmarnock, was completed. A survey was made of the shore line of Carters Creek, Fleets Bay, Tabbs, Dimers, and Indian creeks, and the adjacent region, and also of the shore line of the bay from Windmill Point to Smiths Point,

including the shore line of Dividing, Balls, Cloverdale, Mill, Crains, Cockrells, and Taskmakers creeks, and Ingrams Cove and Bay. The survey also covered the shore line of Great and Little Wicomico rivers and 75 per cent of the necessary topography of the adjacent region back to the high land overlooking the bay, which is from 80 to 120 feet above high water.

As many as possible of the old triangulation stations were recovered and the triangulation was extended by making determinations of additional stations with the plane table along the rivers and creeks to the head of steamboat navigation.

MAINE, MASSACHUSETTS, AND NEW HAMPSHIRE.

[O. B. FRENCH.]

SUMMARY OF RESULTS.—Triangulation: 335 square miles area covered, 31 stations occupied, 154 geographic positions determined.

On October 1 a party was organized to do the triangulation necessary for the topographic survey of Great Bay and the Piscataqua River, New Hampshire.

The nearest available stations of the old triangulation were recovered and the work was extended to cover the region between Exeter, N. H., and North Berwick, Me., and between the ocean and Dover and Newmarket. The geographic positions of all the prominent objects, such as church spires, cupolas, flagstaffs, and chimneys, within the above limits were determined. The work was completed on November 6.

The work of collecting data for the revision of the charts of Cape Cod Bay was then taken up and was in progress on June 30.

One hundred and seventeen stations of the old triangulation in this region were searched for and 53 of them were recovered. Forty-nine of the old stations have been destroyed and 15 were not found, though it is possible that some or all of these may be recovered if it becomes necessary to incur the expense that would be involved in the recovery of the positions by triangulation. Observations were made at as many as necessary of these stations to determine the positions of all objects needed in the chart-revision work. The region covered extends from Scituate to Wellfleet and along the ocean side from Chatham to Pomet life-saving station. Computations were made as the work progressed and the changes on the charts were plotted, as noted, except the topographic details from Ship Pond to Wellfleet.

The chart-revision work in the vicinity of Cape Cod was suspended in December (28–31) in order to visit Nantucket Island for the purpose of revising the ocean shore line at the point known as the "Haulover." The old opening in the shore line at this point has been closed by the shifting sand and there is nothing left at present to indicate that an opening ever existed. The present position of the shore line was determined.

MAINE, MASSACHUSETTS, AND FLORIDA.

[N. H. HECK.]

SUMMARY OF RESULTS.—Sixty square miles of area covered, 951 miles run while dragging, 782 soundings made, 6 tide stations occupied, 10 hydrographic sheets completed.

Hydrographic work with wire drags was in progress along the coast of Maine on June 30, and was continued until November 19.

The following is a brief statement of the work accomplished by the wire-drag party, which was operated in two sections during most of the season in Maine, each working in a different locality:

Eastern Bay.—The area covered extends from the limit of the work previously examined with the drag to the head of the bay.

Blue Hill Bay.—A considerable area was covered in this bay. It was found necessary to work with the tide, as no headway could be made against it. The danger resulting from the grounding of the drag, which caused the launches to swing and be held broadside to the tide, was eliminated by a safety device which enables a boat to head to the tide without delay.

North end of Jericho Bay and Casco Passage.—The north end of Jericho Bay was examined and a number of shoal spots were found. Casco Passage was also examined and a shoal was found which fixes the maximum depth of water which can be carried through the passage.

Fox Islands Thorofare.—The entire length was covered except a small portion at the eastern end.

Muscle Ridge Channel.—The work in this channel was completed. It furnished a good example of wire-drag work under difficult conditions.

South and east sides of West Penobscot Bay.—The work in this section was not completed.

After the work in Maine was suspended for the season, on October 28, the party proceeded to New Bedford, Mass., and began the examination of Buzzards Bay with the long wire drag. A considerable area was covered before the work was suspended on November 21.

Wire-drag work was resumed in the vicinity of Key West, Fla., on January 9, 1909, and it was continued until May 12, when it was suspended for the season. Twenty-one square miles of area was covered with the drag, involving 381 miles of distance traveled while dragging, and numerous current observations were made. The areas covered may be stated as follows:

Southwest Channel from the end of the work previously done to the entrance; West Channel from the limit of previous work to the 18-foot curve; between the edge of the outer reef and a ridge three-fourths of a mile south of it; a portion of Hawk Channel south of Key West; and Key West Harbor, including a portion of the Northwest Channel.

The work in the harbor was unusually difficult on account of the strong currents and the large number of anchors, moorings, and other obstructions. The weather was very unfavorable during the greater portion of the season and the work was seriously delayed. A hydrographic survey was made of channels through the banks west of Key West.

The plan of work with the drag was changed, in order to secure greater economy and a better system of covering the area under examination. In order to facilitate plotting this work, several graphical instruments were tried and eventually a special form of circular slide rule was devised by one of the aids in the party, and a new form of protractor by the chief of party, and both these devices were used with success. On two days during the season the work was done on the outer reef in water so clear that the bottom wire and weights were visible. The way in which the drag catches on an obstruction was plainly seen, and it was evident that no rock could be so smooth that

the drag would pass over it without its effect showing on the spring balances used in towing the drag. Soundings made on coral heads in this vicinity, with the sounding lead visible all the time, showed the extreme difficulty of determining the least depth of water on such obstructions in this way, as the tendency was for the lead to circle around the shoal as opposed to the efforts to place it on its top. In ordinary work, when nothing is seen below the surface of the water there is very little chance of the lead remaining on top of such obstructions.

Wire drag work was resumed on the coast of Maine on June 28, and was in progress on June 30.

OREGON AND WASHINGTON.

[J. S. HILL.]

SUMMARY OF RESULTS.—Reconnaissance: 2 250 square miles of area covered, 20 stations selected. Triangulation: 1 800 square miles of area covered, 47 stations occupied, 53 geographic positions determined.

Triangulation along the coast of Oregon was in progress on July 1, and the work was continued until November 25. During this period the triangulation along the coast was extended from Umpqua River to Tillamook Bay, Oregon. Additional work was done in the vicinity of Umpqua Light-house, Suislaw River, Heceta Light-house, Yaquina Light-house, Nestucca Bay, and Tillamook Bay to determine the geographic positions of these light-houses and to establish stations along the shores of the waters mentioned.

Unusual difficulty was encountered in the rough country along the coast in transporting the party and the necessary supplies, and considerable delay resulted from this cause. The work was done by two parties operating independently, one carrying forward the main scheme while the other completed the subsidiary schemes in the localities mentioned.

On May 1 the extension of the triangulation along the coast of Oregon and Washington was resumed. A reconnaissance was made as far north as Grays Harbor and triangulation was done in the vicinity of Coquille River and at the mouth of Columbia River. The geographic positions of Coquille River, Tillamook Rock, Desdemona Sands, North Head, and Fort Stevens Wharf light-houses were determined, and the jetty off the mouth of Columbia River was located. The work was in progress on June 30.

ARKANSAS, ILLINOIS, KENTUCKY, MISSISSIPPI, MISSOURI, NEBRASKA, NORTH CAROLINA, TENNESSEE, AND VIRGINIA.

[W. M. HILL.]

STATIONS OCCUPIED.—*Arkansas:* Harrisburg, Marianna, Osceola, and Wyne. *Illinois:* Chester, Elizabethtown, Jonesboro, Metropolis, Mount Vernon, Murphysboro, Shawneetown, and Waterloo. *Kentucky:* Benton, Brandenburg, Cadiz, Dixon, Elkton, Greenville, Hardinsburg, Hartford,* Marion,* and Murray. *Mississippi:* Corinth and Iuka.* *Missouri:* Ava, Benton,* Bloomfield, Butler, Carthage, Centerville, Eminence, Forsythe, Galena, Greenfield, Hartville, Jackson, Keytesville, Mexico, Nevada, Neosho, Ozark, Perryville, Pineville, St. Louis, and Van Buren. *Nebraska:* Manteo.* *North Carolina:* Fayetteville. *Tennessee:* Alano, Ashland City,* Bolivar, Camden,* Caruthersville,* Centerville, Clarksville, Decaturville,* Dresden,* Dyersburg, Erin, Henderson, Hohenwald, Huntingdon, Jackson, Lexington, Linden,* Nashville, Paris,* Savannah,* Selma,* Somerville,* Tiptonville,* Trenton,* Union City,* Waverly, and Waynesboro. *Virginia:* Bedford.*

* Meridian lines also established.

Magnetic work was done in the field July 1 to December 11 and March 10 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 several of the stations. The stations were marked by stone posts.

Several of the stations had been previously occupied, and the observations were repeated to determine the annual change in declination.

ARIZONA.

[W. B. KEELING.]

Preparations for the construction of a magnetic observatory near Tucson, Ariz., were begun at that place on May 13. Several possible locations were carefully examined. A selection was made of one on government land which was afterwards made a government reservation by executive order.

The construction of the building was in progress on June 30,

NEBRASKA, SOUTH DAKOTA, UTAH, AND WYOMING.

[FORD KURTZ.]

SUMMARY OF RESULTS.—Leveling: 457 kilometers of line completed; 127 bench marks established.

On July 1 the work of extending the standard levels in Utah northward from the vicinity of Sahara was in progress, and the line was continued until July 18, when a junction was made, at Opal, Utah, with the work of a party leveling toward the south, which completed the connection between sea level in the Pacific Ocean at San Diego, Cal., and the transcontinental line of levels at Ogden, Utah. The line followed the San Pedro, Los Angeles and Salt Lake Railroad, and the party lived in an "outfit box car," which was hired for the purpose, as the country traversed afforded nothing but the railroad to facilitate the work. This car was hauled forward by the railroad company as the work progressed and left on convenient side tracks. The officials of the company kindly granted authority to use velocipede cars as the means of transportation, which greatly facilitated the progress of the work, and the Survey is under obligations to the officials and especially to those of the engineering department for courtesies extended to the party.

After completing the work as stated above the party was transferred to Crawford, Nebr., in order to extend the standard levels westward from that place. The work began on July 29 and was continued until November 5, when a junction was made with the work of a party running east, which completed the large circuit, Cheyenne, Wyo.–Ogden, Utah–Pocatello, Idaho–Butte, Mont.–Huntley, Mont.–Crawford, Nebr.–Cheyenne, Wyo. The line followed the Burlington and Missouri River Railroad, which is operated by the Chicago, Burlington and Quincy Railroad. The party lived in an "outfit box car," which was hired for the purpose. This car was hauled forward by the railroad company as the work progressed and left on convenient side tracks. The officials of the company kindly granted authority to use velocipede cars as the means of transportation, which greatly facilitated the progress of the work, and the Survey is under obligation to these officials for the many courtesies extended to the party.

From Ardmore, S. Dak., to Osage, Wyo., the line followed the route of some leveling done by the United States Geological Survey, and the elevations of 23 of the bench marks established in that work were determined. The elevation of the track in front of all the railroad stations was also determined.

On June 30 arrangements were completed at El Reno, Okla., to start a line of levels westward from that place.

MARYLAND, NEW YORK, AND VIRGINIA.

[E. B. LATHAM.]

SUMMARY OF RESULTS.—Hydrography: 2 square miles of area covered, 50 miles of lines sounded, 1 565 soundings made, 1 tide station occupied, 1 hydrographic sheet completed. Topography: 449 miles of shore line surveyed, 59 miles shore line of creeks surveyed, 25 miles of road surveyed, 3 topographic sheets completed. Triangulation: 160 square miles of area covered, 15 stations occupied, 102 geographic positions determined.

On July 1 the topographic resurvey of the shore line of Chincoteague Bay, Maryland and Virginia, was in progress and the work was continued until October 31, when the work assigned to the party was completed. A resurvey of a portion of the ocean shore line south of Ocean City, Md., was then completed, and on December 18 the party was disbanded.

In February (15–19) the geographic positions of Assateague anchorage light and of Fishing Point light were determined by triangulation, and also the position of several objects at the Assateague Life-Saving Station.

On April 6 the collection of data for the revision of the charts on the south shore of Long Island, N. Y., was begun westward from Fire Island, and in May a hydrographic survey was made of the bar and channel at Fire Island Inlet. The topographic revision covered the south shore of Long Island and of Great South Bay from Fire Island Inlet to Jones Inlet. A search was made for all old triangulation along the shore from Nichols Point to Jones Inlet, 13 in number, and 3 of them were recovered.

The collection of data for chart revision was in progress on June 30.

NEW YORK.

[JOHN W. MAUPIN.]

SUMMARY OF RESULTS.—Hydrography: 14 square miles of area covered, 103 miles of lines sounded, 3 607 soundings made, 1 tide station established, 1 hydrographic sheet completed. Topography: 4 square miles of area covered, 19 miles of shore line surveyed, 14 miles of roads surveyed, 1 topographic sheet completed.

In August a party was organized to revise the topography and hydrography on the south shore of Long Island in the vicinity of the entrance to Jamaica Bay.

Field work began on August 13 and was completed October 24. The topographic work was done between Rockaway pier and Coney Island pier, and the hydrography extends from Barren Island to Coney Island pier and covers the entrance to Jamaica Bay. The topographic work was nearly all along the shore lines, and it developed considerable changes in places, some portions having washed away and others having built up.

NORTH CAROLINA.

[J. W. MAUPIN, December 15 to June 5; J. B. BOUTELLE, June 6–30, Commanding Steamer *Endeavor*.]

SUMMARY OF RESULTS.—Hydrography: 139 miles of lines sounded, 7 054 soundings made. Topography: 8 square miles of area covered, 56 miles of shore line surveyed, 7 miles of shore line of creeks surveyed. Triangulation: 360 square miles of area covered, 70 stations occupied, 130 geographic positions determined.

In December a party was organized on the steamer *Endeavor* for supplemental surveys on the coast of North Carolina.

The old triangulation from Pamlico light-house to Portsmouth Island, and thence through Pamlico and Roanoke sounds to Roanoke Island, and then through Croatan Sound, was examined and as many of the old stations were recovered as possible. Additional stations were established, where necessary, and the geographic positions of aids to navigation and prominent objects along the shores were determined.

Substantial signals were built at many of the triangulation stations left in position for subsequent use in making hydrographic surveys.

After June 6 the party was engaged in topographic and hydrographic work included in the resurvey of Oregon, New Loggerhead, and Hatteras inlets and along the western shore of Croatan Sound, from Roanoke Marshes to Redstone Point. The work was in progress on June 30.

ARIZONA, CALIFORNIA, MONTANA, UTAH, AND WYOMING.

[H. W. MAYNARD.]

SUMMARY OF RESULTS.—Leveling: 647 kilometers of line completed and 187 bench marks established.

The extension of the standard levels in Utah was in progress on July 1, and the work was continued until the 18th, when a junction was made at Opal, Utah, with a line brought from the south by another party, thus completing the connection between sea level at San Diego, Cal., and the transcontinental line of levels at Ogden, Utah. The line followed the San Pedro, Los Angeles and Salt Lake Railroad. The party lived in an outfit car hired from the railroad company, which was hauled forward and left on convenient side tracks by the company as the work progressed. Velocipede cars were used as the means of transportation and the Survey is under obligation to the officials of the company for granting this privilege.

In August the party was transferred to Huntley, Mont., to extend the levels eastward from that place, and observations began on August 20 and were continued until November 6, when the line was completed to Cadiz, Wyo., joining the line brought from the east by another party and completing the large circuit, Cheyenne, Wyo.–Ogden, Utah–Pocatello, Idaho–Butte, Mont.–Huntley, Mont.–Cheyenne, Nebr.–Cheyenne, Wyo. The line followed the Chicago, Burlington and Quincy Railroad. The party lived in two small box cars hired from the company and arranged for the purpose, and velocipede cars were used as the means of transportation. The Survey is under obligation to the officials of the company for granting these privileges.

In April a party was organized to extend the leveling work of the Survey eastward from Goffs, Cal. The work began on the 16th and was in progress at the close of the fiscal year.

The line followed the Atchison, Topeka and Santa Fe Railway, and the Survey is under obligation to the officials of the company for the privilege of using velocipede cars as the means of transportation and of hiring outfit cars for quarters, by which the progress of the work was greatly facilitated.

On June 30 the work had been completed to a point in the vicinity of Gleed, Ariz.

INDIANA.

[FRED. A. MOLBY.]

STATIONS OCCUPIED.—Auburn, Columbia City, and Rochester.

Observations to determine the value of the three elements of terrestrial magnetism were made at the stations named above June 21 to 30, and the work was in progress on the latter date.

CALIFORNIA.

[FREMONT MORSE.]

SUMMARY OF RESULTS.—Triangulation: 295 square miles of area covered, 4 stations occupied, 6 geographic positions determined.

Preparations were made for the determination of the geographic position of Bonita Point and Mile Rock light-houses in December, but it was necessary to postpone the completion of the work until May.

Bonita Point light had been determined before the earthquake of 1906, and a redetermination of its position was considered desirable, as it had been shown that many of the triangulation stations in this region had been disturbed by this earthquake. The position of the light on Mile Rock had not been previously determined. The work was based on three triangulation stations whose positions had been determined since the earthquake, and night signals were successfully used, this season of the year being very unfavorable for observations over long lines in the daytime. The observations began on May 8, and the work was completed on the 12th.

FLORIDA.

[W. E. PARKER.]

SUMMARY OF RESULTS.—Hydrography: 7 square miles of area covered, 81 miles of lines sounded, 1 279 soundings made, 1 tide station established, 1 hydrographic sheet completed.

At the request of the Light-House Board a hydrographic resurvey of the approaches and entrance to Bahia Honda Harbor, Florida, was made (March 29 to April 22).

The tide station was established on the southeastern shore of Big Pine Key, and a plane of reference for the reduction of soundings was deduced by combining observations made at this point with simultaneous tide observations at Key West.

WASHINGTON.

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

SUMMARY OF RESULTS.—Topography: 39 miles of shore line surveyed, 1½ miles of shore line of creeks surveyed, 2 miles of roads surveyed, 4 topographic sheets completed.

On November 19 the *McArthur* sailed from Seattle for Juan de Fuca Strait to make a topographic survey of the shore line westward from Port Crescent to Neah Bay.

Unfavorable weather delayed the work and it was not completed until February 23. During this period a resurvey was made along the water front of Port Angeles. The vessel then proceeded to Bellingham, Wash., and completed a survey along the water front of that place by March 7, and later went to Seattle to have repairs made.

CONNECTICUT, MASSACHUSETTS, AND NEW YORK.

[H. P. RITTER.]

The collection of data for the revision of the charts along the New England coast was in progress on July 1, and was continued at intervals when other duties of the observer permitted during the remainder of the fiscal year. The work consisted in taking a published chart in the field and in making all important corrections necessary to show the existing topographic conditions, and in a number of cases the hydrographic changes also. This work was completed along the coast of Connecticut from Oyster Point to Bridgeport and from Fairfield to Georges Rock. Work was done in Connecticut between Georges Rock and Westcott Cove, and in New York on the south shore of Long Island between Long Beach and Edgemere.

In June the Speed Trial Courses off Provincetown, Mass., were examined, and the one recently established by a private corporation was verified as requested by the Navy Department.

In connection with the work of chart revision, 37 old triangulation stations were recovered and remarked when necessary. Statements of the present condition of these stations were prepared.

CALIFORNIA.

[A. F. RODGERS, July 1 to December 9;* J. J. GILBERT, December 10–25; F. MORSE, December 26 to June 6; F. WESTDAHL, June 7–30.]

An officer served during the year in charge of the suboffice at San Francisco, Cal., as the representative of the Superintendent and attended 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.

CONNECTICUT, DELAWARE, NEW JERSEY, NEW YORK, PENNSYLVANIA, AND RHODE ISLAND.

[JOHN ROSS, Commanding Steamer *Hydrographer*.]

The Coast Pilot party on this vessel was at work on July 1, collecting information in the field for a revision of United States Coast Pilot, Atlantic Coast, Parts IV and V: Point Judith to New York, and New York to Chesapeake Bay entrance. In July the *Hydrographer* visited the harbors in Block Island Sound, Fishers Island Sound, Gardiners Bay, and Long Island Sound, noting changes, obtaining new information, and testing sailing lines. This work was continued in Hempstead and Manhasset bays, East River, Hudson River, New York Bay and tributaries, Raritan and Delaware rivers, and Delaware Bay. The work was completed on September 7, and the vessel proceeded to Arundel Cove, Maryland, where she was placed out of commission.

*Assistant Aug. F. Rodgers died on December 9, 1908, after serving continuously since January 1, 1847.

MICHIGAN, MINNESOTA, NORTH DAKOTA, AND NEW YORK.

[E. SMITH, O. B. FRENCH.]

The determination of differences of longitude between selected places was in progress at the close of the last report with the observers named above in charge of cooperating parties, and the work between the places named below was completed on August 15: Dalton, Minn., and Bismarck, N. Dak.; Detroit and Bunday Hill, Mich.; Albany and Fishkill Landing, N. Y.

The determination of the differences of longitude was made by the telegraphic method, and transit micrometers were used in making the observations.

Additional information was obtained in regard to the astronomic station at Minneapolis, Minn.

FLORIDA, MARYLAND, MASSACHUSETTS, NEW JERSEY, AND PENNSYLVANIA.

[EDWIN SMITH.]

SUMMARY OF RESULTS.—Astronomic observations: 3 azimuths measured, 3 latitudes determined. Triangulation: 170 square miles of area covered, 30 stations occupied, and 76 geographic positions determined.

During the period August 29 to October 9 astronomic observations were made to determine the latitude at 1 station in New Jersey, 1 in Pennsylvania, and 1 in Maryland. An azimuth was measured in Massachusetts, in New Jersey, and in Pennsylvania. Selected triangulation stations were occupied and the azimuths of lines in the triangulation were determined.

In January a party was organized to recover old triangulation stations and do supplementary work along St. Johns River, and in the vicinity of Apalachicola Bay, Florida. Several old stations were recovered and the supplemental work was extended along the river in the vicinity of Jacksonville, and in front of the city. Observations were made at 11 stations in the triangulation of the river by the Corps of Engineers, U. S. Army, in connection with its improvement. The old triangulation stations between the mouth of the river and Palatka were visited, and the marks were recovered whenever possible. One hundred and thirteen stations were searched for and 23 of these were recovered and remarked if necessary. The other stations have been destroyed. The positions of a number of prominent objects in Jacksonville were determined. Tidal bench marks were recovered and additional ones were established at Pilot Town, Mayport, Fulton, Dames Point, and Chaseville. The old bench marks at St. Johns Bluff were found in good condition. The work on St. Johns River was completed on March 20, and similar work at Apalachicola Bay was begun on the 22d, and a search was made for 23 old stations, but only 4 were recovered. New stations were selected and the triangulation was extended from Cape St. George Light-house to Crooked River Light-house and beyond to St. James Island, a distance of 35 miles. A tidal bench mark was recovered on Sand Island and additional bench marks were established. The work closed on May 12.

On June 15 a party was organized to supplement the triangulation in the vicinity of Ocean City, Md., and to determine the geographic positions of aids to navigation. A search was made for old stations, and 3 old stations, established in connection with the

survey of the oyster bars in Maryland, were recovered in the vicinity of Ocean City. Triangulation was extended northward from these stations and was in progress in the vicinity of Fenwick Island Light-house on June 30.

CALIFORNIA, FLORIDA, HAWAII, LOUISIANA, MARYLAND, 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.

CONNECTICUT.

[H. M. TRUEBLOOD.]

The work of collecting data for the revision of the charts along the coast of Connecticut was in progress from July 1 to September 16, and work was done during this period between Georges Rock and Sheffield Island.

Some of the old triangulation stations in this region were recovered, and observations were made to determine the geographic positions of a few additional stations.

DELAWARE AND NEW HAMPSHIRE.

[D. B. WAINWRIGHT.]

SUMMARY OF RESULTS.—Topography: 29 square miles of area covered, 50 miles of shore line surveyed, 72 miles of roads surveyed, 2 topographic sheets completed.

The topographic survey of the shores of Great Bay, N. H. including the stream flowing into it, and of the Piscataqua River, was in progress on July 1, and the work was continued until October 15. The survey was completed along the shore of Piscataqua River, Great Bay, and Exeter River from Portsmouth to Exeter, and thence northward to New Market.

In April an inspection was made of the Speed Trial Course range beacons at Delaware Breakwater, Delaware, and these beacons were found in position and in good condition.

The survey of shores of Great Bay was resumed on June 22, and the work was in progress on June 30.

HAWAII.

[W. F. WALLIS.]

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 magnetic 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. Numerous earthquake shocks, including slight tremors, were recorded, the total being 145 for the year. The most notable shock recorded was the one which caused the Italian disaster on December 27, 1908.

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

MASSACHUSETTS AND CONNECTICUT.

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

SUMMARY OF RESULTS.—Hydrography: 3 086 square miles of area covered, 1 510 miles of lines sounded, 9 286 soundings made, 3 tide stations established, 4 hydrographic sheets completed. Magnetic observations: 3 stations on land occupied, 7 stations at sea occupied.

On August 31 the steamer *Bache* left Baltimore for Georges Bank, off the coast of Massachusetts, to make a hydrographic resurvey of the bank and magnetic observations en route. The vessel reached Georges Bank on September 8 and the hydrographic work began immediately.

With the aid of the light-house tender *Mayflower* a whistling buoy was placed on the bank, and this buoy, the watch buoy near Nantucket Light-ship, and the light-ship were located by astronomic observations as often as possible during the season. Whenever it was practicable to do so the lines of soundings were connected with these points. The work was closed on October 23. An examination was then made of the Middle Ground Shoal, Vineyard Sound, Massachusetts, and completed on October 28. The vessel then proceeded to Fishers Island Sound and made a resurvey of Middle Ground Shoal in that locality. Unfavorable weather delayed the work, and it was not completed until November 11.

An uncharted rock in Captain Harbor, Connecticut, was located, and on November 14 the vessel started to Baltimore.

DELAWARE, FLORIDA, AND MARYLAND.

[ISAAC WINSTON.]

In July and August extensive repairs were made to the Tide Indicator at Reedy Island, Del., by a mechanician sent from the office for that purpose. A new float well, consisting of a strong wooden box inclosing a copper float tube was put in place, and the float of the tide gauge now rests on a column of kerosene oil 7 to 8 feet high, which is intended to prevent any interference by ice with the operation of the indicator in winter. The indicator is established at the Reedy Island Quarantine Station of the Public Health and Marine-Hospital Service and the Survey is under obligation to the surgeon in command of the station for the assistance rendered by his orders.

In October the geographic position of the new light-house in Chesapeake Bay, off the mouth of Magothy River, known as Baltimore Light-house was determined by connecting it with the triangulation in the vicinity.

In January work on the coast of Florida was resumed.

The self-registering tide gauge at Fernandina, Fla., was inspected, and the position of the tide staff was verified by leveling from it to two bench marks in the vicinity.

Additional observations were made in the vicinity of Jupiter Inlet in order to strengthen the triangulation at that place by reconciling conflicting observations. The recovery of old triangulation stations between Indian Key and Key West, and the determination of the geographic positions of aids to navigation along the Florida Reefs began on January 29, and was continued until May 3.

During this period 91 stations within the limits of charts Nos. 167, 168, and 169 were searched for, 28 were recovered, 62 have been destroyed, and 1 was not found.

The geographic position of 11 aids to navigation were determined and 13 new triangulation stations were established in connection with this work.

INDIANA, OHIO, AND NEW YORK.

[CHARLES F. WOODYARD.]

STATIONS OCCUPIED.—*Indiana:* Indianapolis. *Ohio:* Circleville, Columbus, and Painesville. *New York:* Ithaca.

During the period June 11 to 30 observations to determine the value of the three elements of terrestrial magnetism were made at the stations named above, and the work was in progress at the close of the fiscal year.

MARYLAND.

[C. C. YATES.]

SUMMARY OF RESULTS.—Triangulation: 500 square miles of area covered, 323 stations occupied, 334 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 within the State of Maryland.

The field work undertaken by the Survey in the Patuxent River in Charles, St. Marys, and Calvert counties was completed.

The field work in St. Marys, St. Georges, and St. Inigos rivers was also completed, and later the work along the Wicomico River in Charles and St. Marys counties was done. In December the field work in Bretons and St. Clements bays was finished, and on the 19th field work was suspended to bring up the office work.

On April 14 field work was resumed in Kent County, and on June 30 this work was in progress and was practically completed in Chester River.

The descriptions of the boundaries and landmarks in Wicomico and Worcester counties were prepared for publication.

Three charts to accompany the reports were completed during the year and published.

ALASKA.

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

SUMMARY OF RESULTS.—Hydrography: 75 square miles of area covered, 275 miles of lines sounded, 2 216 soundings made, 1 tide station established, 1 hydrographic sheet completed. Topography: 200 square miles of area covered, 203 miles of shore line surveyed. Triangulation: 118 square miles of area covered, 31 stations occupied, 27 geographic positions determined.

The survey of Uyak Bay, Kodiak Island, Alaska, began on June 5 of the previous fiscal year, and the statistics given above include the work done from that date to June 30. The survey of Uyak Bay and adjacent water was continued until September 24, when work was suspended for the winter. The triangulation in Uyak Bay was extended from the entrance to the head of the bay, a distance of 32 miles, and observations were also made at several stations on Shelikof Strait in cooperation with the party on the steamer *Patterson.* A topographic survey was made of a portion of the shores of Takli Bay and of the bay to the northward. A hydrographic reconnaissance was made of the approach to Russian Anchorage in Takli Bay. Tide observations were made for a portion of the season at Kodiak Mining Camp, to the eastward of Amook Island, and connected by simultaneous readings with the gauge maintained by the party on the *Patterson* at Uyak Cannery, and a reference plane for soundings was deduced from the observations at the latter gauge. The *Yukon* was hauled out at Kodiak for the winter and on October 19 the party was disbanded.

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

The steamer *Patterson* sailed from Seattle for Kodiak, Alaska, on April 15, and between May 1 and 16 the steamer *Yukon* and the launches *Alpha* and *Delta* were prepared for use in the field. The vessel reached Controller Bay on May 20, and a party was established on land to continue the survey of the bay which was begun several years ago and soon suspended in response to an urgent request from the Navy Department for a survey in another locality. The survey of the bay was continued during the month of June, and soundings were made along the coast to the westward to determine whether dangers to navigation exist, as reported, close to the steamer route in this region. The work was in progress on June 30.

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

SUMMARY OF RESULTS.—Astronomic observations: 1 latitude determined (solar observations). Base measurement: 1 base line measured. Hydrography: 18 square miles of area covered, 439 miles of lines sounded, 6 359 soundings made, 5 tide stations established, 2 hydrographic sheets completed. Magnetic observations: 20 stations occupied. Topography: 95 square miles of area covered, 114 miles of shore line surveyed, 5 topographic sheets completed. Triangulation: 116 square miles of area covered, 66 stations occupied, 78 geographic positions determined.

The triangulation of Dixon Entrance was in progress on July 1, and the work was continued until August 10, when connection was made with the triangulation stations at the south end of Tlevak Strait. The topographic work around Cape Chacon, Nichols Bay, Point Nunez, and Cape Muzon was then completed. A short base line was measured at the head of Nichols Bay and solar observations were made to determine an azimuth

and the latitude of one of the stations, and magnetic observations were made at several stations. The work assigned to the party in the vicinity of Dixon Entrance was completed on August 23.

A detached survey was then made of a bay on the south side of Cholmondeley Sound based on a latitude and an azimuth determined by solar observations. Magnetic observations were also made in connection with the work. In September a survey was made of the head of Kasaan Bay, and in October the triangulation was extended from the entrance of Tlevak Strait, along the shores of Cordova Bay, and through Sukkwan Strait to Salterey Point.

On September 19 the steamer *Equator* was hauled off a reef at Clump Point just in time to escape a heavy gale which passed over this region the following day.

While waiting for the completion of a boathouse at Metlakahtla for storage purposes a topographic survey of the village was made, and on November 13 the wharf of the New England Fish Company, at Ketchikan, was located and a few soundings were made in the vicinity. This completed the field work for the season. The vessel proceeded to Seattle and reached there on November 25.

On April 30 the *Gedney* sailed for Alaska. Magnetic observations to determine the error of the ship's standard compass were made at Seattle before starting, and magnetic observations to determine the declination at 13 stations between Seattle and Ketchikan were made with this compass en route.

On May 19 the vessel proceeded to Cape Chacon, Dixon Entrance, and resumed work on the survey of Cordova Bay. The hydrographic and topographic work were extended from Point Nunez to the Barrier Islands. A number of lines were sounded, which showed clear water to the anchorage at the head of the bay. The area from the vicinity of Point Nunez to the boundary line south of Dewey Rocks and Eureka Pass through the Barrier Islands was developed by sounding, and Wallace Rock was located.

The triangulation was extended from the shores of Long Island to Hunter Bay, and a self-registering tide gauge was established near the anchorage south of Hunter Bay. The work was in progress on June 30.

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

SUMMARY OF RESULTS.—Hydrography: 1 742 square miles of area covered, 1 043 miles of lines sounded, 8 451 soundings made, 3 tide stations established, 13 current stations occupied, and 2 hydrographic sheets completed. Magnetic observations: 9 stations occupied on land and 27 at sea. Topography: 44 square miles of area covered, 52 miles of shore line surveyed, 3 topographic sheets completed. Triangulation: 2 189 square miles of area covered, 22 stations occupied, 71 geographic positions determined (including 55 mountain peaks).

The survey of Shelikof Strait and vicinity was begun during the previous fiscal year and was in progress on July 1. The triangulation was extended from Kupreanof Strait to Barren Islands and the hydrographic survey of the strait was completed from Uganik Island to Cape Douglas. The triangle sides were unusually long, and it was necessary to use heliotropes at the distant stations. The positions and elevations of a number of mountain peaks were determined. A topographic survey was made of 40 miles of the coast line along the strait and in Alimvoak Bay, and magnetic observations were made at 3 stations in the strait.

Shelikof Strait is an extensive body of water, approximately 100 miles long and 25 miles wide, and no soundings had previously been made in it. The hydrographic work

covered the northern half of the strait, and the depths are unusually uniform, ranging from 50 fathoms on the westerly side to more than 100 fathoms on the opposite side. No dangers to navigation were discovered offshore.

Topographic work was also done in Alimvoak Bay, around Cape Paramanof, and at Black Cape. Field work closed for the season on October 15, and magnetic observations were made at 2 stations on shore before the vessel started south. Magnetic observations were also made at Seattle, Wash., prior to sailing, and at Union Bay, British Columbia, going to and returning from Alaska. The vessel returned to Seattle on November 1.

On May 7 the *Explorer* sailed from Seattle for Bristol Bay, Alaska, and reached there on May 26. The survey of Nushagak Bay was in progress on June 30. At that date the triangulation had been completed from the entrance to the bay to a point at the head of the bay and some hydrographic and topographic work had been completed.

[H. M. W. EDMONDS, July 1 to January 31; F. L. ADAMS, February 1 to June 30.]

The work at the Sitka Magnetic Observatory was continued during the year. A record of the variation in the relative value of the three elements of terrestrial magnetism was obtained with self-registering instruments.

A seismograph was kept in operation and meteorological observations were made. Observations were made at least once each week to determine the absolute values of the magnetic elements. Time signals were received over the cable and observations to determine local time were made when the cable time service was interrupted.

[J. W. GREEN.]

STATIONS OCCUPIED.—Victors Wood Camp, Fort Hamlin, Rampart, Tanana, Kokrines, Loudon, Nulato, Kaltag, Anvik, Holy Cross, Russian Mission, Andreafsky, Katlik, and St. Michael.

Observations to determine the value of the three elements of terrestrial magnetism at various points along the Yukon River, in Alaska, were in progress on July 1 and the work was continued until August 28. During this period magnetic observations were made at the stations named above. One man accompanied the observer and a small boat was used as the means of transportation down the river.

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

SUMMARY OF RESULTS.*—Hydrography: 203 square miles of area covered, 1 068 miles of lines sounded, 17 330 soundings made, 7 tide stations established, 6 hydrographic sheets completed. Topography: 152 square miles of area covered, 190 miles of shore line surveyed, 7 topographic sheets completed. Triangulation: 2 700 square miles of area covered, 115 stations occupied, 150 geographic positions determined.

The survey of Shelikof and Kupreanof straits and the connecting bays and inlets on the coast of Kodiak Island was in progress on July 1, and was continued until October 17, when the work was suspended for the winter and the vessel returned to Seattle on the 30th. The triangulation in Kupreanof Strait was completed and the work was extended in Shelikof Strait to a junction with the work already completed, extending

* These statistics cover the work of the season March 28 to October 17.

northeastward from Kupreanof Strait to the Barren Islands, and thence southwestward in Shelikof Strait to Cape Kaluk on the Kodiak shore and to Cape Kubugakli on the mainland.

The topographic and hydrographic work was done by parties living on shore in camps established for the purpose.

A survey was made of the greater portion of Uganik Bay and the triangulation was extended into Uyak Bay. Detached surveys were made of Uyak, Northeast, and Karluk harbors, except the hydrographic work, which was only completed in Uyak Bay.

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

SUMMARY OF RESULTS.—Hydrography: 34 square miles of area covered, 68 miles of lines sounded, 372 soundings made, 2 tide stations occupied. Reconnaissance: 580 square miles of area covered. Triangulation: 100 square miles of area covered, 7 stations occupied.

The steamer *Yukon* was prepared for field work by the party on the steamer *Patterson*, May 1 to 15, at Kodiak, Alaska, and hydrographic work in the Chiniak Bay approach to Kodiak Harbor began next day. This work was continued until May 31, when the vessel went to Afognak and began the survey of the coast northward from Afognak Bay. On June 3 a portion of the engine gave way, causing serious injury to the low-pressure cylinder rod, and making it necessary to visit Uyak Bay for repairs. The Survey is under obligation to the superintendent of the Northwestern Fisheries Company, Mr. Fred Davidson, for his kindness in making a new piston rod for the vessel. The vessel returned to Kodiak on the 14th for coal and was able to facilitate the work of the Steamboat-Inspection Service by conveying the local inspectors to Uyak Bay, as the regular passenger steamer had become disabled and was not able to make the June trip. The vessel then returned to the working ground, and during the remainder of the month the time was spent in reconnaissance, signal building, and triangulation, and this work was in progress on June 30.

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

SUMMARY OF RESULTS.—Hydrography: 254 miles of lines sounded, 5 454 soundings made, 3 tide stations established, 11 current stations occupied, 2 hydrographic sheets completed. Magnetic observations: 3 stations occupied on land and 9 stations at sea. Topography: 32 miles of shore line surveyed, 1 topographic sheet completed. Triangulation: 5 150 square miles of area covered, 18 stations occupied, 39 geographic positions determined.

On July 1 the *McArthur* was at Port Graham completing the triangulation of the harbor with shore parties, living in camp, at work on the triangulation of Cook Inlet. The main triangulation was extended up the inlet to the Forelands, a distance of 100 miles, before September 8, when the topographic and hydrographic survey of Port Graham was begun. This work was completed on October 7, and the vessel returned to Seattle on the 24th. A self-registering tide gauge was maintained at Seldovia during the season.

On April 28 the *McArthur* sailed from Seattle for Cook Inlet, via Kodiak, to get the launch *Delta*, and arrived at Port Graham on May 16. Magnetic observations at sea were made en route and during the season. On May 19 work on the extension of the triangulation in Cook Inlet northward from the Forelands was begun, and by June 30, 14 stations had been selected and 12 signals built. Observing parties were established on shore in camps, and topographic work was done whenever possible without interference with the

triangulation. Nine miles of shore line was surveyed before June 30. A self-registering tide gauge was used at Seldovia, and tide observations were also made at a point about 2½ miles above East Foreland.

Current observations were made with the vessel at anchor off Nikishka, and also at 10 other stations where the vessel anchored. The weather was unusually favorable, but the strong tidal currents delayed the work, and extensive mud flats at many points prevented communication with the shore except at high water.

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

SUMMARY OF RESULTS.—Base measurement: 1 base line measured. Hydrography: 73 square miles of area covered, 281 miles of lines sounded, 3 500 soundings made, 4 hydrographic sheets completed. Topography: 36 square miles of area covered, 65 miles of general coast line surveyed, 2 miles of shore line of roads surveyed, 26 miles of shore line of creeks surveyed, 5 topographic sheets completed. Triangulation: 12 square miles of area covered, 11 stations occupied, 37 geographic positions determined.

On July 1 the survey of the outer coast of Hinchinbrook Island, off Prince William Sound, was in progress. The work was done under conditions of unusual difficulty, as the coast is exposed, with a heavy surf, and with sand reefs extending 4 or 5 miles out to sea, and has only two landing places for small boats. Camps were established at these two places and the work was done by parties living on shore. It was not possible to land and build hydrographic signals, and natural objects, located by the topographic party from the tops of the high cliffs, were used to locate the soundings.

The topographic work was carried along the top of the cliffs, as it was impracticable to use boats along shore, and it was equally impracticable to get along the shore except at intervals and at low water.

Early in August the survey of the shores of Knights Island was begun, and this work was continued until September 26, when the field work was suspended for the winter. The east coast of Knights Island is mountainous and is indented by deep bays. A survey was made of Bay of Isles, Marsh, Hogan, and Little bays, including a topographic survey of the shores of the bays and the adjacent shores of the island, and a hydrographic survey of the bays and along the shores of the island where topographic work was done. Tide observations were made in the Bay of Isles and in Mummy Bay. The *Taku* returned to Cordova on September 26, and the vessel was laid up for the winter. A plane table survey was made of the new town site which had been recently occupied, and the party started to Seattle on October 10.

Work was resumed at Orca, Alaska, on April 24, and repairs were made to the *Taku*. On May 12 a survey of the head of Orca Bay was begun, to comply with requests from the Secretary of Interior and from the Secretary of War. The triangulation was extended to cover the bay and 3 miles beyond, up the valley. Observations were made on mountain peaks and crests visible from the stations in order to determine their positions and elevations, and a base line was measured on the flats at the head of the bay.

The topographic and hydrographic surveys previously completed were extended to cover the shores and remaining portion of the bay and the topographic work to a point 3 miles up the valley from the head of the bay. The work was completed on June 26, and on June 30 the vessel was at Orca preparing to resume the survey along the shores of Knight Island.

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.—From July 1 to August 21 repairs were being made to this vessel at Canacao. The crew aided in the repair work as far as possible in order to save expense. During this period a supplementary survey was made in Manila Harbor. The vessel sailed August 22 for the east coast of Leyte, carrying the insular mail for Cebu and Tacloban. The mail was landed at Cebu on August 24, and at Tacloban next day. Field work began in the vicinity of Tacloban on the 25th and continued along the coast of the island until December 21, and the vessel returned to Manila on the 24th. Necessary repairs were made to the ship, and she sailed for Cebu on March 13 to make surveys along the east coast of the island and the work was in progress until June 5. Two severe typhoons were weathered during the season, the one on September 23 being the most severe. In this storm a steam launch and dinghy, used by a detached party at work on the east side of San Pedro Bay, were driven ashore and dashed to pieces on the sharp rocks which line the shore. The party was in great danger of losing their lives, but fortunately escaped without serious injury.

Steamer Fathomer.—Repairs were made to this vessel July 2 to August 16, and she sailed next day for Calapan, Mindoro, and surveys were made along the coast of Mindoro and Marinduque islands until March 13, when the field work closed and the vessel reached Manila on the 16th for the usual semiannual repairs which are necessary in these waters. The vessel sailed for Romblon on May 20 and began work on the 22d at the northern end of Tablas Islands and on the east coast of Mindoro. The triangulation was extended southward during June and was in progress on the 30th.

Steamer Marinduque.—The party on this vessel was engaged in making surveys along the east coast of Luzon north of Balesin Islands on July 1, and the work continued until October 10, when work was suspended on account of unfavorable weather and the vessel sailed for Manila to have repairs made. This work was completed during the period October 17 and January 25, when the vessel sailed for the south coast of Mindanao Island, and work was in progress in this locality on June 30.

Steamer Romblon.—The party on this vessel was at work on the east coast of Luzon between Lamon Bay and Calagua Islands on July 1, and this work continued until October 18, when the continuous unfavorable weather resulting from the northeast monsoon forced a suspension of the work, and the vessel sailed for Manila. Repairs were made during the period October 22 and December 22, when the vessel sailed for the southwest coast of Leyte and work was in progress in this locality on June 30.

Steamer Research.—The party on this vessel was engaged on field work on July 1 and continued at work until June 30. During this period surveys were made along the west and north coasts of Cebu, the east coast of Negros, in Tañon Strait, and along the shores of Bantayan Islands.

Launch Morven.—A party using this launch was at work on the coast of Bohol Island on July 1, and the work continued along the north and west coasts of the island until April 30, when the party started to Tacloban, Leyte, to begin work in San Juanico Strait. The survey was extended from the work previously completed in this region along San Juanico Strait. The work was in progress on June 30, and the triangulation was completed to Janabatos Channel, the topographic survey to Santa Rita Pass, and the hydrographic work to Bacol Island.

A speed-trial course was established in Subic Bay, Luzon, at the request of the Admiral commanding the third squadron of the Pacific Fleet. A course 1 mile long was selected, laid off, and marked by buoys in the water and by beacons on shore between August 28 and October 3. The Commandant and other officers at Olongapo aided the party in every possible way.

OFFICE WORK.

The suboffice at Manila is organized to do all the work involved 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. Eleven drawings for new charts and 19 drawings for new editions of charts were prepared during the year and sent to Washington for publication.

A supplement to Section I of the Philippine Islands Sailing Directions, third edition, and Notices to Mariners, Nos. 5 to 13 of 1908, and Nos. 1 to 4 of 1909, were prepared and published.

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A catalogue of charts, Sailing Directions, and Tide Tables was also published.

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.

[E. R. FRISBY.]

SUMMARY OF RESULTS.—Seventy-two square miles of area covered, 14 stations occupied, 24 geographic positions determined.

In response to a request from the Admiral commanding the third squadron of the Pacific Fleet, a party was sent to Subic Bay to select and mark a speed-trial course 1 mile long. The naval authorities at Olongapo furnished a launch and all necessary assistance.

The requirement of a depth of 30 fathoms of water along the course and along an additional mile at each end made it necessary to locate the course on the west side of the bay south of Grand Island. Along this shore of the bay the land has a steep slope and reaches an elevation of 3 000 feet within 2 miles of the shore, and this made it difficult to select a course which could be marked without using beacons of excessive height.

After selecting the course it was found to be very difficult to determine the correct locations for the ends by an extension of the triangulation already completed in this locality, due to unfavorable weather and the absence of roads and trails which made the establishment and determination of the new stations very laborious. The work began on August 28 and was completed on October 3.

The beacons were constructed by the bureau of yards and docks under the direction of the civil engineer attached to the bureau. Acknowledgment is made of the courtesies extended to the party by all the officers at the station. All the facilities of the yard were placed at the disposal of the party.

[C. V. HODGSON.]

SUMMARY OF RESULTS.—Hydrography: 668 square miles of area covered, 3 339 miles of lines sounded, 138 646 soundings made, 7 tide stations established, 10 topographic sheets completed. Topography: 235 square miles of area covered, 298 miles of general coast line surveyed, 12 miles of shore line of river surveyed, 156 miles of roads surveyed, 12 topographic sheets completed. Triangulation: 1 001 square miles of area covered, 42 stations occupied, 91 geographic positions determined.

On July 1 a party was at work using the launch *Morven* on the coast of Bohol Island in the vicinity of Jetafe. A topographic and hydrographic survey was made of the offlying reef and islands, including Danajon Bank and Olango Island. The triangulation was extended across the strait between Cebu and Bohol islands and the topographic work to include the east coast of Mactan Island to a connection with the work previously completed in this locality.

A hydrographic survey was made of the channel between Mactan and Olango islands. This completed the topography as far south as Punta Cruz, Bohol, and the hydrography as far south as Calape Island, including the small rocky bay on which the town of Calape is situated.

A feature of this region is Danajon Bank, which bends in the shape of a boomerang off the north and west coast of Bohol and marks the outer limit of the many reefs and shoals along this part of the coast. The greater portion of this bank is bare at low water as far south as Macaboc Island, and the water deepens abruptly on the inside to 15 fathoms, and on the outside to 50 fathoms and more.

After January 1 the survey was extended around the southern shore of Bohol Island to a junction with the work previously completed by another party on this coast at Point Gorda.

The report on the work contains many interesting details concerning the country and its inhabitants.

The work mentioned above was completed on April 30, and the party then proceeded to Tacloban, Leyte, to take up the survey of San Juanico Strait. Triangulation was extended from the completed work in this vicinity, northward along the strait to Janabatas Channel and a reconnaissance for the triangulation was extended beyond this point into Villa Real Bay. The topographic work was extended from the vicinity of Tacloban to Santa Rita Pass, and the hydrographic work to the vicinity of Bacol Island. Strong tidal currents exist in these waters, especially with spring tides.

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

SUMMARY OF RESULTS.—Astronomic observations: 1 azimuth measured. Hydrography: 1 985 square miles of area covered, 3 890 miles of lines sounded, 67 421 soundings made, 7 tide stations established, 11 hydrographic sheets completed. Magnetic observations: 3 stations occupied. Topography: 332 square miles of area covered, 129 miles of coast line surveyed, 12 miles of shore line of rivers and creeks surveyed, 9 topographic sheets completed. Triangulation: 2 250 square miles of area completed, 60 stations occupied, 79 geographic positions determined.

On July 1 the party on the *Marinduque* was making a survey along the east coast of Luzon in the vicinity of Polillo Island, and this work was continued until October 10, when unfavorable weather caused a suspension of the work and the vessel returned to Manila. During the period mentioned a hydrographic survey was made between the coast of Luzon and Polillo Island, and also of the waters north of Cabalite and Balesin islands.

En route to Manila the geographic position of Ocata Island Light-House was determined and some additional soundings were made in the vicinity. Seven typhoons passed over this region during the season, and each one seriously delayed the work by destroying many signals and causing rough seas. Tide observations were made with a self-registering tide gauge at Port Lamon and with a staff gauge at Hook Bay.

Repairs were made to the vessel at Manila, and she sailed on January 25 for the south coast of Mindanao to make a survey of this coast from the vicinity of Olutanga Island to a junction with work previously completed at Malabang. The natives in this region were actively hostile, and the work was done as a result of the expressed wish of the military authorities, and the effective cooperation of the army was promised. The necessary orders were issued and the facilities of the military posts in the region were placed at the disposal of the party. The vessel reached Fort Margosatubig on January 30, and a detachment of 22 Philippine Scouts was taken on board, and during the season each surveying party sent on shore was armed and was accompanied by a sufficient number of scouts to protect it. The country to be surveyed was found to be densely

covered with hard-wood trees from 5 to 6 feet in diameter, and many other obstacles prevented rapid progress. The triangulation was completed between the limits stated above and a hydrographic survey was made across the entrance to Dumanquilas Bay between Olutanga Island and Baganian Peninsula and along the shore at the head of Illana Bay. A topographic survey was made along the shore from the entrance to Dumanquilas Bay to a junction with the work previously completed at Malabang.

The work was in progress on June 30.

[H. D. KING, Commanding Steamer *Fathomer*.]

SUMMARY OF RESULTS.—Hydrography: 2 008 square miles of area covered, 2 172 miles of lines sounded, 40 730 soundings made, 6 tide stations established, 2 current stations occupied, 10 hydrographic sheets completed. Topography: 229 square miles of area covered, 170 miles of general coast line surveyed, 48 miles of shore line of rivers surveyed, 14 miles of shore line of creeks surveyed, 25 miles of roads surveyed, 7 topographic sheets completed. Triangulation: 2 983 square miles of area covered, 39 stations occupied, 71 geographic positions determined.

The *Fathomer* sailed from Manila on August 17 and reached Calapan, Mindoro, the next morning. Field work began immediately and was continued until March 13, as stated below. Previous to December 31 the following work was completed. Topography and inshore hydrography along the northeast coast of Mindoro Island, from Calapan Point to Dumali Point, and the necessary triangulation and tide observations; topography and inshore hydrography along the coast of Marinduque Island, from Port Banalacan around the south end of the island and up the eastern shore to Salomague Point, including Tres Reyes Islands, with triangulation covering the coast; offshore hydrography between Marinduque and northeast coast of Mindoro Island and between Marinduque and the Dos Hermanos Islands, and the extension of the triangulation to a connection with Boac Astronomic Station, with a reconnaissance for triangulation to a connection with Maestro de Campo, Banton, and Elefante islands. After January 1 work was done under the following heads:

Triangulation.—The main scheme was completed around Marinduque Island and tertiary triangulation was extended along the coast of Luzon to Arena Point.

Topography.—Maestro de Campo Island and Bondoc Peninsula from Matataha Bay to Arena Point were surveyed.

Hydrography.—The inshore hydrography was completed along the coast of Maestro de Campo Island and the coast of Bondoc Peninsula, from Matataha Bay to Arena Point, and a few lines of soundings were made in Masagasai Bay, Marinduque, to supplement the work previously done. The offshore hydrography covers the area between Mindoro and Banton islands and extends south to latitude 12° 47½′, and between Banton Island and Bondoc Peninsula it extends south to latitude 12° 57½′. Work was suspended on March 13, and the vessel returned to Manila for repairs.

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

SUMMARY OF RESULTS.—Astronomic observations: 1 azimuth determined. Base measurements: 1 base line measured. Hydrography: 1 941 square miles of area covered, 6 227 miles of lines sounded, 78 669 soundings made, 9 tide stations established, 2 current stations occupied, 7 hydrographic sheets completed. Topography: 143 square miles of area covered, 187 miles of coast line surveyed, 68 miles of coast line of rivers and creeks surveyed, 73 miles of road surveyed, 9 topographic sheets completed. Triangulation: 4 565 square miles of area covered, 57 stations occupied, 256 geographic positions determined.

During the period July 1 to May 13 the *Research* was continuously engaged, except for twenty-one days in March and April, when repairs were made to the vessel, in making surveys of the northern and western coasts of Cebu and the northern and eastern coasts of Negros. The survey of the region was extended to a line 20 miles north of Cebu, and it is now completed from Panay on the west to Leyte on the east, and as far north as this line. To the southward the hydrographic survey was completed between Cebu and the Bantayan group and as far as the southern end of this group, or to the northern entrance to Tañon Strait. The main scheme of triangulation was extended 40 miles farther south, down the strait to San Carlos, Negros, and Balamban, Cebu. The topographic survey was extended 35 miles along the western coast of Cebu, completing the topography on this coast as far south as Tuburan. The coasts and waters surveyed had only been mapped previously by exploratory surveys and were represented on existing charts in a very general way. Many ranges of hills, rivers, and creeks were found, not shown on the charts, and the waters were proved to be much more favorable for navigation than had been supposed. The report of the work contains an excellent description of the region and an account of the people and the existing conditions. Exceptionally favorable conditions for extending the triangulation were found on both shores. A continuous range of hills, about 500 feet high, extends along the coasts near each shore with isolated summits and many of them are almost entirely cleared or under cultivation. There are numerous towns with large stone churches and on the Negros shore there are a great number of sugar houses with tall chimneys.

The statistics show that a large amount of work was done at a very small cost.

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

The *Fathomer* sailed from Manila on May 20 and began field work at the northern end of Tablas Island and on the east coast of Mindoro on the 22d. The time previous to June 30 was nearly all employed in selecting triangulation stations, building signals, and opening lines in the extension of the work to the southward. Some observations were made in June, and the work was in progress at the close of the fiscal year.

