REPORT

OF THE

CHIEF SIGNAL OFFICER

TO THE

SECRETARY OF WAR,

FOR

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REPORT

OF

THE CHIEF SIGNAL OFFICER.

OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., November 1, 1868.

GENERAL: It has been the province of this office to keep informed, with the approval of the War and Navy Departments, of the studies in its branch of duty at the naval and military academies, and to give the facilities in its control; to consider plans which may aid the telegraphic communication of military and naval forces when they are in service together; to arrange for the supply of the army with such apparatus and equipments, and such instruction for their use as may be required; to superintend the construction of field electric telegraph trains, and the preparation of a drill for them, and to organize a school of telegraphs and signals at which both officers and enlisted men may be instructed, to be qualified in their turn to instruct others. Concomitant with these duties, has been that of experimenting with the appliances used for them.

The plan of providing the army such instruction, in both symbolic and electric telegraphy, as may be useful in the ordinary course of service, has been in progress for the past year.

Under General Order No. 92, of 1867, provision was made early in the present year for the preparation of the needed apparatus, in so far as the appropriation permitted, and copies of the Manual of Signals have been furnished each company and post. A class of instructed officers is nearly ready for assignment.

At the date of the last annual report of the chief signal officer of the army, the effort to so concert the studies of signalling and telegraphy at the military and naval academies of the United States that the graduates of either school might be, before entering the service as officers, instructed in similar theories, and practiced in similar modes, in order that messages might be sent in the same way in either arm of the service, and might be readable without further preconcert by officers of either the army or of the navy, was practically at its inception.

The course at the Military Academy at West Point has continued under the direction of Brevet Lieutenant Colonel P. S. Michie, United States engineers, instructor of military signals and telegraphy, and has been improved as experience in this tuition has indicated the means to that end. The cadets of the first and second classes have been those selected to be instructed. The course has comprehended the study of the theories of military and naval signalling, and of the Manual of Signals in the recitation room, and practice in the field, between stations upon the "plain" and stations some miles distant. In this practice the cadets have been