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

SUMMARY OF RESULTS.—Base measurement: 1 base line measured. Hydrography: 2 860 square miles of area covered, 4 443 miles of lines sounded, 80 211 soundings made, 5 tide stations occupied, 11 hydrographic sheets completed, 1 current station occupied. Magnetic observations: 5 stations occupied. Topography: 141 square miles of area covered, 226 miles of coast line surveyed, 10 miles of shore line of rivers and creeks surveyed, 53 miles of roads surveyed, 8 topographic sheets completed. Triangulation: 4 030 square miles of area covered, 44 stations occupied, and 109 geographic positions determined.

The party on this vessel was engaged on July 1 in surveys on the east coast of Luzon, between Lamon Bay and Calagua Islands, and the work was continued until October 18.

The hydrographic survey north of Calagua Islands and in the vicinity of Tanao Islands was completed and soundings were made offshore between Jesus and Dagdap points, Luzon, and offshore soundings were made between Maculabo and Balesin islands, to a depth of 40 fathoms. A topographic survey was also made between these two points and along the shores of Jomalig Island.

Magnetic observations were made at Capalonga, and some supplementary work was done in San Miguel Bay. The vessel returned to Manila on October 22.

The *Romblon* sailed from Manila on December 22 for southwest coast of Leyte and reached her working ground on the 26th.

Field work began immediately and was continued during the remainder of the fiscal year. Old triangulation stations were recovered on Leyte, Bohol, and Lapinig islands, and the triangulation was extended southward, completing the connection between these islands and between Mindanao and Camaguin islands. A hydrographic survey was made over the region covered by the triangulation. The inshore hydrography began on the southeast side of Danajon Banks, and was extended southward, developing anchorages at Cabulao and Cogton bays and the shoals which extend 2 miles offshore, to a junction with work previously completed near Jagna. On the coast of Leyte the inshore hydrography was extended southward around the south end of the island and a short distance up Lion Bay and also around Limasaua Island. This work included Port Liloan and Panaon Strait. The offshore hydrography extends from Punta Gorda, Bohol, southward to Camiguin Island and eastward to Leyte and the northwest point of Mindanao.

The topographic work began at the northeast end of Lapinig Island, Bohol, joining work previously completed, and was extended southward to a junction with previous work near Jagna, completing this work along the coast of Bohol. On the Leyte shore the survey was extended southward from former work near Green Point around the southern end of the island and up Lion Bay nearly to Malitbog, and it included the shores of Limasaua Island and detached surveys along Panaon Strait and Port Liloan.

Current observations were made while the ship was at work between Bohol and Camiguin islands, where stops of fifteen minutes were necessary to make soundings, the drift of the ship being noted at each stop. Three floats were released in this locality and these were recovered at places which verified the data obtained on board.

In Panaon Strait a float was followed through eight times to determine the conditions at different phases of the tide. The work was in progress on June 30.

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

SUMMARY OF RESULTS.—Astronomic observations: 1 azimuth determined. Base measurement: 1 base line measured. Hydrography: 989 square miles of area covered, 2 809 miles of lines sounded, 25 984 soundings made, 4 tide stations established, 11 hydrographic sheets completed. Topography: 114 square miles of area covered, 109 miles of general coast line surveyed, 17 miles of shore line of creeks surveyed, 63 miles of road surveyed, 10 miles of railroads surveyed, 6 topographic sheets completed. Triangulation: 1 997 square miles of area covered, 41 stations occupied, 88 geographic positions determined.

On August 22 the *Pathfinder* sailed from Manila for the east coast of Leyte, with the mail for Cebu and Tacloban on board. The mail was landed at these ports and field work began at Tacloban on August 25. A base line and an azimuth were measured, the base line on the shore of San Pedro Bay and the azimuth at the longitude station at Tacloban.

Triangulation was extended from the measured base line to form a connection between detached work in this vicinity and between Leyte and Samar islands. The geographic positions of numerous mountain peaks on both islands were determined.

The topographic survey was extended along the coast of Leyte Island from Vigia Point to Taytay Point, a distance of 26 miles. Due to the season, with the prevailing

trade winds, all landings on this coast were made through the surf, which was very heavy during the greater portion of the time, making it dangerous to land.

The inshore hydrography was completed along the coast covered by the topographic work as stated above. A record of the tides was obtained with a self-registering gauge on the west side of Salacot Point during two momths, and readings on a staff gauge were made for one lunar month at the old tide station in Tacloban, to establish a tidal connection between these two places.

Two severe typhoons were weathered, and the one on September 23 was so severe that a steam launch and dinghy were blown on the rocks and destroyed in spite of their being anchored in a protected cove in San Pedro Bay. The officer in charge of the work was on the launch when she went on the rocks, and he was fortunate in escaping alive and without serious injury.

The loss of this launch seriously delayed the progress of the work during the remaining portion of the season.

Field work closed on December 21 and the vessel returned to Manila on the 24th.

The *Pathfinder* sailed from Manila on March 13 for the east coast of Cebu. The field work on that coast began on the 15th and was continued until June 5, when the vessel sailed for Manila. The unsurveyed portion of this coast between Buntalinao Point and Bagacay Point was completed, and an examination of Ormoc Shoal was made.

The observations at the triangulation stations were made by parties living in bivouac camps on shore under very uncomfortable conditions.

The examination made on Ormoc Shoal verified the former work done on this shoal. An exhaustive search was made over the locality reported for the Tritos Shoal under the most favorable conditions, but no trace of it was found. Acknowledgment is made of the assistance rendered and the courtesies extended to the party by Admiral A. P. Nazro, Capt. U. R. Harris, Commander Hugh Rodman, Paymaster J. J. Cheatham, and Naval Constructor Lloyd Bankson, officers at the naval station at Cavite, while repairs were being made to the *Pathfinder*.

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

SUMMARY OF RESULTS.—Hydrography: 792 square miles of area covered, 1 131 miles of lines sounded, 9 862 soundings made, 1 tide station established, 3 hydrographic sheets completed. Topography: 71 square miles of area covered, 49 miles of general coast line surveyed, 26 miles of shore line of creeks surveyed, 37 miles of roads surveyed, 3 topographic sheets completed. Triangulation: 1 707 square miles of area covered, 14 stations occupied, 77 geographic positions determined.

The survey of Tañon Strait was continued after May 15, and the statistics given above relate to the work accomplished before June 30.

The triangulation was extended to a junction with similar work at the south end of the strait, completing the main scheme of triangulation between the islands of Cebu and Negros, and connecting with the astronomic station at Valle Hermosa, Negros.

The topographic survey was extended along the coast of Cebu from Tuburan Point southward to the town of Aluguinsan and the offshore hydrographic survey from the completed work at the north end of the strait to the south end of Refugio Island.

The inshore hydrographic work was not continued south of Tuburan Island. No special difficulties were encountered and the conditions on shore were favorable for the extension of the triangulation and topographic work.

PORTO RICO.

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

SUMMARY OF RESULTS.—Hydrography: 1 742 square miles of area covered, 1 606 miles of lines sounded, 7 483 soundings made, 2 tide stations established, 3 hydrographic sheets completed. Magnetic observations: 4 stations occupied on land, 21 stations occupied at sea. Topography: 30 miles of general coast line surveyed, 3 topographic sheets completed. Triangulation: 11 stations occupied, 8 geographic positions determined.

Hydrographic work west of the island of Porto Rico was assigned to the party on this vessel. Magnetic observations were made on board the vessel in Hampton Roads, Va., on January 22, and the vessel sailed for Porto Rico the next day. A selected route west of the direct route was followed and magnetic observations were made every day during the voyage. While at San Juan, P. R., the geographic positions of the new light-house on Morro Castle and of the wireless-telegraph station in Puerta de Tierra were determined and magnetic observations were made in the harbor on board the ship and on shore.

The vessel proceeded to Mayaguez on February 14 and work in this locality was continued until June 12. Magnetic observations were made on shore and on board the vessel in the harbor, and later on shore on Mona Island.

The principal work of the season was the offshore hydrography of Mona Passage, to the westward of the shoals which extend many miles beyond the mainland in this region. A topographic survey was made of the shore line of Desecheo, Mona, and Monito islands and a hydrographic survey of the adjacent waters. The work was delayed by haze in the atmosphere making the signals indistinct or invisible and by a rough sea during the greater portion of the season. A few deep-sea soundings were made off the north coast and off the south coast in the vicinity of Cape Rojo. The harbor at Yabucoa was examined by sounding, and soundings were also made in the entrance. The *Bache* sailed from St. Thomas for Baltimore on June 14, and again followed a selected course considerably east of the usual course, and magnetic observations were made each day, after the 15th, at sea and in Chesapeake Bay off the Patuxent River on June 21.

[W. B. KEELING, July 1 to August 23; GEORGE HARTNELL, August 24 to June 30.]

The work at the magnetic observatory at Vieques, P. R., was continued during the year, and a record of the relative value of the three elements of terrestrial magnetism was obtained with self-registering instruments. Observations were made every week to determine the absolute value of the magnetic elements. Notable magnetic storms were recorded on January 3, January 26, and May 14.

The seismograph was in continuous operation and a record was obtained of a number of earthquakes, most of which were of moderate intensity.

SPECIAL DUTY.

NEW YORK.

[A. T. MOSMAN.]

The field work of the trigonometric survey of Greater New York was completed by the city authorities under the direction of Assistant Mosman on July 31, 1908. The work began in May, 1903, and was continued whenever the appropriations made by the city permitted until it was completed.

The following is quoted from the letter of the chief engineer transmitting the final report on the triangulation to the mayor:

> The work which has been accomplished will be of very great benefit not only to that portion of the city for which a plan has not yet been prepared, but to those parts already mapped and to those departments which have occasion to make precise surveys. I feel safe in saying that no survey of this kind including a large urban area has ever been attempted, and this report will therefore be of special value to all who are engaged in work of this character.

The triangulation covers an area of 440 square miles. Two primary base lines were measured, observations were made at 161 stations, and 182 geographic positions were determined.

A report of the work has been printed, which contains numerous details and a list of the geographic positions of the points determined with descriptions of all the triangulation stations.

LOUISIANA AND MISSISSIPPI WATER BOUNDARY.

[EBERHARDT MUELLER.]

SUMMARY OF RESULTS.—Topography: 15 miles of shore line surveyed. Triangulation: 225 square miles of area covered, 17 stations occupied, 48 geographic positions determined.

In response to a request from the governors of the States of Louisiana and Mississippi, and under the authority of the Secretary of Commerce and Labor, an officer was detailed for the purpose of marking the water boundary between these States as established in a decree of the United States Supreme Court. This boundary is the deep-water sailing line emerging from the most eastern mouth of the Pearl River into Lake Borgne and extending through the northeast corner of Lake Borgne north of Half Moon or Grand Island; thence east and south through Mississippi Sound, through South Pass between Cat Island and Isle au Pitre, to the Gulf of Mexico as marked on certain charts used by the court.

On July 2, 1908, an act of the Louisiana legislature became a law and made it the duty of the chief engineer of the board of state engineers to run and fix the water boundary described above and to mark and buoy the same, and the work referred to below was done as authorized in this act at the expense of the State of Louisiana.

A patrol boat belonging to the Oyster Commission of Louisiana was placed at the disposal of the party and a small lighter was obtained from Capt. Harry Burgess, Corps of Engineers, U. S. Army, stationed at New Orleans, for use in the work. The work began on February 25 and was completed on June 30. The western portion of the boundary, from the mouth of Pearl River to a point about 1½ miles north of the eastern end of Grand Island, is a curved line, and thence to the gulf the boundary is an irregular or broken line. Three points on the curved line were marked, and marks were also established at the turning points on the other portion of the boundary. The points were marked by intersecting ranges indicated by structures built for the purpose or by the beacons maintained by the United States Light-House Board as aids to navigation.

The marks were made as permanent as the nature of the soil and the available funds permitted. Piles were driven in the soft marsh and concrete was used at the surface to bind them together and form a foundation for the range beacons. Cast-iron blocks were set in the concrete, to which the supports of the wooden beacons were bolted. After the marks were established they were inspected by representatives of the two States.

ALASKA-YUKON-PACIFIC EXPOSITION.

[W. E. PARKER.]

As required by law, an exhibit representing the work of the Coast and Geodetic Survey was prepared and installed at the Alaska-Yukon-Pacific Exposition, at Seattle, Wash., and placed under charge of an officer of the Survey, detailed by the Secretary of Commerce and Labor to perform that duty. He assumed charge on May 19, and continued on this duty during the remainder of the fiscal year.

TIDE OBSERVATIONS IN ARCTIC REGIONS.

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

Previous to his departure for explorations in the north polar regions, Civil Engineer Peary, U. S. Navy, was ordered by the Secretary of the Navy to report for duty in the Coast and Geodetic Survey, which he did, in person and by letter, and by direction of the President he was instructed to make tide observations at various points on the Grant Land and Greenland shores of the polar sea during his stay in those regions. Under date of August 17, 1908, Civil Engineer Peary reported in some detail his movements up to his arrival at Etah, Greenland. During the remainder of the fiscal year he was beyond the possibility of communication.

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. Meetings of the commission in St. Louis were attended in October, November, April, and June. This officer also served as a member of the board created by law to examine and report on a 14-foot channel in the Mississippi River from St. Louis to the Gulf of Mexico, and also to consider the proposed waterway from Chicago to St. Louis.

Meetings of this board were held at St. Louis in November, January, March, and June.

INTERNATIONAL BOUNDARIES.

[O. H. TITTMANN.]

UNITED STATES AND CANADA BOUNDARY.

The work of re-marking this boundary 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, Great Britain, as prescribed in the treaty signed at Washington April 11, 1908.

On July 1 a party, in charge of Messrs. C. H. Sinclair and N. G. Ogilvie, representing the Commissioners, was at Lake Osoyoos inspecting the monuments which had been placed in position marking the boundary west of the summit of the Rocky Mountains. The work was continued westward until October 1, when the last monument on the land boundary, the obelisk at Point Roberts, was inspected, thus completing the work. As the monuments were inspected the proper numbers were attached, and the recovery and re-marking of the line between Point Roberts, Wash., and the summit of the Rocky Mountains is now completed. A vista was opened along the line through the wooded sections, and the 409 miles of boundary is marked by 272 monuments, many of which are the original monuments recovered and restored.

In June Mr. Fremont Morse began establishing reference monuments along the United States shore of the water boundary between Point Roberts and the Pacific Ocean.

On May 10 work in connection with the recovery and re-marking of the boundary east of the summit of the Rocky Mountains was begun by Mr. C. H. Sinclair, and on June 30 the triangulation and topographic survey along the boundary was making good progress.

Similar work was in progress by a Canadian party, accompanied by Mr. F. D. Granger as representative of the United States Commissioner, along the boundary north of Montana.

In August Mr. W. B. Fairfield began the survey of the boundary from the mouth of Pigeon River, at the west end of Lake Superior, to the westward. Three old triangulation stations of the United States Lake Survey were recovered, and from these the work was extended to the mouth of the river and for a short distance above. On November 17 the work was suspended for the winter.

On July 1 the work of recovering and re-marking the United States and Canada boundary between the headwaters of the St. Croix River to St. John River was in progress, under charge of Messrs. J. B. Baylor and G. C. Rainboth, representatives of the United States and British Commissioners. The work was continued until November 23, when it was suspended for the winter. A vista was cut along the line over the whole distance wherever it was wooded, and 212 boundary monuments were placed in position. These monuments mark the whole line except for a distance of 17 miles. A topographic survey was made along the line as usual. After returning to the office the maps and field notes relating to the line north of the State of Vermont were completed and placed on file. Stadia charts and field notes, covering 78 miles of the

line mentioned above, were also completed. Work in the field was resumed on May 1, and monuments were placed in positions over the remaining portion of the line south of St. John River. At the close of the year the triangulation and topographic survey along St. John River was in progress.

On September 2 Mr. J. E. McGrath, representing the United States Commissioner, began an examination of the United States and Canada boundary in the valley of the St. Croix River between Chippeneticook Lakes and Passamaquoddy Bay. Triangulation had previously been extended over this portion of the line and topographic and hydrographic surveys had been made along the river as far as Ryans Ripps (above Woodland). A search was made for the old triangulation stations and 30 out of a total of 44 were recovered. These will furnish an excellent base for any additional work that is required. The observer traveled between Vanceboro and Baring in a canoe in order to examine that portion of the river, and notes were made all along the line of matters bearing on the establishment of the boundary. Observations were made at several triangulation stations for the purpose of extending it to a connection with points to be established on the actual boundary line. Field work was suspended on November 30. On June 11 the joint survey of this portion of the boundary was resumed, with Mr. A. J. Brabazon as the representative of the British Commissioner, and the remainder of the month was spent in a joint reconnaissance for triangulation along the lower portion of the St. Croix River and in building signals at the stations selected for the work.

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. Messrs. G. C. Baldwin and A. J. Brabazon represented the Commissioners in the field, and they succeeded in extending the location of the line 70 miles to the southward, or to a point near White River, and 195 miles south of the Yukon River. Low water delayed the party in reaching the working ground, and the season for work was unusually short. Marks were established and left on the summits and at other places for the use of the surveying and monumenting party which was following the line party.

Mr. Baldwin's report contains a brief description of the country traversed by the line, and an account of the many obstacles which it was necessary to surmount and which taxed the endurance of the party severely. In June this party resumed work on the boundary, starting at the point where it crosses the Yukon River, and on the 30th was locating and opening the line to the northward.

Mr. Thomas Riggs, jr., had charge of the party engaged in making the survey along the boundary, as established by the "line" party mentioned above. This work was in progress on July 1, and it was continued until September 17. The party was divided into three sections, one of which made a reconnaissance for the triangulation and built signals; another made the observations of angles, and the third made a topographic survey along the line. The triangulation was extended 77 miles and reached a point 138 miles south of the Yukon River before August 26, when it was necessary to close work for the season. The topographic work was extended south-

ward 64 miles, and it was suspended on September 17 at a point about 35 miles north of the end of the triangulation. The transportation of outfit and supplies in this region is a problem very difficult to solve, and credit is due the party for hardships endured and for their success in overcoming the many obstacles found in this unexplored territory. The work was resumed on May 23, and had made considerable progress before June 30, on which date two sections of the party were engaged on topographic work, one on reconnaissance and one on triangulation.

In southeastern Alaska a party in charge of Mr. O. M. Leland was at work on July 1 in the vicinity of Unuk River, engaged on the demarcation of the boundary. No definite information in regard to the region crossed by the boundary in this locality could be obtained in advance, and consequently the party was divided into three sections to ascend the Unuk and Leduc rivers and Lake Creek, to explore the region and gain information for use in the next season's work, and to accomplish as much work as possible under the conditions found to exist. Boundary peak 6650 was identified and marked with a copper bolt. Observations were made at this point. A vista 20 feet wide was opened along the boundary across Leduc Valley. Boundary peak 6450 was identified and a signal was erected, and peak 5800 was identified. The line was traced between peaks 6200 and 6500 across two forks of Blue River. Work was suspended in the latter part of September and resumed in the following May (8). On June 30 the three sections of the party were established in camp in the vicinity of the boundary at the points mentioned above and the work was in progress.

A party, under charge of Mr. Fremont Morse ,was engaged on work in connection with the demarcation of the boundary in the vicinity of the Alsek River on July 1, and the work continued until September 10. A base line was measured and an azimuth and the latitude of a station were determined. Triangulation was extended up the river to the boundary, and the position of a point on the boundary was established as the adjacent boundary peaks were not visible from the Alsek Valley or from the accessible mountains near the river. The geographic positions of the adjacent peaks, 5800 and 7450, had been previously determined, and the azimuth of the line between them was deduced and used in establishing the point on the boundary. A vista was cut through the dense growth of bushes on the slopes of the mountains on both sides of the river and through the trees near the river. This vista extends nearly a mile south of the river and more than a mile north of the river. Four monuments were placed in position on the boundary, two south and two north of the river. A number of negatives were made, with photo-topographic cameras, along the line for the purpose of preparing topographic maps.

Progress was also made in the demarcation of the boundary by two Canadian parties accompanied by representatives of the United States Commissioner.

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APPENDIX 2

REPORT 1909

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.

In the Computing Division unusual progress was made in the preparation of the results of field work for publication. These results can not be fully utilized by engineers and other interested persons until they are printed and thus made known and widely distributed.

The number of geographic positions prepared in answer to requests for information was greater than during any previous year and the number of descriptions of stations and of bench marks was less than for the previous year. The output of the Division in the form of correspondence is still slowly increasing.

The preparation of a publication entitled "Precise Leveling in the United States, 1903–1907, with a Readjustment of the Level Net and Resulting Elevations," was completed, and the proof was read.

The preparation of a publication entitled "The Figure of the Earth and Isostasy, from Measurements in the United States," was also completed, and proof reading was in progress at the close of the fiscal year.

This publication is an important contribution to the progress of geodesy because the methods of computation and investigation are somewhat novel and have been found to be effective, and the resulting determination of the figure and size of the earth is of a very high degree of accuracy (probably higher than has yet been attained by any one nation). The investigation has already established the fact that in and around the United States the condition called "isostasy" exists.

The computations connected with a second determination of the figure and size of the earth by the same method were nearly completed. In this determination one and one-half times as many observations are used as in the first determination and the area covered is considerably larger.

The computation of the astronomic observations made in 1908 was completed, and an adjustment was made of the main triangulation along the ninety-eighth meridian from Page, Nebr., to the Canadian boundary, including the connection with the Lake Survey triangulation at Duluth.

An adjustment was also made of the main triangulation from Marysville, Cal., to Tacoma, Wash., and thence to Port Townsend, and westward along Juan de Fuca Strait to the entrance, and northward to the Canadian boundary.

DIVISION OF TERRESTRIAL MAGNETISM.

The correspondence prepared in this Division shows an increase of more than 30 per cent. This is gratifying evidence of the growing appreciation of the useful work accomplished, as nearly all these letters were written in response to requests for information.

The results of the observations made on land and at sea during the previous year were prepared for publication, and the Office revision of the results of observations made during the year were computed as they were received.

The reduction of the observations made at the five magnetic observatories up to December 31, 1904, was completed, the results were prepared for publication, and the proof was read.

Similar work was done for the Cheltenham (Md.) Observatory for the years 1905 and 1906, and these results were also prepared for publication. The reduction of the observations at Sitka, Alaska, for 1905 was completed, and progress was made in bringing the reduction of the observations at the other observatories up to date.

The "United States Magnetic Tables and Charts for 1905" and a reprint of the "Principal Facts of the Earth's Magnetism," with additions, were sent to the printer and the proof was read.

Tabulations were made of the earthquakes recorded at Cheltenham, Md.; Vieques, P. R.; and at Honolulu during 1908, and at Sitka, Alaska, during the four years 1905–1908, and copies were furnished to the International Seismological Association.

All available declination results in and near Alaska, both on land and at sea, were tabulated, reduced to a common epoch, and plotted in the preparation of a new isogonic chart of the Territory.

TIDAL DIVISION.

Harmonic analyses were completed for 8 stations with a combined length of 5 years and 6 months. Nonharmonic reductions were made for 200 stations with a combined length of 28 years and 11 months. Mean sea level was computed for 18 stations with a combined length of 14 years. High and low waters and hourly heights of the sea were tabulated for 199 stations with a combined length of 39 years.

There were received, examined, and registered in this Division records from 39 self-registering tide-gauge stations with a combined length of 19 years, together with staff-gauge records from 98 stations with a combined length of 6½ years.

The total of all tide observations made by the Survey and received during the year is 25 years at 137 stations, and from other sources 21 years at 25 stations, making a grand total of 46 years at 162 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, 10 stations, 10 years; Canal Zone, 2 stations, 2 years; Philippine Islands, 1 station, 2 months.

2. The American Embassy at Mexico, Mexico, tides for 8 Mexican ports with a combined length of 4 years and 10 months.

3. The Hawaiian territorial government, tides at Honolulu for 1½ years.

4. The Philippine government, tides at 2 stations, 2 years.

5. Alaska Boundary Survey, tides at Skagway, 9 months.

The Tide Tables for 1910 were completed, sent to the printer, and the proof was read. Progress was made in the preparation of the Tide Tables for 1911.

At the request of the German Ambassador at Washington the Hydrographic Office at Wilhelmshaven, Germany, was furnished the predicted tides for 1910 at Sandy Hook, N. Y.; Baltimore, Md.; Charleston, S. C.; and San Francisco, Cal., in advance of publication.

By request of the secretary of the marine department of New Zealand, the predicted tides at Wellington and Auckland, New Zealand, for 1910, were sent to him in advance of publication.

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 Notice to Mariners was continued during the year, and since January 1, 1909, the weekly Notice to Mariners has been a joint compilation and publication of the Light-House Board and the Coast and Geodetic Survey, which is issued by the Light-House Board.

All work necessary in connection with this notice is done in the Division.

A new electrotyping plant was installed during the previous fiscal year, and some modifications have been made. It is now in successful operation, and can be operated day and night without the use of a storage battery, as it has automatic safeguards.

The scheme for general charts of the Philippine Islands was revised and the general plan outlined received the approval of the officer in charge of the work of charting the archipelago.

Drawing Section.

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

Chart No.	
494.	York River.
495.	Do.
557.	Potomac River.
584.	Key West Harbor.
951.	Panama Road.
6448.	Everett Harbor.
8280.	Khaz Bay and approaches.
8550.	Prince William Sound.
8588.	Port Chatham.
8802.	Alaska Peninsula.
8996.	St. Paul Island and St. George Island.
9102.	Aleutian Islands.

New drawings were completed for new editions of charts, as follows:

Chart No.	
79.	Chesapeake Bay.
204.	Galveston Bay
8050.	Dixon Entrance to head of Lynn Canal.

Extensive corrections were made to the drawings for 109 charts in preparing them for the issue of new editions. Twenty-two drawings for charts (9 of which were for new charts) were received from Manila and prepared for publication. Three 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.	
248.	Boston Harbor.
366.	Hempstead Harbor.
412.	Chickahominy River.
1002.	Straits of Florida and approaches.
1007.	Gulf of Mexico.
5832.	Humboldt Bay.
6446.	Lake Washington.
8304.	Icy Strait and Cross Sound.
411.	Appomattox River.
517.	Sabine Pass and Lake.
4107.	Pearl Harbor.
4267.	Pagbilao and Laguimanoc bays.
4462.	Matarinao Bay.
5984.	Coos Bay.
8160.	Zarembo Island.
8242.	Harbors in Chatham Strait.
8513.	Controller Bay.
8538.	Resurrection Bay.

All of these plates represent charts already published by photolithography.

The following original etched plate was completed:

Chart No.	
8280.	Khaz Bay and approaches.

The following new bassos for new editions were completed:

Chart No.	
S.	San Francisco to Bering Sea.
T.	General Chart of Alaska.
7.	Cape Ann to Block Island.
111.	Nantucket Sound.
126.	Delaware River.
177.	Tampa Bay.
203.	Sabine Pass to High Island.
206.	Oyster Bay to Matagorda Bay.
207.	Matagorda Bay.
273.	Throgs Neck to Randall Island.
308.	Blue Hill Bay and Eggemoggin Reach.
309.	East Penobscot Bay.
325.	Portland Harbor.
337.	Boston Harbor.
400.	Hampton Roads to Norfolk.
401a.	James River.
477.	Tampa Bay Entrance.
520.	Galveston Entrance.
902.	South Coast of Porto Rico.
904.	Virgin Passage and Vieques Sound.
909.	Jobos Harbor.
920.	Porto Rico.
1000.	Cape Sable to Cape Hatteras.
6300.	Gulf of Georgia and Strait of Juan de Fuca.
6399.	Semiamoo Bay.

The following new bassos for reissues were completed:

Chart No.	
6.	Quoddy Head to Cape Cod.
11.	Cape Hatteras to Cape Romain.
13.	St. Marys Entrance to Cape Canaveral.
148.	Bogue Inlet to Old Topsail Inlet.
179.	Wall Creek to Cedar Keys.
190.	Round Island to St. Josephs Island.
195.	Mississippi River.
448.	St. Andrew Sound.
6445.	Seattle Harbor.

SUMMARY.

Plates for new charts finished	1
Plates for former lithograph charts finished	18
Plates for new editions completed	7
Bassos completed	34

Extensive corrections were made on 140 plates and minor corrections on 861. Seventy-three plates of diagrams for the chart catalogue were corrected.

Printing Section.

New chart printed from copperplate:

Chart No.	
8280.	Khaz Bay and approaches.

New charts printed by photolithography:

Chart No.		Chart No.	
494.	York River.	4415.	Southwest Panay.
495.	Do.	4463.	Escalante Harbor.
557.	Potomac River.	4654.	Delta of the Mindanao River and Polloc Harbor.
584.	Key West Harbor.	8588.	Port Chatham.
4268.	Harbors from Alabat to Pitogo Bay.	8802.	Alaska Peninsula.
4269.	Harbors of Catanduanes.	8996.	St. Paul and St. George Islands
4270.	Harbors of Batan and Babuyan Islands.	9102.	Aleutian Islands.
4271.	Lamit and Sisiran Bays.		
4349.	Malampaya Sound.		

New editions of different charts printed from copperplates	29
New editions of different charts printed from stones	15
New editions of different charts printed by photolithography	32
New prints:	
Number of different charts printed from stones	97
Number of different charts printed from plates	971
Charts printed from stones (impressions, 121 310)	46 014
Charts printed from plates (impressions, 89 666)	82 149

Photographing Section.

The following etched plates were made:

Chart No.		Chart No.	
495.	York River.	5145.	San Pedro Harbor.
4349.	Malampaya Sound and approaches.	8280.	Khaz Bay and approaches.
4447.	Cebu Harbor.	8996.	St. Paul and St. George Islands.
4462.	Matarinao Bay.		

Negatives of 95 charts were made for use in reproducing them by photolithography, and more than usual miscellaneous work was done.

Electrotyping Section.

Altos completed	62
Bassos completed	45
Copper deposited (kilograms)	1 536

CHART DIVISION.

A new edition of the chart catalogue was prepared for the printer and the Table of Depths in the Harbors of the United States was brought up to date. The total issue of charts was 11 per cent larger than during the previous year, and the correspondence showed an increase of 6 per cent. The charts were sold by 163 agents and at the office in Washington.

Charts were received as follows from the Drawing and Engraving Division:

	Number.
Prints from plates	82 149
Prints from stone	46 014

In addition to the above, 1 453 copies of special charts Nos. 11, 13, 14, and 15, prepared for the Maryland Shell Fish Commission and printed by contract, were received for distribution.

Charts were issued as follows:

Sales agents	44 605	Suboffice, Manila, P. I.	9 125
Sales at the Office	2 419	Executive department	7 509
Congressional account	5 851	Foreign Governments	371
Hydrographic Office, U. S. Navy	37 988	Miscellaneous	2 336
Light-House Board	3 803		120 223
Coast and Geodetic Survey Office	6 216		

All the work in connection with the sale of charts is done in this Division. The issue of charts was larger than during any previous year.

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 construction work on the new tide-predicting machine was almost completed, but considerable time will be required to finish and adjust all of the thousands of parts of which it is composed, owing to the pressure of what may be called current work, which leaves very little time to be devoted to this work.

Typical instruments were prepared and sent to the Alaska-Yukon-Pacific Exposition at Seattle, Wash., as an exhibit to illustrate the methods of work used by the Survey.

The zenith telescope at the International Latitude Station at Gaithersburg, Md., was taken apart and cleaned.

Specifications were prepared for cast-iron monuments to be used in marking the United States and Canada boundary, and the patterns for their construction were inspected at St. Paul, Minn.

A number of aluminum-bronze monuments for marking the same boundary were inspected at Pittsburg, Pa.

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 author and subject catalogue of the library was completed. A list of the books, pamphlets, and articles in the library on seismology was compiled. Detailed information relating to the leading subjects covered by the library was prepared at the request of the Bureau of Education for publication under the title "Facilities for Study and Research in the Offices of the United States Government at Washington."

During the year photographic reproductions of the original maps of the international survey of the boundary between the United States and the British possessions in North America, between the headwaters of the St. Croix River and the Lake of the Woods, and of the United States and British field notes of the same survey from the headwaters of the St. Croix River to the intersection of the forty-fifth parallel of north latitude with the St. Lawrence River, were deposited in the archives. These copies were made from the original records in the British foreign office to replace American records which were destroyed.

Accessions.

	Purchased	Donated	Exchanged	Total
Books and pamphlets	131	82	911	1 124
Maps and charts	1	0	1 718	1 719

Issued for temporary use.

	Number.
Books and pamphlets	1 714
Serials	765
Records	4 134
Original sheets	4 922
Maps and charts	2 865

The following list shows the original records received:

Subject	Volumes	Cahiers	Sheets or rolls
Astronomy	38	60	7
Geodesy	310	136	----------
Gravity	6	12	12
Hydrography	348	1	62
Hypsometry	112	22	----------
Log books	66	----------	----------
Magnetism	2	444	109
Tides	266	2	299
Topography	22	----------	82
Total	1 170	677	571

The following records of international boundary surveys were received:

Item	Alaska boundary	United States and Canada boundary
Original sheets	12	82
Volumes of observation	28	35
Cahiers	22	21
Rolls	11	
Photographs	849	210
Negatives	231	196

Photographic prints	801
Photographic negatives	159

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 1908	2 000
Appendices to Report for 1908, published as separates	1 040
Catalogue of Charts, 1908	2 600
Supplement to Catalogue of Charts	2 500
United States Coast Pilot, Pacific Coast, Alaska	1 500
United States Coast Pilot, Pacific Coast, California, Oregon, and Washington	1 146
Supplements to Coast Pilots	4 200
Tide Tables, complete	1 169
Tide Tables, Atlantic Coast	1 563
Tide Tables, Pacific Coast	20 080
Coast Pilot Notes, Bering Sea and Arctic Ocean	1 036
Coast Pilot Notes, Yakutat Bay to Cook Inlet	671
General Instructions for the Field Work of the Coast and Geodetic Survey	1 002
List and Catalogue of Publications, 1908	1 500
Supplement to List and Catalogue	2 000
Precise Leveling in the United States, 1903–1907	2 432
Principal Facts Relating to the Earth's Magnetism	1 000
Results of Magnetic Observations, Baldwin, 1901–1904	900
Results of Magnetic Observations, Cheltenham, 1901–1904	900
Results of Magnetic Observations, Honolulu, 1902–1904	931
Results of Magnetic Observations, Sitka, 1902–1904	950
Results of Magnetic Observations, Vieques, 1903–4	925
Survey of Oyster Bars, Somerset County, Md	2 000
Survey of Oyster Bars, Wicomico County, Md	505
Survey of Oyster Bars, Worcester County, Md	300
United States Magnetic Tables and Charts, 1905	1 500
Work of the Coast and Geodetic Survey	4 000

The following publications were received from the suboffice at Manila, P. I.:

	Number.
Catalogue of Charts, Philippine Islands	20
Sailing Directions	155
Supplements to Sailing Directions	110
Notices to Mariners, Philippine Islands	599

The following publications were issued by the Office:

	Number.
Annual Reports, 1851–1908	2 914
Appendices to Annual Reports	2 405
Bulletins Nos. 1 to 41	482
Catalogue of Charts	2 404
Supplement to Catalogue of Charts	2 500
Catalogue of Charts, Philippine Islands	17
United States Coast Pilots, Atlantic Coast	2 264
United States Coast Pilots, Pacific Coast, Alaska	300
United States Coast Pilots, Pacific Coast, California, Oregon, and Washington	420
Supplements to Coast Pilots	4 977
United States Magnetic Declination Tables	15
Sailing Directions, Philippine Islands	171
Supplements to Sailing Directions, Philippine Islands	12
Special Publications, Nos. 1 to 8	410
Tide Tables, complete	1 495
Tide Tables Atlantic Coast	1 701
Tide Tables, Pacific Coast	10 065
Administration and Work of Coast and Geodetic Survey	3
Coast and Geodetic Survey in Alaska	4 003
Coast Pilot Notes on Bering Sea and Arctic Ocean	133
Coast Pilot Notes on Warren Channel	6
Coast Pilot Notes, Yakutat Bay to Cook Inlet	626
Conversion Tables	20
Deep Sea Sounding and Dredging	2
Efforts made by Navy Department, etc., 1900	1
Field Catalogue of 983 Transit Stars	3
General Instructions for Coast Surveys, Philippine Islands, 1906	11
General Instructions for Field Work, Coast and Geodetic Survey	281
General Proportion of Equations of Steady Motion	9
Geodetic Operations in United States, 1900–1903	6
Geodetic Operations in United States, 1903–1906	1
Historical Sketch, 1884	2
Instructions and Memoranda for Descriptive Reports	2
Laws and Regulations, 1887	5
List and Catalogue, 1902	9
List and Catalogue, 1908	316
Supplement to List and Catalogue, August, 1908	1 483
List of Publications Available for Distribution, 1908	72
Report on Nicaragua Route	5
Precise Leveling in United States, 1903–1907	1 582
Principal Facts Relating to Earth's Magnetism	463
Results of Magnetic Observations, Baldwin, 1901–1904	490
Results of Magnetic Observations, Cheltenham, 1901–1904	505
Results of Magnetic Observations, Honolulu, 1902–1904	503
Results of Magnetic Observations, Sitka, 1902–1904	496
Results of Magnetic Observations, Vieques, 1903–4	495
Standard Mean Places of C. & T. Stars	3
Star Factors A B C	4
Survey of Oyster Bars, Anne Arundel County, Md	42
Survey of Oyster Bars, Somerset County, Md	1 219
Survey of Oyster Bars, Wicomico County, Md	361
Survey of Oyster Bars, Worcester County, Md	30
Table of Coefficients	18
Table of Factors (in feet)	23
Table of Factors (in meters)	3
Table of Heights (in meters)	23
Tidal Researches	4
Tides and Tidal Action in Harbors	3
Treatise on Projections	37
United States Magnetic Tables and Charts, 1905	915
Work of the Coast and Geodetic Survey, 1st edition	93
Work of the Coast and Geodetic Survey, 2d edition	2 005
Notice to Mariners, Philippine Islands	406

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APPENDIX 3

REPORT 1909

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE COAST AND GEODETIC SURVEY BETWEEN JULY 1, 1908 AND JUNE 30, 1909

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, 1908, AND JUNE 30, 1909.

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, 1909. There are also included some results obtained in the preceding fiscal year, not heretofore published.

Five magnetic observatories have been in continuous operation throughout the year—at Cheltenham, Md.; Baldwin, Kans.; Sitka, Alaska; near Honolulu, Hawaii, and on Vieques Island, Porto Rico. There will be found in the tables the values of the magnetic elements at each of the observatories, based on the observations of December and January.

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 34 States and Territories. Especial attention was directed to increasing the number of stations in the middle of the country—in Michigan, Wisconsin, Minnesota, Iowa, Illinois, Indiana, Missouri, Tennessee, and Kentucky—in anticipation of the discontinuance of the magnetic observatory at Baldwin, Kans., in the near future. Numerous old stations were reoccupied in order to determine the change of the magnetic elements since the former occupation.

Summary of results on land.

State	Localities	Stations	Old localities reoccupied	Declination results	Dip results	Intensity results
Alaska	42	45	5	47	34	35
Arizona	6	6	5	6	6	6
Arkansas	5	5	1	5	5	5
California	1	1	1	2	2	2
Connecticut	1	1	0	1	1	1
District of Columbia	2	2	2	2	1	2
Florida	3	3	3	3	3	3
Hawaii	1	1	1	1	1	1
Illinois	39	39	2	39	39	39

Summary of results on land—Continued.

State	Localities	Stations	Old localities reoccupied	Declination results	Dip results	Intensity results
Indiana	7	7	1	7	7	7
Iowa	17	17	3	17	17	17
Kansas	2	2	2	3	3	3
Kentucky	10	10	1	10	10	10
Louisiana	1	1	1	1	1	1
Maryland	5	5	1	13	4	10
Massachusetts	2	2	1	2	2	2
Michigan	8	8	1	8	8	8
Minnesota	11	11	1	11	10	11
Mississippi	2	2	1	2	2	2
Missouri	22	22	2	22	22	22
New York	4	4	2	4	4	4
North Carolina	3	4	3	4	4	4
Ohio	3	4	1	4	4	4
Oklahoma	1	1	1	1	1	1
Oregon	2	2	1	2	2	2
Pennsylvania	1	2	1	4	4	4
Porto Rico	4	5	3	8	6	8
South Carolina	1	1	0	1	1	1
Tennessee	28	28	5	28	28	28
Texas	1	1	1	1	1	1
Virginia	1	2	1	2	2	2
Washington	3	3	3	3	3	3
West Virginia	3	3	1	3	3	3
Wisconsin	27	27	3	27	27	27
Foreign countries	3	4	1	5	4	4
Total	272	281	62	300	272	283

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 two stations were very near together, 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 no radical difference from those given in Magnetic Tables and Magnetic Charts for 1905, based on a discussion in 1906 of all data available at that time, but they do indicate that along the Atlantic coast west declination is increasing somewhat more rapidly than was expected in 1906, and that west of the Mississippi east declination is increasing more rapidly than was expected.

Comparison of declination results at repeat stations.

State and station	Former observation		Last observation		Average annual change
	Date	Declination	Date	Declination	
		° ′		° ′	′
Massachusetts:					
Fairhaven (*b*)	1903 Oc	12 09.5 W	1908 Se	12 26.6 W	−3.4
New York:					
Buffalo (*a*)	1905 My	6 15.2 W	1908 Jy	6 26.8 W	−3.7
Ithaca (*a*)	1907 Je	7 31.9 W	1909 Je	7 43.6 W	−5.8
Pennsylvania:					
Meadville (*a*)	1902 No	4 05.2 W	1908 Jy	4 24.4 W	−3.4
Maryland:					
Cheltenham (*a*)	1907 Oc	5 23.8 W	1909 Oc	5 34.1 W	−5.2
Virginia:					
Bedford City (*a*)	1901 Se	3 31.6 W	1908 No	3 54.3 W	−3.2
West Virginia:					
Parkersburg (*a*)	1898 Je	1 13.7 W	1908 Jy	1 40.7 W	−2.7
North Carolina:					
Manteo (*b*)	1898 Je	4 22.2 W	1908 De	5 03.4 W	−3.9
Beaufort (*b*)	1898 Ap	2 36.3 W	1909 My	3 13.2 W	−3.3
Fayetteville (*a*)	1899 My	1 41.7 W	1909 Je	2 11.2 W	−2.9
Florida:					
Jupiter (*b*)	1906 Mh	1 41.7 E	1909 Fe	1 45.5 E	+1.3
Punta Gorda (*a*)	1906 Ap	2 15.5 E	1909 Fe	2 10.5 E	−1.8
Mississippi:					
Corinth (*a*)	1905 De	4 41.1 E	1909 Je	4 44.8 E	+1.1
Louisiana:					
Rayville (*b*)	1904 Fe	6 18.7 E	1909 Mh	6 29.2 E	+2.1
Tennessee:					
Nashville (*a*)	1905 No	3 48.0 E	1909 Mh	3 37.8 E	−3.0
Huntingdon (*a*)	1905 No	4 19.7 E	1909 Mh	4 20.4 E	+0.2
Jackson (*b*)	1881 Se	5 49.8 E	1909 My	4 57.6 E	−1.9
Columbia (*b*)	1881 Au	4 35.5 E	1909 My	3 38.8 E	−2.0
Kentucky:					
Greenville (*a*)	1901 Jy	3 48.5 E	1908 No	3 47.8 E	−0.1
Ohio:					
Columbus (*a*)	1900 Je	0 43.6 W	1909 Je	1 08.7 W	−2.8
Indiana:					
Indianapolis (*a*)	1907 Jy	1 15.1 E	1909 Je	1 09.2 E	−3.0
Illinois:					
Effingham (*a*)	1905 Jy	4 24.1 E	1908 Au	4 26.6 E	+0.8
Bloomington (*b*)	1905 Je	3 30.6 E	1908 Se	3 25.9 E	−1.4
Michigan:					
Marquette (*a*)	1902 Oc	2 13.0 E	1908 Au	2 06.3 E	−1.1
Wisconsin:					
Milwaukee (*a*)	1902 Oc	3 32.8 E	1908 Jy	3 26.6 E	−1.1
Florence (*a*)	1905 Se	2 28.3 E	1908 Au	2 22.1 E	−2.1
Green Bay (*b*)	1891 Au	4 00.9 E	1908 Au	3 20.4 E	−2.4
Minnesota:					
Mankato (*b*)	1900 Oc	8 59.5 E	1908 Au	8 58.1 E	−0.2
Iowa:					
Oskaloosa (*b*)	1900 Jy	8 00.7 E	1908 Au	7 56.4 E	−0.5
Charles City (*a*)	1900 Au	7 12.4 E	1908 Se	7 20.9 E	+1.0
Dubuque (*a*)	1900 Jy	5 30.2 E	1908 Se	5 26.9 E	−0.4
Missouri:					
St. Louis (*a*)	1900 De	5 04.4 E	1908 Jy	5 06.3 E	+0.3
Mexico (*a*)	1903 Jy	6 32.5 E	1908 Jy	6 36.4 E	+0.8
Arkansas:					
Jonesboro (*a*)	1901 Je	5 19.3 E	1909 Ap	5 24.9 E	+0.7
Texas:					
Isabel (*a*)	1905 De	8 04.2 E	1909 Ap	8 16.7 E	+3.8
Oklahoma:					
McAlester (*a*)	1905 No	8 35.2 E	1909 Ap	8 43.0 E	+2.3

Comparison of declination results at repeat stations—Continued.

State and station.	Former observation		Last observation		Average annual change
	Date	Declination	Date	Declination	
		° ′		° ′	′
Kansas:					
Baldwin (*a*)	1907 Oc	8 31.0 E	1909 Oc	8 33.3 E	+1.2
Wallace (*a*)	1904 No	12 25.2 E	1908 Oc	12 33.4 E	+2.1
Arizona:					
Williams (*c*)	1902 De	14 15.2 E	1908 Se	14 44.1 E	+5.0
Grand Canyon (*c*)	1903 Fe	14 21.8 E	1908 Se	14 46.2 E	+4.4
Ash Fork (*c*)	1902 De	15 07.2 E	1908 Se	15 13.4 E	+1.1
Jerome Junction (*c*)	1903 Fe	14 02.6 E	1908 Se	14 16.6 E	+2.5
Benson (*c*)	1903 Mh	12 48.9 E	1908 Oc	13 11.3 E	+4.0
California:					
Goat Island (*a*)	1906 My	17 43.6 E	1908 No	17 52.2 E	+3.4
Oregon:					
Eugene (*c*)	1906 Je	22 13.5 E	1908 Jy	23 27.6 E	(*)
Washington:					
Seattle (*a*)	1905 No	23 19.2 E	1908 Mh, No	23 31.5 E	+4.6
Port Townsend (*c*)	1904 Fe	23 15.7 E	1908 Au	23 33.7 E	+4.0
British Columbia:					
Union (*a*)	1904 Ap	26 05.6 E	1908 Mh	26 19.6 E	+3.5
Alaska:					
Sitka (*a*)	1907 Oc	30 05.0 E	1909 Oc	30 11.6 E	+3.3
Kodiak (*a*)	1906 Se–Oc	24 13.3 E	1908 Oc	24 12.2 E	−0.6
Dutch Harbor (*a*)	1904 Je	17 57.3 E	1908 Ap	17 38.4 E	−5.0

* Local disturbance.

OBSERVATIONS AT SEA AND THEIR DISTRIBUTION.

Magnetic observations have been made at sea as often as the regular surveying work of the ships of the Bureau would permit. Results were secured by the *Bache* going and returning from her winter working ground in Porto Rico and her summer working ground off the coast of Massachusetts and by the *Patterson* and *Explorer* returning from Alaska in the fall of 1908 and going to Alaska in the spring of 1909. Compass observations were also made on the *Gedney* in the spring of 1909 between Seattle and her working ground in southeastern Alaska.

Summary of results at sea.

Vessel	General region	Results from swings			Results from course observations		
		Declination	Dip	Intensity	Declination	Dip	Intensity
Bache	Atlantic Ocean	25	23	23	7	0	0
Explorer	Pacific Ocean	19	21	21	12	0	0
Gedney	Pacific Ocean	15	0	0	0	0	0
McArthur	Pacific Ocean	4	0	0	0	0	0
Patterson	Pacific Ocean	4	4	4	0	0	0
Total		67	48	48	19	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, and small accessories, while those who are expected to get magnetic results incidental to other 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 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 observations 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 observations whose absolute error (including everything involved—error of observation and reduction) shall 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 all of 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 of reducing these limits of error, but in a large organization, where results must be secured from all kinds of observers, under all conditions, and at times under physical difficulties, and when all sources of error are considered, the degree of accuracy stated must be regarded as satisfactory and sufficient. It happens, of course, that these limits, for one reason or another, are occasionally exceeded, and there may be a few isolated cases in which the errors are two or three times the amounts given.

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COMPARISON OF INSTRUMENTS.

MAGNETOMETERS.

During the year all but two of the field magnetometers were compared with the standard instrument at the Cheltenham magnetic observatory, the results indicating that no changes are required to the corrections adopted in 1908 as a result of a least square adjustment of magnetometer comparisons from 1901 to 1907.* As was pointed out last year,* the corrections for horizontal intensity are nearly all positive, indicating that the adopted standard is too high by about 1 part in 1 000.

The standard magnetometer at Cheltenham is a large observatory instrument made by Edelmann according to Wild's design. The intensity magnet is a solid cylinder 8 cm long and 1.4 cm in diameter. A suspension ring fitting snugly about the center of the magnet is attached to the suspension wire by means of a split stem. The constants of the magnetometer were determined in 1902 at Cheltenham. The moment of inertia of the intensity magnet was obtained with the aid of an inertia bar, and also directly by computation from the dimensions of the magnet and suspension ring. The result obtained by the latter method was adopted, although it is greater than that obtained by the former method by about 3 parts in 1 000, because Wild gives it as his experience with this type of instrument that the direct method is the more accurate one.

During the past year two additional indirect determinations of the moment of inertia have been made, one with the aid of a small mass-ring which has been used with several of the smaller magnetometers and the other with a specially constructed ring of about two-thirds the mass of the magnet. The result in each case agreed very closely with the value obtained in 1902 using an inertia bar of about the same mass as the magnet.

If the smaller value of the moment of inertia was used it would reduce the horizontal intensity results by 0.0015 H and bring the Cheltenham magnetometer into closer agreement with the average of the field magnetometers. The difference is too small, however, to warrant making a change in the adopted standard. Accordingly the magnetometer corrections which were adopted in 1908 have been applied to the results given in this publication.

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	−2.1	+ .0032
11	0.0	.0000
18	0.0	+ .0016
19	0.0	− .0010
20	0.0	+ .0021
21	−1.4	+ .0054
22	+0.9	+ .0016
25	0.0	+ .0016
29	+1.0	.0000
30	0.0	.0000
31	0.0	+ .0010
36	−0.7	+ .0013
37	0.0	+ .0022

*Appendix No. 3, Report for 1908.

DIP INSTRUMENTS.

Several dip circles have been compared with the standard earth inductor at Cheltenham during the year, and as a result some changes are required in the corrections used last year. Dip circle No. 24 has a large and variable correction. From comparisons with other dip instruments at numerous places from Porto Rico to Sitka, Alaska, the following formula has been deduced, which represents closely the change in the correction with change in dip and total intensity:

$$F\,\Delta I = +7'.46 + 11'.83 \cos (I + 36°.9)$$

The other dip circles used and the corrections which have been applied to the results are given in the following table. The figures after the decimal point in the fourth column indicate the particular needles to which the correction applies.

Corrections to dip circles.

Number	Pattern	Needles	Designation	Correction
				′
15	Kew-Casella	5 and 6	15.56	−0.8
[a] 23	Kew-Casella	3 and 4	23.34	−3.7
[b] 23	Kew-Casella	3 and 4	23.34	−2.4
24	French Magnetic Survey	1 and 2	24.12	-----
25	Tesdorpf	IV and VIII	25.48	−2.0
28	L. C.-Casella	1 and 2	28.12	−4.2
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
33	L. C.-Dover	1 and 2	33.12	−0.5
34	L. C.-Dover	5 and 6	34.56	+3.5
36	Kew-Dover	1 and 2	36.12	−0.6
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	−2.3

[a] 1908. [b] 1909.

REDUCTION OF OBSERVATIONS.

A first computation is made by the observer in the field, and he is instructed to carry it far enough before he leaves a station to assure himself that the desired degree of accuracy has been attained. This computation is carefully 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 particular 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 the geographic 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, 1908, and June 30, 1909, except when otherwise stated in a foot note. 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

In the column headed "Instruments" M stands for "magnetometer" and D.C. for "dip circle." Italicised numbers in the magnetometer column indicate that the declination was determined with a compass declinometer or with the compass of a theodolite. When the declination was determined with the compass attachment of the dip circle, the letter C is placed in the magnetometer column. The dip circles have been given the designations indicated on page 83, the figures after the decimal point denoting the needles used. Values of horizontal intensity printed in italics were obtained by combining the observed dip with the total intensity determined with the dip circle by Lloyd's method.

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

F. L. Adams	R. L. Faris	F. A. Molby
J. R. Benton	J. W. Green	C. G. Quillian
J. B. Bingham	George Hartnell	H. A. Seran
W. Bowie	W. M. Hill	S. W. Tay
J. E. Burbank	W. B. Keeling	R. W. Toll
W. H. Burger	W. D. Lambert	W. F. Wallis
W. H. Dunlap	R. F. Luce	P. C. Whitney
H. M. W. Edmonds	T. J. Maher	C. F. Woodyard

SEA OBSERVATIONS.

The results obtained at sea are presented in Table II. The general arrangement is indicated by the headings. Unless otherwise indicated the ship was swung both with

port and with 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	P. A. Welker, W. C. Hodgkins
Explorer	W. C. Dibrell
Gedney	R. B. Derickson
McArthur	H. W. Rhodes
Patterson	W. C. Hodgkins, H. C. Denson

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

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909.*

ALASKA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		East. ° ′	° ′	γ			
Observatory	53 52.6	166 32.1	My 14[a]	16 18.6	66 41.2	20698	8	32.12	H.A.S.
Rocky Point	53 53.4	166 31.7	My 7[a]	18 03.2	67 20.6	20406	8	32.12	H.A.S.
Flat	53 53.4	166 30.2	My 6[a]	17 09.0	66 55.7	20755	8	32.12	H.A.S.
Dutch Harbor	53 53.5	166 32.1	Ap–My[a]	17 38.4	66 52.0	20981	8	32.12	H.A.S.
Do	53 53.5	166 32.1	My 21	17 30.8	66 51.3	20981	IIII	34.56	S.W.T.
Eliza	53 53.9	166 32.3	Ap 30[a]	16 30.0	66 50.0	20754	8	32.12	H.A.S.
South Base	53 54.0	166 30.9	My 1[a]	17 07.3	66 53.7	20713	8	32.12	H.A.S.
North Base	53 54.8	166 30.3	My 4, 5[a]	17 43.5	66 59.9	20551	8	32.12	H.A.S.
Cape Muzon, Cape	54 40.4	132 39.8	Au 20	25 18.7	-- ----	-----	*15*	-----	T.J.M.
Cape Muzon, Y	54 40.6	132 41.1	Au 18	25 52.1	-- ----	-----	*15*	-----	T.J.M.
Sukkwan Strait, Fish	55 10.6	132 48.7	Oc 26	29 34.2	-- ----	-----	*15*	-----	T.J.M.
Sukkwan Strait, Salt	55 10.8	132 48.0	Oc 26	29 36.4	-- ----	-----	*15*	-----	T.J.M.
Cholmondeley Sd. Mar	55 11.8	132 07.1	Se 14	27 37.0	-- ----	-----	*15*	-----	P.C.W.
Kasaan Bay, Crook	55 33.9	132 28.7	Se 28	29 52.4	-- ----	-----	*15*	-----	T.J.M.
Kasaan Bay, near Crook	55 33.9	132 28.7	Se 29	30 17.9	-- ----	-----	*15*	-----	T.J.M.
Sitka	57 03.0	135 20.1	De–Ja	30 11.6	74 36.8	15568	37	2EI	H.M.W.E
Kodiak	57 47.5	152 23.8	Mh 25, 26[a]	24 31.6	71 54.4	17359	8	32.12	C.G.O.
Do.	57 47.5	152 23.8	Oc 19	24 12.2	71 56.0	17392	IIII	34.56	S.W.T.
Uyak Bay, Harvester Island	57 38.5	153 52	Je 9, 29[a]	22 41.2	71 27.0	17648	8	32.12	H.A.S.
Bare Island	57 58	153 04	Jy 6	23 53.3	-- ----	17372	8	-----	H.A.S.
Onion Bay, Raspberry Island	58 02.8	153 13	Je 17,[a] Jy 7	23 47.5	71 49.9	17370	8	32.12	H.A.S.
Afognak, Afognak Island	58 04.8	152 45	Je 25[a]	24 00.6	71 56.5	17305	8	32.12	H.A.S.
Banner, Afognak Island	58 11.5	152 56.6	Se 30, Oc 1	23 56.5	72 07.4	17302	IIII	34.56	S.W.T.
Kiukpalik Island	58 35.8	153 34.5	Au 3, 4	24 43.6	72 18.2	17188	IIII	34.56	S.W.T.
Shuyak, Shuyak Island	58 36.9	152 34.2	Au, Se	24 20.0	72 18.6	17138	IIII	34.56	S.W.T.
Cape Douglas	58 50.6	153 18.2	Se 8	24 29.9	72 24.7	17030	IIII	34.56	S.W.T.
Port Graham, East Base	59 20.8	151 47.4	Oc 1, 7	24 14.4	-- ----	-----	*737*	-----	J.B.B.
Augustine Island	59 21.3	153 24.0	Je 24[a]	22 19.9	-- ----	-----	*737*	-----	J.B.B.
Port Graham, Danger	59 23.6	151 54.7	Se 28	23 32.4	-- ----	-----	*737*	-----	J.B.B.
Point Harriet	60 23.3	152 16.6	Se 5, 6	25 33.4	-- ----	-----	*737*	-----	R.W.T.

[a] 1908.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

ALASKA—Continued.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		East. ° ′	° ′	γ			
East Foreland	60 43.0	151 24.8	Je 21, 22, 23	27 26.0	-- ----	-----	737	-----	T.J.M.
Russian Mission	61 47.4	161 20.6	Au 10	21 27.1	73 36.7	15878	25	25.48	J.W.G.
Andreafski	62 02.9	163 13.0	Au 15	20 13.6	73 29.3	15937	25	25.48	J.W.G.
Holy Cross	62 11.9	159 45.8	Au 7	23 08.2	74 00.6	15543	25	25.48	J.W.G.
Anvik	62 39.5	160 11.9	Au 4	22 42.3	74 47.3	15131	25	25.48	J.W.G.
Kotlik	63 02.4	163 35.5	Au 20	20 31.0	74 09.0	15391	25	25.48	J.W.G.
St. Michael:									
North	63 28.8	162 01.4	Au 25	22 16.6	74 33.4	15124	25	25.48	J.W.G.
Mesa	63 29.1	162 01.4	Au 26	21 36.6	74 36.6	14993	25	25.48	J.W.G.
Hilltop	63 29.2	162 00.8	Au 26	21 10.6	74 34.7	15104	25	25.48	J.W.G.
Kaltag	64 19.6	158 44.9	Jy 28	24 11.0	75 43.5	14082	25	25.48	J.W.G.
Louden	64 37.2	156 42.2	Jy 23	25 06.3	76 04.4	13762	25	25.48	J.W.G.
Nulato	64 43.4	158 06.8	Jy 26	25 25.2	75 56.7	13915	25	25.48	J.W.G.
Kokrines	64 55.5	154 41.5	Jy 20	26 15.4	76 27.7	13365	25	25.48	J.W.G.
Tanana	65 10.3	152 06.4	Jy 16	28 43.4	77 10.0	12924	25	25.48	J.W.G.
Rampart	65 30.7	150 13.0	Jy 11	29 57.4	77 40.7	12409	25	25.48	J.W.G.
Fort Hamlin	65 54.0	149 13.9	Jy 8	31 46.0	78 08.1	12005	25	25.48	J.W.G.
Hodzana River	66 15.0	147 44.8	Jy 4	32 00.9	78 35.8	11558	25	25.48	J.W.G.

ARIZONA.

	° ′	° ′		East ° ′	° ′	γ			
Benson	31 58.6	110 17.9	Oc 5	13 11.3	59 00.0	27531	21	24.12	R.L.F.
Lyons Ranch (nr. Tucson)	32 14.5	110 46.8	Oc 2	13 10.9	59 20.6	27388	21	24.12	R.L.F.
Jerome Junction	34 46.9	112 25.4	Se 28	14 16.6	61 24.9	26181	21	24.12	R.L.F.
Williams	35 14.2	112 09.5	Se 22	14 44.1	61 41.7	26396	21	24.12	R.L.F.
Ash Fork	35 14.4	112 29.2	Se 26	15 13.4	61 58.4	25944	21	24.12	R.L.F.
Grand Canyon	36 05.9	112 09.2	Se 24	14 46.2	62 42.5	25497	21	24.12	R.L.F.

ARKANSAS.

	° ′	° ′		East ° ′	° ′	γ			
Marianna	34 47.3	90 46.3	My 5	5 54.4	65 39.2	24011	19	23.34	W.M.H.
Wynne	35 14	90 47.7	Ap 29, 30	5 41.0	66 05.2	23592	19	23.34	W.M.H.
Harrisburg	35 33.7	90 42.2	Ap 27, 28	5 36.4	66 03.9	23763	19	23.34	W.M.H.
Osceola	35 41.0	89 57.6	Ap 23	5 07.5	66 33.0	23292	19	23.34	W.M.H.
Jonesboro	35 49.3	90 43.4	Ap 24, 25	5 24.9	66 49.9	23290	19	23.34	W.M.H.

CALIFORNIA.

	° ′	° ′		East ° ′	° ′	γ			
Goat Island	37 48.8	122 21.7	No 10	17 52.2	62 11.8	25258	IIII	34.56	S.W.T.
Do.	37 48.8	122 21.7	Ap 13	17 53.3	62 10.6	25252	IIII	34.56	S.W.T.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

CONNECTICUT.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		*West* ° ′	° ′	γ			
Greenwich	41 00.6	73 37.0	No 13	10 13.8	72 12.8	18218	C	33	R.F.L.

DISTRICT OF COLUMBIA.

	° ′	° ′		*West* ° ′	° ′	γ			
Washington, office	38 53.2	77 00.5	Se 5, 7	5 31.6	69 01.7	20713	21	24.12	R.L.F.
Washington, nr. zoo	38 55.2	77 02.5	Jy 29	4 37.3	----	19909	21	-----	R.L.F.

FLORIDA.

	° ′	° ′		*East* ° ′	° ′	γ			
Jupiter	26 56.3	80 02.9	Fe 19	1 45.5	58 19.2	27720	29	30.12	W.H.B.
Punta Gorda	26 57.1	82 02.6	Fe 22	2 10.5	58 18.0	27856	29	30.12	W.H.B.
Apalachicola	29 43.5	84 58.8	Mh 13, 15	3 49.8	60 45.6	26799	29	30.12	W.H.B.

HAWAII.

	° ′	° ′		*East* ° ′	° ′	γ			
Honolulu Magnetic Observatory.	21 19.2	158 03.8	De–Ja	9 26.1	40 54.2	29167	22	22EI	W.F.W

ILLINOIS.

	° ′	° ′		*East* ° ′	° ′	γ			
Metropolis	37 09.2	88 42.4	Oc 5	4 31.4	68 13.6	22068	19	23.34	W.M.H.
Jonesboro	37 27.1	89 18.7	Jy 6, 7	4 31.3	68 02.2	22144	19	23.34	W.M.H.
Elizabethtown	37 28.1	88 19.3	Se 30	4 38.1	68 05.0	22279	19	23.24	W.M.H.
Shawneetown	37 42.7	88 08.8	Se 25, 26	3 53.0	68 53.5	21615	19	23.34	W.M.H.
Murphysboro	37 46.4	89 20.0	Jy 1	5 16.0	67 50.5	22569	19	23.34	W.M.H.
Chester	37 55.0	89 53.6	Jy 8, 9	5 00.4	68 05.2	22252	19	23.34	W.M.H.
Carmi	38 05.1	88 10.5	Au 10	3 29.5	69 04.6	21550	10	31.34	F.A.M.
Mt. Vernon	38 18.4	88 55	Se 22–24	4 05.6	69 16.4	21270	19	23.34	W.M.H.
Waterloo	38 19.9	90 10.8	Jy 10, 11	5 52.1	68 53.0	21708	19	23.34	W.M.H.
Fairfield	38 23.2	88 20.9	Au 11	4 05.1	69 36.5	21149	10	31.34	F.A.M.
Mt. Carmel	38 25.5	87 45.3	Au 7, 8	3 43.6	69 30.3	21169	10	31.34	F.A.M.
Lawrenceville	38 44.2	87 41.2	Au 4, 5	3 40.5	69 54.8	20777	10	31.34	F.A.M.
Louisville	38 47.2	88 31.2	Au 13	4 20.3	69 47.0	20915	10	31.34	F.A.M.
Greenville	38 54.0	89 24.6	Au 19	4 26.7	69 53.3	20773	10	31.34	F.A.M.
Vandalia	38 57.4	89 05.9	Au 17	4 37.6	69 46.4	20816	10	31.34	F.A.M.
Robinson	39 00.0	87 45.6	Au 3	3 21.3	70 03.4	20621	10	31.34	F.A.M.
Jerseyville	39 07.0	90 18.8	Jy 15, 16	5 04.3	69 43.6	20948	18	15.56	W.H.D.
Effingham	39 08.7	88 32.8	Au 14	4 26.6	70 06.9	20576	10	31.34	F.A.M.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

ILLINOIS—Continued.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		East ° ′	° ′	γ			
Toledo	39 16.0	88 14.1	Se 11	3 46.9	70 14.4	20443	10	31.34	F.A.M.
Carlinville	39 17.6	89 52.7	Au 20, 21	5 04.5	69 52.2	20809	10	31.34	F.A.M.
Carrollton	39 17.8	90 24.7	Jy 20	5 16.5	69 46.9	20996	18	15.56	W.H.D.
Marshall	39 24.8	87 42.3	Jy 31	3 24.1	70 15.6	20549	10	31.34	F.A.M.
Charleston	39 29.4	88 10.4	Se 10	3 49.7	70 18.8	20439	10	31.34	F.A.M.
Pittsfield	39 36.2	90 49.2	Jy 24, 25	5 30.5	70 19.7	20478	18	15.56	W.H.D.
Sullivan	39 36.3	88 35.5	Se 9	4 03.9	70 25.2	20311	10	31.34	F.A.M.
Winchester	39 37.2	90 27.2	Jy 21, 22	6 10.5	70 18.6	20472	18	15.56	W.H.D.
Paris	39 38.9	87 40.6	Jy 30	3 21.6	70 38.2	20379	10	31.34	F.A.M.
Mt. Sterling	39 58.9	90 45.7	Au 7, 8	5 51.1	70 17.7	20595	18	15.56	W.H.D.
Petersburg	40 01.2	89 49.6	Au 24	4 20.0	70 45.6	20155	10	31.34	F.A.M.
Monticello	40 02.4	88 34.6	Se 8	3 53.1	70 51.4	19984	10	31.34	F.A.M.
Clinton	40 10.1	88 57.8	Se 5	3 46.7	70 59.8	19837	10	31.34	F.A.M.
Lewistown	40 24.2	90 09.6	Au 25, 26	4 47.2	71 11.3	19777	10	31.34	F.A.M.
Carthage	40 25.1	91 07.7	Au 11	6 10.0	70 58.4	20048	18	15.56	W.H.D.
Macomb	40 27.1	90 40.2	Au 27	5 58.8	70 53.6	20042	10	31.34	F.A.M.
Bloomington	40 30.7	88 59.8	Se 4	3 25.9	71 04.2	19822	10	31.34	F.A.M.
Oquawka	40 56.2	90 56.8	Au 29	5 10.9	71 29.1	19704	10	31.34	F.A.M.
Toulon	41 05.2	89 51.4	Se 2	4 41.1	71 47.2	19325	10	31.34	F.A.M.
Aledo	41 12.2	90 45.3	Au 31	5 54.1	71 32.3	19553	10	31.34	F.A.M.
Waukegan	42 20.7	87 51.0	Jy 6	2 38.6	72 46.2	18295	36	76.12	C.F.W.

INDIANA.

	° ′	° ′		East ° ′	° ′	γ			
Liberty	39 39.0	84 54.9	Jy 21, 22	0 54.4	71 01.4	19797	10	31.34	F.A.M.
Danville	39 45.8	86 29.3	Jy 25	1 30.8	70 59.1	19893	10	31.34	F.A.M.
Greenfield	39 47.3	85 45.3	Jy 23	1 23.5	70 48.6	19849	10	31.34	F.A.M.
Indianapolis	39 48.7	86 12.6	Je 30	1 09.2	70 59.2	19734	36	76.12	C.F.W.
Rochester	41 03.0	86 12.8	Je 30	2 32.3	71 49.2	19268	11	31.34	F.A.M.
Columbia City	41 08.9	85 30.5	Je 28	1 35.0	72 11.6	18962	11	31.34	F.A.M.
Auburn	41 22.8	85 05.2	Je 25, 26	0 19.0	72 17.0	18724	11	31.34	F.A.M.

IOWA.

	° ′	° ′		East ° ′	° ′	γ			
Bloomfield	40 46.1	92 23.4	Je 25, 26	6 47.3	71 31.0	19306	18	36.12	J.R.B.
Mt. Pleasant	40 57.8	91 33.1	Au 14, 15	5 38.5	71 27.1	19698	18	15.56	W.H.D.
Albia	41 00.2	92 47.8	Je 29	6 54.9	[a]71 40.3	19257	18	36.12	J.R.B.
Wapello	41 11.4	91 11.0	Se 22	4 54.5	71 32.4	19517	36	76.12	C.F.W.
Oskaloosa	41 18.2	92 38.9	Au 18–20	7 56.4	71 48.3	19075	18	15.56	W.H.D.
Sigourney	41 20.2	92 13.2	Au 21	6 45.6	71 49.0	19165	18	15.56	W.H.D
Muscatine	41 26.7	91 02.9	Se 21	5 48.7	71 37.1	19265	36	76.12	C.F.W.
Iowa City	41 39.6	91 30.0	Se 19	6 16.3	72 22.5	18700	36	76.12	C.F.W.
Tipton	41 46.6	91 08.2	Se 17	7 28.9	72 15.1	18815	36	76.12	C.F.W

[a] Dip observations July 16, 1909.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

IOWA—Continued.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		East ° ′	° ′	γ			
Clinton	41 54.0	90 10.3	Se 15	4 16.4	71 50.1	19137	36	76.12	C.F.W.
Marion	42 02.9	91 35.7	Au 24, 25	6 42.0	72 19.8	18702	18	15.56	W.H.D.
Grundy Center	42 20.4	92 46.0	Au 27	7 18.2	72 36.5	18433	18	15.56	W.H.D.
Dubuque	42 30.0	90 39.7	Se 12	5 26.9	73 06.2	17957	36	76.12	C.F.W.
Waverley	42 43.4	92 29.0	Au 31, Se 1	6 51.3	72 44.4	18281	18	15.56	W.H.D.
Allison	42 44.3	92 48.5	Au 29	7 07.5	72 41.1	18401	18	15.56	W.H.D.
Charles City	43 02.8	92 40.9	Se 2, 3	7 20.9	73 02.3	18092	18	15.56	W.H.D.
New Hampton	43 03.3	92 19.5	Se 4, 5	8 07.4	72 50.6	18272	18	15.56	W.H.D.

KANSAS.

	° ′	° ′		East ° ′	° ′	γ			
Baldwin	38 47.0	95 10.0	De–Ja	8 33.3	68 49.5	21677	30	55.12	W.B.K.
Baldwin	38 47.0	95 10.0	Oc 9, 10	8 33.6	68 45.5	21691	21	24.12	R.L.F.
Wallace	38 55.1	101 35.5	Oc 12	12 33.4	67 47.1	22407	29	30.12	W.H.B.

KENTUCKY.

	° ′	° ′		East ° ′	° ′	γ			
Murray	36 36.9	88 18.4	Oc 10, 11	4 41.0	67 32.4	22512	19	23.34	W.M.H.
Elkton	36 49.1	87 11.6	Oc 24, 26	4 38.4	67 45.4	22360	19	23.34	W.M.H.
Benton	36 51.4	88 20.7	Oc 8, 9	4 27.4	67 46.8	22449	19	23.34	W.M.H.
Cadiz	36 52.5	87 52.7	Oc 28, 29	3 30.0	67 47.8	22318	19	23.34	W.M.H.
Greenville	37 12.6	87 10.9	No 7, 9	3 47.8	68 32.2	21784	19	23.34	W.M.H.
Marion	37 21.1	88 07.3	No 2, 3	4 42.0	68 01.9	22275	19	23.34	W.M.H.
Hartford	37 27.8	86 54.7	No 11, 12	3 31.9	68 30.4	21806	19	23.34	W.M.H.
Dixon	37 32.5	87 42.9	No 4, 6	3 22.0	68 28.4	21987	19	23.34	W.M.H.
Hardinsburg	37 46.4	86 26.4	No 16, 17	3 49.0	69 18.7	21261	19	23.34	W.M.H.
Brandenburg	38 00.5	86 08.5	No 19	5 19.8	69 46.3	20940	19	23.34	W.M.H.

LOUISIANA.

	° ′	° ′		East ° ′	° ′	γ			
Rayville	32 28	91 45	Mh 27	6 29.2	62 51.3	25856	29	30.12	W.H.B.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

MARYLAND.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		*West* ° ′	° ′	γ			
Potomac	38 02.8	76 19.2	Ap 26	5 59.9	-- ----	-----	*153*	-----	O.W.F.
St. Jerome	38 07.2	76 20.2	Ja 25	5 28.8	-- ----	-----	*153*	-----	O.W.F.
Solomons Island	38 19.0	76 27.4	Au, Ja, Fe	5 32.5	-- ----	-----	*153*	-----	O.W.F.
Benedict	38 30.8	76 40.4	Se 10	5 50.3	-- ----	-----	*153*	-----	O.W.F.
Cheltenham	38 44.0	76 50.5	De–Ja	5 34.1	70 32.0	19908	26	26EI	J.E.B.
Do.	38 44.0	76 50.5	Se 22, 23	5 32.1	70 31.0	19897	20	78.12	J.E.B.
Do.	38 44.0	76 50.5	Se 24, Oc 5	5 32.7	-- ----	19930	25	-----	J.E.B.
Do.	38 44.0	76 50.5	De 18, 19	5 33.9	-- ----	19920	36	-----	F.L.A.
Do.	38 44.0	76 50.5	De 23, 29	5 33.0	-- ----	19913	18	-----	J.E.B.
Do.	38 44.0	76 50.5	Ja 12–26	5 33.8	70 34.1	19909	29	30.12	J.E.B.
Do.	38 44.0	76 50.5	Fe 3, 4	5 34.4	-- ----	19899	10	-----	J.E.B.
Do.	38 44.0	76 50.5	Fe 5, 6	5 33.6	-- ----	19914	11	-----	J.E.B.
Do.	38 44.0	76 50.5	Mh 3–5	5 33.9	70 31.2	19882	19	23.34	J.E.B.
Do.	38 44.0	76 50.5	Ap 6	- ----	-- ----	19884	8	-----	J.E.B.

MASSACHUSETTS.

	° ′	° ′		*West* ° ′	° ′	γ			
Fairhaven	41 37.4	70 54.1	Se 25	12 26.6	73 07.7	17356	C	33.12	R.F.L.
South Hyannis	41 38.1	70 17.1	Se 18	13 23.6	72 40.0	17776	C	33.12	R.F.L.

MICHIGAN.

	° ′	° ′		° ′	° ′	γ			
Hermanville	45 42.7	87 36.1	Au 21	1 42.5E	75 35.9	15649	36	76.12	C.F.W.
Manistique	45 57.5	86 14.8	Au 20	0 13.3E	75 51.3	15258	36	76.12	C.F.W.
Watersmeet	46 15.9	89 10.0	Au 4	3 34.5E	77 08.1	13830	36	76.12	C.F.W.
Munising	46 24.6	86 38.8	Au 18	1 17.3E	76 10.1	15052	36	76.12	C.F.W.
Sidnaw	46 30.8	88 42.4	Au 8	3 22.1E	76 26.5	14710	36	76.12	C.F.W.
Michigamme	46 32.3	88 05.1	Au 10	0 36.5W	76 08.4	16175	36	76.12	C.F.W.
Marquette	46 33.0	87 22.2	Au 13	2 06.3E	75 26.7	15908	36	76.12	C.F.W.
Copper Harbor	47 28	87 52	Jy 21	1 18.4E	77 36.2	13575	20	78.12	W.B.

MINNESOTA.

	° ′	° ′		*East* ° ′	° ′	γ			
Mankato	44 05.9	94 00.5	Au 13, 17	8 58.1	73 28.9	17687	11	36.12	W.D.L.
Lesueur Center	44 23	93 41.0	Au 6–8	9 11.4	74 01.6	17209	11	36.12	W.D.L.
Henderson	44 30.3	93 50.4	Au 19–21	8 40.5	74 11.6	17041	11	36.12	W.D.L.
Hastings	44 43.7	92 53.1	Au 4	6 41.6	74 16.0	16998	11	36.12	W.D.L.
Shakopee	44 47.6	93 29.1	Au 24	8 32.4	74 36.9	16648	11	36.12	W.D.L.
Anoka	45 11.8	93 19.9	Se 1	8 58.8	74 55.9	16246	11	36.12	W.D.L.
Elk River	45 17.1	93 35.2	Se 2, 4	7 57.2	74 54.2	16254	11	36.12	W.D.L.
Princeton	45 34.6	93 41.5	Se 7	13 32.7	75 04.6	16295	11	36.12	W.D.L.
Cambridge	45 34.8	93 08.6	Au 28	9 09.3	75 00.0	16280	11	36.12	W.D.L.
Foley	45 38.8	93 55.6	Se 9	8 37.6	75 23.2	15953	11	36.12	W.D.L.
Little Falls	45 58	94 19.5	Se 12	8 53.4	-- ----	15936	11	-----	W.D.L.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

MISSISSIPPI.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		East ° ′	° ′	γ			
Iuka	34 48.8	88 10.8	Je 25	4 11.2	65 51.1	24087	19	23.34	W.M.H.
Corinth	34 55.3	88 30.8	Je 22, 23	4 44.8	66 08.6	23466	19	23.34	W.M.H.

MISSOURI.

	° ′	° ′		East ° ′	° ′	γ			
Caruthersville	36 12	89 41.4	Ap 20, 21	5 06.1	66 56.0	23087	19	23.34	W.M.H.
Pineville	36 36	94 22.9	Au 6, 7	8 19.1	66 49.4	23287	19	23.34	W.M.H.
Forsyth	36 41.8	93 05.6	Au 14	5 53.4	67 06.8	22937	19	23.34	W.M.H.
Galena	36 47.7	93 28.2	Au 10, 11	6 33.7	67 11.7	22925	19	23.34	W.M.H.
Neosho	36 52.2	94 21.5	Au 4, 5	8 37.0	67 02.8	23119	19	23.34	W.M.H.
Bloomfield	36 53.3	89 55.5	Se 8, 9	7 19.6	67 53.3	22367	19	23.34	W.M.H.
Ava	36 57.2	92 39.4	Au 21	6 58.0	67 13.1	22836	19	23.34	W.M.H.
Van Buren	37 00.5	91 01.1	Au 31	6 04.3	67 35.6	22640	19	23.34	W.M.H.
Ozark	37 02	93 11.6	Au 17, 18	7 03.6	67 10.9	22920	19	23.34	W.M.H.
Benton	37 06.0	89 34.0	Se 11, 12	4 49.9	68 01.5	22213	19	23.34	W.M.H.
Carthage	37 09.7	94 18.1	Au 1, 3	7 54.9	67 21.8	22973	19	23.34	W.M.H.
Eminence	37 10.3	91 22.6	Au 27, 28	6 14.0	67 37.3	22713	19	23.34	W.M.H.
Hartville	37 15.3	92 28.9	Au 24, 25	7 36.0	67 23.0	22949	19	23.34	W.M.H.
Jackson	37 23.4	89 40.6	Se 15, 16	4 24.2	68 16.3	22066	19	23.34	W.M.H.
Greenfield	37 24.7	93 50.0	Jy 28	7 01.8	67 39.4	22678	19	23.34	W.M.H.
Centerville	37 26.5	90 56.5	Se 3	5 58.6	67 44.0	22543	19	23.34	W.M.H.
Perryville	37 44.2	89 52	Se 19, 20	4 30.1	68 38.7	21566	19	23.34	W.M.H.
Nevada	37 52.4	94 21.5	Jy 26	8 12.1	68 03.3	22374	19	23.34	W.M.H.
Butler	38 14.5	94 19.5	Jy 23	7 43.0	68 19.4	22062	19	23.34	W.M.H.
St. Louis	38 38.4	90 16.0	Jy 13–15	5 06.3	69 34.3	21036	19	23.34	W.M.H.
Mexico	39 10.2	91 51.8	Jy 16	6 36.4	69 33.3	21234	19	23.34	W.M.H.
Keytesville	39 26.0	92 57.7	Jy 18	7 03.2	69 30.8	21351	19	23.34	W.M.H.

NEW YORK.

	° ′	° ′		West ° ′	° ′	γ			
Ithaca	42 26.8	76 28.9	Je 13, 14	7 43.6	73 43.1	16942	36	76.12	C.F.W.
Buffalo	42 54.6	78 53.7	Jy 6, 7	6 26.2	73 50.2	17119	10	31.34	F.A.M.
Lockport	43 10.1	78 40.6	Jy 2, 3	4 10.1	74 02.3	16733	10	31.34	F.A.M.
Albion	43 15.1	78 12.2	Jy 1	7 58.5	74 10.7	16751	10	31.34	F.A.M.

NORTH CAROLINA.

	° ′	° ′		West ° ′	° ′	γ			
Beaufort	34 43.1	76 39.9	My 24	3 13.2	66 50.1	22585	29	30.12	W.H.B.
Fayetteville (new)	35 03.0	78 53.2	Je 29, Jy 1	2 13.2	66 58.6	22548	19	23.34	W.M.H.
Fayetteville (old)	35 03.0	78 53.2	Jy 2[a]	2 11.2	66 56.4	22560	19	23.34	W.M.H.
Manteo	35 55.5	75 42.1	De 7–9	5 03.4	67 49.5	21830	19	23.34	W.M.H.

[a] July, 1909.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

OHIO.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		*West* ° ′	° ′	γ			
Circleville	39 37.2	82 52.3	Je 28	1 17.3	70 50.2	19668	36	76.12	C.F.W.
Columbus	39 59.6	83 00.6	Je 24	1 08.7	70 39.9	20024	36	76.12	C.F.W
Painesville	41 45.3	81 15.4	Je 21, 22	3 50.5	72 38.6	18286	36	76.12	C.F.W.
Painesville, A	41 45.3	81 15.4	Je 21, 22	3 48.7	72 40.3	18287	18	36.12	J.R.B.

OKLAHOMA.

	° ′	° ′		*East* ° ′	° ′	γ			
McAlester	34 58.2	95 48.8	Ap 27	8 43.0	65 01.3	24685	29	30.12	W.H.B.

OREGON.

	° ′	° ′		*East* ° ′	° ′	γ			
Eugene	44 03.5	123 05.5	Jy 2, 3	23 27.6	69 26.8	20459	29	30.12	W.H.B.
Yam	45 03.7	123 09.3	Jy 10, 11	22 05.8	68 25.1	21225	29	30.12	W.H.B.

PENNSYLVANIA.

	° ′	° ′		*West* ° ′	° ′	γ			
Meadville	41 36.8	80 11.5	Jy 9–11	4 24.0	72 46.0	18140	10	31.34	F.A.M.
Meadville, aux.	41 36.8	80 11.5	Jy 9, 10	4 24.7	72 46.5	18137	10	31.34	F.A.M
Meadville	41 36.8	80 11.5	Jy 9, 10	4 24.8	72 43.8	18137	18	15.56	W.H.D.
Meadville, aux.	41 36.8	80 11.5	Jy 10, 11	4 24.9	72 44.5	18113	18	15.56	W.H.D.

PORTO RICO.

	° ′	° ′		*West* ° ′	° ′	γ			
Mona Island	18 05.3	67 57.0	Fe 19	1 19.0	48 53.2	*29875*	*C*	28.3	R.F.L.
Do.	18 05.3	67 57.0	My 27	1 20.4	48 55.7	*29739*	*C*	28.3	R.F.L.
Porto Rico Magnetic Observatory	18 08.8	65 26.9	De–Ja	2 07.0	49 40.5	29017	31	1EI	G.H.
Mayaguez, new	18 12.0	67 08.5	Fe 15	1 46.1	49 41.6	*29164*	*C*	28.3	R.F.L.
Mayaguez, old	18 13.8	67 10.4	Fe 16, 17	1 43.6	49 04.7	*29464*	*C*	28.3	R.F.L.
Do.	18 13.8	67 10.4	Je 1	1 46.1	-- ----	*29448*	*C*	28.3	R.F.L.
San Juan, S. Base	18 27.2	66 08.3	Fe 9	1 55.4	50 21.7	*29016*	*C*	28.3	R.F.L.
Do.	18 27.2	66 08.3	Je 5	1 50.9	-- ----	*28891*	*C*	28.3	R.F.L.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

SOUTH CAROLINA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		*East* ° ′	° ′	γ			
McCormick	33 54.8	82 18.0	My 17	0 38.5	65 12.3	24076	29	30.12	W.H.B.

TENNESSEE.

	° ′	° ′		*East* ° ′	° ′	γ			
Selmer	35 10.2	88 34.3	Je 18, 19	4 22.3	66 14.3	23594	19	23.34	W.M.H.
Savannah	35 13.4	88 13.6	Je 15	5 00.2	66 35.3	23328	19	23.34	W.M.H.
Bolivar	35 14.2	89 00.0	My 15, 17	4 44.6	66 27.4	23223	19	23.34	W.M.H.
Somerville	35 15.2	89 20.6	My 7–11	4 39.4	66 19.9	23639	19	23.34	W.M.H.
Waynesboro	35 19.4	87 45.8	Je 11	3 24.3	66 24.6	23369	19	23.34	W.M.H.
Henderson	35 27	88 40.1	My 21	4 30.2	66 18.4	23508	19	23.34	W.M.H.
Hohenwald	35 33.1	87 34.3	Je 6	3 42.4	66 42.6	23155	19	23.34	W.M.H.
Decaturville	35 34.2	88 08.4	My 28	4 52.4	66 53.1	23211	19	23.34	W.M.H.
Jackson	35 35.9	88 48.2	My 13, 14	4 57.6	66 22.5	23340	19	23.34	W.M.H.
Columbia	35 36.7	87 02.5	My 3, 5	3 38.8	67 24.1	22964	29	30.12	W.H.B.
Linden	35 37.7	87 51.9	Je 1, 3	3 10.7	66 38.2	23355	19	23.34	W.M.H.
Lexington	35 39.5	88 24.4	My 24, 25	4 05.4	66 38.9	23332	19	23.34	W.M.H.
Alamo	35 47.6	89 08.4	Ap 2	4 51.6	67 34.8	23345	19	23.34	W.M.H.
Centerville	35 47.7	87 26.8	Je 8, 9	3 32.7	66 49.1	23079	19	23.34	W.M.H.
Trenton	35 59.2	88 55.7	Ap 5	4 42.4	66 53.1	23143	19	23.34	W.M.H.
Huntingdon	35 59.8	88 23.1	Mh 27, 28	4 20.4	67 09.2	22801	19	23.34	W.M.H.
Dyersburg	36 03.4	89 24.1	Ap 13, 14	4 52.3	66 56.5	23076	19	23.34	W.M.H.
Camden	36 04.4	88 05.4	Mh 23, 24	4 02.3	67 03.7	22872	19	23.34	W.M.H.
Waverly	36 05.4	87 47.6	Mh 19, 20	4 21.8	67 07.8	22819	19	23.34	W.M.H
Nashville	36 08.5	86 46.0	Mh 12, 14	3 37.8	67 10.3	22751	19	23.34	W.M.H
				West					
Roan Mountain	36 12	82 04	Je 26	0 19.8	68 00.3	22050	29	30.12	W.H.B.
				East					
Ashland City	36 16.7	87 03.2	Mh 15, 16	3 39.6	67 22.6	22608	19	23.34	W.M.H.
Dresden	36 17.9	88 46.6	Mh 30, 31	4 31.6	67 39.3	22485	19	23.34	W.M.H.
Paris	36 18.4	88 19.3	Oc 14, 15	4 18.6	67 17.3	22763	19	23.34	W.M.H.
Erin	36 20.0	87 41.3	Oc 17	3 47.6	67 40.6	22515	19	23.34	W.M.H.
Tiptonville	36 23.3	89 28.4	Ap 16, 17	4 10.3	67 25.2	22699	19	23.34	W.M.H.
Union City	36 25.1	89 05.0	Ap 8, 9	4 37.4	67 15.8	22864	19	23.34	W.M.H.
Clarksville	36 32.5	87 19.0	Oc 21, 22	4 02.0	67 30.5	22454	19	23.34	W.M.H.

TEXAS.

	° ′	° ′		*East* ° ′	° ′	γ			
Isabel (Fronton)	26 04.6	97 12.4	Ap 6, 7	8 16.7	54 37.4	29972	29	30.12	W.H.B.

VIRGINIA.

	° ′	° ′		*West* ° ′	° ′	γ			
Bedford City, old	37 20.4	79 31.3	No 24, 25	3 54.3	69 26.4	20657	19	23.34	W.M.H.
Bedford City, new	37 21.0	79 31.5	No 27, 28	2 12.4	69 15.7	20961	19	23.34	W.M.H.

TABLE I.—*Magnetic observations on land July 1, 1908, to June 30, 1909*—Continued.

WASHINGTON.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M	D C	
	° ′	° ′		East ° ′	° ′	γ			
Seattle	47 39.6	122 18.4	No 11, 12	23 35.4	70 46.5	19412	8	32.12	H.A.S.
Kala	48 03.5	122 46.1	Au 10	23 33.7	71 12.1	18932	29	30.12	W.H.B.
Bahada	48 22.2	124 35.7	Au 24, 27	24 14.1	70 45.5	19326	29	30.12	W.H.B.

WEST VIRGINIA.

	° ′	° ′		West ° ′	° ′	γ			
Parkersburg	39 16.1	81 33.6	Jy 20	1 40.7	70 49.6	19887	10	31.34	F.A.M.
St. Marys	39 23.6	81 11.4	Jy 17, 18	2 35.8	70 45.8	19810	10	31.34	F.A.M
New Martinsville	39 38.3	80 51.7	Jy 15	1 06.3	70 59.0	19751	10	31.34	F.A.M.

WISCONSIN.

	° ′	° ′		East ° ′	° ′	γ			
Somers	42 37.2	87 52.5	Jy 7	3 12.0	73 06.5	17974	20	78.12	W.B.
Darlington	42 40.9	90 06.2	Se 9	5 18.5	73 29.8	17522	36	76.12	C.F.W.
Lancaster	42 51.2	90 41.7	Se 10, 11	6 13.3	73 19.7	17752	36	76.12	C.F.W.
Milwaukee	43 04.6	87 51.0	Jy 6, 9	3 26.6	73 49.2	17571	36	76.12	C.F W.
Port Washington	43 23.8	87 52.5	Se 5	1 56.9	74 02.1	17094	36	76.12	C.F.W.
Juneau	43 24.5	88 42.1	Jy 11	3 11.5	74 03.8	16976	36	76.12	C.F.W.
West Bend	43 26.1	88 11.0	Se 7	3 56.9	74 16.4	17109	36	76.12	C.F.W.
Portage	43 33.3	89 27.6	Jy 6–16	3 36.4	73 56.0	17249	11	36.12	W.D.L.
Green Lake	43 52.0	88 56.4	Jy 14	3 32.8	74 14.2	16890	36	76.12	C.F.W.
Oshkosh	44 01.4	88 30.9	Jy 17	2 50.3	74 24.9	16800	36	76.12	C.F.W.
Chilton	44 01.6	88 09.3	Se 2	2 38.3	74 17.8	16843	36	76.12	C.F.W.
Appleton	44 15.8	88 26.4	Au 31	2 42.0	74 41.9	16477	36	76.12	C.F.W.
Black River Falls	44 17.3	90 47.8	Jy 18–23	6 14.1	73 56.5	17296	11	36.12	W.D.L.
Waupaca	44 21.2	89 03.9	Jy 20	3 18.9	74 51.8	16320	36	76.12	C.F.W.
Kewaunee	44 27.8	87 30.6	Au 28	2 42.5	74 45.6	16442	36	76.12	C.F.W.
Green Bay	44 31.1	87 59.1	Au 26	3 20.4	74 48.3	16449	36	76.12	C.F.W.
Stevens Point	44 31.3	89 33.6	Jy 22	4 25.5	74 41.1	16444	36	76.12	C.F.W.
Eau Claire	44 48.9	91 28.3	Jy 24, 25	5 59.2	74 32.7	16638	11	36.12	W.D.L.
Oconto	44 53.8	87 51.1	Au 24	2 46.1	75 12.7	15951	36	76.12	C.F.W.
Menomonie	44 54	91 54	Jy 27, 28	6 03.2	74 34.9	16652	11	36.12	W.D.L.
Hudson	44 57.4	92 44.5	Jy 31	3 56.8	74 27.8	17100	11	36.12	W.D.L.
Antigo	45 09.2	89 08.3	Jy 27	4 24.1	75 53.4	15314	36	76.12	C.F.W.
Merrill	45 11.3	89 39.8	Jy 24	4 07.9	75 20.2	15876	36	76.12	C.F.W.
Crandon	45 33.2	88 53.6	Jy 29	3 11.3	75 23.4	15832	36	76.12	C.F.W.
Eagle River	45 54.8	89 14.4	Au 1	3 32.1	75 36.9	15645	36	76.12	C.F.W.
Florence	45 54.8	88 16.1	Au 5	2 22.1	75 58.3	15152	36	76.12	C.F.W.
Little Squaw Bay	46 55.6	90 59.3	Jy 30	5 13.8	76 43.8	14564	20	78.12	W B.

FOREIGN COUNTRIES.

	° ′	° ′		East ° ′	° ′	γ			
British Columbia:									
Beechy Head	48 19.0	123 39.0	Se 14	26 58.8	70 31.1	19365	29	30.12	W.H.B.
Union	49 35.6	124 54.0	Mh 11–13[a]	26 19.6	71 16.5	19033	8	32.12	C.G.O.
Union 2	49 35.8	124 54.0	Oc 31	26 36.0	71 23.9	19000	IIII	34.56	S.W.T.
Union 2	49 35.8	124 54.0	My 11	26 28.0	71 19.5	19064	IIII	34.56	S.W.T.
North Island	54 14.1	133 00.0	Jy 1	29 03.8	-- ----	-----	15	-----	P.C.W.

[a] 1908.

TABLE II.—*Magnetic observations at sea, July 1, 1908, to June 30, 1909.*

ATLANTIC OCEAN.

Locality	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Total intensity	Ship	Headings	Sea
	° ′	° ′		*West* ° ′	° ′	*c.g.s.*	*c.g.s.*			
Off Mona Island	18 06	67 57	Mh 6	0 49	48 32	0.2994	0.4521	Bache	16	Lt. sw.
Do.	18 07	67 57	My 29	1 00	49 12	.2967	.4541	Do.	16	Lt. sw.
Mayaguez Harbor	18 12	67 10	Fe 18	1 29	49 13	.2949	.4514	Do.	16	Sm.
Do.	18 12	67 10	Fe 27	1 50	49 32	.2923	.4504	Do.	16	Sm.
Do.	18 12	67 10	Je 1	1 49	49 25	.2937	.4514	Do.	16	Sm.
Off Mayaguez Harbor	18 14	67 14	Mh 16	2 19	-- --	-----	-----	Do.	16	Sm.
Do.	18 14	67 14	Mh 20	2 00	-- --	-----	-----	Do.	16	Sm.
Do.	18 14	67 14	Ap 3	2 09	49 11	.2909	.4451	Do.	16	Mod. sw.
San Juan Harbor	18 28	66 08	Fe 11	1 56	50 31	.2910	.4576	Do.	16	Sm.
At sea	20 10	65 18	Je 15	0 41	-- --	-----	-----	Do.	3	Mod. sw.
Do.	21 07	68 15	Ja 28	2 09	52 57	.2881	.4781	Do.	16	Sm.
Do.	21 43	65 32	Je 15	1.23	-- --	-----	-----	Do.	3	Mod. sw.
Do.	24 07	65 54	Je 16	5 14	56 27	.2696	.4878	Do.	8	Mod. sw.
Do.	24 15	71 07	Ja 27	2 30	56 14	.2792	.5024	Do.	8	Sm.
Do.	25 34	66 02	Je 16	5 00	-- --	-----	-----	Do.	3	Mod. sw.
Do.	27 22	73 37	Ja 26	2 04	59 43	.2660	.5275	Do.	8	Choppy.
Do.	27 39	66 32	Je 17	4 40	60 32	.2517	.5117	Do.	8	Lt. sw.
Do.	28 51	66 58	Je 17	6 25	-- --	-----	-----	Do.	3	Sm.
Do.	29 55	73 54	Ja 25	3 49	62 22	.2516	.5424	Do.	8	Choppy.
Do.	31 12	68 00	Je 18	5 28	65 50	.2267	.5538	Do.	8	Mod. sw.
Do.	32 02	69 00	Je 18	6 25	-- --	-----	-----	Do.	3	Mod. sw.
Do.	33 30	71 06	Je 19	6 40	63 50	.2366	.5366	Do.	8	Mod sw.
Do.	34 47	75 12	Ja 24	5 35	67 13	.2228	.5753	Do.	8	Choppy.
Hampton Roads	36 58	76 21	No 19	4 27	68 46	.2121	.5857	Do.	16	Sm.
Do.	36 58	76 22	Ja 22	5 03	68 46	.2114	.5836	Do.	16	Sm.
Chesapeake Bay	38 20	76 22	Je 21	5 48	69 43	.2054	.5925	Do.	16	Sm.
Do.	38 38	76 27	Au 31	5 52	70 14	.2026	.5992	Do.	16	Sm.
At sea	39 59	74 00	Se 3	8 23	71 28	.1903	.5987	Do.	8	Lt. sw.
Do.	40 54	69 14	Se 21	13 07	-- --	-----	-----	Do.	1	Sm.
Do.	40 58	71 45	Se 4	12 00	72 18	.1803	.5929	Do.	8	Lt. sw.
Do.	41 30	70 08	Oc 4	13 42	-- --	-----	-----	Do.	3	Sm.
Do.	41 34	70 17	Oc 8	12 46	72 45	.1762	.5942	Do.	16	Sm.

PACIFIC OCEAN.

	° ′	° ′		*East* ° ′	° ′	*c.g.s.*	*c.g.s*			
San Francisco Bay	37 45	122 21	Ap 20	17 48	62 02	0.2543	0.5422	Explorer	16	Sm.
Do.	37 46	122 22	No 14	17 39	62 02	.2532	.5399	Do.	16	Sm.
At sea	41 24	124 35	No 8	20 05	-- --	-----	-----	Do.	3	Mod. sw.
Do.	42 36	124 40	No 8	20 34	65 53	.2299	.5626	Do.	8	Mod. sw.
Do.	46 12	124 14	No 7	22 34	69 00	.2079	.5800	Do.	8	Mod. sw.
Seattle Harbor	47 36	122 22	No 6	23 34	70 47	.1937	.5886	Patterson	16	Sm.
Do.	47 37	122 24	Ap 30	23 37	-- --	-----	-----	Gedney	16	Sm.
Haro Strait	48 37	123 14	Ap 30	23 40	-- --	-----	-----	McArthur	8	Sm.
Do.	48 38	123 14	My 3	24 01	-- --	-----	-----	Gedney	16	Sm.
Georgia Strait	48 55	123 20	My 4	24 27	-- --	-----	-----	Do.	16	Sm.
Do.	49 10	123 37	My 4	25 14	-- --	-----	-----	Do.	16	Sm.
Do.	49 10	123 36	Ap 30	24 57	-- --	-----	-----	McArthur	8	Sm.
Do.	49 21	124 13	My 8	24 35	71 29	.1878	.5915	Explorer	8	Sm.
Do.	49 35	124 51	My 8	25 43	-- --	-----	-----	Gedney	16	Sm.

TABLE II.—*Magnetic observations at sea, July 1, 1908, to June 30, 1909*—Continued.

PACIFIC OCEAN—Continued.

Locality	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Total intensity	Ship	Headings	Sea
	° ′	° ′		*East* ° ′	° ′	*c.g.s.*	*c.g.s.*			
Union Bay	49 35	124 52	Mh 14[a]	25 48	71 26	.1900	.5966	Patterson	16	Sm.
Do.	49 36	124 52	My 11	25 54	71 24	.1906	.5976	Explorer	16	Sm.
Georgia Strait	49 57	125 10	Oc 30	26 20	-- --	-----	-----	Do.	3	Sm.
Johnstone Strait	50 28	126 04	My 2	24 30	-- --	-----	-----	McArthur	8	Sm.
Do.	50 28	126 03	My 9	24 42	-- --	-----	-----	Gedney	16	Sm.
Do.	50 28	126 07	Oc 30	24 32	71 06	.1923	.5938	Explorer	8	Sm.
Do.	50 32	126 42	My 9	26 08	-- --	-----	-----	Gedney	16	Choppy.
Queen Charlotte Sound	50 49	127 28	Oc 29	27 24	-- --	-----	-----	Explorer	3	Sm.
Off Pine Island	50 58	127 46	My 2	25 59	-- --	-----	-----	McArthur	8	Lt. sw.
Fitzhugh Sound	51 26	127 52	Oc 29	26 34	-- --	-----	-----	Explorer	8	Sm.
Do.	51 26	127 52	My 13	25 22	72 40	.1761	.5911	Do.	8	Lt. sw.
Do.	51 32	127 52	My 13	27 33	-- --	-----	-----	Gedney	16	Choppy.
Do.	51 45	127 57	Oc 29	-- --	72 44	.1744	.5876	Explorer	8	Sm.
Lama Passage	52 04	127 56	My 13	25 14	-- --	-----	-----	Gedney	8	Sm.
Millbank Sound	52 16	128 27	My 13	27 11	-- --	-----	-----	Explorer	3	Lt. sw.
Do.	52 22	128 32	Oc 28	30 40	-- --	-----	-----	Do.	3	Sm.
Do.	52 25	128 33	My 13	26 22	-- --	-----	-----	Gedney	8	Choppy.
Finlayson Channel	52 48	128 25	My 14	28 13	-- --	-----	-----	Do.	8	Sm.
Graham Reach	53 11	128 36	Oc 28	28 14	-- --	-----	-----	Explorer	3	Sm.
Wright Sound	53 20	129 11	My 14	26 36	-- --	-----	-----	Gedney	16	Sm.
Do.	53 22	129 17	Oc 28	27 34	73 08	.1714	.5908	Explorer	8	Sm.
Cardena Bay	53 58	130 10	My 14	29 15	74 05	.1609	.5866	Do.	8	Sm.
Arthur Passage	53 59	130 12	My 15	28 18	-- --	-----	-----	Gedney	16	Sm.
Do.	54 03	130 13	Oc 27	27 22	-- --	-----	-----	Explorer	3	Sm.
At sea	54 04	165 40	My 20	13 48	-- --	-----	-----	Do.	3	Choppy.
Do.	54 08	165 23	My 20	-- --	67 08	.2031	.5227	Do.	8	Choppy.
Dixon Entrance	54 27	134 58	My 14	27 56	-----	-----	-----	Do.	3	Sm.
North of Dundas Island	54 41	130 43	My 15	27 03	-- --	-----	-----	Gedney	16	Sm.
At sea	54 46	135 30	My 15	28 20	73 09	.1688	.5823	Explorer	8	Lt. sw.
Off Kirk Point	55 00	131 08	Oc 27	29 08	74 11	.1606	.5892	Do.	8	Sm.
Off Mary Island	55 06	131 10	My 15	28 21	-- --	-----	-----	Gedney	8	Sm.
At sea	55 07	164 11	My 24	19 03	-- --	-----	-----	Explorer	3	Choppy.
Do.	55 12	141 34	My 16	-- --	72 14	.1747	.5724	Do.	8	Sm.
Do.	55 30	156 10	My 18	20 39	-- --	-----	-----	Do.	3	Sm.
Do.	55 31	153 37	My 18	22 05	70 08	.1870	.5504	Do.	8	Lt. sw.
Do.	55 32	147 25	My 17	24 52	71 20	.1812	.5662	Do.	8	Lt. sw.
Do.	55 40	149 42	My 17	22 53	-- --	-----	-----	Do.	3	Mod. sw.
Clarence Strait	55 44	132 22	Oc 26	29 32	74 26	.1578	.5881	Do.	8	Sm.
At sea	56 07	161 56	My 25	18 37	68 44	.1967	.5422	Do.	8	Sm.
Off Kodiak	57 48	152 20	Oc 20	24 14	71 53	.1741	.5599	Do.	16	Sm.
Do.	57 48	152 21	Mh 30[a]	24 08	71 55	.1737	.5597	Patterson	16	Sm.
Kupreanof Strait	58 02	153 13	Je 19[a]	22 32	71 53	.1743	.5606	Do.	16	Sm.
Nushagak Bay	58 49	158 34	Je 19	21 45	71 42	.1740	.5541	Explorer	16	Sm.

[a] Observations made in March and June, 1908, not heretofore published.

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 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.

ALASKA.

Andreafski.—The station is on the second shoulder of a hill about 300 yards south and west of the N. C. Company's buildings and is 75 paces back from a few graves on the first shoulder of the same hill. It is about 100 feet above the river. The town of Andreafski is on the Andreafski River, 2 miles up from its confluence with the Yukon River. Between the town and the hill on which the station is located is a small stream of water. The station is marked by a spruce post 4 inches in diameter and 36 inches long, projecting 8 inches above the surface of the ground. The post is lettered U. S. and has a rifle shell driven in the center of top. The following true bearings were determined:

	° ′	
Base of flagstaff on N. C. Company's hotel (mark)	64 41.7	east of north
Left hand gable end of N. C. Company's oil storage building	49 22.6	east of north

Anvik.—The station is on the grounds of the Episcopal Mission, and is on the point of a hill about 60 feet high, just back of the mission buildings, almost due south from the church. The station is marked by a pine post 6 by 6 by 48 inches, projecting 4 inches above the surface of the ground, lettered roughly U. S., and having a rifle shell driven in the center of top. The following true bearings were determined:

	° ′	
Mountain peak on distant range (mark)	23 12.2	west of south
A second mountain peak to northward	11 34.1	west of north

Augustine Island.—Magnetic observations were made at triangulation station Augustine, which is on the east side of the island, near the foot of the volcano, about 1⅜ miles from the beach and at an elevation of about 1 000 feet. The station is marked by a 6-inch copper bolt set in the top of a large irregular shaped gray rock with the letters U. S. C. & G. S. cut on the side facing the beach. A cairn of rocks was built near the shore, about 650 feet back from the edge of the bluff. From this cairn the station bears N. 73° 30′ W. (magnetic).

Banner, Alimvoak Bay, Afognak Island.—The triangulation station is on the north side of the inner bay, about 30 feet above high-water mark, on a slightly projecting point. The underground mark is a bottle buried about 1 foot below the surface of the ground. The surface mark is a bowlder with a triangle, 3 inches on a side, cut into it. The following true bearing was determined from the triangulation:

	° ′	
Afognak triangulation station	21 48.1	east of south

Magnetic observations were made 10 feet from the triangulation station, in line with triangulation station Afognak.

Descriptions of stations—Continued.

ALASKA—Continued.

Cape Douglas.—The triangulation station is on the highest point on the southeastern part of Cape Douglas. The underground mark is a bottle 1.4 feet below the surface of the ground set in cement. The surface mark is on a rounded bowlder about 12 inches in diameter with a drill hole about 1 inch deep in it. A tripod signal is over the mark. Sea Otter Reef bears S. 33° E. (magnetic) from the station. The following true bearing was determined from the triangulation:

	° ′
Triangulation station North Douglas	13 46.3 west of north

Magnetic observations were made 15 feet from the triangulation station, in line with triangulation station North Douglas.

Cape Muzon.—Magnetic observations were made at triangulation stations Cape and Y. Cape is on the eastern extremity of the large island to the east of Kaigani village. Station Y is on the highest point of a small grassy islet to the northward of Cape Muzon. This islet is about 30 feet high, nearly circular in shape, and devoid of trees excepting a couple of scrubby spruce trees.

Cholmondeley Sound, Mar.—The station is on the highest part of a high-water, rocky islet, about 1¼ miles from station First and about 1½ miles SSE. from the eastern extremity of Hump Island. The true bearing of First is N. 51° 48′.6 E.

Dutch Harbor.—The station of 1900 was reoccupied. It is on the west slope of the hill southeast of the village of Dutch Harbor, at an elevation of about 130 feet. It is 115 feet south of the azimuth mark, on the line to the astronomic station at Unalaska.

Observations were also made at a number of other places about Iliuliuk Bay and Dutch Harbor.

Observatory is north of the astronomic observatory at Unalaska.

Flat is on the east side of Iliuliuk Bay, opposite the entrance to Dutch Harbor.

Rocky Point is about one-third of a mile east of the village of Dutch Harbor, on the bluff at the extremity of Rocky Point.

Eliza is on the shore about one-third of a mile north of the village.

South Base is at the southern end of the spit on the east side of Dutch Harbor.

North Base is at the northern end of the spit.

Fort Hamlin.—The station is near the buildings of the Northern Commerical Company, and is within the limits of the claim filed by them for a trading post. The buildings are all of logs. The station is south of the dwelling house which is also south of the two warehouses. It is 60 feet from the top of the river bank, 83 feet and 81.9 feet, respectively, from the southwest and southeast corners of the dwelling house, and perhaps 120 feet from the edge of the river at normal height of water. The mark used was a bare point of rock on a mountain at the bend of the river about a mile downstream and seen a little to the right of the middle of the river channel. The station is marked by a pine post 3 by 5 by 36 inches, projecting 8 inches above the ground, with center of top marked with a rifle shell and the letters U. S. The following true bearings were determined:

	° ′
Mark	24 47.6 west of south
Point of rock on mountain across river, west	87 12.7 west of north
Edge of cliff on left-hand bank of river, 1 mile up	12 57.6 west of north

Holy Cross.—The station is on the grounds of the Holy Cross Mission, on a slight slope just back of the buildings and near the cemetery. It is 77.6 feet and 56.7 feet from the southeast and northeast corners of the cemetery, respectively, and 55.9 feet from a fence east of the station, measured at right angles. The station is marked by a pine post 6 by 6 by 40 inches, projecting 4 inches above the surface of the ground, lettered on top U. S., and having a brass shell driven in center. The following true bearings were determined:

	° ′
Base of cross on church (mark)	81 03.4 east of south
Pyramidal mountain peak	68 50.8 east of south

Descriptions of stations—Continued.

ALASKA—Continued.

Kaltag.—The station is on the reservation for the military telegraph. It is 190 feet from the southwest corner of the telegraph office, 98 feet from the northwest corner of a log cabin, and 66.6 feet south from the telegraph line. The station is marked by a post 6 inches in diameter and 30 inches long, projecting 10 inches above the ground, lettered U. S., and marked with a rifle shell driven in center of top. The following true bearings were determined:

	°	′	
Mountain peak to the westward (mark)	64	08.8	west of north
Second peak just over top of near-by hill	4	26.8	west of north

Kasaan Bay, Crook.—Magnetic observations were made at the triangulation station and also at a point 20 feet from it in the direction of station Scrub. Station Crook is on a low grassy islet near the northern end of Kasaan Bay, about 1½ miles northeast from Sandy Point. It is on the southeastern side of the islet, about halfway between high and low water mark and about 218 feet from the large white bowlder on the highest part of the island.

Kiukpalik Island.—The triangulation station is on the highest hill on the southwestern part of the island. A bowlder with a cross cut in the top, lying in a mound of earth, marks the station. Two small ponds lie to the eastward. A tripod signal is erected over the mark. The following true bearings were determined from the triangulation:

	°	′	
Triangulation station Shak	69	40.8	west of south
Triangulation station Dark	25	35.3	east of north

Magnetic observations were taken 20 feet from the above-described station and in line with triangulation station Shak.

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. 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

Kokrines.—The station is within the reservation for the United States military telegraph office, and about 240 feet back from the bank of the river. It is distant 211.0 feet from the southeast corner of the telegraph office, and on a line bearing about 35° east of north. The station is marked by a spruce post 4 inches in diameter, 4 feet long, lettered on top U. S. and having a rifle shell driven in center of This post projects 10 inches above the surface of the ground. The following true bearings were determined:

	°	′	
Point of rock on mountain range to the westward (mark)	64	39.8	west of north
Mountain peak	81	14.0	west of north
Mountain peak	82	45.9	west of north

Kotlik.—The station is just west of the village on the south bank of the Kotlik River, about 100 yards from the small mission chapel, and 50 feet back from the bank of the Kotlik River and about 100

Descriptions of stations—Continued.

ALASKA—Continued.

yards above the confluence of the Kotlik River with a small slough of the Apoon Pass. The station is marked by a post 5 inches in diameter and 36 inches long, projecting 6 inches above the surface of the ground, lettered U. S. and having a rifle shell driven in the center of top. The location is further marked by a stake 4 feet high bearing a signal notice. The following true bearings were determined:

	°	′	
West gable of Mr. C. F. Ingersoll's house (mark)	49	47.4	east of north
South gable of log house	48	39.3	east of north

Louden.—The station is within the reservation for the military telegraph, and is west of the telegraph office. It is 50 feet back from the river bank, 48 paces from the southwest corner of a cache and 83 paces from the telegraph office. The station is marked by a spruce post 10 inches in diameter, projecting 16 inches above the ground, and lettered U. S. The post has a rifle shell driven in center of top, and is packed around with stones. The following true bearings were determined:

	°	′	
Mountain peak (mark)	19	11.6	east of south
Small peak on same range as mark	0	27.4	west of south
V-shaped crevice between two points	9	51.1	west of south

Nulato.—The station is on the grounds of the reservation for the military telegraph. It is 61 paces directly back from the telegraph office, 83.7 feet and 29 feet, respectively, from posts Nos. 3 and 4 on the southwest and northwest corners of the reservation. The station is marked with a wedge-shaped stone, set with the large end down, and lettered roughly U. S. The following true bearings were determined:

	°	′	
Mountain peak to the southwest (mark)	44	28.4	west of south
Base of cross on Mission Church	29	30:4	west of south

Port Graham, Danger.—Magnetic observations were made at the triangulation station Danger, on Dangerous Cape, entrance to Port Graham. The station is 5 feet from the edge of the perpendicular rocky bluff. It is marked by a 2 by 4 spruce hub, set over a rock buried 16 inches in the ground. It is 18.1 feet east of a triangle of nails on the blazed surface of a 6-inch spruce tree.

Port Graham, East Base.—Magnetic observations were made at the triangulation station East Base, which is on the northeast side of Graham Harbor. It is in the high grass on the next to the last beach, about 3 feet above and 13 feet back from high-water mark. It is marked by a spruce hub, 5 inches in diameter, set flush with the ground. Reference mark No. 1 is a triangle of nails on the blazed face of a dead spruce tree which bears N. 27° E. (magnetic), distant 166.7 feet. Reference mark No. 2 is a triangle of nails in the blazed face of a spruce tree which bears S. 48° 30′ E. (magnetic), distant 152.7 feet.

Point Harriet.—Magnetic observations were made 25 feet from triangulation station Harriet in the direction of triangulation station North Kalgin, of which the true bearing is N. 53° 22.3′ E. Harriet is on a small hill 300 feet high and about one-half mile in from the beach at a point 1 mile back of Point Harriet. The station is on the north end of the hill and is marked by a 3 by 4 fir hub projecting 6 inches above the ground. Two other hubs were set as reference marks, in pits about 2 feet deep and 3 feet square, one 24.1 feet southwest of the station and the other 11.1 feet southeast of the station.

Rampart.—The station is on the grounds of the Agricultural Experiment Station and is just south of the house. This station is across the river from Rampart. The station is 54 feet and 63.1 feet from the southeast and southwest corners of the house, respectively, and 43.1 feet from the base of the flag pole. It is marked by a round spruce post 3½ inches in diameter, projecting 3 inches above the surface of the ground, lettered U. S. and having a brass shell driven in the top as center. The mark used was a pyramidal mountain peak across the river south, seen against a higher mountain beyond. The following true bearings were determined:

	°	′	
Mark	16	15.5	west of south
Highest point on outcrop of rocks	43	25.3	east of south
West gable of N. C. Company's store	55	45.7	east of south
Small gable over doorway of U. S. military telegraph office	78	13.3	east of south

Descriptions of stations—Continued.

ALASKA—Continued.

Russian Mission.—The station is on the top of the first hill to the right, entering the town from the river, and is about 100 feet above the river. It is within and near the southeast corner of the grant to the Russian Church for mission purposes, and is 14 feet from the base of a wooden cross marking an Indian grave. The station is marked by a spruce post 6 inches in diameter, 40 inches long, and projecting 4 inches above the ground. The post is lettered U. S. and has a brass shell driven in center of top. The following true bearings were determined:

	°	′	
Sharp peak between two higher mountains (mark)	36	30.9	west of south
Mountain peak on first range	13	29.2	west of south
Mountain peak on distant range	65	09.8	east of south
Base of cross on Mission Church	60	16.7	west of south

St. Michael.—Magnetic observations were made at three of the stations occupied in 1905. Station "North" was reoccupied although not well adapted for magnetic observations. It was re-marked with a pine stub having a brass shell driven in the center. Station "Mesa" is in the tundra about a quarter of a mile north of the astronomical station. It is marked by a 2 by 4 inch stub, a stake of splintered board about 5 feet long being driven down on the north side of the stub to mark its location in the long grass. Hilltop: A signal pole and tripod were found standing over the station, which is 85 feet northwest of the store and 100 feet east of the schoolhouse. It is about 1,000 feet from Mesa. The astronomic station bears 35° 00′.0 west of south.

Shuyak Island.—The triangulation station is on the highest part of a bold hill, about 250 feet high, near the northwestern part of Shuyak Island. It is on the highest land in this part of the island. Larsen Island is north (magnetic) of station. The underground mark is a one-half-inch brass bolt, 2½ inches long, set with cement into bed rock 15 inches below the surface of the ground. The surface mark is a large glass bottle set into the ground with the top flush with the surface. A tripod signal is over the station. The following true bearings were determined from the triangulation:

	°	′	
Triangulation station Black Cape	32	29.5	west of south
Triangulation station Banks	85	35.9	east of south
Triangulation station Ushagat	24	36.8	east of north

Magnetic observations were made 21 feet from the above-described station and in line with triangulation station Black Cape.

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

Sukkwan Strait, Fish.—Magnetic observations were made 5 feet from the triangulation station in the direction of Salt. The station is near the extreme northeast end of a rocky shoal, bare at low water. It is on the north side of Sukkwan Narrows, directly opposite Salt. It is marked by a drill hole in a granite bowlder about 4 feet in diameter firmly embedded in the surrounding rock.

Sukkwan Strait, Salt.—Magnetic observations were made 5 feet from the triangulation station in the direction of Fish. Triangulation station Salt is on the last point on the north side of Sukkwan Narrows, visible from Cordova Bay. It is the turning point to the saltery, from which it is distant about one-fourth of a mile. It is marked by a drill hole in the ledge.

Tanana.—The station is on the parade ground of Fort Gibbon, and in the northwest section. It is distant 193.1 feet and 196.5 feet from the southeast and northeast corners, respectively, of the hospital building, and 311.9 feet from the northwest corner of the guardhouse. The station is marked by a round spruce post 4 inches in diameter and 36 inches long, projecting about 1 inch above the ground, and lettered on top U. S., and having the center marked by a brass shell. The following true bearings were determined:

	°	′	
Southwest corner of post exchange building (mark)	59	00.1	east of south
Top of water tower	42	26.0	east of south
North gable of N. A. T. & T. Co.'s store	67	14.2	east of south

Descriptions of stations—Continued.

ALASKA—Continued.

Victor's Wood Camp, Yukon River.—The station is in the clearing around the cabin of Victor Ekengren, near the Hosiana River. It is 80 feet back from the present bank of the river. It is 44.8 feet from the southeast corner of the log cabin, 54.2 feet from the northeast corner of the same, 78.2 feet from the northeast corner of a log cache, and about 45 feet from the southwest corner of another cache near the bank of the river. The mark used was a blaze on a spruce tree about 100 yards south. The station is marked by a spruce post 5 inches in diameter, about 4 feet long, and projecting about 8 inches above the ground; top of post has center marked by a rifle shell and is lettered U. S. The following true bearings were determined:

	°	′	
Blaze on spruce tree (mark)	3	57.5	east of south
First of two sharp points close together on mountain range to southeast	33	18.6	east of south
Second of the two sharp points	33	22.3	east of south
Highest point (not sharp) of mountain range	28	47.0	east of south

ARIZONA.

Ash Fork, Yavapai County.—The station is about one-half mile northwest of the Escalante Hotel and railroad station. It is in the open country, about 800 feet north of the Atchison, Topeka and Santa Fe Railroad tracks. Eight feet north of the station is a lone cedar tree with five trunks extending down to the ground. A bowlder about a cubic foot in general dimensions marks the location of the station. The station is a little west of north of where the first wagon road west of town crosses the railroad tracks. The following true bearings were determined:

	°	′	
Pinnacle of water tank (mark)	36	27.9	east of south
Prominent mountain peak to westward	89	41.1	west of south
Bill Williams peak	82	47.4	east of south
Left edge of railroad standpipe	51	27.9	east of south
Flagstaff on Escalante Hotel	48	35.9	east of south
Railroad-crossing sign	6	02.9	east of south

Benson, Cochise County.—The station is in the open space about 800 feet north (magnetic) from the Southern Pacific Railroad station at Benson; and about the same distance northwest of the iron standpipe on the little hill at the eastern edge of town. The standpipe and the smokestack of the pumping station are in range from the station. A wire fence running north and south passes about 200 feet to the east of station; another wire fence running east and west is 125 feet to the north of the station. The station was not marked. The following true bearings were determined:

	°	′	
The left edge (northeast side) of standpipe (mark)	35	53.4	east of south
Railroad signal (west end of town)	50	28.1	west of south
Summit of mountains to westward	53	02.4	west of north

Grand Canyon, Coconino County.—The station is about one-third of a mile east of the El Tovar Hotel, and on the open hillside about 500 feet south of the rim of the Grand Canyon. The wagon road from the hotel passes around the foot of the hill about 450 feet to the south of the station. The station is on the eastern or uphill side of the open space on the hillside. The open space is about an acre in area and is partly covered with cactus and small bowlders. The station is marked by a cairn of limestone rocks. The mark is the left (south) edge of the smokestack of the electric-light plant at the El Tovar Hotel. The following true bearing was determined:

	°	′	
Mark	88	34.8	west of south

Jerome Junction, Yavapai County.—The station is on the sloping ground on the west side of the "dry wash" which runs just to the westward of the village of Jerome Junction. The station is about one-third mile from the railroad station, and about 180 feet westerly from the corner of a wire fence; the wagon road from town turns to the southward around the corner of this wire fence. Another road

Descriptions of stations—Continued.

ARIZONA—Continued.

branches off from this corner and leads up over the slope to the westward, passing about 40 feet to the northward of the magnetic station. A 6 by 6 inch pine post projecting about 3 feet above ground is 180 feet north 60° east from the station. The following true bearings were determined:

	°	′	
U. V. & P. Railroad tank (mark)	79	26.9	east of north
Chimney on greenhouse	4	06.4	east of north
Schoolhouse flagstaff	38	32.4	east of north
Town water tank (yellow)	67	16.4	east of north

Lyon's ranch, Pima County.—The station is about 400 feet westerly from the wire fence at the western end of Lyon's ranch, and about 30 feet south of the road leading from Tucson to Agua Caliente Ranch. The west end of Lyon's ranch is approximately 9½ miles from Tucson. The station is about 900 feet west-northwest from Lyon's house and windmill. Bullock's ranch house is about one-quarter of a mile to the westward of the station. The station was not marked. The center of the upper part of the tower of Lyon's windmill was used as a reference mark, and its true bearing is 65° 19′.2 east of south.

Williams, Coconino County.—The station is on the west side of Rowe's ranch, which is about 2½ miles south of the town of Williams. The wagon road from Williams passes about 175 yards to the westward of the station. The station is about 80 feet west of the west fence of the ranch, and about due west of the ranch houses which are on the east side of the ranch. A small dry ditch passes about halfway between the station and the west fence of the ranch. Rowe's ranch is now the property of C. M. Wolf, of Williams, Ariz. The mark used was the north edge of the southernmost house of the group of houses on the east side of the ranch. The following true bearing was determined:

	°	′	
Mark	89	36.3	east of north

ARKANSAS.

Harrisburg, Poinsett County.—The station is in the western part of an inclosed wooded field belonging to the county farm, across the road east of the county-farm house, about one-half a mile northeast of the town's center. It is 76.4 feet from the fence bounding this field on the northwest and 136.4 feet northeast of the county-farm barn. The station is marked by a limestone post 6 by 8 by 33 inches, projecting about 7½ inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Spire of Christian Church (mark)	42	15.3	west of south
Cupola on public school	63	34.5	west of south
East gable of small yellow house with red roof	85	27.2	west of south

Jonesboro, Craighead County.—The station of 1901 was reoccupied. It is on the grounds of Mrs. Warner, just south of the town and at the end of Main street. A meridian line was established with the north stone just at the fence and the south stone on the hill. The south stone was used as the magnetic station. The station was marked with an 8-inch stone projecting about 4 inches above ground. The distance between the meridian stone is 880.9 feet. The following true bearing was determined in 1901:

	°	′	
Eastern edge of water tower near top (mark)	0	11.2	east of north

Marianna, Lee County.—The station is in a pasture belonging to H. N. Hutton between the road to Pelton and Ringville and the St. Louis, Iron Mountain and Southern Railroad. It is about 1½ miles west of the town's center and about one-quarter of a mile north of a house belonging to J. T. Robertson. It is 93.7 feet from the southwest fence of the pasture and 37 feet southeast of the center of a large hollow tree stump about 4 feet in diameter. The station is marked by a limestone post 6 by 8 by 33 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearing was determined:

	°	′	
North gable of house belonging to J. T. Robertson (mark)	20	27.4	west of south

Descriptions of stations—Continued.

ARKANSAS—Continued.

Osceola, Mississippi County.—The observations were taken over the 81st milepost on the levee, about 1 mile south of the town's center. This post is of granite, 6 by 6 inches, projecting about 9 inches above ground, and is marked U. S. on the east side, 80 on the north side, and 81 on the south side. It is across the road from a small pond, and about 1 500 feet a little east of north from J. Driver's house. It is 614 feet northeast from the fence along the southwest edge of the levee, 4 feet east of a white post marked St. F. L. D., and 155 feet north of a large tree stump about 3 feet in diameter. The exact spot is indicated by the point to which the stone is cut at the top. The following true bearings were determined:

	°	′	
Upper west edge of water tank about 100 feet north of jail (mark)	12	30.8	west of north
Top of steeple of small church	70	10.7	west of south
Southwest corner of small railing around the extreme top of court-house roof	11	21.2	west of north
Point at top of water tank back of J. Driver's house	13	23.4	west of south

Wynne, Cross County.—The station is in the southeastern corner of the court-house square, about one-quarter of a mile southeast of the town's center. It is 88.7 feet northwest from the southwest corner of the fence surrounding the public school, 66.6 feet from the fence bounding the public-school grounds on the west, and about 282 feet south of the court-house. The station is marked by a limestone post 6 by 8 by 33 inches, projecting about 6 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Spire on tallest steeple of Methodist Church (mark)	54	12.6	west of north
Top of town water tank	72	59.2	west of north
Ball at top of court-house cupola	22	03.0	west of north

CALIFORNIA.

Goat Island, San Francisco Bay.—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. It is nearly in line with the top of the hill and the smokestack at the naval training station. It is also about 50 feet north of the line of the two flag poles, one 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 on ground belonging to the navy. It is marked by a rough stone 6 by 6 by 12 inches, with a flat top in which there is a small drill hole. The stone is flush with the surface of the ground. The following true bearings have been determined:

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

CONNECTICUT.

Greenwich, Fairfield County.—The station is in the center of the northwest quarter of Tweed Island, Captain Harbor, off Greenwich, Conn., in about the center of a flat ledge nearly flush with the surface. This ledge is about 6 by 12 feet with the long dimension east and west, and is on nearly the highest part of the island. The station is 129.2 feet from the northwest corner of an old shed used as a stable; 131 feet from its southwest corner; 92.5 feet easterly from the northeast corner of an old pier on the northwest corner of the island; 90.2 feet from the southeast corner of the pier; 82 feet from the central trunk of a large tree divided into three trunks on the north central edge of the island; and 46 feet northwest from the nearer of two large trees about 6 feet apart, and nearest to the center of the island of any trees on said island. The station is marked by a cross cut into the ledge, with a drill hole in the center to mark the station. The following true bearing was determined:

	°	′	
To Great Captain Island Light-house	10	55.2	west of south

Descriptions of stations—Continued.

DISTRICT OF COLUMBIA.

Washington.—Two stations have been occupied. The principal station is the small observatory in the yard adjoining the Coast and Geodetic Survey Office. The following true bearing was determined in 1893:

	° ′	
Tower of the Bell School (mark)	87 50.9	west of north

The second station is the magnetometer pier of the small observatory of the Carnegie Institution of Washington, which is located near the Zoological Park, and about 200 yards west-northwest of the Ontario apartment house. The mark used was the west edge of the west chimney of Lipscomb's residence, the true bearing of which is 11° 40′.0 west of south, as determined by the Department of Terrestrial Magnetism of the Carnegie Institution.

FLORIDA.

Apalachicola, Franklin County.—The magnetic station is located near the south corner of the park in Apalachicola known as Florida Promenade, in the corner formed by the intersection of Broad or Sixth avenue and Water or First street. It is 73.9 feet from the inside edge of sidewalk along Broad avenue, 27.6 feet from the line of the street edge of the sidewalk along Water street, and 150.9 feet from the center of transit pier near center of Florida Promenade. The station is marked with a wooden stub 2 by 2 by 12 inches. The following true bearings were determined:

	° ′	
Lantern on beacon at breakwater (mark)	15 21.1	east of south
Flagstaff on Franklin Hotel	11 24.3	west of north
Top of standpipe	54 52.8	west of north
Flagstaff on armory	26 31.4	west of north
Center of transit pier	8 43.7	east of north

Jupiter, Dade County.—The station of 1906 was recovered. It is 20 feet back from the edge of the sea bluff and is surrounded with scrub palmettos 4 to 6 feet high. Cabbage palmettos are to the west of it, but on lower elevation. The underground mark consists of a wine bottle, mouth up, 28 inches below the surface of the ground. The surface mark is a 5 by 5 inch wooden painted post, projecting 14 inches above ground, with a copper nail in the top. One side of the post near the top has carved on it the letters U. S. The following true bearings were determined in 1906:

	° ′	
Chimney on house of C. R. Carlin (mark)	67 33.4	west of south
Spire on light-house	71 02.6	west of north
West gable of boathouse at old life-saving station	6 41.9	east of south
East gable of house of Harry Dubois	50 16.8	west of south

A temporary fisherman's shanty has been erected to the east of the station and distant about 20 feet. Magnetic observations were therefore made on the sand beach 157.2 feet southeast of the station of 1906. The spot was marked by a small wooden stub.

Punta Gorda, De Soto County.—The station of 1906 was reoccupied. It is at the foot of Gill street in the park extending along Charlotte Harbor, 94.1 feet from the north corner of Doctor Burland's yard, 103.1 feet from the west corner of Mr. J. H. Farrington's yard, and 52.5 feet from a palmetto north of east. The station is marked by a marble post 6 by 6 by 30 inches, sunk 5 inches below ground and lettered U. S. C. & G. S., 1903. The following true bearings were determined in 1906:

	° ′	
East gable Phosphate Company's warehouse	85 01.2	west of north
Flagstaff Punta Gorda Hotel	56 02.1	east of north
Schoolhouse steeple	81 49.7	east of south

The following true bearing was determined in 1909:

	° ′	
Rod on boathouse (mark)	20 02.7	east of north

Descriptions of stations—Continued.

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.

Aledo, Mercer County.—The station is in the fair grounds, about 1 mile southwest of the court-house. It is inside of the race track in front of the grand stand, east from its center. It is 27 paces northeast from the judges' stand and 47 paces north from the grand stand. The station is marked by a Bedford stone post 6 by 7 by 34 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Base of pole on court-house tower (mark)	58	46.3	east of north
Cone-shaped staff on cupola of Archie Bridgeford's barn	5	48.4	west of north

Bloomington, McLean County.—The station of 1891 being no longer suitable for magnetic observations, a new station was established about 40 rods north and about 120 rods west from the old one. It is in a 100-acre field belonging to the State Normal School, but at present leased by the Augustine Company nursery and the Phoenix Nursery Company. The station is in the edge of a turn, now about 800 feet from the south fence of the field, and squarely in front (north) of house No. 709 on Sudduth road, which passes on the south side of the field. The station is marked by a Bedford stone post 8 by 8 by 54 inches, projecting 18 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Cross on St. Marys Catholic Church steeple (mark)	13	13.2	west of south
Staff on tower of main building at the Normal University	68	42.5	east of south
Staff on cupola of Gregory residence	29	15.3	east of north
Northwest corner of house No. 709 Sudduth road (approx.)	0	19.4	west of south

Carlinville, Macoupin County.—The station is in the county fair grounds, about 1 mile northwest from the court-house. It is among some large trees, 22 paces from the north fence of the grounds, and 19 paces west from the extreme west line of the race track. The station is marked by a Bedford stone post, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The stone may be a few inches from the spot where observations were taken, as the temporary marking was disturbed before the stone was set. The following true bearings were determined:

	°	′	
Cross on English Catholic Church (mark)	14	45.6	east of south
Steeple on German Catholic Church	23	36.8	east of south
Center post on court-house dome	40	09.6	east of south

Carmi, White County.—The station is in the county fair grounds, 1 mile south of the town. It is southward from the center of the tract surrounded by the race track. It is 406 feet east from the southeast corner of the grandstand and about 347 feet from the northeast corner of the stand. The station is marked by a Bedford stone post 6 by 6 by 42 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Methodist Episcopal Church steeple (mark)	58	05.0	east of north
Cross on center of Catholic Church steeple	49	12.0	east of north

Carrollton, Greene County.—The station is in the fair grounds, about 1 mile east of town. It is 182.4 feet from the southwest corner of the grandstand and 89 feet from the fence inclosing the race

Descriptions of stations—Continued.

ILLINOIS—Continued.

track. The station is marked by a Bedford stone post 6 by 6 by 36 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Methodist Church spire (mark)	88	24.8	west of south
North edge of north chimney of High School	80	07.1	west of south
North edge of standpipe	84	54.7	west of north

Carthage, Hancock County.—The station is in a walk of the Moss Ridge Cemetery in the northwestern part of the town. It is 22.2 feet from the Cox monument, 54.9 feet from the Shipton monument, and 12.4 feet from a small monument to the northeast, the measurement in each case being made to the nearest corner of the base. The station is marked by a Bedford stone post 6 by 6 by 36 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Highest point of the hand on the statue of justice on top of court-house (mark)	21	41.0	east of south
Top of water tower	20	47.9	east of south

Charleston, Coles County.—The station is on the grounds of the Eastern State Normal School, at the south edge of the city. It is about 80 rods south from the main building. A brick tile sewer passes about 10 feet west of the station, and two manholes are one north from and the other south from the station at about equal distances. The station is 68.6 feet east from the east fence of the athletic grounds and 123.8 feet southeast from the northeast corner post of the athletic field fence. The station is marked by a Bedford stone post 8 by 8 by 34 inches, projecting 4 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Lower part of the iron pole bearing wind gauge on tower of main building (mark)	0	07.2	west of north
Flag pole on tower of main building	0	06.3	west of north
Southwest edge of tower on main building below the rounded part	0	14.3	west of north

Chester, Randolph County.—The station is in the northwest corner of a field belonging to the southern Illinois penitentiary, about 1 mile west of the center of town. This field is north of and between a small brick cabin about 150 feet west of the west wall of the penitentiary and a white stone spring or fountain. The south end of the fence on the west boundary of the field ends at this fountain. The station is 50 feet east of the fence on the west boundary of the above field and 53.9 feet south of the north fence. The station is marked by a Bedford limestone post 6 by 6 by 32 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Top of small red cupola on Insane Asylum building (mark)	39	35.3	east of south
Spire of Catholic Church	78	52.0	east of south
Top of tower at west side of southeast corner of penitentiary wall	30	04.3	east of south
Rod on tower at southwest corner of penitentiary wall	9	12.2	east of south

Clinton, Dewitt County.—The station is in the Woodlawn Cemetery, at the northwest edge of the city. It is on a low unused tract between the old and the new parts of the cemetery. It is down the hill about 60 yards to the northwest from the McIntosh monument. It is 55 paces north from the cemetery fence by the public road, and 88 paces southeast from the small steel wagon bridge in the cemetery. The station is marked by a Bedford stone post 7 by 8 by 42 inches, projecting 8 inches above the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
South edge of third base at the left of the name "McFarland" on the McFarland-Lisenby monument (mark)	83	29.6	west of north
North edge of base of McIntosh monument	67	25.0	east of south

Descriptions of stations—Continued.

ILLINOIS—Continued.

Effingham, Effingham County.—The station of 1905 was reoccupied. It is in the new part of the Protestant Cemetery, 1 mile east of town. It is in the north end of the cemetery. It is 21.2 feet east of the graded street running through the grounds from north to south and 203 feet from the east edge of the main cross street. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1905:

	°	′	
Catholic Church spire (mark)	84	49.2	west of south
West edge of Stewart Phelon monument	12	28.8	west of north

Elizabethtown, Hardin County.—The station is in the southwest corner of the property belonging to Mr. Charles Lamb, about one-fourth mile east of the center of town, and about 20 feet northwest from the edge of a bluff on the northwest bank of the Ohio River. It is 53 feet east of the fence on the west border of Mr. Lamb's property, and 146.8 feet a little south of west from the southern post of the gate to the front entrance of Mr. Lamb's house. It is marked by a glazed earthen pipe 2 feet long and 6 inches in diameter at top, and projecting about 1½ inches above ground. A hole in the top of a stone 1 foot long in the center of the pipe indicates the exact spot. The following true bearings were determined.

	°	′	
Church steeple at Tolu, Ky., about 5 miles to the east (mark)	73	38.6	east of south
Base of post on southeast corner of upper piazza of Rose Hotel	62	23.3	west of south

Fairfield, Wayne County.—The station is in the city park at the northeast corner of the city. It is on a clear space east of the drive which enters the park from the southeast corner. The station is marked by a sandstone post 5 by 10 by 30 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The east side of this stone is beveled. The following true bearings were determined:

	°	′	
Cumberland Presbyterian Church tower (mark)	27	00.6	west of south
Southwest edge of the main part of Lowary E. Sunderland monument	60	19.4	east of south

Greenville, Bond County.—The station is in the Montrose Cemetery at the northwest corner of the city, about six blocks from the county court-house. It is on a reserve plot of ground adjoining the main drive on the west. It is 86 feet southeast from the base of the Thomas monument, 54.8 feet west from the base of the John H. Mahle monument, and 61.9 feet north from the base of the Chapman monument. The station is marked by a Bedford stone post 6 by 6 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Southwest edge opposite name on McNeill monument (mark)	27	13.0	west of north
North edge opposite name on Hentz monument	88	33.1	west of south

Jerseyville, Jersey County.—The station is in an east and west driveway of the new part of the cemetery between lots No. 20 and No. 17. Measuring from the northwest corner of the stone marking the northwest corner of lot No. 20, the station is 46.4 feet east and 8.5 feet north. The driveway is 14.7 feet wide. The station is marked by a Bedford stone post 6 by 6 by 24 inches, set 6 inches below the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
West edge of farthest chimney on residence of Jno. Lowe (mark)	22	28.4	east of north
Apex of last "a" in "Chicamauga" on the G. A. R. monument	7	23.0	east of south
Top of Lancrey monument	70	47.1	west of south

Descriptions of stations—Continued.

ILLINOIS—Continued.

Jonesboro, Union County.—The station is west of the central part of the space within the old race track in the county fair grounds, about one-half mile north of the center of town, and about 150 feet northeast of a small pond. It is 191 feet a little north of west from the west side of the judges' stand, in line with two stumps, each about 2 feet in diameter. It is 19.7 feet a little north of west from the western of these stumps. The station is marked by a Bedford limestone post 8 by 8 by 24 inches, projecting about 3 inches above the ground. The following true bearings were determined:

	° ′
Ball on cupola of court-house (mark)	13 30.1 west of south
Western edge at top of flue of jail	10 44.1 west of south

Lawrenceville, Lawrence County.—The station is in the city cemetery about one-half mile northwest from the court-house. It is a few feet from the edge of the river bank at the north end of the drive which enters through the main gate. The northwest corner of the potter's field comes up to the station. It is 118.7 feet northwest from the base of Clinton S. Miner monument and 152.5 feet northwest from the base of the Snyder monument. The station is marked by a Bedford stone post 6 by 6 by 42 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Southwest edge of second base of the heavy granite Kirkwood monument (mark)	25 47.9 east of south
Southeast edge of second base of the Porter monument	53 54.1 west of south

Lewistown, Fulton County.—The station is in Oak Hill Cemetery, one-half mile north from town. It is on the west side of the lot set apart for the old soldiers' monument. It is exactly in line with the north edges of the David Cassel and the George H. Wetzel monuments, sighting opposite the smaller type inscriptions on each. It is 13.2 feet west from the northwest corner of the base of the old soldiers' monument, and 21.7 feet from the southwest corner of the base of the same monument. It is 23.2 feet east from the northeast corner of the base of David Cassel monument, and 50.2 feet west from the northwest corner of the base of the George H. Wetzel monument. It is 50.7 feet north from the northeast corner of the Abigail Fluke monument. It can be accurately located by easy measurement and is therefore not marked. The following true bearing was determined:

	° ′
Ball on tip of court-house tower (mark)	12 21.3 east of south

Louisville, Clay County.—The station is on the north side of the public-school grounds about 200 feet north from the school building. The north edge of the south walk on the street which leads away from the school grounds to the westward, would, if continued across the school grounds, pass 4 feet south of the station. The cement walk from the schoolhouse to the northeast corner of the grounds is 49.1 feet east from the station. The station is marked by a Bedford stone post 6 by 6 by 28 inches, lettered U. S. C. & G. S., 1908. This stone is covered by a mound of dirt about 5 inches higher than the surrounding ground. The following true bearings were determined:

	° ′
Knob on northwest corner of three-story brick building on corner west from the northwest corner of court-house square (mark)	66 36.1 east of south
Northwest edge of water table on school building	23 58.0 west of south

Macomb, McDonough County.—The station is in the county fair grounds, about three-fourths mile southwest from the court-house. It is in the east side of the grounds surrounded by the race track, and a little north from the center. It is 529.7 feet slightly north of east from the northeast corner post of the grandstand, 196.6 feet southwest fron the quarter-mile post, and 142 feet slightly south of west from a well with wooden pump, at the east side of the race track. The station is marked by a Bedford limestone post 6 by 8 by 34 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Knob on highest ventilator at the center of St. Francis Hospital (mark)	61 06.3 west of north
Base of flag pole on 3d ward school	32 43.5 east of north

Descriptions of stations—Continued.

ILLINOIS—Continued.

Marshall, Clark County.—The station is in the Marshall Cemetery about 1¼ miles northwest from the court-house. It is in the center of the intersection of two driveways at the extreme east corner of the present burial grounds. The fence by the public road on the west has heavy iron posts set in concrete. Counting from the south, the fourth post is at the front end of the driveway in which the station is located at the back end. This driveway separates the old portion from the unplotted portion of the cemetery. The station is 43.7 feet from the eastern edge of the base of a heavy granite monument marked "Casteel," and 83.7 feet southeast from the eastern edge of the J. N. Holloway monument. The station is marked by a Bedford stone post 5 by 7 by 36 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Iron post in fence by front end of drive (mark)	36 01.3	west of south
Center point on Isaac Wilkin granite monument at front of cemetery	83 14.4	west of south

Metropolis, Massac County.—The station is west of the central part of Fort Massac Park, about 1½ miles southwest of the center of the town. It is 137 feet a little north of west of the northwest corner of the park well, 18.6 feet east of the center of a curving footpath to the west, and about 450 feet north of the D. A. R. monument on the site of the old fort. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Top of east edge of town water tower (mark)	49 58.9	west of north
Tip of the water tank of Metropolis Bending Works	72 44.1	west of south
Western edge of metal plate marked with inscription on D. A. R. monument	15 09.5	west of south

Monticello, Piatt County.—The station is in the fair grounds 1 mile north of the court-house. It is inside of the race track near the southeast edge of the inclosure, and 31 paces north from the one-eighth mile post of the race track. It is 67 paces slightly west of south from a large cement water tank which stands near the center of the inclosure. The station is marked by a Bedford limestone post 8 by 8 by 40 inches, projecting 1 foot above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
East edge of city water tower, just below enlargement at top (mark)	9 31.2	east of south
East edge of cement water tank	17 30.2	east of north

Mount Carmel, Wabash County.—The station is in the middle of Ninth street at the east end of the opened portion of the street. It is on the bluff of the Wabash River bottom, about 300 feet east from the southeast corner of the cemetery. It is 64.1 feet north from the northeast corner of the one-story frame house No. 619 Ninth street, and about 4½ feet east from a line along the east wall of the house. It is 36.2 feet from the row of trees on the south side of the street and 42.4 feet from the row of trees on the north side of the street. The station is marked by a Bedford limestone post 6 by 8 by 30 inches, projecting 3 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearing was determined:

	° ′	
Southwest edge of the taller chimney on a one-story frame house at the Fifth street ferry (mark)	74 59.4	east of south

Mount Sterling, Brown County.—The station is in the Protestant Cemetery, in a walk near the fence on the north side. It is 36.6 feet from the southeast corner of the base of the Givens monument and 42.6 feet from the northeast corner of the base of the Rottger monument. The station is marked

Descriptions of stations—Continued.

ILLINOIS—Continued.

by a Bedford limestone post 6 by 6 by 36 inches, sunk flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Flag pole on standpipe (mark)	53 03.8	west of south
Court-house dome	49 33.5	west of south
East edge of brick chimney on residence of Fred Schug	41 40.8	east of north

Mount Vernon, Jefferson County.—The station is in the southwestern part of the field within the race track at the county fair grounds, about 1½ miles south of the center of the town. It is 201 feet from the fence around the inside of the race track to the south, 166.5 feet from the west fence around the inside of the race track, and 217.6 feet southeast of the southeast corner of the judges' stand. The station is marked by a Bedford limestone post 5 by 7 by 30 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Base of flagstaff on cupola of court-house (mark)	10 35.7	west of north
Methodist Church steeple	17 20.5	west of north
Flagstaff on public school	6 55.3	east of north
Baptist Church spire	3 32.9	west of north
Base of flagstaff on a cupola	9 16.1	west of north

Murphysboro, Jackson County.—The station is in the northeast corner of the field in the southeast corner of the county fair grounds, about 1½ miles north of the center of the town. This field contains three exhibition buildings, including the art building and the two entrance gates with the ticket offices. The station is 138.7 feet west of the fence bounding the fair grounds on the east, and 107.5 feet south of the fence bounding the above field on the north. The station is marked by a cement post 6 by 7 by 30 inches, projecting 8 inches above the ground. The following true bearings were determined:

	° ′	
Point at top of Mobile and Ohio Railroad water tank (mark)	20 09.3	west of south
Base of rod at top of art building	12 37.0	west of south
Base of rod at top of octagonal exhibition building	21 39.8	west of south
East point of gable on row of cattle stalls on north border of grounds	14 17.3	west of north

Oquawka, Henderson County.—The station is in the Oquawka Cemetery, about one-half mile northeast from the court-house. It is in the south edge of the potters field, a few yards east from the driveway which passes between the old and the new parts of the cemetery. It is 49.6 feet north from the northeast corner of the base of the Tweed monument (red granite), and 105.3 feet northwest from the base of the Nelk monument (black granite). The station is marked by a Bedford limestone post 0.5 by 0.8 by 3.2 feet, projecting 0.3 of a foot above the ground, roughly lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Base of rod on Methodist Church tower (mark)	53 32.1	west of south
Baptist Church steeple	45 12.6	west of south

Paris, Edgar County.—The station is in East Park, about 1 mile northwest of the court-house. It is in the southwest corner of the park, 50 paces east from the west fence line of the park, 55 paces north from the south fence line of the park, and 105 paces west from the west fence of the Catholic Cemetery. There are four rows of trees south of the station and four irregular rows west of it. The station is marked by a Bedford stone post 5 by 7 by 36 inches, projecting about 5 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Center staff on Big Four Railway water tank	37 02.8	west of south
Southwest edge of the polished part of "Bushu" blue granite monument	74 45.9	east of south

Descriptions of stations—Continued.

ILLINOIS—Continued.

Petersburg, Menard County.—The station is in Rose Hill Cemetery, about 1 mile east from town. It is in a pasture lot which has not been surveyed for cemetery purposes. It is in line with the center of the east and west driveway which passes on the north side of the block on which the John and Lydia Tice monument and the Capt. S. H. Blane monument stand. It is 146 paces west from the center of the driveway on which these monuments front, and 44.5 feet east from the west fence of the cemetery property. The station is marked by a Bedford limestone post 8 by 8 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Southwest edge opposite the name on the Tice monument (mark)	78	49.0	east of south
Southwest edge opposite the name and below the chamfer on Blane monument	64	28.8	east of south

Pittsfield, Pike County.—The station is in a walk in the northeastern part of the cemetery at the west end of town. It is 44.8 feet from the northeast corner of the base of the Mary D. Shibley monument, and 58.5 feet from the northwest corner of the Perry monument The station is marked by a Bedford limestone post 8 by 8 by 36 inches, sunk flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
North edge of standpipe near center of town (mark)	86	37.1	east of north
Methodist Church spire	84	41.3	east of north
Court-house spire	88	36.4	east of south

Robinson, Crawford County.—The station is in the city park and county fair grounds. It is very nearly in the center of the tract of land inclosed by the race track, and is 110 paces from the inner track fence on the east, 92 paces from the inner track fence on the west, and 149 paces from the same fence on the north. The station is marked by a Bedford limestone post 7¼ by 8 by 52 inches, projecting 12 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Pole on court-house tower (mark)	15	48.4	east of north
Short steeple on Methodist Episcopal Church tower	9	40.0	east of north

Shawneetown, Gallatin County.—The station is in the eastern corner of the county fair grounds, about 1 mile northwest of the center of the town. It is 134.9 feet northwest of the fence on the southeast and 228.9 feet southwest of the row of horse stalls bounding the fair grounds on the northeast. The station is marked by a Bedford limestone post 5 by 7 by 30 inches, projecting about 10 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Southern edge of judges' stand (mark)	63	28.5	west of south
North gable of grand stand	73	00.6	west of south
Northeast corner of the northern of two live-stock sheds	23	07.8	west of south

Sullivan, Moultrie County.—The station is in the new fair ground and racing park due east from the court-house, and just outside the city limits. It is outside of the race track at the southeast corner, nearly in line with the center of the south side of the track. The fence line at south edge of track passes 29 feet south of the station. The east fence of the grounds is 60.6 feet east from the station. The station is marked by a Bedford limestone post 8 by 8 by 31 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Pole on court-house dome (mark)	89	05.4	west of south
Center knob on tower of the Masonic Home building	82	00.8	east of north

Descriptions of stations—Continued.

ILLINOIS—Continued.

Toledo, Cumberland County.—The station is in the cemetery, one-half mile south of the town. It is in the old part of the cemetery and in the south edge of the main driveway, a few feet east from a wash or ravine which crosses the cemetery. It is 29.8 feet south from the southwest corner of the base of the Mitchell monument, 94.1 feet east from the Hanker monument, and 50.4 feet northeast from the northeast corner of the base of the Amberson monument. The station is marked by an oak stake driven in the ground so as to project about 2 inches above the ground. The following true bearings were determined:

	° ′
Tip on iron post at southwest corner of cemetery fence (mark)	23 47.4 west of south
Southwest edge opposite the small type on the gray granite Vandyke monument	39 46.1 east of south
South gable on John Rhodes's farm residence	29 12.7 east of north

Toulon, Stark County.—The station is in Toulon Academy grounds at the south edge of town. It is at the center of the grounds, about 6 feet south of an east-and-west line along the north wall of academy hall, and 295.5 feet from the southeast corner of the building. It is in line with the sixth tree row from the north side and with the twelfth tree row from the east side of the grounds. The station is marked by a Bedford limestone post 6 by 7 by 34 inches, flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearing was determined:

	° ′
Southeast edge of white stone water table on academy hall (mark)	77 37.4 west of south

Vandalia, Fayette County.—The station is on Sturgess Hill, about 1 mile southwest from the courthouse. Three monuments set by the United States Coast and Geodetic Survey stand in the yard about 30 yards north from Mr. Leever's house. They are white marble about 6 inches square, the northwest one being lettered on top U. S. C. & G. S., with cross lines to mark the center. The other two have arrows pointing toward this lettered stone. A station was established 62.7 feet northwest from the lettered stone, 105.2 feet northwest from the east one of the three, and 101 feet northwest from the south one of the three stones. The magnetic station is marked by a Bedford limestone post 6 by 6 by 26 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Cross on Catholic Church brick tower (mark)	6 26.3 east of north
West edge of lower part of the upper half of the large brick chimney at paper mill	16 51.8 west of north

Waterloo, Monroe County.—The station is in a field belonging to the county, and known as the jail lot. This lot or field extends immediately northeast from the northeast corner of the ground surrounding the jail. The station is 50 feet north of the fence at the southern boundary of the above field, 58.2 feet south of the fence at the northern boundary, and 94.3 feet west of the fence at the eastern boundary of the field. The station is marked by a Bedford limestone post 6 by 6 by 32 inches, projecting about 4½ inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Spire of Evangelical Church (mark)	62 04.7 west of north
Cross on steeple of Catholic Church	86 30.8 west of south
Base of flagstaff on public school	39 28.7 west of south

Waukegan, Lake County.—The station is on land belonging to Mr. Turner, relative of the present chief of police. The land is on the south side of West Belvedier street, near the city limits. The station is 89 feet south of the fence along the south line of this street, and 59 feet north of a hard-maple tree, the east tree of a group of five or six. It is also 51.5 feet east of another hard-maple tree. The station is

Descriptions of stations—Continued.

ILLINOIS—Continued.

marked by a marble post 6 by 6 by 24 inches, sunk flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Court-house flag pole (mark)	58 34.5	east of north
South schoolhouse flag pole	48 27.8	east of north
North schoolhouse flag pole	38 49.2	east of north

Winchester, Scott County.—The station is in the driveway along the extreme eastern side of the cemetery. It is on the line of lot No. 54, though the stone is entirely in the driveway. It is 9.8 feet north of the southeastern corner of lot No. 54 and 29.3 feet south of the northeast corner. The station is marked by a Bedford limestone post 6 by 6 by 36 inches, set 1 inch below the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Cupola on barn of Mr. John Rough (mark)	84 36.8	east of north
Base of flag pole on court-house	87 26.0	west of south

INDIANA.

Auburn, Dekalb County.—The station is on the county farm, about 2 miles northwest from the city. It is in the southeast corner of a large wood lot and nearly 80 rods northwest from the new brick county home. It is 45 paces west of a proposed lane that will run north and south from the public road to the southeast corner of the wood lot. It is also 15 paces north from the rail fence that runs east and west along the south side of the wood lot (large maple grove). There are two small pesthouses due west from the station, and the south walls of their foundations are in line with it. The southeast corner of the east building is 55 paces from the station. The station is marked by a Bedford limestone 6 by 8 by 36 inches, projecting 8 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
West ventilator of county home (mark)	22 48.8	east of south
East ventilator of county home	26 49.3	east of south
Northwest gable on a brick farmhouse	73 21.0	east of south

Columbia City, Whitney County.—The station is on the county farm, about 1½ miles west from the court-house. It is on a point of land at the edge of the west bank of a small creek which crosses the farm about 30 rods east from the county home. It is about 20 rods slightly east of south from a concrete culvert over the creek at the public highway. A line along the north wall of the county home passes about 10 paces south of the station. It is in line with a row of apple trees which if produced across the lawn would pass 2 feet from the northwest corner of the house. The station is marked by a Bedford limestone 6 by 6 by 36 inches, projecting 8 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Court-house tower (mark)	67 22.0	east of north
Lutheran Church tower	63 00.4	east of north
Public-school tower	56 34.3	east of north

Danville, Hendricks County.—The station is on the county poor farm about 1 mile east of Danville. It is in a pasture on the north side of the public road which crosses the farm, and is about 200 feet northeast from the bridge which crosses a small creek at the west side of the farm. It is 15 paces north of the pasture fence. A meridian line was established with the north stone in a clearing 800 feet north from the magnetic station. The marking stones are heavy Bedford limestone posts 0.68 by 1 by 4.5 feet, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. Copper plugs 2½ inches long are driven in the center of both stones. The following true bearing was determined:

	° ′	
Christian Church spire	81 00.8	west of north

Descriptions of stations—Continued.

INDIANA—Continued.

Greenfield, Hancock County.—The station is in the Park Cemetery, about one-half mile southeast of the court-house. It is at the center of a circular mound 30 feet in diameter, at the intersection of the streets 1 square from the north and 1 square from the east side of the cemetery. It is 56.2 feet from the base of the Walker monument, 55.7 feet from the base of the Howard monument, and 88.8 feet from the base of the Bush monument. The station is marked by a Bedford limestone post 8 by 12 by 33 inches, projecting about 4 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Dome of Methodist Episcopal Church (mark)	49	15.9	west of north
Southern of two crosses on court-house tower	39	27.7	west of north
Southeast tower of Hotel Columbia	29	13.0	west of north

Indianapolis, Marion County.—The station of 1900 was reoccupied. It is in Riverside Park, about 5 miles northwest of the court-house. It is near the break of the hill in the western part of the park, about 200 yards north of Thirtieth street. It is 45, 42, and 18 feet, respectively, from three trees northwest of the bear cage. It is marked by a stone post 6 by 6 by 36 inches, projecting 12 inches above the ground and lettered U. S. C. & G. S. The following true bearings were determined in 1909:

	°	′	
Tip of water tank near dwelling house (mark)	20	29.0	west of north
Steeple on small church or school	88	58.2	west of north
Lightning rod on Highland Golf Clubhouse	15	45.2	west of south

Liberty, Union County.—The station is on the county fair grounds about one-half mile east from the county court-house. It is squarely in front of the grand stand and exactly on a line with the middle front post and the middle back post of the grand stand. It is 120 paces east from the stand and is 38 paces from the inside line of the race track to the east from the station. The station is marked by a Bedford limestone post 8 by 8 by 36 inches, projecting about 4 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Flag pole on tower of brick country schoolhouse (mark)	63	11.7	east of north
Gable end of brick farmhouse	39	54.4	east of north
West gable of two-story frame house	83	08.3	east of south

Rochester, Fulton County.—The station is in the southeast corner of the Rochester Normal University campus, about three-fourths of a mile southeast from the court-house. It is 237.8 feet from the southeast corner of the wall of the university building (erected 1895), and a line running east along the south wall of this building passes 16.5 feet north of the station. The station is marked by a Bedford stone 6 by 6 by 36 inches, projecting 8 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of court-house tower (mark)	28	07.1	west of north
Staff on a brick schoolhouse tower	36	53.7	west of north
Northeast edge of the water table on the Normal University building	68	46.7	west of north

IOWA.

Albia, Monroe County.—The station is in Oak View Cemetery about one-half mile west of the court-house. It is 300 feet due west of the gate of the cemetery, 35 feet north of the north edge of the principal road into the cemetery, and 12 feet southwest of the Sholly monument. The station is marked by a marble post 6 by 6 by 20 inches, projecting about 2 inches above the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Top of flag pole on Jefferson school (mark)	15	16.9	west of north
Center of intrados of iron arch over cemetery gate	89	28.5	east of south

Descriptions of stations—Continued.

IOWA—Continued.

Allison, Butler County.—The station is in the southeast corner of the fair grounds, 145.7 feet from the east fence and 75.5 feet from the south fence. The station is marked with a Bedford limestone post 6 by 6 by 24 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Top of water tank (mark)	22 35.0	west of north
Court-house cupola	19 26.6	west of north
Cupola on barn of Tom Curtis	80 03.5	east of south

Bloomfield, Davis County.—The station is in the I. O. O. F. cemetery, about 1 mile north of the court-house. It is 114 feet from the south fence of the cemetery and is situated at the north edge of the pathway south of the Gibson lot. It is at the southwest corner of the lot and 12 feet southwest of the southwest corner of the tombstone of David Gibson. The station is marked by a marble post 6 by 6 by 20 inches, buried with its face flush with the surface of the path and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Lamp-post on top of court-house (mark)	11 17.7	west of south
Top of city water tank	5 43.8	west of south

Charles City, Floyd County.—The station of 1900 was reoccupied. It is on the campus of Charles City College, 199.8 feet from the northeast corner of the college building and 22.6 feet from a small pine tree to the northwest. It is also 93 feet from the center of the road which runs near the college building. The station is marked by a white limestone post 7 by 7 by 36 inches, set flush with the ground and lettered U. S. C. S. The following true bearings were determined in 1908:

	° ′	
Southeast corner of gable chimney of Mr. Ryan's house (mark)	35 34.4	east of north
Chimney on Mrs. Makepeace's house	64 39.5	west of south

Clinton, Clinton County.—The station is in Eagle Point Park about 3½ miles north of Clinton, near the edge of the bluff of the Mississippi River. It is 105.5 feet from the southeast corner of the dance hall, and 50 feet from the fence east of station running along the edge of the bluff. The station is marked by a Bedford limestone post 6 by 6 by 18 inches, sunk 2 inches below the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Right edge of tall white monument in the cemetery west of the park	67 29.8	west of south
Right edge of northeast corner post of the dance-hall porch	62 37.7	west of north

Dubuque, Dubuque County.—The station of 1907 was reoccupied. It is in the grounds of Mr. J. V. Rider, on Seminary Hill, in the southwest corner of the yard near the limestone bluff. It is marked with a marble post lettered U. S., and sunk flush with the surface of the ground. The following true bearings were determined in 1908:

	° ′	
Left edge of east chimney on Home of the Good Shepard	61 47.7	west of south
North spire on Catholic Sisters' school	87 41.2	west of north
Rod on tower of Catholic Sisters' school	86 58.1	west of north

Grundy Center, Grundy County.—The station is inside of the race-track inclosure at the fair grounds. It is 169.3 feet from the inside fence of the track on the southeast, and 362 feet from the inside fence at the middle of the bend at the northern end of the track. The station is marked by a Bedford limestone post 6 by 6 by 24 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Court-house tower (mark)	47 42.6	west of north
Tower of schoolhouse	37 47.9	west of north
Spire of German Presbyterian Church	26 43.2	west of north

Descriptions of stations—Continued.

IOWA—Continued.

Iowa City, Johnson County.—The station is in the fair grounds east of town, and east of the race track. It is 38 feet northwest from the northwest corner of the small dining hall, and 108 feet north of the northwest corner of an open building used for exhibiting machinery. The station is marked by a Bedford limestone post 6 by 6 by 20 inches, set flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Flag pole on a mill or factory	31	13.6	west of south
Base of flag pole on grand stand	62	07.5	west of south
Spire of Catholic Church	79	47.9	west of north

Marion, Linn County.—The station is within the race-track inclosure on the fair grounds. It is 135.6 feet from the inside fence of the race track and 219.9 feet from the nearest corner of a shed near the judges' stand. The station is marked by a white marble post 6 by 6 by 30 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire of Presbyterian Church (mark)	18	02.1	west of south
Most western of small spires on tower of Methodist Church	16	40.4	west of south
Top of watchtower	15	27.2	west of south

Mount Pleasant, Henry County.—The station is in the grounds of the state hospital for the insane, about 400 yards from the gate and 25 yards from the hedge on the west side. It is 45.1 feet from an elm tree to the southwest and 41.8 feet from another elm tree to the northwest. The station is marked by a Bedford stone post 6 by 8 by 36 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire of Catholic Church (mark)	88	13.6	west of north
South edge of standpipe in town	69	18.4	west of north
Northwest corner of the end chimney of poorhouse	66	48.5	east of south

Muscatine, Muscatine County.—The station is in the baseball grounds in the old fair grounds west of town. It is 67.3 feet from the west fence of the ball grounds and 118.5 feet from the north fence. The station is marked by a Bedford limestone post 6 by 6 by 18 inches, set flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Right edge of chimney on a house	5	25.4	east of south
Flag pole on golf clubhouse	24	45.6	east of south

New Hampton, Chickasaw County.—The station is in the southeast corner of the fair grounds, 54 feet from the south fence and 60 feet from the east fence. The station is marked by a Bedford limestone post, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire of Irish Catholic Church (mark)	76	33.6	west of north
Tip of water tower	79	01.7	west of north (?)
Spire of Lutheran Church	88	53.9	west of south (?)
Spire of German Catholic Church	80	10.9	west of south (?)

Oskaloosa, Mahaska County.—The astronomical station is on the grounds of Penn College in the barnyard back of the farmhouse. It is about 600 or 700 yards to the north of the college and car line. It is 68.8 feet northeast from the corner of the barn and 29.8 feet southwest from the windmill. It is marked by a post of dark gray marble 6 by 6 by 24 inches, set flush with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Court-house spire (mark)	11	29.7	east of south
West edge of standpipe	15	18.3	west of south
Cupola of Penn College	20	44.9	west of south

Descriptions of stations—Continued.

IOWA—Continued.

The magnetic observations were made in the pasture to the south of the barnyard in a line with the court-house spire and the astronomical station, about 60 yards from the astronomical station

Sigourney, Keokuk County.—The station is in the Catholic cemetery in the northwest part of the town. It is 13.8 feet south of the crucifix and 36.3 feet east of the base of the Mary C. Miller monument. The station is marked by a blue Bedford limestone post 6 by 8 by 36 inches, set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
South edge of chimney on Mr. Henry Marks's residence (mark)	67 09.6	west of south
Cupola of Mr. Marks's barn	70 13.0	west of south
Cupola on residence of Mr. C. E. Vohans in Sigourney	49 21.5	east of south

Tipton, Cedar County.—The station is inside of the race track at the fair grounds, near the north end of the inclosed space. It is 69 feet from the station to the nearest point north in the inside race-track fence and 218.5 feet southeast to the judges' stand. The station is almost due west of the north end of the grand stand. It is marked by a Bedford limestone post 6 by 6 by 15 inches, set flush with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
South cupola of a barn	70 49.8	west of south
North cupola of same barn	72 04.7	west of south
Center of windmill tower at fair grounds	79 25.8	east of south

Wapello, Louisa County.—The station is in the fair grounds northwest of town and south of the race track. It is 58.5 feet southeast from the nearest point in the race-track fence and 90.8 feet east from the grandstand. It is also 87 feet southwest from the corner of a small house standing by the race track. The station is marked by a cement block 8 by 8 by 18 inches, set flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	° ′	
Spire of church	32 04.0	east of south
Left edge of iron smokestack	50 49.4	west of south
Left edge of judges' stand	79 35.8	west of north

Waverly, Bremer County.—The station is on a slight elevation just back of the stables on the fair grounds. It is 48.4 feet from the fence on the south, 63.8 feet from a small pine tree on the southeast, and 36.4 feet from another small pine tree on the southwest. The station is marked by a Bedford limestone post projecting 6 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Spire of Lutheran Church (mark)	25 24.8	east of north
Cupola on high school	11 21.2	east of north
Eastern edge of stack on sugar factory	25 42.9	east of north

KANSAS.

Baldwin Magnetic Observatory, Baldwin, Douglas County.—Observations were made in the absolute house of the magnetic observatory. The mark used is the flagstaff on Science Hall, Baker University, and bears 48° 20′.6 west of true north.

Wallace, Wallace County.—The station of 1904 was reoccupied. It is on the grounds of the public school, southwest of the building. It is 102.3 feet and 116.4 feet, respectively, from the southwest corner of the entrance at the south side of the building and the southwest corner of the main part of the building. It is 40 feet north of the edge of the road that passes along the south side of the grounds and 75 paces from the east edge of the grounds. The station 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 1908:

Descriptions of stations—Continued.

KANSAS—Continued.

	°	′	
South gable of barn north of small frame house about 1 600 feet northeast (mark)	74	07.6	east of north
Wallace Bluff triangulation station	6	29.9	east of south
Base of flagstaff on Union Pacific Railway Company building	0	14.6	west of south
Methodist Episcopal Church spire	6	55.8	west of south

KENTUCKY.

Benton, Marshall County.—The station is on property owned by the sheriff, Mr. Pete Ely, about one-half mile a little east of south of the court-house, and about 500 feet northwest of the farmhouse of Mrs. Verdin. The station is on the southwest edge of a small grove of about 26 oak trees, 4 of which are almost in line on the southwest side. It is 32.6 feet southwest of the center of the trunk of the oak tree at the northwest edge of this grove and 41.4 feet northwest of the center of the trunk of the oak tree at the southwest corner of the grove. The station is marked by a Bedford limestone post 6 by 7 by 30 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Court-house cupola (mark)	35	11.4	west of north
Methodist Church steeple	58	06.2	west of north
Cupola of public school	44	40.8	west of north

Brandenberg, Meade County.—The station is in the northeastern part of property belonging to the Methodist Church near the southeastern corner of the ground surrounding the Masonic Hall, about one-fourth mile south of the center of town. It is 70.9 feet southwest of the fence bounding the Masonic ground on the northeast, 135.4 feet north of the fence in front of the Methodist Church, and about 192 feet east of the south corner of Masonic Hall. The station is marked by a Bedford limestone post 5 by 7 by 30 inches, projecting about 6 inches above ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Base of cross on Catholic Church (mark)	17	46.8	west of north
Baptist Church spire	42	45.4	west of north
Court-house spire	7	26.2	east of north

Cadiz, Trigg County.—The station is south of the central part of a field used as a pasture and belonging to Mr. C. A. Chappell, and it is about 1 000 feet northeast of the court-house and 250 feet west of Mr. E. R. Street's house. The station is 79.6 feet northwest of the fence on the southeast of this field and 96.8 feet northeast of the fence on the southwest. The station is marked by a Bedford limestone post 5 by 7 by 30 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire on county court-house (mark)	31	09.6	west of south
Cross on southwest corner of the cupola on Baptist Church	29	42.2	east of south

Dixon, Webster County.—The station is in the eastern part of a field used as a baseball ground and owned by Mr. Ben Watson, about one-half mile west of the center of town. It is almost directly south of the grandstand, 79.8 feet from the fence on the east, and 179.6 feet from the fence on the south. It is marked by a limestone post 6 by 8 by 26 inches, projecting about 2½ inches above the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Rod on steeple of Methodist Church (mark)	53	43.6	east of south
South gable point of yellow house	77	10.2	east of south

Elkton, Todd County.—The station is in the northwest corner of the ground surrounding the Vanderbilt Training School, about three-fourths mile west of the center of town. It is 94.8 feet east of the

Descriptions of stations—Continued.

KENTUCKY—Continued.

west fence and 75.6 feet south of the north fence. The station is marked by a Bedford limestone post 5 by 7 by 30 inches, projecting about 9 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Lower northeast corner of dormitory on the bricks (mark)	13	33.5	west of south
Upper northeast corner of cupola of main school building, under eave	20	20.3	east of south
Top of eastern stone gate post in northeast corner of grounds	83	50.8	east of south

Greenville, Muhlenberg County.—The station of 1901 was reoccupied. It is about one-fourth mile northeast of the court-house, in the grounds of the Greenville Seminary. The south end of the meridian line which had been established in 1901 was used as the magnetic station. This line is marked by stone posts and is 285.5 feet long. The south stone is 72.5 feet east of the fence along Trowbridge street and 78.8 feet north of the fence along the main cross street.

Hardinsburg, Breckinridge County.—The station is in the southeastern part of the race-track inclosure at the county fair grounds, about 1½ miles east of the center of town. It is 220.4 feet north of the fence around the inside of the race track to the south and 148.9 feet west of the fence around the inside of the race track to the east. The station is marked by a Bedford limestone post 5 by 7 by 27 inches, projecting about 4 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Upper northwest corner of Floral Hall, under eave of roof (mark)	57	54.4	west of north
Base of flagstaff on judges' stand at race track	71	38.8	west of north
Point of eastern gable on roof of grand stand	77	26.6	west of north

Hartford, Ohio County.—The station is south of the central part of the infield within the race track at the fair grounds, on the north bank of the river and about one-half mile northwest of the center of town. It is 197.6 feet north of the south side of the fence on the inside of the race track measured in line with the meridian stones, and 287.4 feet southeast of the nearest point of the judges' stand at the race track. The station is marked by a limestone post 5 by 9 by 36 inches, projecting about 12 inches above the ground. The following true bearings were determined:

	°	′	
Presbyterian Church steeple (mark)	80	03.1	east of north
Spire on cupola of grade school	73	46.8	east of north
West point of gable roof on small cupola on J. W. Ford's mill	61	29.5	east of north
North peak on gable roof of Mrs. Campbell's house	41	55.9	west of south

A stone was set 380 feet due north of the magnetic station to mark the meridian line.

Marion, Crittenden County.—The station is in the southwest corner of the cemetery, about 1 mile northwest of the center of town, and in a small triangle of ornamental ground immediately east of the Morgan lot. It is 11.1 feet northeast of the southeast corner of the limestone border around the Morgan lot and 15.1 feet southeast of the northeast corner of the same. It is also 23 feet southwest of the southwest corner of the monument to Malinda Hawkins. The station is marked by a limestone post 3½ by 9½ by 30 inches, projecting about 9½ inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Steeple of South Presbyterian Church (mark)	73	07.2	east of south
Southern point on gable roof of tobacco factory	85	38.1	east of north
Spire on the six-sided cupola of an old frame schoolhouse	89	35.1	east of south

A stone similar to the one marking the magnetic station was placed 266.7 feet north of the magnetic station to mark the north end of the meridian line.

Murray, Calloway County.—The station is in the southwestern corner of the grounds surrounding the public school, about one-half mile southwest of the center of town, and about 330 feet a little west of

Descriptions of stations—Continued.

KENTUCKY—Continued.

south of the school building. It is 47.3 feet from the west fence and 128.8 feet from the south fence. The station is marked by a Bedford limestone post 3½ by 7 by 30 inches, projecting about 8 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Christian Church spire (mark)	67	25.9	east of north
Methodist Church spire	81	59.5	east of north
Baptist Church steeple	86	34.9	east of north

LOUISIANA.

Rayville, Richland Parish.—The meridian line of 1904 was recovered but the magnetic station was not reoccupied. Observations were taken at a point 14.5 feet due north of the north meridian stone. The south meridian stone was used as a mark. The following true bearings were determined in 1909:

	°	′	
Spire on Rayville State Bank	62	32.4	east of south
Spire on court-house	3	30.8	east of south

MARYLAND.

Benedict, Charles County.—Magnetic observations were made 32.8 feet from triangulation station City, in prolongation of the line to station Teague, which bears 0° 45′.1 east of true north.

Cheltenham, Prince George County.—The station is at the Coast and Geodetic Survey magnetic observatory, on the grounds of the state reform school.

Potomac, St. Marys County.—Magnetic observations were made 49.2 feet from the triangulation station Potomac in the direction of Point No Point Light-house, which bears 15° 29′.6 east of true north.

St. Jerome, St. Marys County.—Magnetic observations were made 32.8 feet from the triangulation station St. Jerome in prolongation of the line to Point No Point Light-house. Point No Point Light-house is about 2 miles distant and bears 78° 16′.6 east of true north.

Solomons Island, Calvert County.—Magnetic observations were made 42.7 feet from triangulation station Sand in prolongation of the line to station Carroll, which bears 68° 55′.2 east of true south.

MASSACHUSETTS.

Fairhaven, Bristol County.—The station is in the western end of an open field about 320 feet east of Fort Phœnix, and 320.5 feet west-northwest from a white beacon with a black ball on top of it on the shore line north of Fort flats. The station is about 60 feet from the shore line and 18 feet from the eastern edge of a rocky ledge extending from the shore line north. It is 64 feet from a lone red cedar tree on the shore line at the foot of the rocky ledge, 149 feet south from a rough stone wall on the south side of a road running parallel with the shore line, and 172 feet south of a smooth stone wall on the north side of the same road. The station is marked by a drill hole surrounded by a circle drilled in the rock, about 3 inches in diameter. The rock on which the station is located is smooth topped, level with the surface of the ground and is 5 feet long, east and west, and about 3 feet wide at the westerly end, tapering at the easterly end. The following true bearings were determined:

	°	′	
Butlers Flat light-house	12	52.6	east of south
Fort Rodman observatory tower	0	52.5	west of south

South Hyannis, Barnstable County.—The station is on a small sand hill near the seacoast, about 340 yards east of the railroad wharf at Hyannis Harbor. It is on land owned by Captain Whidden, of Malden, Mass., and 164.6 feet east-southeast of the southeasterly corner of an unpainted shingled cottage on the sea shore, owned by Walter Hopkins, of Malden, Mass. It is 22 feet back from the sea edge of the sand hill and 67 feet from mean high water. It is 21 feet south of a scrub pine standing about 3 or 4 feet high, and 49 feet west of another similar scrub pine standing alone. It is also 42 feet

Descriptions of stations—Continued.

MASSACHUSETTS—Continued.

from a property stake on the edge of the sand hill. The station is marked by a square cement post set flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Bishop and Clerk's light-house	22	15.4	east of south
Old tower on Point Gammon	26	36.6	east of south
Spindle on east end of breakwater	30	43.6	west of south

MICHIGAN.

Copper Harbor, Keweenaw County.—The station is 100 feet north of the old flagstaff at Fort Wilkins, about 2 miles east of Copper Harbor, and is identical with the station of the United States Lake Survey magnetic survey. The stone pillar mentioned in the Lake Survey description is still standing. The mark used was a pine tree about 500 feet from the station. No permanent marks could be found.

Hermansville, Menominee County.—The station is on the school grounds, south of the school building. It is 76 feet from the southwest corner and 74.5 feet from the southeast corner of the schoolhouse, and 92.5 feet from the fence along the west side of the grounds. The station is marked by a granite block 6 by 8 by 12 inches, set flush with the ground and having a drill hole in the center of top. The following true bearings were determined:

	°	′	
Large flag pole in the part of town known as "Little Italy" (mark)	1	39.2	west of south
Tip of cupola on C. & N. W. station	53	22.0	west of south
Spire of M. E. Church	63	18.9	west of north

Manistique, Schoolcraft County.—The station is on the central school grounds, in the southeast corner. It is 39.1 feet from the east fence and 47 feet from the south fence. The observations were made over a rock which is native to the spot, projecting about 1 inch above ground and having a small hole drilled in the center. The following true bearings were determined:

	°	′	
Church spire (mark)	31	32.8	west of north
Tip of water tank	12	04.4	east of north
Church steeple	24	43.4	east of south
Flag pole on store	0	16.3	west of south

Marquette, Marquette County.—The station of 1902 was reoccupied. It is on the United States reservation near its western boundary, about 800 feet northwest of the light-house. It is on the summit of a knoll just north of the life-saving station. It is marked by a small terra-cotta pipe sunk flush with the ground. This pipe is 248.5 feet from the northwest corner of the life-saving station, 104.5 feet from the western boundary of the reservation, and about 10 feet east of a small pine tree. The following true bearings were determined in 1908:

	°	′	
Whistle on waterworks plant (mark)	21	59.5	west of south
Spire of Mr. Watson's house	75	35.0	west of south
Spire of Mr. Kaufmann's house	88	08.6	west of south

Michigamme, Marquette County.—The station is on a vacant space used for a baseball grounds, southeast of the public school. It is 116.7 feet southeast from the southeast corner post of the school grounds and 122.3 feet from the fence inclosing the house across the street south of the school. The station is marked by a small stone sunk 1 inch below the surface of the ground, with a small hole roughly drilled in the center. The following true bearings were determined:

	°	′	
Cross on Catholic Church (mark)	42	43.5	east of north
Spire of Methodist Church	7	43.0	west of north
Flag pole on Mount Chasta	59	25.5	east of north

Descriptions of stations—Continued.

MICHIGAN—Continued.

Munising, Alger County.—The station is in the school grounds, 128.8 feet from the northeast corner of the school building, and 42.6 feet from the inside edge of the cement sidewalk along the north side of the grounds. The station is marked by a small stone sunk 1 inch below the surface of the ground, with a small hole drilled in the center. The following true bearings were determined:

	°	′	
Flag pole on bank building (mark)	12	47.6	east of north
Right edge iron smokestack of Lake Superior veneer plant	73	55.3	east of north
Left edge of highest part of paper mills	87	39.2	east of north

Sidnaw, Houghton County.—The station is on the school grounds, 82.5 feet from the south fence, 83.5 feet from the north fence, and 31.8 feet from the east fence. The station is marked by a small stone with a hole roughly drilled in the center, sunk 2 inches below the surface of the ground. The following true bearings were determined:

	°	′	
Pinnacle of silo on Roycroft farm, near the cow barn (mark)	69	19.6	east of south
Flag pole on store	39	29.6	east of south
Church steeple	54	24.0	west of south

Watersmeet, Gogebic County.—The station is in the public school grounds, 103.7 feet south of the southeast corner of the school building, and 29 feet west of the east fence. The station is marked by a rough limestone post, with small hole in center, sunk an inch below the surface of the ground. The following true bearings were determined:

	°	′	
Center of windmill (mark)	74	04.4	west of south
Cross on Catholic Church	14	06.4	east of south

MINNESOTA.

Anoka, Anoka County.—The station is on the grounds of the state insane asylum, in front of the entrance to the main building. It is 200 feet to the southeast corner of projecting part of main building near entrance steps, 22 feet to a small evergreen tree, and 121.7 feet to a small oak tree nearly in line with city standpipe. The station is marked with a marble post 6 inches square, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Flagstaff on west cupola on asylum barn	15	29.9	east of north
Peak of cupola toward city	77	20.5	east of north
Top of building	26	20.2	east of south
Ornament on highest point of cottage No. 2	51	42.6	west of south

Cambridge, Isanti County.—The station is on the grounds of the Lutheran Church, near the town and north of it, in the rear of the building near the line of the adjoining cemetery. It is 27.3 feet to the parsonage barnyard fence, and 64.3 feet to a pine tree. The station is marked by a limestone post 6 inches square, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Top of city water tank (mark)	13	39.9	west of south
Flagstaff, cupola of high school	30	13.9	west of south
Piston of parsonage windmill	88	54.3	east of north
Eastern edge of church	6	18.9	east of south

Elk River, Sherburne County.—The station is on the grounds of the Roman Catholic Church, near the fence. It is 28.7 feet from the west fence of the grounds and 16.3 feet from the rear (north) fence. The station is marked by a marble post 6 inches square, set flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
East edge of chimney	13	17.2	east of north
Cross on church spire	35	23.6	east of south
Lower western corner of windowpane	7	14.9	east of south

Descriptions of stations—Continued.

MINNESOTA—Continued.

Foley, Benton County.—The station is on the grounds of district school No. 8, sometimes called the Strand School, on the road to Parent. The station is 64.5 feet from an elm tree on the road, and 62.3 feet to the southwest corner of school. The station is marked by a limestone post sunk flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
North edge of chimney of Strand's house	41	40.9	west of south
Telegraph pole by house near railroad	18	56.0	east of south

Hastings, Dakota County.—The station is on the grounds of the state insane asylum, in the rear of the main building between the greenhouse and the barns. It is 188 feet from the workshop by the greenhouse, and 217.4 feet from the northeast corner of a barn. The station is marked by a limestone post 6 by 6 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Ventilator on eastern end of roof of main asylum building	2	55.5	east of north
Peak of asylum water tank	30	52.5	east of north
Southern edge of top of stack of old Gardner mill	82	15.0	west of north
Spire of Baptist Church	37	51.3	west of north
Spire of Irish Catholic Church	26	04.0	west of north

Henderson, Sibley County.—The station is in Brown Cemetery near the town on the Old Fort road. It is on the east side of the cemetery driveway, 18.5 feet from its edge and 47.2 feet from the north fence. The station is marked by a limestone post 6 inches square, sunk flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
East edge of east chimney of Bertrand's house	46	57.1	east of north
Gable of old barn	15	14.6	east of north
Western point of Welch monument	14	52.5	east of south

Lesueur Center, Lesueur County.—The station is on the grounds of district school No. 11, near Greenwood Union Cemetery on the road to Montgomery. It is near the northwest corner of the grounds, 98.3 feet from the northwest corner of the schoolhouse, 20 feet from the northern boundary of the grounds, and 30 feet from a small box-elder tree by the road. The station is marked by a limestone post, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire of Evangelical Lutheran Church	2	44.7	west of south
West gable of Trzinski's house	14	58.2	west of north
Southern edge of chimney on Pope's house	54	31.3	east of south

Little Falls, Morrison County.—The station is in the German Catholic Cemetery about 1 mile southeast from the center of town. It is 39.6 feet from the south fence, and 71 feet from the west fence. It is marked by a wooden peg driven in the ground. The following true bearings were determined:

	°	′	
Nearest spire of Polish Catholic Church	12	15.7	west of north
Flagstaff on court-house	26	19.8	west of north
Cross on cupola of St. Otto's Orphan Asylum	62	04.1	west of north
Cross in Polish Cemetery	23	04.8	east of south

Mankato, Blue Earth County.—The station is on the grounds of the county poor farm, about 4 miles south of the city on the road to Good Thunder. It is in the field south of the driveway leading to the main building, near the northeast corner of the field. It is 21.3 feet to the east fence along the Good Thunder road, 20.7 feet to the north fence. The station is marked by a limestone post 6 inches square, sunk flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

Descriptions of stations—Continued.

MINNESOTA—Continued.

	°	′	
Cupola of poor-farm barn	74	00.3	west of south
Telegraph pole on crest of hill	1	13.1	east of south
South edge of chimney on house east of road	77	11.6	east of south

Princeton, Millelacs County.—The station is on the grounds of the Methodist Church at Greenbush (near Greenbush townhall) about 4 miles north and east from Princeton. The station is 39 feet from the rear fence, 16.3 feet from the east fence, and 81.4 feet from the northeast corner of the church. It is marked by a 2 by 6 inch slab of marble with a square indentation in the center of top. The following true bearings were determined:

	°	′	
Weather vane on cupola of Foltz's barn	34	11.7	west of north
North edge of red tank	80	15.8	east of north
Gable of house	24	07.7	west of south

Shakopee, Scott County.—The station is on the grounds of a public school on the Marystown road about 2½ miles west of the town. The station is 54.6 feet from the southwest corner of the school, on the line of the south wall extended. It is marked by a limestone post 6 inches square, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
South edge of south chimney of Schmitt's house	67	18.4	east of north
West point of roof of old shed	16	31.4	west of south
Chimney, center of Latone's house	58	56.5	west of south

MISSISSIPPI.

Corinth, Alcorn County.—The station is in the grounds of the public school, 76.3 feet from the southeast corner of the building and 86.6 feet from the northeast corner. It is 30.7 feet from the fence to the south. The station is marked by a blue limestone post, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Baptist Church spire (mark)	57	42.2	west of north
West gable of house	6	26.7	west of south
Iron pipe on S. D. Bramlitt's house	70	44.7	east of south
East gable of C. S. Graham's house	48	11.4	west of south

Iuka, Tishomingo County.—The station is in the southwest corner of the Mineral Spring Park, about 600 feet southeast of the county court-house. It is 98.6 feet from the fence bounding the park on the west and 87.6 feet from the fence on the south. The station is marked by a limestone post 6 by 6 by 32 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Eastern outer edge of entrance arch on south side of court-house (mark)	17	43.6	west of north
Top of gate, northwest corner of Mineral Spring Park	5	35.7	east of north

Three hundred feet to the north a nail in a tree and the center of an iron stake driven in the ground mark the north end of a meridian line.

MISSOURI.

Ava, Douglas County.—The station is in the northwestern corner of the baseball grounds, immediately east of the picnic grounds, and about one-half mile a little south of west from the center of the town. The ground is owned by Messrs. Williams and Pettit. The station is 98 feet east of the fence on the west and 193 feet south of the fence on the north side of the baseball grounds. The station

Descriptions of stations—Continued.

MISSOURI—Continued.

is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 8 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Base of flagstaff on cupola of high school (mark)	70 37.4 east of north
Spire on Methodist Church	67 58.9 east of south
Upper northwest corner of court-house	79 01.7 east of south

Benton, Scott County.—The station is in the southwestern corner of the grounds surrounding the Catholic School of St. Denis Parish, and is about 1 200 feet northwest of the county court-house. It is 90.9 feet from the fence on the west and 86.7 feet from the fence on the south. It is marked by a rough field stone about 5 by 6 by 26 inches, projecting about 4 inches above the ground. A cross cut in the top of the stone indicates the exact spot. The following true bearings were determined:

	° ′
Top of water tank in court-house square (mark)	13 34.7 east of south
Center of ornamental rod on court-house cupola	16 16.7 east of south
Spire of Methodist Church	35 12.6 east of south
Base of cross on Catholic schoolhouse	78 21.2 east of north

A stone similar and of about the same size as the one marking the magnetic station was placed 220.2 feet north of the magnetic station, and a cross cut in the top marks the north end of the meridian line.

Bloomfield, Stoddard County.—The station is in the southwest corner of the ground surrounding the high school, about one-fourth mile west of the center of town. It is 114 feet north of the fence bounding the ground on the south, and 126 feet east of the fence on the west. The station is marked by a Bedford limestone post 6 by 6 by 32 inches, projecting about 8½ inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Center of top of tallest cupola on grammar school (mark)	37 21.4 east of south
Top of water tank back of Barret hotel	78 18.4 east of south
Lower northwest corner of stone foundation of high-school building	84 43.9 east of north

Butler, Bates County.—The station is in the southeast corner of the grounds around the Franklin, or East, school, about one-half mile east of the center of the town. It is 47.3 feet north of the fence line on the south, 61.4 feet west of the fence line on the east, and 181.8 feet southeast of the southeast corner of the school building. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting 9 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Northeast corner of school building, just above stone foundation (mark)	45 12.6 west of north
Southwest edge of school building, just under roof, on bricks	65 21.1 west of north

Carthage, Jasper County.—The station is in the southwest corner of Carters Park, about three-fourths of a mile southeast of the center of the town, and near the corner of East Chestnut avenue and South River street. It is 101.5 feet north of the fence bounding the park on the south, 235 feet east of the fence on the west, and 230.6 feet northeast of the nearest point on the monument to the battle of Carthage. The station is marked by a Bedford limestone post 6 by 6 by 24 inches, projecting about 3 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′
Point on north gable of house with four gables and painted roof (mark)	69 31.4 west of south
Southeast corner, just under eaves of house on northwest corner of above street corner	75 38.4 west of south
Southwest corner of power house, just above foundation	14 40.6 west of north
Upper northeast corner of monument to battle of Carthage	66 41.6 west of south

Descriptions of stations—Continued.

MISSOURI—Continued.

Caruthersville, Pemiscot County.—The station is in the eastern part of the oval within the race track at the county fair grounds, on the western edge of the baseball field, about 1 mile southwest of the town's center. It is 317 feet southeast from the southeast corner of the judges' stand at the race track and 247.4 feet south of the northern part of the fence inside of the race track. It is marked by a limestone post 6 by 6 by 33 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	° ′	
Rod on steeple of Sanctified Church (mark)	81 18.5	east of south
Rod on small shingled cupola of house	88 12.0	east of north
Top of west cupola on public-school building	67 04.2	east of north

Centerville, Reynolds County.—The station is near the top of a steep hill in the southeastern part of town. It is at the eastern end of a lane running up the hill and on the north side of the property of Mr. T. J. Jordan, the county collector. It is in the northern end of a strip of land belonging to the village, and running along the eastern edge of Mr. Jordan's property. It is 52.6 feet south of the fence on the southern boundary of the field on the northern side of this strip, 26.6 feet east of the southeast corner of the fence around the field at the northwest corner of this strip, and 40.9 feet east of the fence on the eastern boundary of Mr. Jordan's property. The station is marked by a cement block 4 by 8 by 14 inches, projecting 1 inch above the surface of the ground and lettered U. S., 1908. The following true bearings were determined:

	° ′	
Steeple of Baptist Church (mark)	39 04.2	west of north
Cupola on Methodist Church	38 50.2	west of north
Point at top of east gable of court-house	35 58.6	west of north

Eminence, Shannon County.—The station is in the southeastern corner of the ground surrounding the public schoolhouse, about 1 500 feet north of the center of town. It is 92 feet north of the fence across the road to the south, 72.5 feet west of the fence across the road to the east, and 132.8 feet southeast of the southeast corner of the schoolhouse. The station is marked by a Bedford limestone post 6 by 6 by 32 inches, projecting about 9 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
East edge of bay window at northeast corner of court-house, just under top (mark)	11 34.8	east of south
Point of east gable of house across road west of the southwest corner of the court-house	0 07.5	east of south
Lower northwest corner of D. L. Bale's store	11 51 2	east of south

Forsyth, Taney County.—The station is east of the central part of the ground surrounding the Presbyterian College, about three-fourths of a mile north of the center of town. It is 205.3 feet northeast of the northeast corner of the college building, and 161.3 feet east of the northeast corner of the carpenter's shop. The station is marked by a Bedford limestone post 6 by 6 by 34 inches, projecting about 12 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	° ′	
Northwest corner of college building, just under eaves (mark)	51 03.4	west of south
Center of northwest corner of college building	51 03.1	west of south
Base of flagstaff on cupola of college building	40 30.5	west of south

Galena, Stone County.—The station is in the eastern part of the ground surrounding the public school, on a hill about one-fourth of a mile west of the center of the town. It is 132.2 feet northeast of the southeast corner of the south extension of the school building, and 115.6 feet east of the northeast corner of the north extension of the school building. The station is marked by a Bedford limestone post

Descriptions of stations—Continued.

MISSOURI—Continued.

6 by 6 by 30 inches, projecting about 10 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Corner stone at the southeast corner of public square (mark)	89	17.9	east of north
Base of white post marked "Railroad Crossing" on S. P. R. R.	88	54.2	east of south
Base of pole on cupola of schoolhouse	79	27.1	west of south

Greenfield, Dade County.—The station is in the northern part of the ground surrounding the public school and about one-fourth of a mile northeast of the center of the town. It is 27 feet south of a hedge on the northern boundary of the grounds, 86 feet west of a hedge on the eastern boundary, and 204 feet a little east of north from the northwest corner of the northern extension of the school building. It is also 58.1 feet east of the center of the trunk of the only tree in the northwest corner of the ground. The station is marked by a white glass bottle, 6 by 13 inches, with the neck 2 inches below the surface of the ground. The following true bearings were determined:

	°	′	
Cupola on Presbyterian Church (mark)	67	16.1	west of south
Northwest corner of northern extension of school building, just above foundation	5	28.5	west of south
Center of sector-shaped front piece on roof of opera house	42	14.0	west of south

Hartville, Wright County.—The station is in the northwest corner of the pasture or field immediately south of the ground around the residence of the Steel family. The field belongs to the Steel estate and is about three-fourths of a mile southeast of the center of the town. The station is 73.1 feet south of the fence on the north, and 73.5 feet east of the stone wall bounding this field on the west. The station is marked by a Bedford limestone post 6 by 6 by 32 inches, projecting about 12 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire on Christian Church (mark)	52	53.4	west of north
Base of rod on cupola of schoolhouse	56	54.0	west of north
Methodist Church spire	58	55.8	west of north
Upper southwest corner of the Steel residence	27	05.3	east of north

Jackson, Cape Girardeau County.—The station is in the northwest corner of the ground surrounding the Jackson Military Academy, about 1 200 feet southwest of the court-house. It is 176.2 feet northwest of the nearest point on the academy flag pole and 182.3 feet north-northwest of the northwest corner of the academy building. It is marked by a Bedford limestone post 5 by 5 by 30 inches, projecting about 9½ inches above the ground and lettered U. S., 1908. The following true bearings were determined:

	°	′	
Pestle in mortar sign on cupola over S. E. Wood's drug store	23	40.8	east of north
Spire of First Presbyterian Church	9	20.9	west of north
Court-house cupola	40	31.4	east of north
Southeast corner of Judge Miller's residence, under eave of roof	47	47.9	west of north
West point at top of roof of M. E. Church South	61	57.5	east of north

Keytesville, Chariton County.—The station is in the southeast corner of the grounds surrounding the high school. It is 120.2 feet west of the fence along the sidewalk to the east across the road, and 237.6 feet a little east of south of the southeast corner of the high-school building. It is also 44.6 feet southeast of the center of the trunk of a tree about 3½ feet in diameter. The station is marked by a sandstone post 6 by 6 by 30 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1908, on the south side. Another sandstone post 10 by 12 by 24 inches is situated 287.3 feet north of the magnetic station, and marks the north end of a meridian line. The following true bearings were determined:

Descriptions of stations—Continued.

MISSOURI—Continued.

	°	′	
Southwest corner of school building just above stone foundation on bricks (mark)	19	02.9	west of north
Northeast corner, just under roof, of J. W. Agee's house	41	41.8	west of north
East gable point on the roof of the Whitesides House	63	13.0	west of south
Base of spire on cupola of high school	9	36.2	west of north

Mexico, Audrain County.—The station of 1903 was reoccupied. It is about three-quarters of a mile east of the public square, on the grounds of the Missouri Military Academy. It is 260.5 feet north from the northwest corner of the north dormitory. It is marked by a stone 6 inches square on top, and is lettered U. S. C. & G. S. The following true bearing was determined in 1903:

	°	′	
West post on the cupola of the Reed farmhouse	44	27.2	east of north

Neosho, Newton County.—The station is in the northern part of the grounds of the United States Fisheries station, about three-fourths of a mile northeast of the center of the town. It is 76 feet south of the fence bounding the grounds on the north, 42 feet north from the north edge of the second fish pond along the north fence counting from the west, and 131.5 feet southeast of the eastern post of the gate near the center of the north fence. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 10½ inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Flagstaff on cupola of Benton School (mark)	58	03.8	west of south
Flagstaff on tallest cupola of fishery building	30	22.2	west of south
Base of flagstaff on red cupola on Ed. Haas's grocery store	41	48.3	west of north

Nevada, Vernon County.—The station is in the northern part of a pasture immediately southwest of the cow barn at the insane asylum, or State Hospital No. 3. It is about 2 miles north of the center of the town. The station is 108.9 feet west of the southwest corner of the fence around a small garden patch, also southwest of the cow barn, and 103.5 feet south of the fence on the northern boundary of the pasture. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 10 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Base of flagstaff on central cupola of asylum office building (mark)	31	46.1	east of south
Most western spire on asylum buildings	22	48.7	east of south
West edge of top of tallest smokestack	50	43.5	east of south

Ozark, Christian County.—The station is south of the central part of the city lot, which was at one time the old public square, and which is now the northern part of the town park. It is about one-fourth of a mile northwest of the center of the town. It is 94.6 feet west of the fence on the west side of the house on the east side of this lot, and 62.5 feet north of the fence across the road to the south. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 9 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Northeast corner of the Ozark water mill, just under eave of roof (mark)	23	53.0	west of north
Gable point on tallest cupola on fire engine house	7	35.3	east of south
Northeast corner at top of brick building and over S. G. Johnson's store	9	54.4	east of south

Perryville, Perry County.—The station is in the southwest corner of the baseball field on the grounds of St. Mary's Seminary, about 1¼ miles a little south of west of the center of town. It is about 600 feet south of the seminary buildings and about 100 feet northeast of a statue on a grass mound. It is 81.3 feet north of the fence bounding the baseball field on the south, 44.8 feet east of a hedge on the east side of the above statue, and 54.3 feet southeast from the nearest edge of an old spring lined with stone.

Descriptions of stations—Continued.

MISSOURI—Continued.

The station is marked by a Bedford limestone post 5 by 5 by 32 inches, projecting about 8 inches above the ground and lettered U. S., 1908. The following true bearings were determined:

	°	′	
Base of cross on cupola over seminary office (mark)	5	14.4	west of north
Ball at top of seminary water tank	50	23.8	west of north
Base of cross on second seminary building counting from the east	1	44.7	west of north

Pineville, McDonald County.—The station is on ground belonging to the county road, about 250 feet southeast of the public school, and about one-fourth of a mile north of the center of the town. It is in a triangle formed by a road on the northwest, a fence on the south, and a fence on the east. It is 49.2 feet west of the fence to the east, 60.5 feet north of the fence to the south, and 52.6 feet south of the fence to the north across the road. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 9 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Top of red water tank belonging to Mrs. La Mance (mark)	6	03.5	west of south
Northeast corner of schoolhouse, just under projecting brickwork under roof	58	04.2	west of north

St. Louis, St. Louis County.—The station of 1900 was reoccupied. It is on the baseball grounds in Forest Park, about 500 feet southeast of the police substation, and is marked by a limestone post 6 by 6 by 36 inches, lettered U. S. C. & G. S., projecting about 4 inches above the ground. The following true bearings were determined in 1900:

	°	′	
Center of base of flagstaff on police station (mark)	22	02.1	west of north
Center of base of flagstaff on Y. M. C. A. building	68	42.6	west of south

Van Buren, Carter County.—The station is on the west slope of the hill on the property of Mrs. Carter, about 1 500 feet east of the center of the town. It is just south of the road running east from the northeast corner of the court-house square, about 1 200 feet from that corner. It is 92.5 feet south of the fence on the north side of the road and 67.7 feet east of the last inclosed field on the south side of the road. The station is marked by a white glass quart bottle, with the neck about 3 inches below the surface of the ground. The following true bearings were determined:

	°	′	
Rod on steeple of Baptist Church (mark)	59	34.4	west of north
Methodist Church steeple	75	31.7	west of south
South point on gable of livery and feed stable	84	09.9	west of north

NEW YORK.

Albion, Orleans County.—The station is on the county fair grounds about one-half of a mile to the westward from the city. It is on an open space between the sheep pens and the ticket office at the Washington street entrance to the grounds. It is 63.5 feet from the northwest corner of the ticket office and 58.6 feet from the first sheep pen on the west of the driveway. The aisle through the pen, if produced, would pass very close to the station. The station is marked by a marble post 8 by 8 by 24 inches, projecting 2 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
High stone spire on Presbyterian Church (mark)	71	36.3	east of north
Baptist Church spire	78	02.8	east of north
Flag pole on Western House of Refuge	71	33.0	west of north
Flag pole on Floral Hall, Orleans County Agricultural Society	9	17.5	east of north

Descriptions of stations—Continued.

NEW YORK—Continued.

Buffalo, Erie County.—The station of 1905 was reoccupied. It is in the parade grounds of Fort Porter, in front of the main barracks and in the rear of the stone building known as the "Castle" and occupied by the commandant of the fort. The station is roughly at the intersection of two lines, one connecting the middle of door 11 of the barracks and the northwest corner of the Castle, and the other joining the southwest corner of the adjutant's quarters and the southwest corner of the building 34 and 35. The station is 108.7 feet from the extreme northwest corner of the Castle and 84.2 feet from the board fence in the rear of it, and 47.8 feet west from the west edge of the cement walk leading from the Castle to the Fort Exchange door. A new tent peg was driven down by the west side of the peg marking the station of 1905. The following true bearings were determined in 1908:

	°	′	
Southwest corner, above water table, of building No. 34–35 (mark)	70	46.4	west of south
Spire of Episcopal Church at Old Ladies' Home	20	07.0	east of north

Ithaca, Tompkins County.—The station of 1907 was reoccupied. It is located about 90 rods southeast of the station of 1890, and is on the south knoll southeast from the playground of Alumni Field, known as Kite Hill on the university map plans. It is almost due north of the Lehigh Valley Railroad station at East Ithaca and almost due east about 100 rods from the university heating station. The station is on the summit of the knoll and is marked by a cement post 7 by 7 by 30 inches, projecting 4 inches above the ground and lettered U. S. C. & G. S., 1907. The following true bearings were determined in 1907:

	°	′	
Sphere at base of eagle on State Agricultural College (mark)	14	47.9	west of north
Library tower (approximately)	58	23.5	west of north
Sage College, main tower tip	68	06.6	west of north
North smokestack at heating plant	89	52.6	west of north

Lockport, Niagara County.—The station is on the county fair grounds at the southeast end of the city. It is at the east end of the oval within the race track, and very nearly on the long diameter of the oval. It is 66 feet from the inside fence of the race track at the east, 149 feet from the high board fence on the east boundary of the fair ground, and 229 feet from the board fence on the south boundary of the grounds. The station is marked by a white marble post, 10 inches square at base, 6 inches square at the top, and 42 inches long, projecting about 5 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Center pole of cupola on stone house (mark)	27	17.0	west of south
Pole on stone house two blocks south of gate to fair grounds	59	04.1	west of south
South edge of north post at front gate to grounds	83	49.5	west of north

NORTH CAROLINA.

Beaufort, Carteret County.—The station of 1898 being no longer suitable for magnetic work, a new station was located in the northwest corner of the court-house grounds, to the westward of the north monument of the 1898 meridian line. As a new court-house had been erected on this meridian line, the north stone was moved to mark the position of the new station. The stone is a granite (rough) post about 9 inches square and about 3½ feet long, projecting about 14 inches above ground. The top is rounded and has a drill hole to mark the exact point. The station is north 10½° west and distant 194.7 feet from the northwest corner of the west steps of the court-house, 33.8 feet from the center of the sidewalk along the west side of the court-house square, and 77.4 feet from the center of the walk along the north side of the square. The following true bearings were determined:

	°	′	
Methodist Church spire (white) (mark)	0	29.0	west of south
Spire on Methodist Church (colored)	0	53.7	east of south
Ball on court-house dome	18	50.5	east of south
Northwest corner of west steps of court-house	10	29.1	east of south

Descriptions of stations—Continued.

NORTH CAROLINA—Continued.

Fayetteville, Cumberland County.—The station of 1899 was reoccupied. It is the south monument of a meridian line in a lot owned by the city near the old court-house square, in front of Mr. Underwood's house. The north monument is in the court-house square. The following true bearings were determined in 1909:

	° ′
South meridian stone (mark)	00 01.0 west of south
Lower western inside edge of central arch at base of the old market house	17 00.9 west of south

Observations were also taken over the north monument.

Manteo, Dare County.—The station is in the southeastern corner of the field immediately surrounding the poorhouse, about 1½ miles west of the center of town. It is 42.7 feet northwest of the fence on the southeast boundary of the field, and 99 feet northeast of the fence on the southwest. The station is marked by a granite post 7 by 7 inches, projecting about 15 inches above the ground and lettered N. C. G. S.—U. S. C. S., 1898. The following true bearing was determined:

	° ′
Southeast corner of poorhouse, just under eave of roof (mark)	47 47.4 west of north

A similar stone was set 200 feet north of the magnetic station to mark the north end of a meridian line.

OHIO.

Circleville, Pickaway County.—The station is in the yard of the county infirmary or poor farm, about 4 miles east of the town. It is 80 feet west of the fence along the drive, and 192 feet southeast of the northwest corner of the main building of the infirmary. The station is marked by a sandstone 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:

	° ′
Left lightning rod on Children's Home (mark)	81 01.2 west of north
North tip of a brick house	6 18.2 west of south

Columbus, Franklin County.—The station of 1900 was recovered. Observations were made over the station established in the campus of the Ohio State University and marked by a stone post in 1891. Its exact location is well known to the university authorities. The new physics building of the university now stands about 150 feet south of the station. The following true bearings were determined in 1909:

	° ′
Spire on house (mark)	16 24.1 west of south
Flag pole on main building	59 08.1 west of north
Flag pole on round tower of brick building	32 15.7 east of north

Painesville, Lake County.—The station is in the township park about 3 miles from the town, and about one-half of a mile east of Fairport on the shore of Lake Erie. It is 104 feet east from the station to the fence bounding the park, and 172 feet southwest to the northeast post of the east porch of the cement building, and approximately 105 feet north to the edge of the bank along the lake. The station is marked by a Bedford limestone post 6 by 6 by 22 inches, lettered U. S. C. & G. S., and sunk level with the ground. The following true bearings were determined:

	° ′
Water tank on breakwater (mark)	80 47.5 west of north
Light-house on breakwater	69 42.8 west of north
Flag pole on elevator	47 40.4 west of south

For the purpose of comparison, observations were also made at a point 50 feet from the station in range with the mark (A).

Descriptions of stations—Continued.

OKLAHOMA.

McAlester, Pittsburg County.—The station of 1905 was reoccupied. It is about 2 miles north of the center of the tower on ground owned by the city and fenced in to protect the watershed and pumping station. It is in the southeastern part of the grounds near a corner of the fence along the southern border, where it takes a turn to the north along the property owned by Mr. R. B. Coleman. The station is 142 feet from the south fence and 153 feet from the east fence. The station is marked by a limestone post 5½ by 5½ by 30 inches, showing 5 inches above ground and lettered U. S. C. & G. S., 1905. The location of the stone is known to Mr. I. C. Shreve, superintendent of waterworks. The following true bearings were determined in 1905:

	°	′	
Spire on Methodist Church (mark)	7	19.8	east of south
Upper eastern corner of standpipe	19	11.7	east of south

The following true bearing was determined in 1909:

Spire on high school	17	12.1	east of south

OREGON.

Eugene, Lane County.—As the station of 1906 was no longer suitable for magnetic observations, a new station was established on the eastern part of Skinners Butte, near the north side of the narrow flat top, being about 80 feet from the eastern brow of the butte. The station is marked by a marble post 5 by 5 by 18 inches. A similar stone post is 57.8 feet southwest of the station. Both stones are marked with a cross and the letters U. S. They were set as reference marks for the astronomical station. The following true bearings were determined:

	°	′	
Tall pine on distant ridge to north (mark)	11	56.6	west of north
Spire of Patterson School	35	32.5	east of south
Spire of Methodist Episcopal Church	2	52.8	west of south
Astronomical station (distant 60 feet)	60	01.4	east of south

Yam, Polk County.—The magnetic station is on the flat top of the west end of the knoll on which the triangulation station is located. It is 41.3 feet from the triangulation station. The latitude pier of 1908 stands about 15 feet northeast of triangulation station. The magnetic station is marked by a wooden stub with a screw in top to mark the point. The following true bearings were determined:

	°	′	
Tip of tall prominent pine tree on a ridge (mark)	19	56.8	west of south
Triangulation station	55	23.8	east of north
Dome of state capitol building in Salem	33	17.2	east of south

PENNSYLVANIA.

Meadville, Crawford County.—The station of 1902 was reoccupied. It is in St. Bridget's Catholic cemetery, in the prospective addition east of the older portion, being 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:

	°	′	
Allegheny College chapel tower (mark)	17	19.5	west of north
Presbyterian Church spire	18	03.3	west of north
Tower on Hulings Hall of Allegheny College	18	46.5	west of north

Observations were also made at a second station (A) 25 paces distant and on line to the central spire on Allegheny College chapel tower.

Descriptions of stations—Continued.

PORTO RICO.

Mayaguez.—The station of 1907 was reoccupied. It is in the center of the open space in front of the Roosevelt School (formerly the United States military hospital). It is about 100 feet from the northwest corner of the wire fence in front of the school, about 63 feet from the corner of the board fence on the north, and about 70 feet from the northeast corner of the shack directly in front of the school building. The station is marked by a pine stake. The following true bearings were determined in 1907:

	°	′	
Nearest edge of chimney on sugar mill (mark)	55	33.8	west of north
Southwest tangent to United States barracks	15	35.9	west of north
Southwest tangent to Roosevelt School	31	26.7	east of south

As the old station is no longer suitable for magnetic observations a new station was occupied at Algorrobo Point, about 2 miles north of Mayaguez on a nearly level plateau about 30 feet in elevation. This plateau is surrounded on the north and east sides by a grove of cocoanuts and on the other two sides by Mayaguez Bay. On the extreme end of Algorrobo Point, about 50 feet from the plateau and separated from it by a narrow gorge through which a road passes, is a large rock of volcanic origin of nearly equal elevation with the plateau. The magnetic station is near the southeast corner of the plateau, 5 feet south from a small mango tree and about 10 feet from the edge of the cliff. It is marked by a square cement block, projecting about 5 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
West end of iron pier, Mayaguez	37	19.6	east of south
Rear range light, Mayaguez	42	35.9	east of south

Mona Island.—A station was established on the extreme west cape of Mona Island. It is on a sandy point about 75 feet from the outer line of vegetation and about 150 feet from the nearest point of the shore line to the westward. It is on an open space on the point and gives a clear view of the ocean between south southwest and north through the westward. The cape is a dividing point between Sardinero anchorage on the north and Isabela anchorage on the south. The station is marked by a stone, projecting about 8 inches above ground and lettered U. S. The following true bearings were determined:

	°	′	
Extreme east tangent, Monita Island (mark)	1	9.8	west of north
Extreme west tangent, Monita Island	4	31.8	west of north
West tangent of northwest cliff, Mona Island	19	23.2	east of north
East tangent, upper cliff, Monita Island	1	29.8	west of north

Porto Rico Magnetic Observatory, Vieques Island.—Since April, 1907, the observatory has been in operation at the new site, about five-eighths of a mile west of old Fort Isabel, the former location. The buildings comprise an absolute observatory, variation observatory, seismograph house, and an office.

San Juan South Base.—Observations were made 50 feet from the South Base triangulation station, in the direction of Morro Light-house, within a few feet of the point occupied in 1904 and 1908. The station is marked by a cement stone with a drill hole in its center. This stone projects 4 or 5 inches above ground and is lettered U. S. C. & G. S., 1909. The following true bearing was determined from triangulation:

	°	′	
Morro light-house	37	09.4	east of north

SOUTH CAROLINA.

McCormick, Abbeville County.—The station is on the grounds of the public school. It is 112.2 feet northeast from the east corner of the schoolhouse, 11 feet east from a large white oak, 11.2 feet northwest from a medium-sized red oak, 10 feet north from a medium-sized poplar, and 76.8 feet from

Descriptions of stations—Continued.

SOUTH CAROLINA—Continued.

the fence on the opposite side of the highway. The station is marked by a hole in an old brick buried with the top 3 inches below ground. The following true bearings were determined:

	°	′	
East edge of large chimney on Mrs. Carrol's residence (mark)	37	09.4	east of south
Spire of Methodist Church	17	32.6	east of south
Spire of public school	72	34.8	west of south

TENNESSEE.

Alamo, Crockett County.—The station is in the northeastern portion of the ground surrounding the Campbellite Church, about 1 000 feet west of the town's center. It is 198 feet northeast from the northeast corner of the Campbellite Church and 84 feet from the east fence of the church grounds. The station is marked by a limestone post 6 by 6 by 33 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Corner at center of top of Methodist Church steeple (mark)	48	33.6	east of north
Rod at southwest corner of frieze at top of court-house cupola	63	48.6	east of north
Lower southeast corner of Campbellite Church on the cement	43	48.6	west of south

Ashland City, Cheatham County.—The station is in the western part of a field northwest from the northwest corner of the school grounds and about one-quarter of a mile a little east of north of the town's center. It is 98 feet from the fence bordering the field on the northwest and 244.5 feet northeast from the northwest corner of a fence of a field immediately west of the ground around a house owned by John Duke. The station is marked by a Bedford limestone post 6 by 6 by 30 inches projecting about 6 inches above ground and lettered U. S. C. & G. S., 1909. A cross in the center of a field stone 384 feet to the north marks the northern end of a meridian line. This stone is 4 by 9 by 28 inches and projects 5 inches above the ground. The following true bearings were determined:

	°	′	
Steeple of Methodist Episcopal Church South (mark)	12	31.5	west of south
Northwestern edge of top piece on north roof of schoolhouse	4	54.2	east of south
Point at north end of gable roof on court-house	27	43.8	west of south

Bolivar, Hardeman County.—The station is on the grounds of St. Catherine's Episcopal School, about one-quarter of a mile southwest of the town's center, and about 300 feet south of the main school building. It is 52 feet south of the fence to the south of the school buildings and 190 feet southwest from the southeast corner of this fence. The station is marked by a limestone post 6 by 6 by 31 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Lower northeast corner of primary school (mark)	19	32.4	west of north
Upper northeast corner of main school building under roof	25	26.0	west of north
Upper eastern edge of water tank on western school building	48	06.1	west of north

Camden, Benton County.—The station is in the western part of a pasture belonging to Mr. W. L. Morris, about one-half mile a little east of north of the town's center. This pasture is immediately east of Mr. Morris's house and barn. The station is 145.7 feet east of the northeast corner of the fence surrounding the barn and 46.6 feet southeast of the center of the trunk of a lone cedar tree. It is marked by a Bedford limestone post 6 by 6 by 33 inches, projecting about 9 inches above ground and lettered U. S. C. & G. S., 1909. Three hundred and seventy-five feet due north is a marble post 6 inches square at the top, projecting about 3 inches above ground. A hole in the top of the stone marks the north end of the meridian line. The following true bearings were determined:

	°	′	
Point of east gable of Arthur Bain's house (mark)	28	06.0	west of north
Base of rod on tower of Methodist Church	32	06.3	west of south

Descriptions of stations—Continued.

TENNESSEE—Continued.

Centerville, Hickman County.—The station is in the northeastern corner of the ground surrounding the high school, about one-quarter of a mile northeast of the town's center and about 310 feet a little east of north of the high school building. It is 54.3 feet from the fence bounding this ground on the east and 92 feet from the fence on the north. The station is marked by a limestone post 6 by 6 by 33 inches, projecting about 5 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
East cupola on jail (mark)	25	38.8	west of south
West cupola on jail	26	17.0	west of south
East gable of Primitive Baptist Church	2	46.0	west of south

Clarksville, Montgomery County.—The station is in the northwestern part of the grounds of the Southwestern Presbyterian University, about 20 feet southwest of the southwest corner of the football field and about one-half mile northeast of the center of town. It is 68.3 feet from the fence on the west boundary of the university grounds and 30 feet southwest from the center of a lone poplar tree at the southwest corner of the football field. The station is marked by a Bedford limestone post 4 by 7 by 30 inches, projecting about 10 inches above the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Base of cross on steeple of Episcopal Church (mark)	22	18.7	west of south
Top of belfry on south side of Stewart Hall	24	02.1	east of south
South edge at top of a smokestack on a factory	60	17.3	east of north
Rod on court-house cupola	22	41.8	west of south

Columbia, Maury County.—The station of 1881 could not be reoccupied and a new magnetic station was established on the grounds of the Athenæum High School. The magnetic station is distant 5.6 feet from the south stone of a meridian line and the two stations are in line with a rosette on the gable of Mr. McLemore's residence. The south meridian stone is 135.2 feet southwest from the southwest corner of Athenæum building and 48.6 feet west of a driveway to the east. The stone is marked U. S., and projects 3 inches above ground. An octagonal marble post 7¼ inches in diameter, with a 1¼-inch brass bolt in the top, distant 417.7 feet from the south stone, marks the north end of the meridian line. It is near the southwest corner of the rectory. The following true bearings from the magnetic station were determined:

	°	′	
Rib of window of automobile shed of rectory (mark)	7	48.1	west of north
Rosette on gable of Mr. McLemore's residence	84	01.0	west of south
Southwest corner of Athenæum building	21	28.9	east of north
East edge of top of cupola on Christian Church	69	09.0	east of north

Decaturville, Decatur County.—The station is in the southwestern corner of the ground surrounding the Decatur College, about 1 200 feet southeast of the town's center. It is 39.9 feet east of the fence which bounds this ground on the southwest and 31.4 feet from the fence on the south. The station is marked by a limestone post 6 by 6 by 33 inches, projecting about 9 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Upper northeast corner of jail (mark)	25	14.1	west of north
Steeple of Baptist Church	58	43.7	west of north
Top of tallest monument in cemetery	24	49.1	west of north

Two hundred and thirty-four feet to the north a cement post, 5 by 6 by 35 inches, projecting about 8 inches above ground, marks the north end of a meridian line. This post is 14.8 feet south of the north boundary.

Dresden, Weakley County.—The station is in the southeastern part of the oval within the race track at the county fair grounds, about 1½ miles west of the town's center. It is 108 feet west of a lone cedar

Descriptions of stations—Continued.

TENNESSEE—Continued.

tree just inside the race track, 150 feet a little south of west from a red marking post on the inner edge of the race track, and 174 feet east of the southeast corner of a fence around the judges' stand. The station is marked by a Bedford limestone post 6 by 6 by 34 inches, projecting 8 inches above ground and lettered U. S. C. & G. S., 1909. A cross in the top of a limestone post 4 by 4 by 30 inches, projecting 5 inches above ground, set 258 feet to the north, marks the north end of the meridian line. The following true bearing was determined:

	°	′	
Spire of cupola on John Thomoson's house (mark)	40	31.6	east of south

Dyersburg, Dyer County.—The station is in the eastern part of a pasture (which is an old burying ground) belonging to Mr. John M. Nichols, about three-quarters of a mile northwest of the town's center. This pasture is the second inclosed field north of the ground surrounding Mr. Nichols's house. The station is 100 feet from the east fence of the pasture and 103 feet east of a small gum tree, almost entirely hidden by vines, which hold up a fragment of an old gate. It is also about 60 feet south of a gulley about 15 feet deep. This station is marked by a limestone post 6 by 6 by 33 inches, projecting 8 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Center of top of steeple of Methodist Church (mark)	10	25.6	east of south
Upper western corner on cupola of John M. Nichols's house	25	38.0	west of south
Point of most eastern gable on roof of Mr. Pewitt's house	38	57.5	west of north

Erin, Houston County.—The station is in the southwestern corner of a pasture belonging to Mr. J. W. Bratschi, north of the Erin High School and about one-fourth mile west of the center of town. It is 77.8 feet from the fence on the west boundary of the pasture and 68.5 feet from the fence on the south boundary. The station is marked by a Bedford limestone post 5 by 7 by 30 inches, projecting about 8 inches above the ground and lettered U. S. C. & G. S., 1908. A hole in the top of a second stone set 332.3 feet north of the magnetic station marks the north end of a meridian line. The following true bearings were determined:

	°	′	
Steeple of Cumberland Presbyterian Church (mark)	76	00.9	east of north
Court-house cupola (rod)	77	52.8	east of north
Top of cupola of V. R. Harris's house	87	14.3	east of south

Henderson, Chester County.—The station is in the southwestern corner of a piece of ground belonging to J. D. Johnson. It is near the northeast corner of Depot and Hamlet streets and about one-half mile southeast of the town's center. It is 121.1 feet from the fence on the south side of Depot street and 199 feet from the fence on the west side of Hamlet street. 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:

	°	′	
Cupola on old Georgia Robinson Normal College (mark)	65	49.7	west of north
East gable of a small house	4	21.6	west of north
East gable of the Haggard House	50	48.0	west of south

Hohenwald, Lewis County.—The station is in the northern corner of the triangular piece of ground surrounding the high school, about 1 200 feet northwest of the town's center. It is 145.3 feet from the boundary fence to the northwest, 82.6 feet from the boundary fence to the northeast, and 225.8 feet a little east of north from the northeast corner of the high school building. The station is marked by a limestone post 6 by 6 by 32 inches, projecting about 6 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Top point of ornamental triangle on front roof of Crude & Loveless Building (mark)	17	52.6	east of south
West gable of E. N. Henson's house	28	36.2	east of south
Southeast corner post of small fence on the roof of house belonging to superintendent of high school	46	05.6	west of south

Descriptions of stations—Continued.

TENNESSEE—Continued.

Huntington, Carroll County.—The station of 1905 was reoccupied. It is situated in the front campus of the Southern Normal University. It is 219.6 feet from the southeast corner of the main building, 187.8 feet from the southwest corner of the same, 63.1 feet from the main walk, and 110.9 feet from the southeast corner of the fence surrounding President J. A. Baber's dwelling. The station was marked by an oak stake, driven flush with the ground, with a tack indicating the exact spot. The following true bearings were determined in 1905:

	°	′	
Tower of J. B. Sander's house (mark)	52	15.6	east of north
Upper southeast corner of Mr. Norton's house	9	38.0	east of south
Tower of G. A. Baber's house	56	45.0	west of north
Tower of B. Woodward's house	71	02.1	west of north
Tower of Miss Mollie Grizzard's house	52	40.0	west of south

This station is now marked by a Bedford limestone post 6 by 6 by 33 inches, projecting about 3 inches above ground and lettered U. S. C. & G. S., 1909.

Jackson, Madison County.—The station of 1881 was not available, and a new station was established in the eastern part of the county fair grounds, which forms part of the city park, 1 mile southeast of the town's center and about one-quarter of a mile east of the electric railroad power station. It is 34.3 feet east of the eastern part of the fence around the outside of the race track, 274.8 feet southwest of the southwest corner of the row of horse stalls in the northeast corner of the grounds, and about 39 feet west of the bank of a small stream. The station is marked by a limestone post 6 by 6 by 30 inches, projecting about 5 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Ball at top of Mobile and Ohio Railroad water tank (mark)	6	19.4	west of north
Top of ornamental arch over east door of power station	77	02.4	west of north
Base of flagstaff on judges' stand	85	58.7	west of south

Lexington, Henderson County.—The station is in the southeastern corner of a piece of unclaimed land called "The Bone Yard." It is about 300 feet southeast of the cotton gin, and about one-quarter of a mile southeast of the town's center. It is 283 feet from the fence on the south and 128 feet from the southwest corner of the next field to the northeast. 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:

	°	′	
Spire on Mallalieu Methodist Episcopal Church (mark)	52	36.8	west of south
Cupola on Thomas Edward's house	48	34.6	west of south
Upper northeast corner of jail	78	05.1	west of south
Tower of Baptist Church	53	33.1	west of south

About 500 feet to the north a hole in the top of a cement block, 8 by 8 by 24 inches, projecting about 1 inch above ground, marks the north end of a meridian line. This stone is 12 feet south of the north boundary.

Linden, Perry County.—The station is on Capt. W. C. Webb's farm, about three-quarters of a mile southwest of the town's center and about 160 feet east of Captain Webb's house. It is 67.6 feet from the fence to the east and 92.6 feet east from the north post on Captain Webb's front gate, and 113.2 feet southeast from the northeast corner of the fence surrounding Captain Webb's house. 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:

	°	′	
West gable of Mon Dodson's house (mark)	84	29.9	east of north
West gable of Mrs. Eureka Starbuck's house	72	46.4	east of south
North gable of William Yand's house	80	12.8	east of north

The north end of the meridian line is marked by a hole in top of a slate rock about 4 by 8 by 35 inches, projecting about 9 inches above ground, and about 351 feet to the north.

Descriptions of stations—Continued.

TENNESSEE—Continued.

Nashville, Davidson County.—The station of 1905 was reoccupied. It is in the Mount Olivet Cemetery, about 3 miles from the center of the city, and is in the southwestern portion of the laid-out part, 61 feet from the monument marked "Wade," 89.7 feet from one marked "Collins," and 96.8 feet from a large white-oak tree across the driveway. The station is marked by a Bedford limestone post 5 by 8 by 30 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1905:

	° ′	
Cupola on Charles Cole's dwelling (mark)	4 46.8	east of south
Dome of Capitol	64 08.4	west of north
Compton Obelisk	76 55.4	east of north
Bart W. Hooper Obelisk	73 44.6	east of south

Paris, Henry County.—The station is in the southeastern corner of a pasture belonging to Mr. R. Looney, about 400 feet southeast of the cotton gin, about 400 feet northwest of the public school, and about one-half mile a little north of west of the center of town. It is 38 feet southwest from the fence bounding the pasture on the northeast, 87.1 feet from the fence on the southeast, and 6.3 feet northeast from the natural center of the wood rings of a large tree stump about 2.2 feet in diameter. It is marked by a Bedford limestone post 6 by 7 by 30 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1908. A second stone was set about 300 feet south of the magnetic station to mark the true meridian. The following true bearings were determined:

	° ′	
North point of cupola of Louisville and Nashville Railroad station (mark)	53 26.0	west of south
Rod on steeple of Methodist Episcopal Church, West Parish	28 53.2	west of south
Rod at top of Louisville and Nashville Railroad water tank	73 06.4	west of south

Roan Mountain, Carter County.—The station is located on the south bank of the Doe River. It is in a vacant lot belonging to Mr. Maher, about 8.9 feet from the edge of the river bank, and about 114.5 feet north and at right angles to the north fence of the residence of Mr. James Julian. It is also about 50.2 feet east of the northwest corner of Mr. Julian's lot. The station is marked by a hole in a brick buried upright, with its top about 2 inches below the ground and surrounded on the top by a small quantity of crushed brick. The following true bearings were determined:

	° ′	
East gable on residence of Mr. William Smith (mark)	62 07.3	west of north
Rib on window under gable of residence of Mr. Nathan Allen	8 07.8	west of north
Spire on Baptist Church	47 02.9	west of south

Savannah, Hardin County.—The station is in the northern part of the ground surrounding the Savannah Institute or high school, about one-half of a mile northeast of the town's center. It is 90.3 feet from the fence on the north; 180.2 feet northeast of the northeast corner of the institute building, and 210.5 feet from the fence on the east. 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:

	° ′	
North gable of A. A. Watson's house (mark)	36 28.6	east of south
East gable of institute building	21 16.2	west of south
West gable of Dr. F. C. Williams' house	70 39.5	east of south

The south end of the meridian line is about 222 feet to the south and is marked by a hole in the top of a limestone post 5 by 7 by 42 inches, projecting 14.5 inches above ground.

Selmer, McNairy County.—The station is in the southern corner of the ground surrounding the high school and about one-quarter of a mile north of the county court-house. It is 101.7 feet northwest of the fence across the road running along the southeast side of this ground, and 199.7 feet a little west of south from the southwest corner of the school building. The station is marked by a limestone post

Descriptions of stations—Continued.

TENNESSEE—Continued.

6 by 6 by 32 inches, projecting about 4 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Northwest gable of court-house (mark)	6	57.0	west of south
Lower northeast corner of jail	10	47.9	west of south
Northeast gable of Clem Lee's house	68	08.6	west of north

The north end of the meridian line is about 206.7 feet to the north and is marked by a hole in the top of a rough field stone 4 by 16 by 36 inches, projecting about 9 inches above ground.

Somerville, Fayette County.—The station is at the northern end of Main street, about one-half a mile north of the court-house. It is on ground which was formerly the picnic or fair grounds, and is between a deep gulley to the south and a railroad cut of the Nashville, Chattanooga and St. Louis Railroad. The station is 224 feet northeast of the northwest corner of the negro clubhouse, and 163 feet northeast from the center of the trunk of a large oak tree, about 63 feet east of this clubhouse. It is marked by a limestone post 6 by 8 by 34 inches, projecting about 9 inches above ground and lettered U. S. C. & G. S., 1909. A hole in a limestone post of the same size projecting 6 inches above ground, which is in Main street, about 500 feet south, marks the south end of a meridian line. The following true bearings were determined:

	°	′	
Base of rod on belfry of colored Baptist Church (mark)	9	54.0	east of south
Head of figure of Justice on court-house	0	57.5	west of south
Rod on water tank	13	34.0	east of south
Spire on Methodist Church	5	26.4	east of south

Tiptonville, Lake County.—The station is in the southwestern part of a field belonging to Mr. R. C. Donaldson, and about one-half mile northwest of the town's center. This field is at the southwest corner of Lake and Cedar streets. The station is 52 feet from the south fence and 97.6 feet from the west fence of this field. It is marked by a limestone post 6 by 6 by 33 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1909. A nail in the top of a cypress stake about 4 inches in diameter projecting 10 inches above ground and 200 feet to the north marks the north end of a meridian line. It is expected that the county officials will replace this stake with a stone. The following true bearings were determined:

	°	′	
Rod on steeple of colored Baptist Church (mark)	75	30.9	east of north
Point on steeple of Presbyterian Church	4	32.5	east of south
Base of rod on steeple of Baptist Church	23	52.5	west of south

Trenton, Gibson County.—The station is in the western part of the oval within the race track at the county fair grounds, about three-quarters of a mile east of the town's center. It is 184 feet northeast of the northeast corner of a yellow exhibition building on the north side of the track for riding horses, 164 feet southeast from the southeast corner of an inclosed field or pasture which cuts into the northwestern part of the fair grounds, and 141 feet east of the center of the trunk of a tree about 1½ feet in diameter. The station is marked by a limestone post 6 by 6 by 33 inches, projecting about 8 inches above the ground, and lettered U. S. C. & G. S., 1909. An oak stake 2 inches in diameter and 2½ feet long was set 390 feet to the south, and projects about 5 inches above ground. A nail in the top of this stake marks the south end of a meridian line. It is expected that the county officials will replace this stake with a stone. The following true bearings were determined:

	°	′	
Base of spire of Presbyterian Church (mark)	87	45.8	west of north
Spire on Methodist Church	85	58.5	west of south
Top ball on steeple of Baptist Church	86	15.8	west of north
Spire on cupola of court-house	65	12.4	west of north

Union City, Obion County.—The station is in the western part of the oval within the race track at the county fair grounds, about three-quarters of a mile southwest of the town's center. The mag-

Descriptions of stations—Continued.

TENNESSEE—Continued.

netic station is 76.6 feet northeast of the fence inside of the race track. It is marked by a limestone post 6 by 6 by 34 inches, projecting 9 inches above ground and lettered U. S. C. & G. S., 1909. Four hundred and eighty feet due north is a limestone post 3½ by 8½ by 42 inches, projecting 14 inches above ground, which marks the north end of the meridian line. This stone is 23.6 feet south of the fence on the inside of the race track and 246.6 feet northwest from the southwest corner of the judges' stand. The following true bearings were determined:

	°	′	
Spire on steeple of Cumberland Presbyterian Church (mark)	42	49.3	east of north
Northwest point on gable of stable marked Union City	64	09.8	east of north
Point at top of roof of band stand	19	04.5	east of north

Waverly, Humphreys County.—The station is to the west of the race track in the county fair grounds, about one-half mile east of the town's center. It is on the outer edge of the track, 53.5 feet west of the fence inside of the track, and 210 feet a little west of south from the southeast corner of the stable in the northwest corner of the grounds. The station is marked by a Bedford limestone post 6 by 6 by 32 inches, projecting 4 inches above ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined:

	°	′	
Flagstaff on cupola of court-house (mark)	88	51.4	west of south
Southern gable of house painted light green with red roof	88	46.4	west of south
Base of flagstaff on judges' stand	84	25.6	east of north

Waynesboro, Wayne County.—The station is in a field owned by Dr. C. Buchanan at the southwest corner of the intersection of the road across the north side of the county court-house and Green River. It is about 1 200 feet east of the county court-house, 249 feet south of the north fence, 288 feet southwest of the fence along Green River, and about 14 feet west of the bank of a small branch stream. 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:

	°	′	
Steeple on Baptist Church (mark)	87	25.4	west of south
County court-house cupola	79	04.2	west of north
East gable of jail	82	02.0	west of south

TEXAS.

Isabel, Cameron County.—The station of 1905 (Fronton) could not be found, and a new station was established as near the old one as possible. This new station is marked by a wooden stake embedded in a rough mass of concrete about 4 inches underground. This station is about 17 paces from the shore line at the foot of the slope of the ridge, and about 130 feet east of the triangulation station Fronton, which is on the same ridge with and about 100 yards north of the light-house. The latter station is in the yard of Mrs. Wren, 10.9 feet from the southwest corner of the porch and 21.6 feet from the southwest corner of the yard fence, and is marked by a tile and concrete station mark. The following true bearings from the magnetic station were determined:

	°	′	
West edge of Champion's store (mark)	15	59.3	west of south
Isabel light-house spire	47	35.7	west of south
Brazos light-house	80	07.7	east of south
North edge northwest chimney Jefferson Inn	38	42.8	east of north

VIRGINIA.

Bedford City, Bedford County.—The station of 1901 was reoccupied. A meridian line was established in 1901 on the grounds of the Randolph Macon Academy. It is marked by two limestone posts, 6 by 8 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S. N. M. and U S.

Descriptions of stations—Continued.

VIRGINIA—Continued.

C. & G. S. S. M., respectively. The south stone is at the foot of the walk leading to the main entrance of the school building and the north stone is about 600 feet distant, near the baseball grounds. Observations were made over the south stone. The following true bearings were determined:

	°	′	
Steeple of Episcopal Church	71	23.5	east of south
Flagstaff on Academy building	25	13.1	east of north
North meridian stone	0	00.1	west of north

As there was evidence of local disturbance in this locality a new station was established in the southeastern part of the property belonging to the Elks' National Home, about 700 feet south of the building, and about 1 mile northwest of the center of town. It is 173.7 feet northeast from the fence on the north side of the Norfolk and Western Railroad tracks, measured at right angles to the fence, and 3.6 feet east of the east edge of an old walk with wooden borders which runs northeast and southwest from the eastern side of the circular iron fence around the Elks' Home building. It is also about 30 feet west of the bottom of a bank about 8 feet high. The station is marked by the stone which marked the north end of the old meridian line, which was removed from its former location. This stone projects about 8 inches above the ground. The following true bearings were determined:

	°	′	
Base of flagstaff on most eastern tower of Elks' Home (mark)	14	26.0	east of north
Highest point of Peak of Otter to the northwest	30	49.6	west of north
Cupola on Cooperative Female Seminary	14	09.5	east of south

A post made of cement, and about 8 by 8 by 30 inches, was set about 600 feet to the north to mark the north end of the meridian line established at the new location. The stone was lettered U. S. C. & G. S., and projects about 8 inches above the ground. It is on the lawn immediately south of the Elks' National Home building, about halfway between this building and the circular iron fence.

WASHINGTON.

Bahada, Clallum County.—The station is on the grounds of the Indian agency at Bahada (Baaddah), on the point at the east side of Neah Bay. It is between the residence of the superintendent and the resident physician's house, and 39 feet from the edge of the bluff to the west. It is marked by a bottle, mouth up, buried about 2 feet. Above this and about 6 inches below ground is a rough flat stone having a drill hole in top to mark the station. The following true bearings were determined:

	°	′	
Wrecking mast at United States life-saving station on Waaddah Island (mark)	30	11.0	west of north
Southwest corner of superintendent's building	19	35.8	west of north
Weather vane of signal tower of United States Weather Bureau	39	11.9	east of north
Northeast corner of resident physician's building	4	55.8	west of south

Kala, Jefferson County.—The station of 1904 could not be recovered. The station occupied in 1908 is identical with the reference mark placed at $Kala_2$ triangulation station. It is on the north shore of the sand spit Kala Point, locally known as "Coon Spit" on the west side of Port Townsend Bay, just north of Irondale. The station is about midway between the east end of the spit and the main shore line, about 25 paces south of high-water mark. The triangulation station has no surface mark. The magnetic station (reference mark) is marked by a 6 by 26 inch sewer tile projecting 4 inches above the ground, the upper part being filled with concrete and bearing an inverted nail to mark the exact point. The following true bearings were determined:

	°	′	
Spire on court-house in Port Townsend (mark)	1	36.2	east of north
Spire of public school in Port Townsend	0	34.4	east of north
Scowalan triangulation station	43	07.3	east of north
Kala triangulation station	67	23.2	east of north

Descriptions of stations—Continued.

WASHINGTON—Continued.

Seattle, King County.—The station of 1903 was reoccupied. It is in the grounds of the state university, about 600 feet north of the administration building, 315 feet from the southwest corner of the gymnasium, and 20 feet west of the path between the administration building and the gymnasium. The station is marked by a stone post 8 inches square, projecting 2 inches above the ground, and lettered U. S. C. & G. S., 1903. The following true bearing was determined in 1905:

	°	′	
East corner of administration building (mark)	23	08.9	west of south

WEST VIRGINIA.

New Martinsville, Wetzel County.—The station is in the field of Mr. Walker, by the Walker cemetery, about five-eighths of a mile to the south from the court-house. It is 34 feet south from the present south line of the cemetery lots, and 2 feet west from the west line of the lots. It is 48.4 feet from the southwest corner of the base of a red granite monument erected to Martha J. Grimm. The station is marked by a blue marble post 6 by 6 by 30 inches, projecting 4 inches above the ground, and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Court-house tower (mark)	32	55.5	west of north
Tower of Methodist Episcopal Church	24	24.9	west of north
Tower of Magnolia High School	21	02.6	west of north
Gable end of farmhouse (1 mile)	78	44.9	east of north.

Parkersburg, Wood County.—The station of 1898 was reoccupied. Observations were made over the north monument of the meridian line at Parkersburg. This north meridian monument is in the city park, formerly the old county fair grounds. It is located in a clump of trees northeast of the old grand stand. The south meridian monument is 697 feet due south of the north monument, and is also in the city park, near the superintendent's house. These monuments are very heavy Cleveland sandstone posts, sunk with their tops extending a few inches out of the ground. The centers of copper disks set in the centers of the tops of these monuments mark the two ends of this meridian line. Mr. J. S. A. Farrar, city engineer, knows the exact location of these monuments.

St. Marys, Pleasants County.—The station is on a hillside in Mr. Zack Riggs's pasture. It is slightly east of south from the overhead bridge which crosses the Baltimore and Ohio Railroad just south of the city, and is about 450 yards from the bridge. It is on a bench of the hillside and is sheltered on the south by an abrupt rise of the hill. This bench overlooks the city from the southwest. The station is exactly in line with the weather vane on the front tower and the flag pole on the rear tower of the brick public-school building. A private road runs up the hill about 10 feet south from the station. The station is marked by a blue marble post 6 by 6 by 30 inches, projecting about 4 inches above the ground, and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Weather vane on front tower of St. Mary's public school (mark)	38	31.6	east of north
Tall church spire at Newport, Ohio	67	30.9	west of north

WISCONSIN.

Antigo, Langlade County.—The station is on the fair grounds. It is 42 feet northeast from an old stump about 2 feet in diameter, and 48.5 feet northeast from the north end of the fence on the inside of the race track in front of the grand stand, and 99.6 feet east of the fence along the outside (west side) of the race track. The station is marked by a Bedford limestone post 6 by 8 by 18 inches, sunk flush with the surface of the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Methodist Church spire (mark)	23	52.2	west of south
Spire of German Catholic Church	45	53.6	west of south
Spire of Polish Catholic Church	2	57.3	west of south

Descriptions of stations—Continued.

WISCONSIN—Continued.

Appleton, Outagamie County.—The station is in the grounds inclosed by the race track at the fair grounds. It is almost on a line west of the center of College avenue. The station is 73.4 feet north and slightly east of the north one of two hickory trees within the inclosure, and 185 feet west from the inside fence of the race track. The station is marked by a white marble post 4 by 6 by 24 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Cupola on house south of station (mark)	6	24.3	west of south
Cupola on barn, fair grounds	47	57.8	east of south
Flag pole on band stand	26	01.6	east of north
Flag pole on judges' stand	20	48.7	east of north

Black River Falls, Jackson County.—The station is on the county farm, in front of the main building, 92.1 feet from the northwest corner in a northerly direction, 49 feet from center of driveway leading to front door and 82.8 feet from a pine tree at the branching of the driveways. The station is marked by a concrete block, 8 by 12 inches on top, set flush with the ground. The following true bearings were determined:

	°	′	
City standpipe (westernmost point of red top)	2	11.7	east of north
Cupola of Pleasant Valley School	60	47.4	east of south
West point of chimney on south gable of yellow house	13	27.2	east of north

Chilton, Calumet County.—The station is in the fair grounds southwest of town, in the open space west of the entrance between the race track and sheds. It is 105.4 feet south of the stall numbered 6 in the sheds, 97.7 feet north from the outside race-track fence, and 203.5 feet west from a corner of the fence around the fair grounds. This corner is about 125 feet west of the entrance to the grounds. The station is marked by a small bowlder sunk 2 inches below the surface of the ground, and having a small hole drilled in the top. The following true bearings were determined:

	°	′	
Base of flag pole on judges' stand (mark)	15	24.3	west of south
Base of flag pole on north end of grand stand	21	28.5	west of south
Base of flag pole on exhibition building	63	36.3	west of south

Crandon, Forest County.—The station is in the court-house grounds, south of the court-house. It is 101.2 feet from the southwest corner and 114.5 feet from the southeast corner of the court-house, also 81.4 feet east of the northeast corner of the sheriff's barn. The station is marked by a Bedford limestone post 6 by 8 by 20 inches, lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Schoolhouse flag pole (mark)	62	06.7	east of north
Flag pole on drug store	37	42.4	west of north
Church spire	78	07.0	west of north

Darlington, Lafayette County.—The station is in the fair grounds, just inside of the entrance. It is 75 feet to the northeast corner of a small house near the entrance, and 70 feet north from the nearest point in the fence along the river. It is also about 35 feet from the corner posts of the small park. The station is marked by a small rough limestone sunk 2 inches below the surface of the ground, with a small hole drilled in the center. The following true bearings were determined:

	°	′	
Flag pole of grand stand	54	19.4	east of north
Flag pole of judges' stand	61	27.7	east of north
Flag pole on floral hall	68	14.4	east of north

Eagle River, Vilas County.—The station is in the northwest corner of the school grounds, in the east part of town. It is 109.5 feet northwest from the northwest corner of the school building, 19 feet

Descriptions of stations—Continued.

WISCONSIN—Continued.

from the fence along the north side of the grounds, and 27 feet from the west fence. The station is marked by a cement block sunk 1 inch below the surface of the ground The following true bearings were determined:

	°	′	
Court-house flag pole (mark)	37	58.0	west of north
Spire of church	46	43.4	west of south
Spire of church	3	39.8	west of south

Eau Claire, Eau Claire County.—The station is on the grounds of the county insane asylum, south of the main building near the turn of the driveway. It is 226.2 feet to the east corner of the south wing of main building and 37.2 feet from a bush of the inner row of bushes along the driveway, the second from the west end of a line of bushes. The station is marked by a marble post 5 by 5 by 19 inches, sunk flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
East point of roof on front porch of main building	15	38.4	east of north
South edge of top of smokestack on paper mill	78	03.4	east of south
South spire of German Catholic Church	57	44.8	east of south

Florence, Florence County.—The station of 1905 was reoccupied. It is in the old Florence Cemetery, in the north and south driveway that leads to the entrance of the cemetery. The station is 45 feet from the small headstone of Clarence H. Morrison, 94.2 feet from the headstone marked Jennie E. N. Carlson, and 93.6 feet from the headstone marked Charles Schulte. The station is marked by a Bedford limestone post, 6 by 6 by 28 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1905:

	°	′	
High-school spire (mark)	85	54.4	west of north
Court-house pinnacle	76	17.6	west of south
Catholic Church spire	87	30.4	west of north

Green Bay, Brown County.—The station of 1891 was reoccupied as nearly as could be determined. It is in a park east of the city, south of "White Pine Grove." The station was not marked, as it was not suitable for future magnetic observations.

Green Lake, Green Lake County.—The station is on the public-school grounds and north of the school building. It is 96.7 feet from the northeast cornner and 100.2 feet from the northwest corner of the building, and 55.2 feet from the fence along the north side of the grounds. The station is marked by a small cement block sunk level with the ground and lettered U. S. The following true bearings were determined:

	°	′	
Right edge of chimney on house about 1 mile distant (mark)	28	02.6	east of south
Northwest corner of church	37	29.2	west of south
Flag pole on schoolhouse	3	02.6	west of south

Hudson, St. Croix County.—The station is on the old fair grounds, south of the River Falls road, and about a mile from the center of the city. The land is now owned by Mr. Morris Fulton. The station is 25.5 feet from the nearer edge of the race track, 205.2 feet from a wild cherry tree at the turn of the track near Fulton's house. The station is marked by a marble post 5 inches square, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
West gable of white house near windmill	5	55.0	west of north
Spire of white church in Lakeland	87	39.6	west of north
Easternmost point of chimney of Mr. Morris Fulton's house	30	28.3	west of north

Juneau, Dodge County.—The station is on the high-school grounds, 109.3 feet southwest of the southwest corner of the school building. It is 51.3 feet from the fence on the west side of the grounds

Descriptions of stations—Continued.

WISCONSIN—Continued.

and 71.5 feet from the fence along the south side. The station is marked by a rough limestone post about 5 by 5 by 20 inches, having a small hole in center of top, and sunk flush with the ground. The following true bearings were determined:

	°	′	
Iron pipe from jail at point where brace wires are attached (mark)	15	42.0	east of north
Tip of water tower	31	02.6	east of north
Center of church spire	16	29.3	east of south

Kewaunee, Kewaunee County.—The station is on the United States Life-Saving Service grounds, east of the life-saving station house, and about 35 feet from the shore of the lake. It is 62 feet from the southeast corner of the station house, and 84.5 feet south of the southeast corner of the day house. The station is marked by a limestone rock about 4 by 6 by 10 inches, sunk 4 inches below the sod, and has a small hole drilled in the center. The following true bearings were determined:

	°	′	
Tip of tower of Congregational Church (mark)	20	34.0	west of south
A weather vane in town	75	37.5	west of south
Right edge of iron smokestack at the Kewaunee Canning Factory	61	27.5	west of north

Lancaster, Grant County.—The station is in the fair grounds, about the middle and near the west side of the race-track inclosure. It is 93 feet from the inside race-track fence on the west, and 162 feet northwest from the northwest corner of the large square building used as an exhibition hall. The station is marked by a marble slab 3 by 9 by 18 inches, set flush with the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Court-house flag pole	65	42.6	west of south
North edge of water tower	65	34.2	west of north
Flag pole on fruit exhibit hall	40	16.8	east of south

Little Squaw Bay, Bayfield County.—Observations were made at a point about 2 miles southwest of Detour triangulation station of the United States Lake Survey, which is on Sand Point, Bayfield County, just south of Sand Island, on the south shore of Lake Superior, about 50 miles east of Duluth. The magnetic station is on the northeast side of a small stream and marsh, 160 feet from the mouth of the stream. Across the stream is an abandoned lumber camp of log houses. The spot is marked by a hole drilled in a large bowlder set flush with the ground. The mark is a cedar log 12 inches in diameter, projecting 4 feet above the ground. It is 16.9 feet from the station. A trench 8 feet in diameter was dug around the post and a mound of earth built around it. The following true bearing was determined:

	°	′	
Cedar log (mark)	30	53.3	west of south

Menomonie, Dunn County.—The station is on the grounds of the county insane asylum, in a field about 700 yards to the rear of the asylum buildings. This field is on the east side of a lane, and is entered near a bend of the lane near the sorghum house. The station is 286.8 feet from a jog in the west fence of the field, and 386 feet to a larger jog in the south fence. The station is marked by a marble post 5 by 5 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Flagstaff on cupola on main asylum building	6	50.5	west of south
Northern edge of city standpipe	44	40.1	west of south
Peak of tank on north end of barn of stock farm	84	04.2	east of north
Pole on reservoir hill (water signal)	10	19.6	east of south

Merrill, Lincoln County.—The station is on the fair grounds, 146 feet east of the fence along the west side and 100.5 feet north and a little west of the northwest corner of the west stable. The station

Descriptions of stations—Continued.

WISCONSIN—Continued.

is marked by a marble post 6 by 6 by 18 inches, sunk 1 inch below the surface of the ground, and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Flag pole on west end of sash and door factory (mark)	3	51.8	west of south
Flag pole on brewery	47	12.3	west of south
Flag pole on court-house	75	47.6	west of south
Steeple of Presbyterian Church	88	13.8	west of north

Milwaukee, Milwaukee County.—The station of 1902 was reoccupied. It is in Lake Park near North Point Light-house, 74.25 feet from stone at northwest corner of light-keeper's grounds, and 76.5 feet from the northwest corner of the light-keeper's tool house. The station was re-marked by a marble post 6 by 6 by 21 inches, lettered U. S. C. & G. S. The following true bearings were determined (in 1908):

	°	′	
Flag pole on street-car pavilion (mark)	00	14.2	east of north
Tower of Mr. Middleton's residence	21	03.2	west of north

Oconto, Oconto County.—The station is in the space inclosed by the race track at the fair grounds. It is 62.5 feet east and a little south of a large tree, the only large tree in the grounds. It is also 57.2 feet northeast of the northeast corner of a small shed or candy stand, and 222.2 feet west from the inside fence of the race track to the east. The station is marked by a cement block roughly lettered U. S. The following true bearings were determined:

	°	′	
Spire of Lutheran Church (mark)	33	21.2	west of south
Flag pole on Catholic clubhouse	2	35.2	west of south
Center of statue on court-house	1	08.9	east of south
Flag pole on exhibition hall	39	25.7	east of south

Oshkosh, Winnebago County.—The station is in North Park, within a few feet of the water's edge of Winnebago Lake. It is about 50 rods north of the park superintendent's house. It is 12.7 feet north of a station occupied by the United States Lake Survey (according to information furnished by park superintendent), which is marked by a small iron peg driven in a rock. The station is also 77 feet east of the east edge of a drive running north and south about 100 feet from the water's edge. It is also 67.5 feet south of a double elm tree which stands with others on a small piece of ground raised 3 or 4 feet above the surrounding level. The station is marked by a marble post 6 by 6 by 18 inches, sunk flush with the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Flag pole on yacht club house (mark)	13	06.7	west of south
Tall flag pole on grounds of yacht club	10	41.5	west of south
Windmill about 1 mile across the bay	2	51.8	east of north

Portage, Columbia County.—The station is on the east side of Hamilton street, about 600 yards beyond the tracks of the Chicago, Milwaukee and St. Paul Railroad. The ground on which the station is located is known as Schulze's pasture, and also as the golf grounds. The station is 80.2 feet from the southeast fence corner of a plot of land around an abandoned house, the line being very nearly a continuation of the fence separating the house lot from Schulze's pasture. The station is marked by a limestone post 6 by 6 by 20 inches, sunk flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Cupola, Lincoln School	13	30.0	west of south
Methodist Church spire	27	59.0	west of south
Weather vane on fire-engine house	32	24.4	west of south
Flagstaff on high school	47	35.6	west of south
Center of chimney on yellow house	55	39.1	east of north

Descriptions of stations—Continued.

WISCONSIN—Continued.

Port Washington, Ozaukee County.—The station is in the baseball grounds owned by Mr. John Kaiser, in the northwest part of the town. It is in the southwest corner of the grounds, 48.5 feet from the west fence and 90 feet from the south fence. The station is marked by a white marble post 6 by 6 by 19 inches, set 1 inch below the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Spire of Lutheran Church (mark)	51	34.4	east of south
Spire of Catholic Church	61	58.8	east of south
Flag pole on Miller Brewery Company's malt house	33	13.1	west of south

Somers, Kenosha County.—The magnetic station is in the horse lot to the north of Somers triangulation station of the United States Lake Survey. The latter bears S. 18° 32′.8 E. from the magnetic station. The triangulation station is in the southeast quarter of the northeast quarter, section 22, Somers Township, Kenosha County. It is 1½ miles south and 1½ miles east of the village called Somers, and on the property of John Solentine, about 360 feet east of the Chicago-Milwaukee country road, and 8.5 feet from the northeast corner of the implement house to the east of Mr. Solentine's large barn. It is marked by a stone set 2 feet below the surface of the ground.

The magnetic station is marked by a drill hole in a stone placed 2½ feet below the surface of the ground. Mark No. 1 is a dressed stone 203.9 feet away in the northeast corner of the lot in which the magnetic station is located. The mark projects 4 inches above the ground. Mark No. 2 is a similar stone set flush with the ground 329.5 feet away, in a roadway under a gate at the southeast corner of the same lot. The following true bearings were determined:

	°	′	
Mark No. 1	66	16.3	east of north
Mark No. 2	34	19.5	east of south
North gable of barn	4	26.7	east of south
Cupola of red barn (1 000 feet)	40	53.8	west of north
Cupola of red barn (4 600 feet)	50	18.5	east of north
Cupola of red barn (2 300 feet)	32	09.6	east of north

Stevens Point, Portage County.—The station is in the fair grounds, 138.9 feet north of the grand stand, 150 feet east of the northeast corner of the agriculture building, and 176.2 feet northeast from the northeast corner of the exhibition building. It is marked by a marble post 6 by 6 by 18 inches, sunk 2 inches below the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Steeple of Unitarian Church (mark)	33	50.9	west of south
Base of flag pole of third ward school	42	57.5	west of south
Cupola of normal school	73	10.5	west of south

Waukesha, Waukesha County.—The station is located on the campus of Carrol College, 192.5 feet west from the second window north of the southwest steps of the main building and 127 feet north and slightly west of the northwest corner of the Rankin Hall of Science. The station is marked by a marble post 6 by 6 by 19 inches, sunk flush with the ground and lettered U. S. C. & G. S., 1908. The following true bearings were determined:

	°	′	
Spire of Baptist Church (mark)	18	50.4	west of north
Base of flag pole on tower of Milwaukee Waukesha Brewery	64	14.5	west of north
Base of flag pole on south end of main building of Carrol College	84	12.0	east of south
Extreme left edge of large chimney, Rest Haven Sanitarium	32	27.6	east of north

Waupaca, Waupaca County.—The station is on the public school grounds, 100 feet northwest of the northwest corner of the west building and 63.2 feet east from the inside edge of the cement sidewalk along the street on the west side of the grounds. The station is marked by a marble post 6 by 6 by 18

Descriptions of stations—Continued.

WISCONSIN—Continued.

inches, set 2 inches below the surface of the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Court-house flag pole (mark)	64	24.0	west of north
Right edge of red building	64	51.4	east of north
Center of base of flag pole on schoolhouse	43	50.8	east of south

West Bend, Washington County.—The station is within the race track inclosure in the fair grounds northeast of town. It is 227.1 feet south of the northeast corner of a long shed near a well, and 240.5 feet from the fence along the south side of the grounds. The shed above mentioned is at the south side of the grounds. It is also 189.5 feet from the southwest corner of a T-shaped building east of the station. The station is marked by a marble post 6 by 6 by 16 inches, sunk level with the ground and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Court-house spire	19	45.6	west of south
Catholic Church spire	47	58.8	west of south
Tip of water tank	89	51.2	west of south
Church spire in town of Barton	18	33.0	west of north

FOREIGN COUNTRIES.

Beechy Head, Vancouver Island, British Columbia.—The station is on the highest part of a small knoll about 200 yards northeast from the house of Mrs. George Brown, at the northwest part of Beecher Bay. It is on the flat part of the top and a little south of the large rocks which form the north end of the knoll. The knoll overlooks Beecher Bay and the open field of Mrs. Brown. The station is marked by a rough stone about 10 inches square on bottom, 4 inches square on top, and about 14 inches high. The top projects about 2 inches above the ground and has a one-half inch drill hole three-fourths inch deep to mark the station. Two reference marks were put in as follows: The north reference mark is a one-half inch drill hole 1 inch deep on the highest part of the highest large rock at the north end of the knoll, and is 47.9 feet from the station. The east reference mark is a one-half inch drill hole 1 inch deep on a large rock on brow of knoll, almost east of and 70.2 feet from the station. The following true bearings were determined:

	°	′	
West gable of barn on deserted farm belonging to Mr. Smith (mark)	19	24.0	west of south
Center of chimney of Mrs. Brown's house	70	39.6	west of south
North reference mark	42	11.8	east of north
East reference mark	85	45.2	east of north

North Island, British Columbia.—Magnetic observations were made at the triangulation station North, which is on the highest hill in the northeastern part of the island, a little to the eastward of the summit. The station is marked by a green glass bottle projecting about 1 inch above the ground.

Union, British Columbia.—The station of 1906 was reoccupied. It is about 1 000 feet north of the old 1906 station, in a direct line to the church spire at Comox, on a low shingle spit across the small stream. The station is marked by a dressed post of fir, 3 inches square, set about 30 inches deep and projecting about 8 inches above the ground. 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:

	°	′	
Church spire at Comox	18	44.8	west of north
Light-house at southeast end of Baynes Sound	33	34.7	east of south
Northeast corner of chimney of brickkiln	0	35.5	west of south

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APPENDIX 4

REPORT 1909

DISTRIBUTION OF THE MAGNETIC DECLINATION IN ALASKA AND ADJACENT REGIONS FOR 1910

By

R. L. FARIS

Inspector of Magnetic Work; Assistant, Coast and Geodetic Survey

CONTENTS.

ILLUSTRATIONS.

DISTRIBUTION OF THE MAGNETIC DECLINATION IN ALASKA AND ADJACENT REGIONS FOR 1910.

INTRODUCTION.

The distribution of the magnetic declination over a given area is best represented by an isogonic chart on which are drawn lines of equal magnetic declination, each line passing through all the places at which the declination is the same. In practice, since the observations are necessarily more or less widely distributed, it seldom happens that the observed values of the magnetic declination are identical at more than a very few places; but the position of any desired isogonic line may be determined approximately by interpolation between the observed values. For performing this interpolation either a graphical or an analytical method may be employed.

The analytical method consists in deriving by the method of least squares a formula in which the declination is expressed in terms of the latitude and longitude. This method is usually employed where the observations are few in number and widely distributed, or where it is desired to determine for a limited area the uniform distribution most nearly approximating the observed facts. The resulting isogonic lines are necessarily smooth curves, uniformly distributed.

The graphical method consists in plotting the declination results on a map and drawing the isogonic lines to conform as nearly as possible to the plotted values. In this way it is possible to give a general idea of the irregularities of distribution and to show the presence of local disturbances.

The first isogonic chart of Alaska was prepared in 1883 for the epoch 1885. This was necessarily only a rough approximation, owing to the small number of available results and the uncertainty of the reduction to epoch. In 1889 a new isogonic chart, for 1890, was published, but it was based on very nearly the same data as the 1885 chart. In the succeeding five years many new observations were made and our knowledge of the secular change of declination was very much increased. Consequently, the chart for 1895, constructed in 1894, represented a decided improvement over those that had preceded it. In 1895 a chart for 1900 was prepared by shifting the isogonic lines of the 1895 chart to correspond with the predicted change in declination for the five-year interval. In 1902 a comparison of the results of observations made between 1894 and 1902 with the 1900 chart indicated that little, if any, change was required in the position of the isogonic lines to adapt them to the year 1902.

All of these isogonic charts were constructed by the analytical method, using a formula involving the first and second powers of the latitude and longitude, since the observations were too widely distributed to attempt to show more than the general distribution of declination. At the present time so much additional data has become

available that it is now possible to make use of the graphical method and show some of the irregularities of distribution, at least in southeastern Alaska. The observations reveal the prevalence of local disturbance all along the coast from Cape Muzon to St. Michael. It is especially marked at a number of places in southeastern Alaska, sufficient in amount to affect the compasses of passing steamers. (Coast Pilot of Alaska, Part I, p. 12.) The most remarkable of these areas of local disturbance occurs on Douglas Island, near Juneau, where special observations made in 1904 revealed the presence of a local magnetic pole, at which point the needle lost its directive property and toward which, within a very limited area, the needle pointed from every direction. St. George Island in Bering Sea was also found to be a highly disturbed region, when observations were made there in 1897. These areas of extreme local disturbance are in general too limited in extent to be shown on a map of the scale suitable for an isogonic chart.

The limits adopted for the new isogonic chart of Alaska are somewhat different from those of the earlier ones. It still extends far enough to the east and south to join on to the isogonic chart of the United States, but it has been contracted on the west, because of the lack of reliable data along the coast of Asia. The scale of the present chart has been changed from that of the former ones, so that it is now about four times the size of the previous isogonic charts of Alaska.

SECULAR CHANGE OF DECLINATION.

January 1, 1910, has been adopted as the epoch of the isogonic chart and all results have been reduced to that date. Where the same station has been occupied more than once, only the most recent value has been used, but where several stations in the same locality have been occupied at different times, the different results are given. No attempt has been made to use results of observations made prior to 1870, on account of the uncertainty of the reduction to 1910.

For determining the secular change of declination since 1870 the results tabulated below are available. For earlier observations at Sitka, Port Etches, Kodiak, Unalaska, and Port Clarence, see Appendix 1, Report for 1895. For each station the tabulated values were plotted on cross-section paper and a smooth curve drawn to correspond approximately with the plotted values. The correction to reduce an observation to the year 1910 was then obtained by taking the difference between the ordinate at the date of observation and the 1910 ordinate. For stations where observations were made only at two dates, the annual change was assumed to be uniform during the interval. For convenience a table has been prepared for each "repeat" station giving the reduction to 1910 at five-year intervals. For observations at other than "repeat" stations, the reduction to 1910 was obtained by interpolation between the "repeat" station values. The use of the symbols (*a*), (*b*), (*c*), etc., after the name of the observer in the following tables indicates the organization to which the observer belongs. (See explanations, p. 163).

SITKA.

Most of the magnetic observations in the vicinity of Sitka have been made at three stations: (1) Japonski Island, where the Russians maintained a magnetic observatory from 1842 to 1867; (2) Parade ground in front of the Presbyterian Church; (3) Absolute building of the Coast and Geodetic Survey magnetic observatory. A magnetic survey of Sitka and vicinity in 1901 developed a very uniform distribution of magnetism, the

magnetic declination being 9′.5 greater at the site of the absolute observatory than on Japonski Island, and 3′.7 greater than at the parade ground. These corrections have been applied in the following table. Where a number of observations were made in the same year, only the mean value is given. The values beginning with 1902 are observatory results. In the diagram which follows the table (fig. 1) the tabular values are shown by dots.

Magnetic declination at Sitka.

[Latitude, 57° 02′.9. Longitude, 135° 20′.1 W.]

Date	Declination East ° ′	Observer	Station
1867.6	28 58.5	A. T. Mosman (*a*)	Japonski Island
1874.3	29 03.2	M. Baker (*a*)	Parade ground
1880.4	29 14.3	M. Baker and W. H. Dall (*a*)	Japonski Island
1881.7	29 20.7	H. E. Nichols (*a*)	Do.
1892.6	29 37.6	F. Morse and J. E. McGrath (*a*)	Japonski Island and parade ground
1894.4	29 40.6	F. Morse (*a*)	Parade ground
1896.5	29 43.1	Do.	Do.
1900.8	29 47.4	L. A. Bauer (*a*)	Parade ground and absolute observatory site
1901.5	29 50.5	J. A. Fleming (*a*)	All three stations
1902.5	29 51.1	H. M. W. Edmonds (*a*)	Absolute observatory
1903.5	29 53.9	Do.	Do.
1904.5	29 55.8	Do.	Do.
1905.5	29 59.6	Do.	Do.
1906.5	30 03.1	Do.	Do.
1907.5	30 06.8	Do.	Do.
1908.5	30 10.4	Do.	Do.

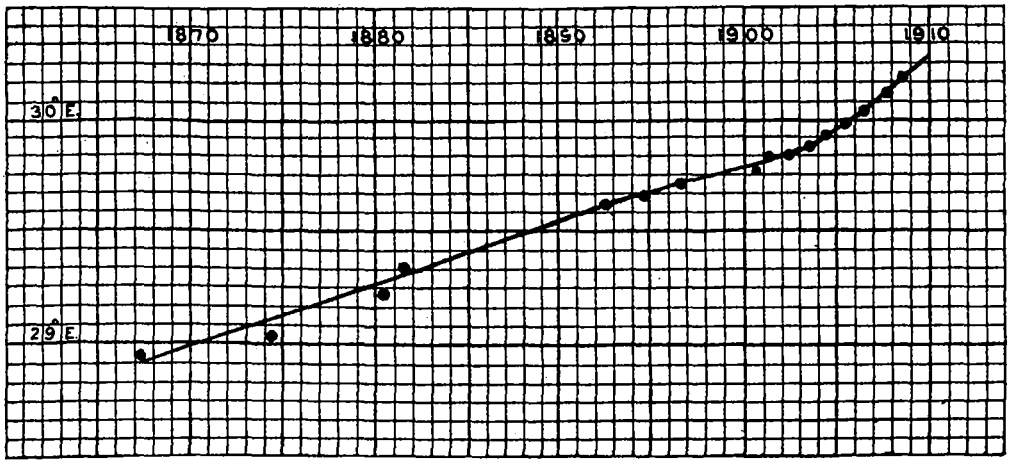

FIG. 1.—Secular change of declination at Sitka.

KODIAK.

Nearly all of the recent observations have been made at the same station, on a bluff on the north side of St. Paul Roadstead, about three-fourths of a mile east of the town.

Magnetic declination at Kodiak.

[Latitude, 57° 47′.5. Longitude, 152° 23′.8 W.]

Date	Declination	Observer
	East ° ′	
1867.7	26 04.7	A. T. Mosman (*a*)
1874.4	25 22.0	M. Baker (*a*)
1880.5	25 09.2	Do.
1896.4	24 33.8	H. P. Ritter (*a*)
1906.8	24 13.3	W. M. Steirnagle and P. C. Whitney (*a*)
1907.6	24 06.9	A. Crowell (*a*)
1908.5	24 11.8	S. W. Tay (*a*)

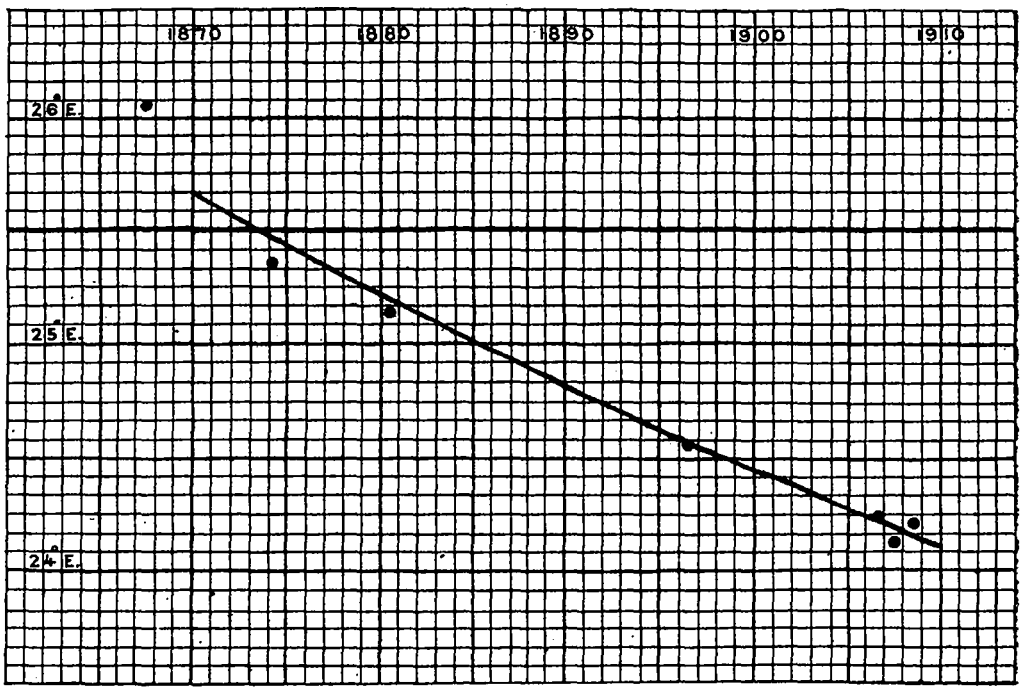

FIG. 2.—Secular change of declination at Kodiak.

DUTCH HARBOR.

Several stations have been occupied in the vicinity of Dutch Harbor at different times.

In 1867 Assistant Mosman observed at the end of the spit at the eastern entrance to Captain's (now Dutch) Harbor, in $\phi = 53° 54'.0$ and $\lambda = 166° 30'.9$.

In 1871, 1873, 1874, and 1880 Messrs. Dall and Baker observed at the astronomic station on Amaknak Island, just across from Iliuliuk village (now Unalaska) $\phi = 53° 52'.9$; $\lambda = 166° 32'.3$.

In 1883 R. A. Marr observed at a point about 8 feet south of this astronomic station.

In 1889 J. E. McGrath's station was 267.9 feet northwest of what was supposed to be the location of the old station of Dall and Baker. At the same time J. H. Turner made observations at a point 257.1 feet east of the old station. He reoccupied this station in 1891, as did O. B. French in 1896. In his records of 1891, Mr. Turner says: "Basaltic rock underlying the surface may possibly affect magnetic measures made in this region."

In 1900 Dutch Harbor had become the more convenient anchorage for vessels, and in that year a new station was established near the village of Dutch Harbor, at the "Azimuth Mark" erected in connection with the astronomic observations of 1896 in

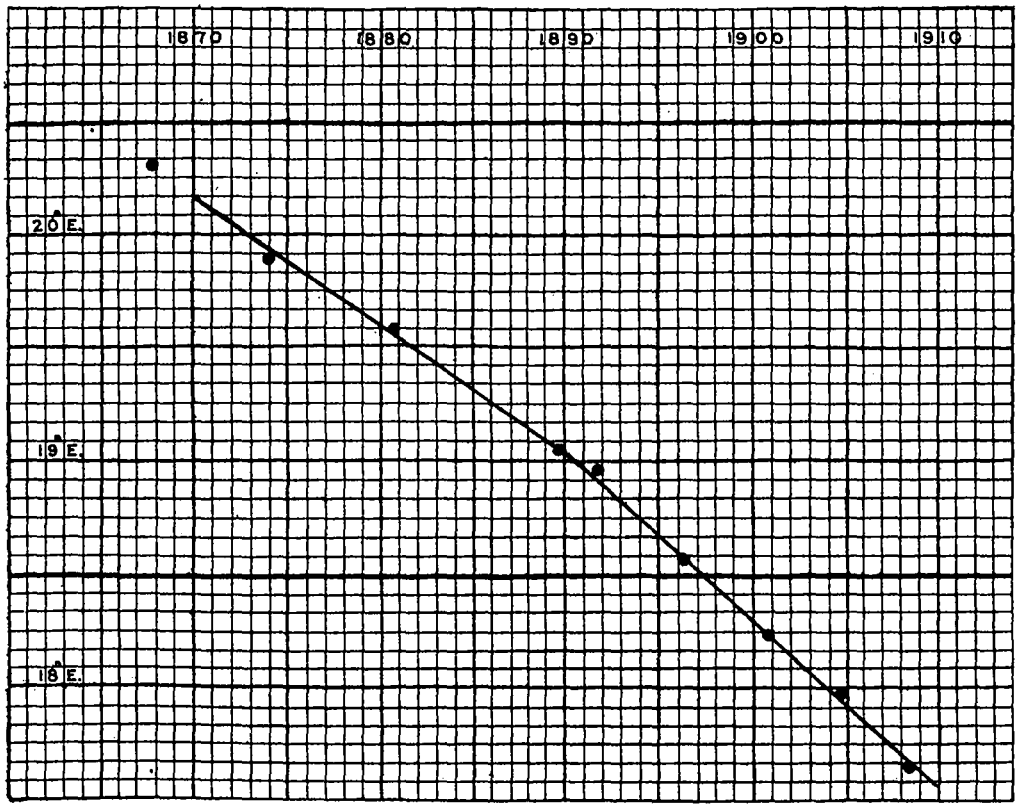

FIG. 3.—Secular change of declination at Dutch Harbor.

$\phi = 53° 53'.4$ and $\lambda = 166° 32'.1$. This station has been in use up to 1908. In that year observations were also made at a number of places about the bay, one of which, South Base, is only a short distance from Mr. Mosman's station of 1867.

The observations of Dall and Baker show an annual decrease in declination of 2'.8 from 1873 to 1880. Observations at Turner's station give an annual decrease of 4'.5 from 1889 to 1896. Observations at the Dutch Harbor station give an annual decrease of 4'.7 from 1900 to 1908. Assuming station South Base of 1908 to be comparable with Mosman's station of 1867, the average annual decrease for that interval is 3'.9, which is very nearly the average of the values for the shorter periods.

Assuming an annual decrease of 4′.5 from 1896 to 1900, observations at Turner's station (1889–1896) require a correction of +50′.5 to reduce to the Dutch Harbor station. Assuming an annual decrease of 3′.5 from 1880 to 1889, observations at the old astronomic station (1871–1880) must be increased by 6′.5 to reduce to Turner's station and hence require a correction of +57′.0 to reduce to the Dutch Harbor station. From observations in 1908, results at South Base must be increased by 31′.0 to reduce to Dutch Harbor station. This correction will be used for the 1867 value. The reduced values are given in the following table:

Magnetic declination at Dutch Harbor.

[Latitude, 53° 53′.4. Longitude, 166° 32′.1 W.]

Date	Declination	Observer	Station
	East ° ′		
1867.7	20 18.4	A. T. Mosman (*a*)	At end of spit
1873.4	20 04.2	W. H. Dall (*a*)	Astronomic station
1873.7	19 56.3	M. Baker (*a*)	Do.
1874.7	19 39.8	Dall and Baker (*a*)	Do.
1880.6	19 35.0	Do.	Do.
1889.5	19 02.9	J. H. Turner (*a*)	Turner's station
1891.6	18 57.4	Do.	Do.
1896.3	18 34.1	O. B. French (*a*)	Do.
1900.8	18 14.0	J. F. Pratt (*a*)	Dutch Harbor
1904.5	17 57.3	H. L. Beck (*a*)	Do.
1908.3	17 38.4	H. A. Seran (*a*)	Do.

KISKA, KISKA ISLAND.

[Latitude, 51° 59′.1. Longitude, 182° 27′.6 W.]

Date	Declination	Observer	Station
	East ° ′		
1873.6	11 06.4	W. H. Dall (*a*)	
1904.6	8 18.2	H. L. Beck (*a*)	Astro
1904.6	8 14.3	Do.	Post
1904.7	8 04.5	H. C. Denson (*a*)	Barrel
Average annual change, −5′.6			

ST. PAUL ISLAND, PRIBILOF ISLANDS

[Latitude, 57° 07′.2. Longitude, 170° 16′.4 W.]

Date	Declination	Observer
	East ° ′	
1874.6	17 24.0	W. H. Dall (*a*)
1880.6	17 39.2	Dall and Baker (*a*)
1897.5	16 42.0	G. R. Putnam (*a*)
Average annual change, −3′.4		

ST. MICHAEL.

Observations have been made at a number of stations at St. Michael, and they indicate the presence of much local disturbance. There is not sufficient data, however, to reduce all the observations to the same station, and only an approximate determination of the secular change is possible.

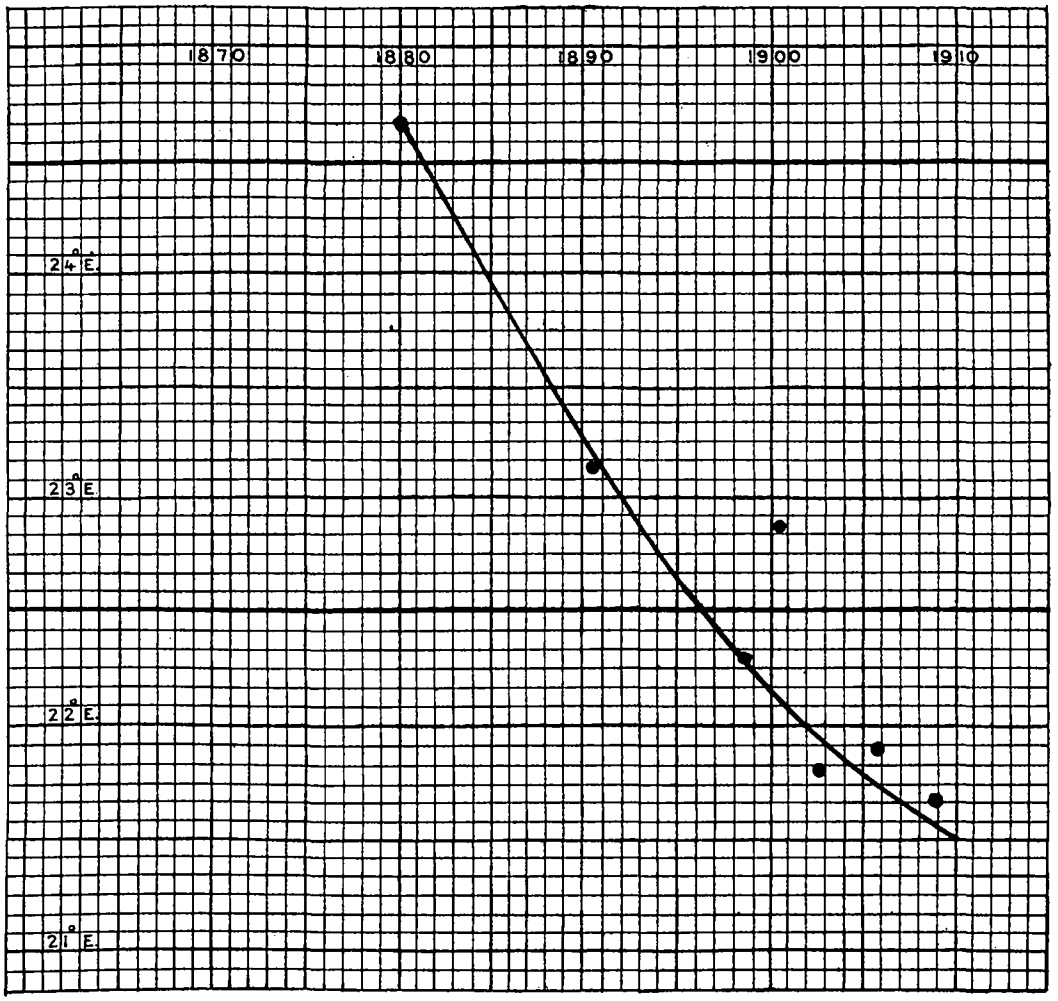

FIG. 4.—Secular change of declination at St. Michael.

Magnetic declination at St. Michael.

[Latitude, 63° 29′. Longitude, 162° 01′ W.]

Date	Declination	Observer	Station
	East ° ′		
1879.6	24 40	Lieut. J. W. Danenhower (*d*)	
1889.5	23 15.0	J. E. McGrath (*a*)	
1889.5	23 09.8	J. H. Turner (*a*)	
1890.9	23 07.0	Do.	
1891.3	23 02.4	Do.	
1898.6	22 17.3	G. R. Putnam (*a*)	
1900.5	22 54.0	E. R. Frisby (*a*)	
1902.7	21 48.0	W. Eimbeck (*a*)	Mean of five stations
1905.6	21 53.8	B. A. Baird (*a*)	Mean of six stations
1908.7	21 41.3	J. W. Green (*a*)	Mean of three stations

FORT YUKON.

[Latitude, 66° 34′. Longitude, 145° 18′ W.]

Date	Declination	Observer
	East ° ′	
1889.6	34 46.9	J. E. McGrath (*a*)
1890.6	35 12.0	J. H. Turner (*a*)
1908.5	34 01.6	J. W. Green (*a*)
Average annual change, −3′.1		

FORT EGBERT.

[Latitude, 64° 47′. Longitude, 141° 12′ W.]

Date	Declination	Observer
	East ° ′	
1905.6	35 50.9	E. Smith (*a*)
1908.5	35 55.5	J. W. Green (*a*)
Average annual change, +1′.6		

NEAR INTERNATIONAL BOUNDARY, YUKON RIVER.

[Latitude, 64° 41′. Longitude, 140° 54′ W.]

Date	Declination	Observer
	East ° ′	
1888.2	35 46.5	W. Ogilvie (*c*)
1889.8	35 47.3	J. E. McGrath (*a*)
1890.5	35 44.1	Do.
1891.4	35 43.0	Do.
1907.7	35 41.2	J. C. Pearson (*b*)
1908.5	35 36.2	J. W. Green (*a*)
Average annual change, −0′.4		

FORTY-MILE.

[Latitude, 64° 25′. Longitude, 140° 34′ W.]

Date	Declination	Observer
	East ° ′	
1887.7	35 01.1	W. Ogilvie (*c*)
1907.7	34 51.8	J. C. Pearson (*b*)
1908.5	34 41.2	J. W. Green (*a*)
Average annual change, −0′.7		

FORT SELKIRK.

[Latitude, 62° 47′. Longitude, 137° 25′ W.]

Date	Declination	Observer
	East ° ′	
1887.6	34 17.0	W. Ogilvie (*c*)
1907.7	33 59.7	J. C. Pearson (*b*)
Average annual change, −0′.9		

TANTALUS (LEWES RIVER).

[Latitude, 62° 05′. Longitude, 136° 05′ W.]

Date	Declination	Observer
	East ° ′	
1887.6	33 54.8	W. Ogilvie (*c*)
1907.7	34 15.6	J. C. Pearson (*b*)
Average annual change, +1′.0		

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From the foregoing tables it will be seen that the secular change of the magnetic declination is well determined for the past forty years at Sitka, Kodiak, and Dutch Harbor, and fairly well at St. Michael since 1880. At Kiska the three stations occupied in 1904 show little local disturbance and the comparison with the 1873 value is therefore probably reliable. On St. Paul Island there is no doubt local disturbance. The results at the stations along the Yukon River near the international boundary indicate that there has been little change in declination in that region since 1887.

The following table has therefore been used for reducing to the common epoch, 1910, the observations in Alaska and vicinity:

Secular change of the magnetic declination in Alaska.

	Washington, west	Sitka	Kodiak	Dutch Harbor	Kiska	St. Michael	Fort Yukon	Fort Egbert
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
Latitude	47 30	57 03	57 48	53 53	51 59	63 29	66 34	64 47
Longitude	122 30	135 20	152 24	166 32	182 28	162 01	145 18	141 12
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1870	+1 29	+1 16	−1 30	−2 32	−3 44			
1875	+1 20	+1 08	−1 15	−2 19	−3 16			
1880	+1 13	+0 59	−1 00	−2 03	−2 48	−3 14		
1885	+1 05	+0 50	−0 47	−1 46	−2 20	−2 24		
1890	+0 54	+0 42	−0 36	−1 27	−1 52	−1 42	−1 03	0 00
1895	+0 44	+0 34	−0 27	−1 07	−1 24	−1 10	−0 47	0 00
1900	+0 34	+0 29	−0 18	−0 45	−0 56	−0 40	−0 31	0 00
1905	+0 18	+0 18	−0 09	−0 23	−0 28	−0 16	−0 15	0 00
1910	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00

TABLE OF MAGNETIC DECLINATIONS.

The following table contains the values of magnetic declination used in the construction of the isogonic chart. Principal dependence has been placed on the observations of the Coast and Geodetic Survey, but all available sources have been drawn upon for results of observations in the area covered by the chart. For convenience the results have been divided into several groups, as follows:

Group	Results C. & G. S.	Results other sources
(1) Washington, northwestern part	58	0
(2) British North America	31	111
(3) Southeastern Alaska	171	0
(4) Yakutat Bay to Sannak Islands	53	7
(5) Aleutian Islands	30	4
(6) Bering Sea and Arctic Ocean	32	12
(7) Yukon River	18	0
(8) Interior, results from reconnaissance surveys	0	86
(9) Observations on shipboard	93	77

In groups 4, 5, and 7 the results are arranged in order of longitude. For the sake of uniformity all longitudes in the tables are expressed as west of Greenwich. In the other groups the arrangement is by latitude, beginning with the most southerly station.

In the column headed "Source" a very brief reference is made to the publication or other source from which a result was derived. Fuller references are given below to supplement those in the table.

The results of magnetic observations by the Coast and Geodetic Survey up to 1881, together with descriptions of stations, were published as Appendix 9 to the Report of the Superintendent for 1881. These as well as later results are contained in United States Magnetic Declination Tables for 1902, together with descriptions of the new stations occupied between 1881 and 1902. This publication also contains results from other sources, at that time available. Beginning with 1903, the results of magnetic observations made during each fiscal year and descriptions of the stations occupied have been published as an appendix to the Annual Report for that year. (App. 5, 1903; App. 3, 1904; App. 3, 1905; App. 3, 1906; App. 5, 1907; App. 3, 1908; App. 3, 1909.)

Results obtained by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington are referred to as Carnegie Institution.

The results of observations made by parties of the United States Geological Survey engaged in exploring the interior of Alaska have been published in the Annual Report of the Director for 1899 and in its various other publications.

Results obtained by officers attached to ships of the United States Navy, both on land and on shipboard, were published in Hydrographic Office Publication No. 109 (H. O. 109). Later results have been furnished in manuscript (U. S. N. MSS.).

Results obtained by officers attached to ships of the British navy between 1890 and 1900 were published in 1901 by the Hydrographic Department of the British Admiralty. (B. A., 1901.) Later results were published in 1905, 1907, and 1908 (B. A., 1905; B. A., 1907; B. A., 1908).

Some results obtained by Canadian surveyors, not included in the declination tables, were published in the Annual Report of the Interior Department of Canada for 1898. They have been corrected for diurnal variation, so far as possible.

A number of results were secured in the summer of 1908 by the party engaged in running out the one hundred and forty-first meridian boundary between Alaska and British North America. These have been combined in five groups.

In the secular change tables in the column headed "Observer," and in the declination tables in the column headed "Source," a letter follows the name of the observer or source to indicate the organization or department under whose direction the observations were made, viz:

(*a*) Observations made by observers of the United States Coast and Geodetic Survey.

(*b*) Observations made by observers of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington.

(*c*) Observations made by observers in the employ of the Canadian government.

(*d*) Observations made by officers of the United States Navy.

(*e*) Observations made by officers of the British navy.

(*f*) Observations made under the direction of the British Northwest Boundary Commission of 1858.

(*g*) Observations made by observers of the United States Geological Survey.

(*h*) Observations made by officers of the United States Revenue-Cutter Service.

(*p*) Observations made incidentally by persons not known to be under the direction of any special organization.

Table of magnetic declinations in Alaska and adjacent regions.

WASHINGTON (NORTHWESTERN PART).

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Vancouver	45 38	122 40	1895.2	21 32.4	22 17	D Tables, 1902 (*a*)
Lower Cascades	45 39	122 00	1881.8	19 29.3	20 29	Do.
Stevenson	45 41	121 52	1906.5	21 25.0	21 36	App. 5, 1907 (*a*)
Cape Disappointment	46 17	124 03	1895.2	21 55.8	22 39	D Tables, 1902 (*a*)
North Yakima	46 34	120 32	1906.2	22 35.8	22 48	App. 3, 1906 (*a*)
Ellensburg	47 00	120 32	1906.2	22 52.2	23 04	Do.
Olympia	47 02	122 54	1881.8	21 34.6	22 40	D Tables, 1902 (*a*)
Olympia (Howard △)	47 03	122 53	1906.1	23 20.5	23 33	App. 3, 1906 (*a*)
Nisqually	47 07	122 38	1859.1	21 23	23 18	D Tables, 1902 (*p*)
Hot Springs	47 12	121 33	1906.2	22 17.9	22 30	App. 3, 1906 (*a*)
Tacoma	47 16	122 27	1906.1	23 06.6	23 19	Do.
Port Orchard	47 32	122 38	1906.6	22 41.6	22 52	App. 5, 1907 (*a*)
Leavenworth	47 36	120 33	1906.2	22 32.0	22 44	App. 3, 1906 (*a*)
Seattle	47 40	122 18	1908.2	23 27.6	23 35	App. 3, 1908 (*a*)
Spokane Falls	47 40	117 26	1881.7	21 39.4	22 29	D Tables, 1902 (*a*)
Everett	47 58	122 13	1900.9	23 15.3	23 44	Do.
Kala	48 04	122 46	1908.6	23 33.7	23 38	App. 3, 1909 (*a*)
Port Townsend	48 07	122 45	1904.1	23 15.7	23 35	App. 3, 1904 (*a*)
Port Angeles	48 08	123 26	1908.1	23 58.3	24 05	App. 3, 1908 (*a*)
Striped Peak	48 10	123 41	1908.2	23 31.6	23 58	Do.
Dungeness	48 11	123 07	1907.9	24 05.0	24 13	Do.
Slip	48 16	124 14	1893.6	23 30.6	24 15	D Tables, 1902 (*a*)
Cape Flattery	48 22	124 38	1881.8	22 44.2	23 52	Do.
Bahada	48 22	124 36	1908.6	24 14.1	24 18	App. 3, 1909 (*a*)
Waadah	48 23	124 36	1893.6	23 26.3	24 11	D Tables, 1902 (*a*)
Mount Vernon.	48 24	122 21	1900.9	23 08	23 37	Do.
Classet	48 24	124 40	1893.7	23 06.4	23 50	Do.
Tatoosh	48 24	124 44	1893.7	23 45.1	24 29	Do.
San Juan Island	48 28	122 58	1897.6	23 31.4	24 08	Do.
Bellevue	48 32	123 10	1894.4	26 48	27 31	Do.
Mat	48 33	122 57	1894.6	23 18	24 01	Do.
Slope	48 33	123 00	1894.6	23 22	24 05	Do.
Bamboo	48 34	123 01	1894.6	23 42	24 25	Do.
Windlass	48 35	123 10	1894.5	23 20	24 03	Do.
Shaw Island	48 36	122 58	1895.6	23 43.6	24 24	Do.
Goose	48 36	123 02	1894.5	23 33	24 16	Do.
Clover	48 36	123 10	1894.5	22 50	23 33	Do.
Root	48 37	122 57	1894.5	23 11	23 54	Do.
Fairview	48 38	123 02	1894.5	23 55	24 38	Do.
Spieden	48 38	123 06	1894.5	23 29	24 12	Do.
Morse Island	48 38	123 11	1894.4	23 30	24 13	Do.
Limestone	48 39	123 00	1894.5	23 36	24 19	Do.
Middleton	48 42	123 04	1894.5	22 36	23 19	Do.
Doughty	48 43	122 57	1894.5	23 27	24 10	Do.
Dry	48 43	123 02	1894.5	25 11	25 54	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

WASHINGTON (NORTHWESTERN PART)—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		East ° ′	East ° ′	
New Whatcom	48 44	122 29	1900.9	23 20.6	23 50	D Tables 1902 (*a*)
Patos	48 47	122 58	1894.5	23 04	23 47	Do.
Similkameen River	49 00	119 41	1905.7	24 38.3	24 52	App. 3, 1906 (*a*)
Similkameen R. 16 m. west	49 00	120 04	1905.7	24 30.2	24 44	Do.
Pasayten River	49 00	120 33	1905.7	24 49.0	25 03	Do.
Skagit River	49 00	121 06	1905.6	22 46.7	23 01	Do.
Depot Creek	49 00	121 19	1905.6	23 33.1	23 47	Do.
Silicia Creek *	49 00	121 36	1901.4	26 45.8	27 14	D Tables, 1902 (*a*)
Do.	49 00	121 36	1905.6	29 00.0	29 14	App. 3, 1906 (*a*)
Lemolo	49 00	122 07	1905.6	23 09.0	23 23	Do.
Sumas	49 00	122 16	1905.6	23 46.8	24 01	Do.
Blaine	49 00	122 44	1905.5	24 21.6	24 36	Do..
Point Roberts	49 00	123 04	1905.6	24 32.9	24 47	Do.

BRITISH NORTH AMERICA ADJACENT TO ALASKA.

	° ′	° ′		East ° ′	East ° ′	
Beechy Head	48 19	123 39	1908.7	26 58.8	27 04	App. 3, 1909 (*a*)
Do.	48 20	123 39	1892.8	24 37.0	25 24	D Tables, 1902 (*a*)
Sherringham *	48 23	123 55	1893.5	22 43.0	23 29	Do.
Victoria	48 25	123 24	1907.7	24 15.2	24 24	Carnegie Instit. (*b*)
Esquimalt	48 25	123 26	1881.8	22 55.6	24 05	D Tables, 1902 (*a*)
Do.	48 26	123 26	1893.8	23 20.0	24 06	B. A., 1901 (*e*)
Do.	48 26	123 26	1895.9	23 35.0	24 17	Do.
Do.	48 26	123 26	1896.9	23 38.0	24 18	Do.
Do.	48 26	123 26	1905.8	24 19	24 34	B. A., 1907 (*e*)
Do.	48 26	123 28	1898.3	23 42.9	24 20	D Tables, 1902 (*e*)
Discovery	48 26	123 14	1892.7	23 11.0	23 59	D Tables, 1902 (*a*)
Arch Rock *	48 28	124 12	1893.6	25 37.8	26 24	Do.
Gordon Head *	48 30	123 18	1894.4	23 36	24 20	C. & G. S. Mss. (*a*)
Darcy Island	48 34	123 16	1894.4	22 57	23 41	Do.
Vancouver Island	48 34	124 38	1893.6	23 51.3	24 37	D Tables, 1902 (*a*)
Halibut	48 37	123 16	1894.4	22 40	23 24	C. & G. S. Mss. (*a*)
Tom	48 40	123 16	1894.4	23 35	24 19	Do.
Fairfax	48 42	123 18	1894.4	23 13	23 57	Do.
Douglas	48 44	123 11	1894.5	23 50	24 34	Do.
South Pender Island	48 44	123 14	1905.6	24 12.5	24 28	B. A., 1907 (*e*)
Saltspring Island	48 51	123 30	1905.6	24 15	24 31	Do.
Active Pass	48 52	123 19	1904.7	24 03.5	24 22	B. A., 1905 (*e*)
Oyster Harbor	49 00	123 48	1904.9	24 34.0	24 52	B. A. 1905 (*e*)
Onchucklin Harbor	49 00	125 00	1861.5	24 13	26 03	D Tables, 1902 (*p*)
Sumas Prairie	49 01	122 12	1858.5	21 30	23 27	D Tables, 1902 (*f*)
Rose Island	49 01	123 39	1905.7	24 45	25 00	B. A., 1907 (*e*)
Schweltza Lake	49 02	122 00	1859.5	21 37	23 31	D Tables, 1902 (*f*)
Garry Point, Fraser River	49 07	123 11	1864.5	22 58	24 38	D Tables, 1902 (*p*)
Jacko Point	49 10	123 54	1904.4	24 59.5	25 20	B. A., 1905 (*e*)
Nanaimo	49 10	124 00	1862.5	22 57	24 42	D Tables, 1902 (*p*)
Port Hammond	49 12	122 39	1885.4	22 48	23 50	Canadian Surveyor (*c*)
Harrison River	49 13	121 56	1885.4	22 25	23 27	Do.
New Westminster	49 13	122 53	1862.5	22 40	24 25	D Tables, 1902 (*p*)
Departure Bay	49 13	123 57	1881.8	23 55.6	25 04	D Tables, 1902 (*a*)

* Local disturbance.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

BRITISH NORTH AMERICA ADJACENT TO ALASKA—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Barkley Sound	49 14	124 50	1861.5	24 37	26 24	D Tables, 1902 (*p*)
Hecate Bay	49 15	125 56	1861.5	22 39	24 25	Do.
Nanoose Harbor	49 15	124 08	1904.5	24 48.5	25 08	B. A., 1905 (*e*)
Jericho	49 16	123 12	1891.6	23 42	24 31	D Tables, 1902 (*c*)
Port Moody	49 17	122 51	1891.5	23 00	23 49	Do.
Seymour Creek	49 18	123 01	1891.6	24 04	24 53	Do.
Burrard Inlet	49 18	123 07	1897.5	24 39.0	25 16	B. A., 1901 (*e*)
Vancouver	49 18	123 07	1898.4	24 30.0	25 05	Do.
Do.	49 18	123 07	1904.5	25 11.5	25 32	B. A., 1905 (*e*)
Do.	49 18	123 07	1906.6	25 10.0	25 22	O. J. Klotz (*c*)
Baynes Sound, Maple Spit	49 28	124 45	1898.4	24 25.7	25 01	B. A., 1901 (*e*)
Yale	49 34	121 25	1871.5	24 00	25 24	D Tables, 1902 (*p*)
Denman Island	49 36	124 51	1895.5	23 24.0	24 06	B. A., 1901 (*e*)
Baynes Sound, Beak Point	49 36	124 51	1898.6	24 14.1	24 49	Do.
Union	49 36	124 54	1908.0	26 17.5	26 25	App. 3, 1908 (*a*)
Union 2	49 36	124 54	1908.6	26 33.1	26 38	App. 3, 1909 (*a*)
Friendly Cove	49 36	126 38	1881.7	23 36.2	24 45	D Tables, 1902 (*a*)
Port Augusta	49 38	124 55	1905.6	26 34	26 50	B. A., 1907 (*e*)
Do.	49 40	124 55	1905.6	26 44	27 00	Do.
Do.	49 40	124 56	1896.8	26 04	26 44	B. A., 1901 (*e*)
Do.	49 40	124 56	1897.4	26 12	26 50	Do.
Comox	49 40	124 55	1904.5	26 40.5	27 00	B. A., 1905 (*e*)
Comox, Goose Spit	49 40	124 56	1898.3	26 14.7	26 50	B. A., 1901 (*e*)
Head of Howe Sound	49 42	123 09	1873.5	23 54	25 14	D Tables, 1902 (*p*)
Salmon River	49 58	121 31	1885.5	25 02	26 04	Canadian surveyor (*c*)
Duncan Bay	50 04	125 19	1896.8	24 57.0	25 36	D Tables, 1902 (*e*)
Squirrel Cove	50 08	124 57	1864.5	23 56	25 34	D Tables, 1902 (*p*)
Menzies Bay	50 08	125 24	1895.6	24 02.0	24 42	B. A., 1901 (*e*)
Mouth of Thompson River	50 13	121 36	1871.5	25 00	26 23	D Tables, 1902 (*p*)
Spences Bridge	50 24	121 21	1885.6	23 48	24 48	Canadian surveyor (*c*)
Thompson River, mouth of Nicola	50 27	121 22	1871.5	25 30	26 53	D Tables, 1902 (*p*)
North Harbor	50 29	128 04	1881.7	24 53.7	25 57	D Tables, 1902 (*a*)
Magnetic station	50 39	120 07	1885.7	25 05	26 05	Canadian surveyor (*c*)
Kamloops	50 39	120 20	1885.7	24 03	25 03	Do.
Near Black Canyon	50 40	121 18	1885.6	27 28	28 28	Do.
Thompson River	50 41	120 12	1871.5	24 00	25 23	D Tables, 1902 (*p*)
Thompson River, near Kamloops	50 42	120 30	1877.5	24 15	25 27	Do.
Beaver Harbor	50 43	127 25	1866.5	24 30	26 01	Do.
Ashcroft	50 44	121 17	1907.7	27 36.1	27 44	Carnegie Instit. (*b*)
Thompson River	50 46	121 05	1871.5	23 30	24 53	D Tables, 1902 (*p*)
St. Cloud	50 46	121 08	1885.6	23 56	24 56	Canadian surveyor (*c*)
Mouth of Hat Creek	50 47	121 33	1873.5	27 00	28 20	D Tables, 1902 (*p*)
Tracey Harbor	50 51	126 53	1863.5	26 40	28 18	Do.
Anchorage Cove	50 53	126 12	1881.6	25 42.7	26 47	D Tables, 1902 (*a*)
Waddington Harbor	50 54	124 50	1881.6	25 22.0	26 26	Do.
Blunden Harbor	50 54	127 19	1903.8	26 32.8	26 55	B. A., 1905 (*e*)
North Thompson River	50 57	120 28	1871.5	23 52.5	25 16	D Tables, 1902 (*p*)
Queen Charlotte Sound	50 59	127 31	1903.8	26 14.4	26 36	B. A., 1905 (*e*)
Treadmill Harbor	51 06	127 34	1864.5	24 08	25 44	D Tables, 1902 (*p*)
North Thompson River	51 12	120 22	1871.5	24 07.5	25 30	Do.
Do.	51 28	120 25	1873.5	25 20	26 40	Do.
Safety Cove	51 32	127 57	1864.5	23 38	25 14	Do.
North Thompson River	51 33	120 17	1871.5	25 30	26 52	Do.
McLoughlin Bay	52 08	128 10	1881.6	26 42.9	27 45	D Tables, 1902 (*a*)

Table of magnetic declinations in Alaska and adjacent regions—Continued.

BRITISH NORTH AMERICA ADJACENT TO ALASKA—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Rose Harbor	52 09	131 15	1881.7	26 00.6	27 03	D Tables, 1902 (*a*)
Kynumpt Harbor	52 12	128 12	1866.5	26 10	27 42	D Tables, 1902 (*b*)
North Bentinck Arm	52 23	126 48	1864.5	24 46	26 22	Do.
Carter Bay	52 50	128 25	1866.5	25 59	27 31	Do.
Head of Dean Inlet	52 52	127 13	1876.5	27 00	28 14	Do.
Anchor Cove	53 12	132 14	1866.5	24 59	26 29	Do.
Head of Gardner Inlet	53 15	127 37	1875.5	26 30	27 43	Do.
Alpha Bay	53 52	130 18	1866.5	26 34	28 04	Do.
Queen Charlotte Island	54 00	132 35	1907.5	28 23	28 32	B. A., 1908 (*e*)
Masset, Graham Island	54 05	132 15	1907.7	27 58.8	28 07	Do.
North Island	54 14	133 00	1908.5	29 03.8	29 09	App. 3, 1909 (*a*)
Port Essington	54 14	129 47	1879.5	27 20	28 27	D Tables, 1902 (*b*)
Head of Wark Channel	54 18	129 43	1879.5	27 30	28 37	Do.
20 miles up Skeena River	54 19	129 19	1879.5	27 20	28 27	Do
31 miles up Skeena River	54 22	129 00	1879.5	26 45	27 52	Do.
50 miles up Skeena River	54 30	128 35	1879.5	26 30	27 37	Do.
Port Simpson	54 34	130 26	1906.5	28 35	28 48	B. A., 1907 (*e*)
Do.	54 34	130 26	1907.3	28 23	28 33	B. A., 1908 (*e*)
Do.	54 34	130 26	1895.4	28 37.2	29 13	D Tables, 1902 (*a*)
Lion Point	55 53	130 01	1895.4	30 13.4	30 48	Do.
Magnetic station	58 28	130 02	1887.5	30 26	31 10	D Tables, 1902 (*c*)
Lake Lindeman	59 47	135 05	1887.5	32 16.8	32 49	Do.
Lake Marsh	60 21	134 17	1887.5	32 46.1	33 16	Do.
Miles Canyon	60 42	135 04	1887.6	30 55.2	31 20	Do.
White Horse	60 44	135 02	1907.6	32 19.4	32 24	Carnegie Instit. (*b*)
Do.	60 44	135 02	1908.4	32 05.6	32 09	App. 3, 1908 (*a*)
Magnetic station	61 29	129 39	1887.5	33 45	34 15	D Tables, 1902 (*c*)
Do.	61 49	131 01	1887.5	34 30	35 00	Do.
Lewes River	62 04	136 04	1887.6	33 54.8	34 11	Do.
Tantalus	62 06	136 06	1907.7	34 15.6	34 20	Carnegie Instit. (*b*)
Fort Selkirk	62 47	137 25	1907.7	33 59.7	34 02	Do.
Do.	62 48	137 25	1887.6	34 17.0	34 27	D Tables, 1902 (*c*)
White River	63 12	139 38	1887.6	34 27.9	34 33	Do.
Near Boundary	63 15	140 59	1908.5	33 06	33 06	Boundary survey (*a*)
Stewart	63 18	139 18	1907.7	34 04.4	34 04	Carnegie Instit. (*b*)
Stewart River	63 22	139 28	1887.6	33 52.8	33 56	D Tables, 1902 (*c*)
Near Boundary	63 34	140 59	1908.5	33 34	33 34	Boundary survey (*a*)
Dawson	64 04	139 26	1907.6	35 08.6	35 09	Carnegie Instit. (*b*)
Do.	64 04	139 26	1908.5	35 04.0	35 04	App. 3, 1908 (*a*)
Fortymile	64 25	140 34	1908.5	34 41.2	34 41	Do.
Do.	64 25	140 34	1907.6	34 51.8	34 52	Carnegie Instit. (*b*)
Do.	64 26	140 32	1887.7	35 01.1	35 02	D Tables, 1902 (*c*)
Mackenzie River	64 27	125 03	1888.6	41 34.6	-- --	Do.
Camp Davidson	64 41	140 54	1908.5	35 36.2	35 36	App. 3, 1908 (*a*)
Do	64 41	140 54	1907.7	35 41.2	35 41	Carnegie Instit. (*b*)
Boundary	64 41	140 54	1888.2	35 46.4	35 46	D Tables, 1902 (*c*)
Boundary A	64 41	141 00	1907.7	35 31.0	35 31	Carnegie Instit. (*b*)
Fort Norman	64 54	125 43	1888.6	33 39.0	-- --	D Tables, 1902 (*c*)
Porcupine River	65 43	139 40	1888.4	37 34.0	-- --	Do.
Fort Good Hope	66 16	128 31	1888.5	41 30.9	-- --	Do.
Camp Colonna	67 25	140 59	1890.5	38 06.8	-- --	D Tables, 1902 (*a*)
Fort McPherson	67 26	134 57	1888.5	46 00.8	-- --	D Tables, 1902 (*c*)
Herschel I., S. E. side	69 33	138 57	1889.6	43 40	-- --	D Tables, 1902 (*d*)
Mouth of Firth River	69 39	139 51	1890.3	43 22	-- --	D Tables, 1902 (*b*)

Table of magnetic declinations in Alaska and adjacent regions—Continued.

SOUTHEASTERN ALASKA.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Cape Muzon, Cape	54 40	132 40	1908.6	25 18.7	25 24	App. 3, 1909 (*a*)
Cape Muzon, Y	54 41	132 41	1908.6	25 52.1	25 57	Do.
Portland Canal, S. B.	54 46	130 24	1888.6	29 37.3	30 24	D Tables, 1902 (*a*)
Howkan	54 50	132 50	1881.7	27 03.4	28 02	App. 9, 1881 (*a*)
Breeze	54 54	132 39	1907.7	28 52	29 00	App. 3, 1908 (*a*)
Nice	54 58	132 47	1907.7	29 13	29 21	Do.
Cent	54 59	132 54	1907.7	29 02	29 10	Do.
Cordova Bay, Nut	55 02	132 35	1905.5	28 58	29 14	App. 3, 1905 (*a*)
Tamgas Harbor	55 04	131 28	1883.6	28 34.7	29 31	D Tables, 1902 (*a*)
Boreas	55 04	132 58	1907.7	29 17	29 25	App. 3, 1908 (*a*)
Mary Island	55 06	131 14	1895.5	28 21.7	28 56	D Tables, 1902 (*a*)
Jump	55 07	133 01	1907.7	29 05	29 13	App. 3, 1908 (*a*)
Side	55 08	132 56	1907.7	29 38	29 46	Do.
Moira Sound, Clarno	55 08	132 08	1905.4	28 35	28 52	App. 3, 1905 (*a*)
Time	55 09	132 56	1907.7	29 32	29 40	App. 3, 1908 (*a*)
Lap	55 10	132 53	1907.8	29 52	30 00	Do. (*a*)
Sukkwan Strait, Salt	55 11	132 48	1908.8	29 36.4	29 40	App. 3, 1909 (*a*)
Sukkwan Strait, Fish	55 11	132 49	1908.8	29 34.2	29 38	Do.
Mac	55 11	133 02	1907.7	29 00	29 08	App. 3, 1908 (*a*)
Flat	55 12	133 05	1907.6	29 13	29 22	Do.
Cholmondeley Sd., Mar	55 12	132 07	1908.7	27 37	27 42	App. 3, 1909 (*a*)
Portland Canal, Ast'l Pt.	55 13	130 04	1888.7	27 44.3	28 31	D Tables, 1902 (*a*)
Guide	55 13	133 04	1907.7	29 56	30 04	App. 3, 1908 (*a*)
South Base	55 13	133 06	1907.8	28 05	28 13	Do.
North Base	55 13	133 06	1907.8	27 33	27 41	Do.
Gone	55 14	133 06	1907.6	28 30	28 39	Do.
Cabin	55 16	133 08	1907.7	29 03	29 11	Do.
Pin	55 16	133 12	1907.6	29 13	29 22	Do.
Stone	55 17	133 12	1907.6	28 54	29 03	Do.
Mud	55 17	133 13	1907.7	30 14	30 22	Do.
Antonio	55 17	133 14	1907.6	30 25	30 34	Do.
Tongass Narrows	55 20	131 39	1906.8	28 47	28 59	App. 5, 1907 (*a*)
Ketchikan, I	55 20	131 40	1907.6	29 08.2	29 17	App. 3, 1908 (*a*)
Ketchikan, II	55 20	131 40	1907.7	28 59.5	29 08	Do.
Flores	55 21	133 18	1907.7	29 06	29 14	Do.
McKenzie Inlet	55 21	132 21	1905.6	29 56	30 12	App. 3, 1906 (*a*)
Peninsula Point	55 23	131 44	1885.6	28 07.2	28 59	D Tables, 1902 (*a*)
Ignace	55 23	133 25	1907.6	29 16	29 25	App. 3, 1908 (*a*)
Clam	55 28	133 25	1907.7	29 45	29 53	Do.
Fish	55 29	133 11	1907.7	29 45	29 53	Do.
Kasaan Bay, Long Island	55 30	132 19	1880.4	27 48	28 48	App. 9, 1881 (*a*)
Southwest Base	55 30	133 12	1907.7	29 36	29 44	App. 3, 1908 (*a*)
Northeast Base	55 30	133 11	1907.6	29 20	29 29	Do.
Port	55 32	133 28	1907.7	29 37	29 45	Do.
Kasaan Bay, Crook	55 34	132 29	1908.7	29 52.4	29 57	App. 3, 1909 (*a*)
Kasaan Bay, near Crook	55 34	132 29	1908.7	30 17.9	30 23	Do.
Gibson Anchorage	55 35	132 30	1906.5	27 45.0	27 58	App. 3, 1906 (*a*)
Philip Rock	55 38	133 26	1907.7	29 42	29 50	App. 3, 1908 (*a*)
Twin	55 42	133 38	1907.6	29 11	29 20	Do.
Union Bay	55 45	132 12	1885.6	30 29.8	31 21	D Tables, 1902 (*a*)
Iphigenia Bay:						
Gull	55 45	133 44	1903.7	29 03.6	29 25	App. 3, 1904 (*a*)
Surf	55 50	133 38	1903.7	29 01.0	29 22	Do.
Surf A	55 50	133 38	1903.7	29 00.4	29 21	Do.
Black	55 52	133 46	1903.7	28 25.0	28 46	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

SOUTHEASTERN ALASKA—Continued.

Station	Latitude	Longitude	Date of observation.	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Iphigenia Bay—Continued.						
Black A	55 52	133 46	1903.7	28 33.2	28 54	App. 3, 1904 (*a*)
Black B	55 52	133 46	1903.7	28 24.6	28 46	Do.
Lichen	55 54	133 50	1903.7	26 05.7	26 27	Do.
Lichen A	55 54	133 50	1903.7	26 37.6	26 59	Do.
Green	55 54	133 37	1903.7	29 28.3	29 49	Do.
Green A	55 54	133 37	1903.7	29 22.1	29 43	Do.
Warren	55 56	133 54	1903.7	32 05.9	32 27	Do.
Warren A	55 56	133 54	1903.7	30 47.1	31 08	Do.
Heather	55 57	133 49	1903.7	28 32.5	28 54	Do.
Heather A	55 57	133 49	1903.7	28 34.4	28 55	Do.
Head of Portland Canal	55 56	130 00	1888.5	30 08.6	30 55	D Tables, 1902 (*a*)
Dewey Anchorage	55 56	132 22	1886.7	28 30	29 19	Do.
Burroughs Bay	56 02	131 06	1893.4	30 23.9	31 02	Do.
Lake Bay	56 03	132 52	1905.7	29 42	29 57	App. 3, 1906 (*a*)
Port McArthur	56 04	134 06	1886.6	27 50	28 38	D Tables, 1902 (*a*)
Albans	56 05	133 58	1903.7	29 08.7	29 30	App. 3, 1904 (*a*)
Shakan	56 09	133 28	1886.5	33 00	33 49	D Tables, 1902 (*a*)
Shakan Point	56 09	133 36	1886.6	29 25	30 13	Do.
Shakan Entrance	56 09	133 38	1881.6	30 03.2	31 00	App. 9, 1881 (*a*)
Red Bay, Sumner Strait	56 20	133 15	1886.4	29 40	30 29	D Tables, 1902 (*a*)
Wrangell, North Base	56 27	132 23	1886.5	29 20	30 09	Do.
Wrangell	56 28	132 23	1893.5	29 38.3	30 15	Do
Duncan Canal, East Base	56 36	133 06	1887.6	30 05.7	30 53	Do.
Frederick Sound	56 55	132 51	1887.4	29 38	30 24	Do.
Portage Bay, Frederick Sound	57 00	133 20	1887.5	30 29.3	31 15	Do.
Vicinity of Sitka:						
Sitka Magnetic Obsy	57 03	135 20	1909.0	30 11.6	30 16	App. 3, 1909 (*a*)
Jamestown Bay	57 03	135 17	1901.5	29 52.6	30 19	C. & G. S. Mss. (*a*)
Parade Ground	57 03	135 20	1901.5	29 46.9	30 13	Do.
Public Garden	57 03	135 20	1901.4	29 47.2	30 13	Do
Block House D.	57 03	135 20	1901.4	29 44.4	30 10	Do.
Gov't Reservation 1	57 03	135 20	1901.4	29 40.0	30 06	Do.
2	57 03	135 20	1901.4	29 43.6	30 10	Do.
3	57 03	135 20	1901.4	29 37.8	30 04	Do.
Swanson Property	57 03	135 20	1901.5	29 50.4	30 16	Do.
Japonski Island	57 03	135 21	1901.5	29 41.4	30 07	Do.
Indian Park 1	57 03	135 19	1901.4	29 43.6	30 10	Do.
2	57 03	135 19	1901.4	29 41.2	30 07	Do.
3	57 03	135 19	1901.4	29 38.0	30 04	Do.
Experiment Farm 1	57 03	135 20	1901.4	29 45.4	30 11	Do.
2	57 03	135 20	1901.4	29 37.7	30 04	Do.
3	57 03	135 20	1901.4	29 48.7	30 15	Do.
Cross Mountain	57 03	135 17	1901.5	29 54.0	30 20	Do.
Watson's Point	57 04	135 22	1901.5	29 50.6	30 17	Do.
Woewodski Harbor	57 10	134 15	1889.5	29 35	30 18	D Tables, 1902 (*a*)
Cape Fanshaw	57 11	133 34	1887.5	30 05.1	30 51	Do.
Do.	57 12	133 30	1889.3	30 13	30 56	Do.
Gambier Island, Poke	57 27	133 50	1889.5	30 16	30 59	Do.
Killisnoo	57 27	134 30	1895.7	29 28.1	30 01	C. & G. S. Mss.(*a*)
Do.	57 28	134 34	1900.8	28 14.2	28 41	D Tables, 1902 (*a*)
Slocum Arm	57 33	136 02	1906.7	30 12	30 24	App. 5, 1907 (*a*)
Khaz Bay	57 34	136 05	1906.7	30 48	31 00	Do.
Sanford Cove, Clot	57 41	133 28	1889.7	28 12	28 54	D Tables, 1902 (*a*)
Icy Strait, First	58 05	135 07	1901.5	30 35	30 57	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

SOUTHEASTERN ALASKA—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Icy Strait, Peach	58 10	135 03	1901.4	30 28	30 50	D Tables, 1902 (*a*)
Port Althorp	58 12	136 24	1880.5	32 15.5	33 06	App. 9, 1881 (*a*)
Auke Point	58 12	134 33	1890.5	30 44	31 19	D Tables, 1902 (*a*)
Taku River, Hat	58 12	134 09	1893.5	31 02	31 33	Do.
Cross Sound, Spence	58 12	136 38	1901.6	30 09	30 31	Do.
Cross Sound, Jog	58 13	136 02	1901.5	29 04	29 26	Do.
Cross Sound, Lack	58 13	136 08	1901.5	31 19	31 41	Do.
Funter Bay	58 14	134 55	1890.7	30 15	30 50	Do.
Vicinity of Juneau:						
Station 14	58 12	134 15	1903.6	30 54.7	31 13	App. 3, 1904 (*a*)
17	58 12	134 22	1903.6	31 09.5	31 28	Do.
18	58 13	134 30	1903.6	31 07.8	31 26	Do.
23	58 13	134 17	1903.6	30 12.2	30 30	Do.
15	58 14	134 16	1903.6	31 39.2	31 57	Do.
13	58 14	134 17	1903.6	32 32.3	32 50	Do.
16	58 15	134 20	1903.6	29 31.8	29 50	Do.
12	58 15	134 19	1903.6	29 40.7	29 59	Do.
19	58 15	134 38	1903.6	31 08.1	31 26	Do.
Sheep Creek	58 15	134 19	1900.8	29 32	30 00	App. 3, 1903 (*a*)
Station 7	58 16	134 20	1903.6	30 12.0	30 30	App. 3, 1904 (*a*)
24	58 16	134 21	1903.6	32 40.6	32 59	Do.
Juneau Isle	58 16	134 23	1903.6	33 03.2	33 21	Do.
Station 1	58 16	134 23	1903.5	32 56.0	33 14	Do.
9	58 17	134 24	1903.6	32 09.0	32 27	Do.
25	58 17	134 24	1903.6	32 29.1	32 47	Do.
28	58 18	134 41	1903.6	30 54.4	31 12	Do.
26	58 18	134 26	1903.6	31 57.8	32 16	Do.
Juneau School	58 18	134 25	1903.7	31 51.9	32 10	Do.
Station 22	58 18	134 25	1903.6	31 50.0	32 08	Do.
Juneau Hill	58 18	134 24	1903.6	33 33.1	33 51	Do.
Station 5	58 18	134 23	1903.6	31 39.4	31 57	Do.
8	58 18	134 26	1903.6	31 43.4	32 01	Do.
10	58 18	134 24	1903.6	32 16.3	32 34	Do.
3	58 20	134 28	1903.6	31 41.0	31 59	Do.
21	58 21	134 30	1903.6	31 28.2	31 46	Do.
27	58 21	134 32	1903.6	31 18.2	31 36	Do.
Dixon Harbor	58 22	136 53	1905.7	30 14.2	30 26	App. 3, 1906 (*a*)
Dundas Bay	58 22	136 22	1900.8	31 14.1	31 37	D Tables, 1902 (*a*)
Icy Strait, Gus	58 23	135 55	1901.5	30 19	30 41	Do.
Lynn Canal, Point Lena	58 24	134 46	1890.4	30 24	30 58	Do.
Taku River:						
Astro sta.	58 26	133 59	1893.6	30 16.3	30 46	Do.
Island	58 30	133 54	1893.4	30 49	31 19	Do.
Duck	58 31	133 52	1893.4	30 52	31 22	Do.
Terrace	58 31	133 46	1893.4	30 57	31 27	Do.
Islet	58 32	133 44	1893.4	30 12	30 42	Do.
Fishery	58 32	133 41	1893.5	32 06	32 36	Do.
Wood	58 34	133 40	1893.5	32 25	32 55	Do.
Lean	58 34	133 40	1893.5	31 28	31 58	Do.
Nob	58 35	133 40	1893.5	31 58	32 28	Do.
Shoal	58 35	133 38	1893.5	32 34	33 04	Do.
Fast	58 36	133 35	1893.5	31 38	32 08	Do.
Lituya Bay	58 37	137 40	1874.4	30 02.8	30 50	App. 9, 1881 (*a*)
La Perouse, Lituya Bay	58 38	137 41	1894.6	30 10.1	30 36	D Tables, 1902 (*a*)
Camp Muir, Glacier Bay	58 50	136 05	1890.7	30 26	30 58	Do.
Anchorage Pt., Chilkat Inlet	59 10	135 28	1894.5	30 29.0	30 54	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

SOUTHEASTERN ALASKA—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Chilkat*	59 12	135 27	1890.6	30 39	31 09	D Tables, 1902 (*a*)
Chilkoot*	59 12	135 21	1890.6	19 39	20 09	Do.
Chilkat River:						
Dalton	59 20	135 48	1894.5	31 56.9	32 22	Do.
Open	59 21	135 48	1894.5	31 54.5	32 19	Do.
Sight	59 23	135 53	1894.5	29 54.9	30 20	Do.
Koklux*	59 24	135 53	1894.5	24 08.3	24 33	Do.
Upper	59 24	135 54	1900.5	32 23.7	32 44	Do.
Porcupine Creek	59 25	136 16	1900.5	31 25.3	31 45	Do.
Taiya River, Limber	59 32	135 20	1894.6	32 09.0	32 33	Do.

YAKUTAT BAY TO SANNAK ISLANDS.

	° ′	° ′		*East* ° ′	*East* ° ′	
Mt. Hoorts, Yakutat Bay	59 45	139 32	1892.6	30 51	31 17	D Tables, 1902 (*a*)
Port Mulgrave, Yakutat Bay	59 34	139 47	1892.7	29 55.8	30 22	Do.
Ocean Cape, Yakutat Bay	59 33	139 52	1892.7	30 24	30 50	Do.
Malaspina, N. E. Base	59 45	140 06	1892.6	30 42	31 08	Do.
Malaspina, S. W. Base	59 44	140 12	1894.5	30 43	31 06	Do.
Yahtse, East Base	59 49	141 08	1894.6	30 29.6	30 53	Do.
Controller Bay	60 10	144 11	1899.5	29 32	29 26	Alaska Development Company (*p*)
Wingham Island	59 59	144 23	1906.5	28 52.0	28 52	App. 5, 1907 (*a*)
Kokinhenik Island	60 18	145 03	1898.5	29 25.9	29 28	D Tables, 1902 (*a*)
Orca	60 35	145 41	1898.4	28 46.6	28 47	Do.
Do.	60 35	145 41	1900.6	29 27.2	29 27	Do.
Reef	60 34	145 59	1900.6	28 57.7	28 58	Do.
Valdez	61 07	146 17	1905.8	29 12.2	29 13	App. 3, 1906 (*a*)
Mag	60 28	146 26	1900.6	28 40.0	29 39	D Tables, 1902 (*a*)
Port Etches: First	60 20	146 31	1902.6	28 21	28 20	App. 5, 1903 (*a*)
Grass	60 21	146 34	1902.7	28 17	28 16	Do.
Port Etches	60 21	146 38	1874.4	29 09.8	-- --	App. 9, 1881 (*a*)
Seward	60 06	149 26	1905.6	27 00.6	26 57	App. 3, 1906 (*a*)
Nuka Bay	59 32	150 40	1906.8	26 02.6	25 57	App. 5, 1907 (*a*)
Kachemak Bay, Cook Inlet	59 46	151 09	1895.8	24 35	24 10	F. N. Curtiss (*p*)
Coal Point, Ugolnoi	59 36	151 24	1880.5	25 48.5	24 53	App. 9, 1881 (*a*)
Port Chatham	59 14	151 45	1906.7	24 30.0	24 24	App. 5, 1907 (*a*)
Kachemak Bay, Cook Inlet	59 30	151 45	1892.3	25	24 30	Z. L. Tanner (*d*)
Port Graham, East Base	59 21	151 47	1908.8	24 14.4	24 12	App. 3, 1909 (*a*)
Dangerous Cape	59 24	151 53	1880.5	24 32.5	23 36	App. 9, 1881 (*a*)
Port Graham, Danger	59 24	151 55	1908.7	23 32.4	23 30	App. 3, 1909 (*a*)
Point Harriet	60 23	152 17	1908.7	25 33.4	25 31	Do.
Ushagat, Barren Island	58 56	152 18	1907.7	23 30.5	23 26	App. 3, 1908 (*a*)
Kodiak	57 48	152 24	1908.8	24 12.2	24 10	App. 3, 1909 (*a*)
Narrow Strait	57 55	152 31	1907.6	23 52.4	23 48	App. 3, 1908 (*a*)
Shuyak Island, Shuyak	58 37	152 34	1908.7	24 20.0	24 17	App. 3, 1909 (*a*)
Afognak Island, Afognak	58 05	152 45	1908.5	24 00.6	23 58	Do.
Afognak Island, Banner	58 12	152 57	1908.7	23 56.5	23 54	Do.
Bare Island	57 58	153 04	1908.5	23 53.3	23 50	Do.
Onion Bay, Raspberry Island	58 03	153 13	1908.5	23 47.5	23 44	Do.
Cape Douglas	58 51	153 18	1908.7	24 29.9	24 28	Do.
Augustine Island	59 21	153 24	1908.5	22 19.9	22 17	Do.

*Local disturbance.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

YAKUTAT BAY TO SANNAK ISLANDS—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Kiukpalik Island, Shelikof Strait	58 36	153 34	1908.6	24 43.6	24 41	App. 3, 1909 (*a*)
Iliamna Bay	59 37	153 37	1907.5	22 58.8	22 54	App. 3, 1908 (*a*)
Uyak Bay, Harvester Island	57 38	153 52	1908.5	22 41.2	22 38	App. 3, 1909 (*a*)
Miller Island	56 58	154 07	1906.7	23 06.0	22 58	App. 5, 1907 (*a*)
Snug Harbor	57 00	154 09	1906.5	23 01.4	22 53	Do.
Chirikof Island	55 48	155 43	1874.4	23 00.9	21 29	App. 9, 1881 (*a*)
Semidi Islands	56 05	156 39	1874.4	22 56.9	21 21	Do.
Chignik Bay	56 19	158 24	1874.5	22 01.7	20 18	Do.
Chiachi Islands	55 52	159 05	1874.5	21 55.9	20 09	Do.
Little Koniuji Island	55 03	159 22	1893.5	20 22	19 26	H. O. 109 (*d*)
Little Koniuji Island, N. W. Harbor	55 03	159 23	1880.5	21 25.2	19 55	App. 9, 1881 (*a*)
Kupreanof Harbor	55 48	159 25	1901.4	20 39	20 12	D Tables, 1902 (*a*)
Little Koniuji Island	55	160	1893.5	20 15	19 19	H. O. 109 (*d*)
Shumagin Island, Humboldt Harbor	55 19	160 31	1880.6	20 17.0	18 42	App. 9, 1881 (*a*)
Port Moller	55 55	160 35	1874.6	21 22.2	19 29	Do.
Portage Bay	55 35	160 38	1893.7	20 23	19 27	H. O. 109 (*d*)
Dolgoi Island, South end	55 03	161 43	1880.6	17 59	16 19	App. 9, 1881 (*a*)
Belkofski, Dolgoi Island	55 05	162 00	1880.6	21 25.7	19 45	Do.
Bailey Harbor, Belkofski	55 09	162 07	1879.5	21 08	19 24	G. W. Bailey (*h*)
Peterson Bay, Sannak I.	54 24	162 38	1901.7	18 19	17 47	D Tables, 1902 (*a*)
Acherk Harbor, Sannak I.	54 29	162 49	1901.6	18 18	17 46	Do.
Amagat Island	54 54	162 53	1901.5	18 25	17 53	Do.
Otter Cove	54 46	163 20	1901.6	19 30	18 57	Do.

ALEUTIAN ISLANDS.

	° ′	° ′		*East* ° ′	*East* ° ′	
Ugamak	54 13	164 47	1901.6	18 45	18 10	D Tables, 1902 (*a*)
Tigalda Island, Tigalda Bay	54 08	165 00	1901.6	17 03	16 28	Do.
Tigalda Island, Tigalda	54 08	165 08	1901.6	22 56	22 20	Do.
Basalt Rock	54 07	165 23	1901.6	17 32	16 56	Do.
Rootok Island, Rootok Pass	54 03	165 31	1901.7	16 28	15 53	Do.
Egg Island, Egg	53 52	166 03	1901.5	18 22	17 44	Do.
Biorka Island, Biorka	53 50	166 13	1901.5	18 48	18 10	Do.
Unalaska Island, Shelf	53 53	166 14	1901.5	17 38	17 00	Do.
Biorka Island, Strait	53 48	166 18	1901.5	17 32	16 54	Do.
Unalaska Island, Food	53 52	166 19	1901.5	16 09	15 31	Do.
Unalaska Island, Round	53 46	166 23	1901.5	20 51	20 13	Do.
Unalaska Island, Flat	53 53	166 30	1908.3	17 09.0	17 01	App. 3, 1909 (*a*)
Amaknak I., North Base	53 55	166 30	1908.3	17 43.5	17 36	Do.
Amaknak I., South Base	53 54	166 31	1908.3	17 07.3	16 59	Do.
Unalaska Island, Obs'y	53 53	166 32	1908.4	16 18.6	16 12	Do.
Amaknak I., Astro. sta.	53 53	166 32	1880.6	18 38.0	16 37	C. & G. S. Mss (*a*)
Amaknak Island, near Astro. station	53 53	166 32	1889.5	17 46.0	16 17	Do.
Amaknak Island, near Astro. station	53 53	166 32	1896.3	17 43.6	16 44	Do.
Amaknak I., Rocky Point	53 53	166 32	1908.4	18 03.2	17 56	App. 3, 1909 (*a*)
Amaknak I., Dutch Harbor	53 54	166 32	1908.3	17 38.4	17 30	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

ALEUTIAN ISLANDS—Continued.

Station.	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Amaknak Island, Eliza	53 54	166 32	1908.3	16 30.0	16 22	App. 3, 1909 (*a*)
Unalaska Island, Eider	53 58	166 35	1901.5	16 23	15 45	D Tables, 1902 (*a*)
Unalaska Island, Cove Pt.	53 24	167 30	1880.8	16 15.3	14 12	Do.
Atka Island, Nazan Bay	52 11	174 15	1873.6	16 57.3	14 04	App. 9, 1881 (*a*)
Bay of Waterfalls	51 42	176 49	1901.7	10 45	10 02	H. O. Mss. (*d*)
Adak I., Bay of Islands	51 49	176 52	1873.6	13 52.1	10 49	App. 9, 1881 (*a*)
Amchitka Island	51 24	180 48	1873.6	7 17.1	3 59	Do.
Kiska Island, Barrel	52 00	182 27	1904.7	8 04.5	7 34	App. 3, 1905 (*a*)
Kiska Island, Post	51 59	182 28	1904.6	8 14.3	7 44	Do.
Kiska Island, Astro	51 59	182 28	1904.6	8 18.2	7 48	Do.
Kiska	51 58	182 30	1901.6	7 06	6 19	H. O. Mss. (*d*)
Attu Island, Gibson Island	52 56	186 46	1893.5	4 35	3 03	H. O. 109 (*d*)
Attu Island, Chicagof Hbr.	52 56	186 47	1894.5	10	8 33	A. F. Fechtebeer (*d*)
Attu Island, Chicagof Hbr.	52 56	186 48	1873.5	7 43.0	4 18	App. 9, 1881 (*a*)

BERING SEA AND ARCTIC OCEAN.

	° ′	° ′		*East* ° ′	*East* ° ′	
St. George Island	56 36	169 32	1897.7	19 02.7	18 04	D Tables, 1902 (*a*)
St. Paul Island	57 07	170 16	1897.5	16 42.0	15 42	Do.
Hagemeister Island	58 48	160 40	1874.6	22 52.8	20 59	App. 9, 1881 (*a*)
Clark Point	58 49	158 32	1890.6	23 40	22 33	U. S. S. Albatross (*d*)
Nunivak Island	60 04	167 14	1902.7	17 00	16 30	App. 5, 1903 (*a*)
Nunivak I., Cape Etolin	60 25	166 08	1874.6	21 33.8	18 16	App. 9, 1881 (*a*)
Kun	61 51	165 34	1899.6	19 44.8	19 03	D Tables, 1902 (*a*)
Bright	62 11	163 58	1899.7	20 37.9	19 56	Do.
Black (Kripniyuk)	62 20	165 19	1898.7	19 42.5	18 54	Do.
Kwiklokchun	62 34	164 51	1898.6	19 48.8	19 01	Do.
Head of Apoon	62 54	164 01	1899.6	20 35.8	19 54	Do.
Okweah	63 02	164 37	1899.6	20 38	19 56	Do.
Quit, near Kotlik	63 02	163 33	1899.7	21 15	20 33	Do.
Kotlik	63 02	163 36	1908.6	20 31.0	20 27	App. 3, 1909 (*a*)
Pastoliak	63 03	163 13	1898.6	21 01	20 13	D Tables, 1902 (*a*)
St. Lawrence Island	63 16	168 43	1902.7	17 26	16 54	App. 5, 1903 (*a*)
St Michael, I	63 29	162 01	1905.6	22 11.7	21 58	App. 3, 1906 (*a*)
II	63 29	162 01	1905.6	22 02.2	21 48	Do.
IIIA	63 29	162 01	1905.6	21 31.6	21 18	Do.
III	63 29	162 01	1902.7	21 43	21 16	App. 5, 1903 (*a*)
North	63 29	162 01	1908.7	22 16.6	22 13	App. 3, 1909 (*a*)
Mesa	63 29	162 01	1908.7	21 36.6	21 33	Do.
Hilltop	63 29	162 01	1908.7	21 10.6	21 07	Do.
St. Lawrence Island	63 43	171 23	1879.6	19 05	15 45	A. Wykander (*p*)
Plover Bay	64 22	173 22	1880.7	18 26	-- --	App. 9, 1881 (*a*)
Konyan Bay	64 50	172 57	1879.6	17 52	-- --	A. Wykander (*p*)
Current	65 07	165 19	1900.7	20 53.3	20 16	D Tables, 1902 (*a*)
Port Clarence	65 16	166 51	1880.7	22 45	19 38	App. 9, 1881 (*a*)
Do.	65 17	166 46	1900.7	19 55.4	19 18	D Tables, 1902 (*a*)
St. Laurence Bay	65 35	170 44	1879.5	20 23	-- --	A. Wykander (*p*)
Big Diomede Island	65 45	169 04	1880.7	21 49	-- --	App. 9, 1881 (*a*)
Chamisso Hbr., Kotzebue Sound	66 13	161 49	1880.7	26 49	23 42	Do.
Pitlekai	67 05	173 30	1878.7	19 43	-- --	A. Wykander (*p*)

Table of magnetic declinations in Alaska and adjacent regions—Continued.

BERING SEA AND ARCTIC OCEAN—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Point Hope, nr. end of spit	68 19	166 46	1889.7	23 10	20 28	H. O. 109 (*d*)
Valley of Three Rivers	68 37	141 00	1890.3	40 33	-- --	D Tables, 1902 (*a*)
Irkaipi	68 50	180 00	1878.7	17 54	-- --	A. Wykander (*p*)
Near Cape Lisburne	68 53	166 06	1880.6	25 42.8	-- --	App. 9, 1881 (*a*)
Near Icy Cape	70 13	162 15	1880.6	30 05.7	-- --	Do.
Icy Cape, near Indian village	70 20	161 52	1889.7	28 51	-- --	H. O. 109 (*d*)
Cross Island	70 27	147 52	1889.6	38 40	-- --	Do.
Wainwright Inlet	70 35	160 36	1880.6	38 27	-- --	C. L. Hooper (*h*)
Wrangell Island	70 57	178 10	1881.6	19 55	-- --	Berry & Putnam (*p*)
Cape Smyth	71 18	156 39	1889.6	33 40	-- --	H. O. 109 (*d*)
Utkiavi, near Point Barrow	71 18	156 40	1883.2	35 37.2	-- --	D Tables, 1902 (*a*)

YUKON RIVER.

	° ′	° ′		*East* ° ′	*East* ° ′	
Andreafski	62 03	163 13	1908.6	20 13.6	20 10	App. 3, 1909 (*a*)
Russian Mission	61 47	161 21	1908.6	21 27.1	21 23	Do.
Holy Cross	62 12	159 46	1908.6	23 08.2	23 04	Do.
Anvik	62 40	160 12	1908.6	22 42.3	22 38	Do.
Kaltag	64 20	158 45	1908.6	24 11.0	24 07	Do
Nulato	64 43	158 07	1908.6	25 25.2	25 21	Do.
Louden	64 37	156 42	1908.6	25 06.3	25 02	Do.
Kokrines	64 56	154 42	1908.6	26 15.4	26 11	Do.
Tanana	65 10	152 06	1908.5	28 43.4	28 39	Do.
Rampart	65 31	150 13	1908.5	29 57.4	29 53	Do.
Fort Hamlin	65 54	149 14	1908.5	31 46.0	31 44	Do.
Shaman	66 00	149 06	1891.5	33 11	32 05	D Tables, 1902 (*a*)
Hodzana River	66 15	147 45	1908.5	32 00.9	31 57	App. 3, 1909 (*a*)
Fort Yukon	66 34	145 18	1891.5	35 05.9	34 08	D Tables, 1902 (*a*)
Do.	66 34	145 18	1908.5	34 01.6	33 58	App. 3, 1908 (*a*)
Circle	65 50	144 04	1908.5	34 10.6	34 07	Do.
Island, near Kandig River	65 22	143 06	1908.5	34 56.4	34 54	Do.
Fort Egbert	64 47	141 12	1908.5	35 55.5	35 56	Do.

RESULTS FROM RECONNAISSANCE SURVEYS IN THE INTERIOR.

	° ′	° ′		*East* ° ′	*East* ° ′	
Katmai	58 04	154 53	1898.8	24 33	24 08	Report 1899, part 7 (*g*)
Savonoski	58 34	155 27	1898.8	23 56	23 28	Do.
Naknek Lake	58 48	156 35	1898.8	24 53	24 22	Do.
Nushagak	58 56	158 27	1898.8	25 02	24 26	Do.
Ualik Lake	59 07	159 28	1898.7	23 13	22 35	Do.
Kwinak	59 46	162 01	1898.6	20 38	19 58	Do.
On Portage	59 48	160 00	1898.7	22 01	21 21	Do.
Kagati Lake	59 53	160 15	1898.7	21 14	20 34	Do.
Apokak	60 09	162 15	1898.6	21 25	20 45	Do.
Kuskokwim Bay	60 35	162 16	1898.6	20 44	20 04	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

RESULTS FROM RECONNAISSANCE SURVEYS IN THE INTERIOR—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		*East* ° ′	*East* ° ′	
Bethel	60 47	161 52	1898.6	21 17	20 37	Report 1899, part 7 (*g*)
Kuskokwim River	60 54	161 18	1898.6	20 22	19 42	Do.
Tyonok	61 04	151 10	1902.4	27 00	26 45	Prof. paper 45 (*g*)
Tyonok	61 10	151 10	1898.3	27 15	26 45	Report 1899, part 7 (*g*)
Kuskokwim River	61 17	160 45	1898.6	25 37	24 57	Do.
Mouth Susitna River	61 19	150 38	1898.4	27 15	26 50	Do.
Kuskokwim River	61 26	160 46	1898.6	23 50	23 10	Do.
Knik	61 27	149 46	1906.5	28 38	28 29	Bulletin 327 (*g*)
Kuskokwim River	61 32	160 42	1898.6	23 51	23 11	Report 1899, part 7 (*g*)
Mouth Yentna River	61 35	150 27	1898.4	27 20	26 55	Do.
Susitna River	61 35	150 30	1906.5	25 54	25 45	F. A. Cook (*p*)
Chickaloon Creek	61 45	148 25	1905.6	28 19	28 15	Bulletin 289 (*g*)
Station	61 45	151 41	1902.5	28 00	27 42	Prof. paper 45 (*g*)
Susitna River	61 54	150 07	1898.4	27 50	27 25	Report 1899, part 7 (*g*)
Copper Center	61 58	145 20	1902.5	30 38	30 32	Prof. paper 41 (*g*)
On Skwentna River	61 58	152 40	1898.5	27 20	26 50	Report 1899, part 7 (*g*)
On Portage Creek	61 59	152 57	1898.5	26 58	26 28	Do.
Near Pass	61 59	153 01	1898.5	26 29	25 59	Do.
Do.	61 59	153 05	1898.5	25 45	25 15	Do.
On Portage Creek	62 00	152 46	1898.5	27 19	26 49	Report 1899, part 7 (*g*)
Near Pass	62 00	153 04	1898.5	25 58	25 28	Do.
Station	62 06	151 32	1902.5	28 30	28 12	Prof. paper 45 (*g*)
Do.	62 11	152 54	1902.5	27 15	26 57	Do.
Do.	62 15	152 24	1902.5	27 15	26 57	Do.
Do.	62 17	153 15	1902.5	26 40	26 22	Do.
Do.	62 18	151 50	1906.5	26 11	26 01	F. A. Cook (*p*)
Forks Susitna River	62 20	150 10	1898.5	29 30	29 05	Report 1899, part 7 (*g*)
Station	62 26	153 27	1902.5	26 45	26 27	Prof. paper 45 (*g*)
Do.	62 40	150 40	1906.5	27 52	27 42	F. A. Cook (*p*)
Do.	62 40	152 51	1902.6	27 20	27 02	Prof. paper 45 (*g*)
Mouth Indian Creek	62 49	149 39	1898.5	29 30	29 05	Report 1899, part 7 (*g*)
Station	62 53	152 16	1902.6	27 30	27 12	Prof. paper 45 (*g*)
Do.	63 06	151 43	1902.6	28 10	27 52	Do.
Chisana Mountain	63 14	142 38	1898.6	32 45	32 40	Report 1899, part 7 (*g*)
Station	63 15	151 12	1902.6	28 30	28 11	Prof. paper 45 (*g*)
Do.	63 28	150 38	1902.6	28 45	28 26	Do.
Boundary	63 40	141 00	1908.5	33 38	33 38	Boundary Survey (*a*)
Station	63 42	149 24	1902.6	29 35	29 15	Prof. paper 45 (*g*)
Do.	63 43	149 04	1902.6	29 50	29 30	Do.
Near Boundary	63 50	141 01	1908.5	33 22	33 22	Boundary Survey (*a*)
Do.	64 00	141 01	1908.5	34 22	34 22	Do.
Station	64 10	149 00	1902.7	30 10	29 50	Prof. paper 45 (*g*)
Tortella	64 34	149 05	1902.7	30 45	30 25	Do.
White Mountain	64 42	163 25	1900.5	20 00	19 22	Spec. Pub. b. (*g*)
Norton Bay	64 44	161 50	1900.6	23 45	23 08	Do.
On Fish River	64 55	163 15	1900.5	21 30	20 52	Do.
Do.	65 06	163 02	1900.5	21 45	21 07	Do.
Station	65 06	148 53	1902.7	30 50	30 26	Prof. paper 45 (*g*)
Head Koyuk River	65 23	162 35	1900.7	20 00	19 23	Spec. Pub. b. (*g*)
Station	66 02	149 10	1901.5	32 15	31 47	Prof. paper 10 (*g*)
Mouth Swan River	66 03	162 40	1901.7	23 23	22 50	Do.
Station	66 14	148 34	1901.5	32 30	32 02	Do.
Do.	66 15	148 02	1901.5	32 30	32 02	Do.
Do.	66 16	147 35	1901.4	34 00	33 32	Do.
Dall City	66 22	149 56	1901.5	31 00	30 32	Do.
Station	66 26	147 18	1901.4	33 00	32 33	Do.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

RESULTS FROM RECONNAISSANCE SURVEYS IN THE INTERIOR—Continued.

Station	Latitude	Longitude	Date of observation	Declination		Source
				Observed	1910	
	° ′	° ′		East ° ′	East ° ′	
Station	66 31	146 45	1901.4	33 45	33 18	Prof. paper 10 (*g*)
Do.	66 34	146 13	1901.4	34 30	34 03	Do.
Fort Yukon	66 34	145 19	1901.4	36 00	35 33	Do.
Do.	66 35	145 20	1903.5	34 35	34 15	Bulletin 251 (*g*)
Station	66 36	145 38	1901.4	34 30	34 03	Prof. paper 10 (*g*)
Do.	66 47	161 25	1901.7	25 00	24 28	Do.
Do.	66 51	156 30	1901.6	28 30	28 01	Do.
Do.	66 52	154 47	1901.6	29 20	28 51	Do.
Kikiktak	66 52	162 36	1901.7	24 10	23 38	Do.
Station	66 53	156 57	1901.6	28 15	27 46	Do.
Do.	66 56	160 35	1901.7	26 00	25 28	Do.
Do.	66 58	160 14	1901.7	25 30	24 58	Do.
Do.	66 59	153 40	1901.6	28 30	28 02	Do.
Do.	67 04	153 58	1901.6	29 10	28 42	Do.
Do.	67 05	154 16	1901.6	29 30	29 02	Do.
Do.	67 08	157 45	1901.6	26 30	26 01	Do.
Do.	67 09	159 38	1901.7	25 30	24 58	Do.
On John River	67 20	152 09	1901.5	29 23	28 53	Prof. paper 20 (*g*)
Station	68 10	151 52	1901.5	31 04	30 34	Do.
Do.	68 13	151 45	1901.6	30 30	30 01	Do.

OBSERVATIONS ON SHIPBOARD.

Locality	Latitude North	Longitude West of Greenwich	Date	Declination		Headings*	Source
				Observed	1910		
	° ′	° ′		East ° ′	East ° ′		
At sea	45 49	130 55	1904.3	22 29	22 52	16	App. 3, 1904 † (*a*)
Do.	46 10	130 05	1904.3	23 33	23 55	16	Do.†
Off Point Adams L. S.	46 12	124 14	1908.9	22 34	22 38	8	App. 3, 1909 (*a*)
At sea	46 20	124 55	1899.6	22 17	22 52	--	B. A., 1901 (*e*)
Do.	46 45	124 26	1892.4	20 27	21 16	16	H. O. 109 (*d*)
Do.	47 33	122 27	1905.3	23 15	23 32	16	U. S. N. Mss. (*d*)
Port Orchard	47 33	122 38	1906.4	23 08	23 21	16	App. 5, 1907 (*a*)
Seattle Harbor	47 36	122 22	1908.3	23 20	23 26	16	App. 3, 1908 (*a*)
Do.	47 36	122 22	1907.8	23 25	23 33	4	Do.
Do.	47 36	122 22	1907.5	23 27	23 36	16	Do.
Do.	47 36	122 22	1908.9	23 34	23 38	16	App. 3, 1909 (*a*)
Do.	47 36	122 21	1904.8	23 26	23 45	16	App. 3, 1905 (*a*)
Do.	47 37	122 26	1908.0	23 22	23 29	16	App. 3, 1908 (*a*)
Do.	47 37	122 23	1906.9	23 28	23 39	16	App. 5, 1907 (*a*)
Do.	47 37	122 24	1906.0	23 00	23 14	16	App. 3, 1906 (*a*)
Do.	47 37	122 24	1909.3	23 37	23 39	16	App. 3, 1909 (*a*)
Puget Sound	47 53	122 29	1905.4	24 12	24 29	16	App. 3, 1905 (*a*)
Port Townsend	48 06	122 45	1907.4	24 17	24 27	16	App. 3, 1908 (*a*)
At sea	48 08	123 24	1902.4	23 39	24 05	16	U. S. N. Mss (*d*)
Port Angeles	48 08	123 25	1904.3	24 33	24 54	16	App. 3, 1904 †(*a*)
Do.	48 08	123 26	1897.5	23 00	23 39	32	U. S. N. Mss. (*d*)

*I. Swung only one way. II. Swung both ways. †Corrected results.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

OBSERVATIONS ON SHIPBOARD—Continued.

Locality	Latitude North	Longitude West of Greenwich	Date	Declination		Headings*	Source
				Observed	1910		
	° ′	° ′		*East* ° ′	*East* ° ′		
Port Townsend	48 10	122 45	1892.3	23 04	23 53	32	H. O. 109 (*d*)
Near Port Angeles	48 10	123 25	1896.8	23 20	24 00	16	U. S. N. Mss. (*d*)
Dungeness	48 11	123 06	1907.9	23 57	24 05	16	App. 3, 1908 (*a*)
Off Port Angeles	48 15	123 23	1892.4	23 07	23 56	--	B. A., 1901 (*e*)
Juan de Fuca Strait	48 15	122 56	1904.8	22 14	22 33	16	App. 3, 1905 (*a*)
Do.	48 16	123 39	1907.5	24 05	24 14	3	App. 3, 1908 (*a*
Do.	48 18	122 58	1905.4	23 11	23 28	16	App. 3, 1906 (*a*)
Do.	48 20	124 15	1897.4	23 08	23 47	16	U. S. N. Mss. (*d*)
Do.	48 22	122 22	1902.9	23 40	24 04	I	B. A., 1905 (*e*)
Do.	48 22	125 15	1902.6	22 50	23 16	I	Do.
Victoria	48 22	123 24	1905.4	23 53	24 10	16	App. 3, 1906 (*a*)
Do.	48 23	123 20	1900.7	24 40	25 12	I	B. A., 1905 (*e*)
Do.	48 23	123 25	1892.3	23 11	24 01	16	H. O. 109 (*d*)
Do.	48 23	123 26	1891.6	23 46	24 34	8	Do.
Do.	48 24	123 25	1903.5	23 23	23 46	32	App. 3, 1904 (*a*)
Juan de Fuca Strait	48 25	124 20	1892.4	23 00	23 49	16	H. O. 109 (*d*)
Victoria	48 26	123 26	1902.8	23 33	23 58	I	B. A., 1905 (*e*)
Do.	48 26	123 26	1904.6	23 45	24 04	I	Do.
Do.	48 26	123 28	1905.9	23 20	23 35	I	B. A., 1907 (*e*)
Off San Juan Island	48 32	123 00	1892.5	23 55	24 44	--	B. A., 1901 (*e*)
Haro Strait	48 35	123 13	1907.6	23 01	23 10	3	App. 3, 1908 (*a*)
Do.	48 38	123 14	1909.3	24 01	24 03	16	App. 3, 1909 (*a*)
Bellingham Bay	48 44	122 32	1894.3	23 04	23 49	8	U. S. N. Mss. (*d*)
Georgia Strait	48 52	122 58	1907.4	24 52	25 01	16	App. 3, 1908 (*a*)
Do.	48 52	123 19	1905.7	24 06	24 22	II	B. A., 1907 (*e*)
Do.	48 55	123 17	1905.7	24 06	24 22	II	Do.
Do.	48 55	123 20	1909.3	24 27	24 29	16	App. 3, 1909 (*a*)
Barkley Sound	49 00	125 25	1901.6	22 48	23 17	I	B. A., 1905 (*e*)
Georgia Strait	49 10	123 37	1909.3	25 14	25 16	16	App. 3, 1909 (*a*)
Do.	49 12	123 46	1900.6	24 12	24 43	I	B. A., 1905 (*e*)
Do.	49 15	123 16	1904.6	25 48	26 07	I	Do.
Do.	49 15	123 50	1904.6	24 57	25 16	II	Do.
Do.	49 17	123 53	1898.4	25 20	25 55	II	B. A., 1901 (*e*)
Do.	49 18	123 21	1898.6	25 20	25 55	I	Do.
Do.	49 25	123 15	1904.5	25 36	25 56	I	B. A., 1905 (*e*)
Do.	49 26	124 28	1898.7	24 40	25 15	I	B. A., 1901 (*e*)
Do.	49 28	124 28	1907.6	24 42	24 51	3	App. 3, 1908 (*a*)
Do.	49 30	124 31	1907.4	24 45	24 54	16	Do.
Baynes Sound	49 35	124 51	1909.4	25 43	25 45	16	App. 3, 1909 (*a*)
Do.	49 35	124 52	1907.8	25 40	25 48	16	App. 3, 1908 (*a*)
Do.	49 35	124 52	1908.3	25 48	25 54	16	App. 3, 1909 (*a*)
Do.	49 35	124 53	1906.5	25 48	26 01	16	App. 5, 1907 (*a*)
Do.	49 36	124 52	1908.3	25 50	25 56	11	App. 3, 1908 (*a*)
Do.	49 36	124 52	1908.3	25 37	25 43	16	App. 3, 1909 (*a*)
Union Bay	49 39	124 56	1896.8	26 04	26 44	--	B. A., 1901 (*e*)
Do.	49 39	124 56	1897.0	26 50	27 29	--	Do.
Georgia Strait	49 48	124 54	1907.8	24 54	25 02	16	App. 3, 1908 (*a*)
Do.	49 53	125 03	1893.8	24 45	25 25	16	H. O. 109 (*d*)
Do.	49 54	125 04	1898.3	25 20	25 55	--	B. A., 1901 (*e*)
Do.	49 55	125 00	1898.3	25 13	25 48	--	Do.
Do.	49 57	125 10	1908.8	26 20	26 24	3	App. 3, 1909 (*a*)
Discovery Passage	50 09	125 22	1907.6	25 46	25 55	3	App. 3, 1908 (*a*)

*I. Swung only one way. II. Swung both ways.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

OBSERVATIONS ON SHIPBOARD—Continued.

Locality	Latitude North	Longitude West of Greenwich	Date	Declination		Headings*	Source
				Observed	1910		
	° ′	° ′		East ° ′	East ° ′		
Otter Cove	50 20	125 29	1900.6	24 48	25 19	--	B. A., 1905 (*e*)
Johnstone Strait	50 28	126 03	1909.4	24 42	24 44	16	App. 3, 1909 (*a*)
Do.	50 28	126 07	1908.8	24 32	24 36	8	Do.
Do.	50 32	126 41	1907.8	26 05	26 13	3	App. 3, 1908 (*a*)
Do.	50 32	126 42	1909.4	26 08	26 10	16	App. 3, 1909 (*a*)
Queen Charlotte Sound	50 45	127 15	1903.8	26 06	26 28	I	B. A., 1905 (*e*)
Do.	50 49	127 28	1908.8	27 24	27 28	3	App. 3, 1909 (*a*)
Do.	50 53	127 26	1903.8	26 42	27 04	I	B. A., 1905 (*e*)
Hecate Strait	51 03	128 32	1907.4	25 34	25 43	16	App. 3, 1908 (*a*)
Fitzhugh Sound	51 26	127 52	1908.8	26 34	26 38	8	App. 3, 1909 (*a*)
Do.	51 32	127 52	1909.4	27 33	27 35	16	Do.
At sea	51 58	131 47	1907.4	27 01	27 10	8	App. 3, 1908 (*a*)
Kiska Harbor	51 59	182 28	1904.7	9 26	8 56	16	App. 3, 1905 (*a*)
Lama Passage	52 04	127 56	1909.4	25 12	25 14	11	App. 3, 1909 (*a*)
Do.	52 04	128 06	1907.6	27 00	27 09	3	App. 3, 1908 (*a*)
At sea	52 04	132 15	1906.5	26 18	26 30	8	App. 5, 1907 (*a*)
Milbank Sound	52 22	128 32	1908.8	30 40	30 44	3	App. 3, 1909 (*a*)
Do.	52 25	128 33	1909.4	26 22	26 24	8	Do.
At sea	52 40	167 00	1907.6	16 07	15 56	I	B. A., 1908 (*e*)
Do.	52 48	128 25	1909.4	28 13	28 15	8	App. 3, 1909 (*a*)
Graham Reach	53 11	128 36	1908.8	28 14	28 18	3	Do.
At sea	53 20	129 11	1909.4	26 36	26 38	16	Do.
Wright Sound	53 22	129 17	1908.8	27 34	27 38	8	Do.
At sea	53 48	139 47	1907.6	26 06	26 11	1	Carnegie Instit. (*b*)
Dutch Harbor	53 53	166 32	1904.5	16 26	16 01	16	App. 3, 1905 (*a*)
Do.	53 54	166 31	1904.7	16 46	16 22	16	Do.
Arthur Pass	53 59	130 12	1909.4	28 18	28 20	16	App. 3, 1909 (*a*)
Off Dutch Harbor	54 01	166 32	1892.6	16 49	15 32	32	H. O. 109 (*d*)
Arthur Pass	54 03	130 13	1908.8	27 22	27 26	3	App. 3, 1909 (*a*)
At sea	54 05	142 13	1907.5	24 05	24 12	1	Carnegie Instit. (*b*)
Hecate Strait	54 10	131 51	1906.9	28 40	28 52	I	B. A., 1907 (*e*)
Off North Island	54 12	132 55	1907.8	27 55	28 03	II	B. A., 1908 (*e*)
Chatham Sound	54 15	130 30	1907.8	28 22	28 30	8	App. 3, 1908 (*a*)
Do.	54 16	130 37	1907.3	28 45	28 55	--	H. M. S. Egeria (*e*)
Do.	54 25	130 36	1908.3	29 07	29 13	8	App. 3, 1908 (*a*)
Do.	54 30	130 29	1906.5	29 05	29 18	II	B. A., 1907 (*e*)
At sea	54 30	166 20	1907.7	16 47	16 37	I	B. A., 1908 (*e*)
Off Dundas Island	54 41	130 43	1909.4	27 03	27 05	16	App. 3, 1909 (*a*)
Off northern end Dundas Island	54 41	130 54	1907.8	28 23	28 31	8	App. 3, 1908 (*a*)
Dixon Entrance	54 43	133 26	1906.7	28 14	28 26	I	B. A., 1907 (*e*)
At sea	54 54	166 24	1893.6	17 43	16 30	32	H. O. 109 (*d*)
Revillagigedo Channel	55 00	131 08	1908.8	29 08	29 12	8	App. 3, 1909 (*a*)
Do.	55 00	131 05	1890.4	29 19	30 02	16	H. O. 109 (*d*)
At sea	55 05	166 30	1894.7	18 00	16 51	4	U. S. N. Mss. (*d*)
Revillagigedo Channel	55 06	131 10	1909.4	28 21	28 23	8	App. 3, 1909 (*a*)
Clarence Strait	55 06	131 50	1905.4	28 31	28 48	16	App. 3, 1905 (*a*)
At sea	55 15	146 50	1906.5	24 10	24 10	16	App. 5, 1907 (*a*)
Near Ketchikan	55 17	131 36	1907.6	28 55	29 04	16	App. 3, 1908 (*a*)
Do.	55 17	131 36	1907.8	29 11	29 20	16	Do.
Do.	55 18	131 36	1908.3	29 00	29 06	8	Do.
Unga Strait	55 20	160 52	1894.5	20 28	19 40	8	U. S. N. Mss. (*d*)
Do.	55 24	160 31	1883.5	19 45	18 24	32	H. O. 109 (*d*)
Clarence Strait	55 31	132 06	1896.6	28 34	29 08	30	U. S. N. Mss. (*d*)

*I. Swung only one way. II. Swung both ways.

Table of magnetic declinations in Alaska and adjacent regions—Continued.

OBSERVATIONS ON SHIPBOARD—Continued.

Locality	Latitude North	Longitude West of Greenwich	Date	Declination		Headings*	Source
				Observed	1910		
	° ′	° ′		*East* ° ′	*East* ° ′		
At sea	55 42	138 53	1897.6	27 55	28 00	I	Carnegie Instit. (*b*)
Do.	55 43	151 31	1906.5	22 38	22 36	16	App. 5, 1907 (*a*)
Clarence Strait	55 44	132 22	1908.8	29 32	29 36	8	App. 3, 1909 (*a*)
At sea	55 51	169 54	1891.7	16 32	15 08	16	H. O. 109 (*d*)
Davidson Inlet	55 52	133 38	1904.6	29 19	29 38	16	App. 3, 1905 (*a*)
At sea	55 59	155 41	1906.5	21 53	21 44	16	App. 5, 1907 (*a*)
Seward Passage	56 00	132 02	1904.6	29 18	29 37	II	B. A., 1905 (*e*)
At sea	56 03	170 16	1904.6	15 09	14 44	II	Do.
Do.	56 05	136 40	1894.4	27 57	28 32	16	H. O. 109 (*d*)
Snow Passage	56 15	132 55	1904.6	29 19	29 38	II	B. A., 1905 (*e*)
Sumner Strait	56 24	133 35	1908.3	29 59	30 05	3	App. 3, 1908 (*a*)
Chatham Strait	56 30	134 35	1894.5	30 07	30 42	16	U. S. N. Mss. (*d*)
Off St. George Island	56 39	169 23	1892.5	17 03	15 43	8	H. O. 109 (*d*)
Sitka Harbor	57 02	135 19	1903.6	30 02	30 23	32	App. 3, 1904. (*a*)
Do.	57 03	135 20	1888.4	28 50	29 34	8	H. O. 109 (*d*)
At sea	57 14	144 18	1908.3	28 59	29 01	I	App. 3, 1908 (*a*)
Do.	57 15	144 31	1908.3	28 52	28 54	I	Do.
Do.	57 16	169 30	1894.5	15 50	14 39	8	U. S. N. Mss. (*d*)
Neva Strait	57 20	135 40	1892.3	29 42	30 20	16	H. O. 109 (*d*)
At sea	57 23	149 35	1908.3	26 00	26 00	8	App. 3, 1908 (*a*)
Chatham Strait	57 25	134 51	1893.6	29 39	30 15	16	H. O. 109 (*d*)
Peril Strait	57 29	135 07	1895.6	30 43	31 16	16	U. S. N. Mss. (*d*)
At sea	57 36	151 36	1908.3	23 51	23 48	3	App. 3, 1908 (*a*)
Shelikof Strait	57 38	154 31	1907.6	23 47	23 43	16	Do.
Chiniak Bay	57 46	152 26	1907.4	24 12	24 07	16	Do.
St. Paul Roadstead	57 48	152 20	1908.3	24 24	24 21	16	Do.
Do.	57 48	152 20	1908.8	24 14	24 12	16	App. 3, 1909 (*a*)
Do.	57 48	152 21	1907.8	24 15	24 11	16	App. 3, 1908 (*a*)
Do.	57 48	152 21	1908.2	24 08	24 05	16	App. 3, 1909 (*a*)
Marmot Bay	57 57	152 33	1907.6	24 14	24 10	16	App. 3, 1908 (*a*)
Junction Shelikof and Kupreanof straits	58 02	153 13	1908.5	22 32	22 29	16	App. 3, 1909 (*a*)
Stephens Passage	58 04	134 04	1895.5	31 24	31 56	32	U. S. N. Mss. (*d*)
Young Bay	58 10	134 33	1889.8	31 45	32 22	8	H. O. 109 (*d*)
Icy Strait	58 11	135 30	1896.4	30 52	31 22	30	U. S. N. Mss. (*d*)
Off Couverden Point	58 12	135 02	1887.4	30 53	31 33	16	H. O. 109 (*d*)
Icy Strait	58 12	135 26	1892.7	30 12	30 45	16	Do.
Lynn Canal	58 20	134 55	1888.4	31 00	31 39	16	Do.
Do.	58 20	135 06	1886.5	30 47	31 29	16	Do.
Do.	58 30	140 59	1893.5	29 04	29 19	--	B. A., 1901 (*e*)
Do.	58 34	135 10	1884.4	30 31	31 15	32	H. O. 109 (*d*)
Chilkoot Inlet	59 13	135 23	1886.4	30 00	30 36	32	Do.
Seward	60 05	149 15	1905.8	27 02	26 57	16	App. 3, 1906 (*a*)
Do.	60 05	149 15	1905.8	27 34	27 29	16	Do.
Resurrection Bay	60 08	149 13	1905.4	26 45	26 40	16	Do.

*I. Swung only one way. II. Swung both ways.

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ALPHABETICAL INDEX.

(Exclusive of Appendices 3 and 4.)

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FOR LIBRARY CATALOGUE CARDS.

U. S. *Coast and Geodetic Survey.*

. . . Report of the Superintendent of the Coast and Geodetic Survey, showing the progress of work from July 1, 1908 to June 30, 1909. Washington, Gov't print. office, 1909.

184 pp. 5 progress sketches and 5 maps in pocket. 4 figs. 30 cm.
At head of title: Department of Commerce and Labor.
4 appendices: nos. 3 and 4 also issued separately.
Contents of appendices: 1. Details of field operations. 2. Details of office operations. 3. Results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1908 and June 30, 1909. By R. L. Faris. 4. Distribution of the magnetic declination in Alaska and adjacent regions for 1910. By R. L. Faris.

SLIPS FOR LIST AND CATALOGUE.

LIST ENTRY.

1909.

Report of the Superintendent of the Coast and Geodetic Survey, showing the progress of the work from July 1, 1908 to June 30, 1909. Washington Gov't print. office. 1909.

184 pp. 5 progress sketches and 5 maps in pocket. 4 figs. 30 cm.
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APPENDICES.

1. Details of field operations. p. 23–62.
2. Details of office operations. p. 63–74.
3. Results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1908 and June 30, 1909. By R. L. Faris. p. 75–150.
4. Distribution of the magnetic declination in Alaska and adjacent regions for 1910. By R. L. Faris. p. 151–179. 4 figs. 1 map in pocket.

CATALOGUE ENTRIES.

Faris, Robert Lee.

Results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1908 and June 30, 1909. Rept., 1909, app. 3, p. 75–150.

Terrestrial magnetism.

FARIS, R. L. Results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1908 and June 30, 1909. Rept., 1909, app. 3, p. 75–150.

Faris, Robert Lee.

Distribution of the magnetic declination in Alaska and adjacent Regions for 1910. Rept., 1909, app. 4, p. 151–179.

Alaska.

MAGNETIC DECLINATION. Faris, R. L. Distribution of the magnetic declination in Alaska and adjacent Regions for 1910. Rept., 1909, app. 4, p. 151–179.

Magnetic declination.

ALASKA. Faris, R. L. Distribution of the magnetic declination in Alaska and adjacent Regions for 1910. Rept., 1909, app. 4, p. 151–179.

Distribution of the principal astronomic stations occupied by the U.S. Coast and Geodetic Survey for Latitude, Longitude and Azimuth to June 30 1909.

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

Kilometres 100 50 0 100 200 300 400 500 600 700 800

Explanation of Signs:
- Latitude Stations
- Longitude
- Azimuth
- Combination Stations

West from Greenwich

HAMMER & GEARY CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

Positions and Connections of Telegraphic Longitude Stations from 1846 to June 30 1902

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

Kilometres

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 1909

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

Kilometres 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 - 9 "
" " " " " 9 and more years
The letter a affixed to the symbol indicates that daily predictions for that station are given in the Tide Tables.

West from Greenwich

HOWARD S. GRAVES CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

Positions of Magnetic Stations

occupied to June 30 1909.

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

Kilometres 100 50 0 100 200 300 400 500 600 700 800

125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° West from Greenwich

45° 40° 35° 30° 25° 20°

DOMINION OF CANADA

WASHINGTON

OREGON

CALIFORNIA

NEVADA

IDAHO

MONTANA

WYOMING

UTAH

COLORADO

ARIZONA

NEW MEXICO

NORTH DAKOTA

SOUTH DAKOTA

NEBRASKA

KANSAS

OKLAHOMA

TEXAS

MINNESOTA

IOWA

MISSOURI

ARKANSAS

LOUISIANA

WISCONSIN

ILLINOIS

MICHIGAN

INDIANA

OHIO

KENTUCKY

TENNESSEE

MISSISSIPPI

ALABAMA

GEORGIA

FLORIDA

SOUTH CAROLINA

NORTH CAROLINA

VIRGINIA

WEST VIRGINIA

PENNSYLVANIA

NEW YORK

MAINE

VERMONT

NEW HAMPSHIRE

MASSACHUSETTS

RHODE ISLAND

CONNECTICUT

NEW JERSEY

MARYLAND

DELAWARE

LAKE SUPERIOR

LAKE MICHIGAN

LAKE HURON

LAKE ERIE

LAKE ONTARIO

ATLANTIC OCEAN

PACIFIC OCEAN

GULF OF MEXICO

HAWAIIAN ISLANDS

CUBA

Olympia

Portland

Helena

Butte

Bismarck

Huntley

Boise City

Pocatello

Salt Lake City

Sacramento

Carson City

Cheyenne

Crawford

Denver

Pierre

St Paul

Madison

Des Moines

Lincoln

Topeka

Jefferson City

Springfield

Lansing

Indianapolis

Columbus

Frankfort

Nashville

Charleston

Richmond

Washington

Harrisburg

Albany

Boston

Concord

Augusta

Montpelier

Providence

Hartford

Trenton

Dover

Annapolis

Raleigh

Columbia

Atlanta

Montgomery

Tallahassee

Jackson

Baton Rouge

Austin

Little Rock

Guthrie

Santa Fe

Prescott

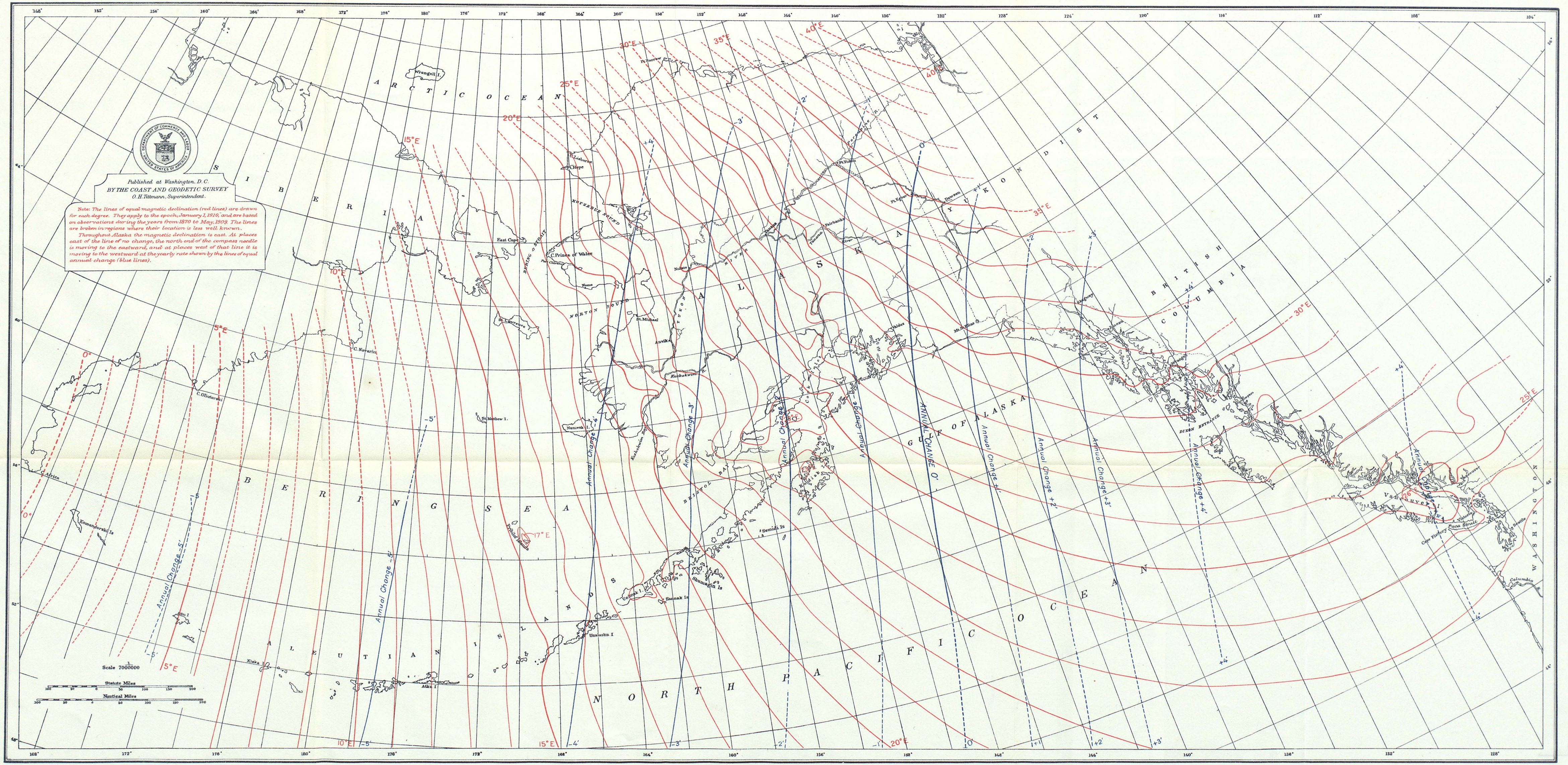
Mexico

Nassau

Kingston

Havana

LINES OF EQUAL MAGNETIC DECLINATION AND OF EQUAL ANNUAL CHANGE IN ALASKA FOR 1910



UNITED STATES
COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1909

Western Sheet

Scale 5.000000

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

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115° 110° 105° 100° 95° 90°

50° 45° 40° 35° 30° 25° 20°

Spokane
Shelby
Glasgow
Great Falls
Buford
Lewiston
Missoula
Walla Walla
Lewistown
Helena
Grand Forks
Bismarck
Miles City
Baker City
Virginia City
Duluth
Aberdeen
Sheridan
Boise
Bellefourche
Deadwood
Watertown
St. Paul
Pierre
St. Peters
Shoshone
Pocatello
Chamberlain
Fond du Lac
Sioux Falls
Madison
Milwaukee
Lander
Douglas
Crawford
Yankton
Logan
Ogden
Green River
Rawlins
Alliance
Sioux City
Dubuque
Salt Lake City
Provo City
Cheyenne
North Platte
Columbus
Omaha
Des Moines
Davenport
Rock Island
Peoria
Nephi
Julesburg
Lincoln
Keokuk
Denver
Grand Junction
Leadville
Colby
Atchison
Quincy
Springfield
Topeka
KANSAS CITY
Pueblo
Scott
Salina
Jefferson City
Panguitch
Monticello
Durango
Dodge City
Wichita
Cairo
Conejos
Trinidad
Kingman
Flagstaff
Santa Fe
Guthrie
Prescott
Holbrook
Albuquerque
Amarillo
Memphis
Little Rock
Socorro
Roswell
Texarkana
Greenville
Dallas
Fort Worth
Shreveport
Vicksburg
Jackson
Tombstone
Juarez
El Paso
Paris
Waco
Natchez
Austin
Baton Rouge
Presidio del Norte
Port Arthur
Houston
NEW ORLEANS
San Antonio
Galveston
Chihuahua
Eagle Pass
Port Isabel
Rockport
Corpus Christi
Laredo
Matamoras
Rio Grande
Monterey
Cape San Lucas
Mazatlan
San Blas
Cape Corrientes
Manzanilla
MEXICO
Tampico
Vera Cruz
Campeche
Frontera
Coatzacoalcos

WASHINGTON
IDAHO
MONTANA
NORTH DAKOTA
MINNESOTA
LAKE SUPERIOR
WISCONSIN
SOUTH DAKOTA
WYOMING
NEBRASKA
IOWA
ILLINOIS
COLORADO
KANSAS
MISSOURI
UTAH
OKLAHOMA
INDIAN TERR.
ARIZONA
NEW MEXICO
ARKANSAS
MISSISSIPPI
LOUISIANA
TEXAS
GULF OF MEXICO
CALIFORNIA
PACIFIC OCEAN

UNITED STATES
COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1909

Eastern Sheet

Scale 5.000000

Statute Miles

50 40 30 20 10 0 50 100 150 200

105° 100° 95° 90° 85° 80° 75°

50° 45° 40° 35° 30° 25°

NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
INDIAN TER.
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
GULF OF MEXICO
CUBA

Bismarck, Fargo, Grand Forks, Devils Lake, Duluth, Minneapolis, St Paul, Aberdeen, Watertown, St Peters, Belle Fourche, Deadwood, Pierre, Chamberlain, Sioux Falls, Yankton, Crawford, Alliance, Stone City, Dubuque, Madison, Milwaukee, Fond du Lac, Green Bay, Grand Rapids, Saginaw, Lansing, Detroit, Toronto, Ottawa, Montreal, Ogdensburg, Rochester, Buffalo, Erie, Cleveland, Toledo, Fort Wayne, Chicago, Des Moines, Davenport, Rock Island, Peoria, Keokuk, Quincy, Springfield, Columbus, Omaha, Lincoln, North Platte, Julesburg, Atchison, Topeka, Kansas City, St Louis, Jefferson City, Cairo, Evansville, Indianapolis, Terre Haute, Logansport, Zanesville, Wheeling, Pittsburg, Harrisburg, Williamsport, Trenton, Philadelphia, Baltimore, Washington, Annapolis, Fredericksburg, Richmond, Norfolk, Cincinnati, Frankfort, Lexington, Louisville, Nashville, Memphis, Corinth, Chattanooga, Knoxville, Raleigh, Newberne, Wilmington, Columbia, Georgetown, Charleston, Augusta, Atlanta, Birmingham, Montgomery, Macon, Savannah, Brunswick, Fernandina, Jacksonville, Tallahassee, St Augustine, Mobile, Pensacola, Apalachicola, Carrabelle, Baton Rouge, New Orleans, Mouths of Mississippi, Port Arthur, Houston, Galveston, Port Lavaca, Rockport, Corpus Christi, Brownsville, Matamoras, Rio Grande, Monterey, Laredo, Eagle Pass, San Antonio, Austin, Waco, Fort Worth, Dallas, Greenville, Texarkana, Shreveport, Vicksburg, Jackson, Natchez, Little Rock, Helena, Amarillo, Guthrie, Wichita, Dodge City, Scott, Cape Canaveral, Tampa, Key West, Tortugas, Miami, Santa Gorda, Havana, Cienfuegos, C. San Antonio, Cape Catoche, Progreso, Campeche, Belize, Frontera, Coatzacoalcos, Vera Cruz, Tampico, Mexico, Monterey

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

PLATE No. 1655

UNITED STATES

COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1909

Eastern Sheet

Scale 5.000000

Statute Miles

50 40 30 20 10 0 50 100 150 200

90° 85° 80° 75° 70° 65°

45° 40° 35° 30° 25° 20°

95° 90° 85° 80° 75°

LAKE SUPERIOR
MICHIGAN
WISCONSIN
MINNESOTA
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
NEW YORK
MAINE
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONN.
R.I.
PENNSYLVANIA
NEW JERSEY
OHIO
INDIANA
ILLINOIS
IOWA
MISSOURI
KENTUCKY
WEST VIRGINIA
VIRGINIA
MARYLAND
DELAWARE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
TENNESSEE
ALABAMA
MISSISSIPPI
LOUISIANA
ARKANSAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
YUCATAN
CUBA
BAHAMA ISLANDS

Duluth, St. Paul, St. Peters, Fond du Lac, Madison, Milwaukee, Prairie du Chien, Dubuque, Green Bay, Lansing, Saginaw, Detroit, Toronto, Ottawa, Montreal, Ogdensburg, Kingston, Rochester, Buffalo, Erie, Cleveland, Toledo, Williamsport, Pittsburg, Wheeling, Harrisburg, Lancaster, Trenton, Philadelphia, Atlantic City, Baltimore, Washington, Annapolis, Fredericksburg, Richmond, Norfolk, Albany, Springfield, Providence, Hartford, New London, Poughkeepsie, New York, Augusta, Bangor, Portland, Concord, Manchester, Cape Cod, Cape Sable, Quebec, St. John, Chicago, Rock Island, Davenport, Des Moines, Peoria, Fort Wayne, Logansport, Indianapolis, Springfield, Quincy, Keokuk, Terre Haute, Columbus, Zanesville, Cincinnati, Kansas City, St. Louis, Jefferson City, Madison, Frankfort, Lexington, Evansville, Louisville, Cairo, Nashville, Chattanooga, Memphis, Corinth, Knoxville, Little Rock, Helena, Texarkana, Shreveport, Vicksburg, Jackson, Natchez, Baton Rouge, New Orleans, Mouths of Mississippi, Mobile, Pensacola, Montgomery, Birmingham, Atlanta, Augusta, Macon, Columbia, Charleston, Georgetown, Wilmington, Raleigh, Newberne, Cape Hatteras, Savannah, Brunswick, Fernandina, Jacksonville, St. Augustine, Tallahassee, Apalachicola, Tampa, Key West, Tortugas, Cape Canaveral, Miami, Punta Gorda, Nassau, Havana, Cienfuegos, C. San Antonio, Santiago de Cuba, Cape Catoche, Progreso, Campeche, Frontera, Coatzacoalcos, Belize

Axis of the Gulf Stream - Warmest Band.

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

ETCHED PLATE No. 2588

UNITED STATES

COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

ALASKA

JUNE 30, 1909

Gravity stations	○
Latitude determinations	◆
Longitude "	◆
Azimuth "	◆
Tidal observations	⊃⊂
Magnetic observations	●
Triangulation	ΔΔΔ
Topography	
Hydrography	
Deep-sea soundings	x x x x

Scale 5,000,000

Statute Miles 100 50 0 50 100 150 200

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° 48°

A R C T I C O C E A N

S I B E R I A

B E R I N G S E A

N O R T H P A C I F I C O C E A N

A L E U T I A N I S L A N D S

G U L F O F A L A S K A

B R I T I S H C O L U M B I A

Y U K O N D I S T

A L A S K A

Pt. Barrow

C. Lisburne

Pt. Hope

C. Prince of Wales

BERING STRAIT

NORTON SOUND

St. Lawrence I.

St. Michael

St. Matthew I.

Nunivak I.

Kuskokwim Bay

BRISTOL BAY

Pribilof Islands

Porcupine R.

Pt. Egbert

Dawson

Yukon R.

Mt. St. Elias

Yakutat

Kodiak I.

Alexander Archipelago

Queen Charlotte Is.

GENERAL PROGRESS SKETCH

D.

161° 160° 159° 158° West of Greenwich 157° 156° 155°

22° 21° 20° 19°

KAUAI

Niihau

OAHU

Honolulu

MOLOKAI

Kaunakakai

Lanai

MAUI

Kahoolawe

HAWAII

HAWAIIAN ISLANDS

(Hawaiian Government Surveys also shown)

Triangulation

Topography

Hydrography

Deep Sea Sdgs. ++++

Longitude determination (telegraphic)

30° 18°

Desecheo I.

Mayaguez

Mona I.

Ponce

Arecibo

Aguadilla Bay

Aguadilla Bay

Cabo Rojo

Fajardo

Culebra I.

St. Thomas

Vieques I.

PORTO RICO

Primary triangulation

Secondary and tertiary triangulation

Topography

Hydrography

West of Greenwich

PLATE No. 2949

UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
PHILIPPINE ISLANDS
JUNE 30, 1909

Latitude determinations
Longitude " (telegraphic)
Azimuth "
Tidal observations
Magnetic observations
Triangulation
Topography
Hydrography
Deep sea soundings

Formosa
Batan Islands
CHINA SEA
PACIFIC OCEAN
SULU SEA
BORNEO
LUZON
MINDANAO
Panay
Negros
Cebu
Bohol
Leyte
Samar
Masbate
Mindoro
PALAWAN
SULU ARCHIPELAGO
Aparri
Tuguegarao
Casiguran
Baler
Dingalan
Lingayen
Vigan
Candon
S. Fernando
Baguio
Bolinao
Dagupan
S. Cruz
Tarlac
Subic
Manila
Cavite
Mariveles
Balayan
Lucena
Atimonan
Batangas
Paluan
Calapan
Boac
Romblon
Mangarin
Culion
Cuyo
Apiz
San Jose
Iloilo
Bacolod
Tacloban
Ormoc
Guiuan
Borongan
Calbayog
Catbalogan
Taft
Virac
Tabaco
Legaspi
Sorsogon
Lucena
Masbate
Puerto Princesa
Cagayan Sulu
Sandakan
Jolo
Siasi
Bongao
Zamboanga
Dapitan
Misamis
Iligan
Cagayan
Lianga
Hinatuan
Tucuran
Malabang
Cotabato
Davao
Mati
Dumaguete
Tagbilaran
Sumgao

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Mercator projection $\frac{1}{5000000}$ *in lat. 13° N.*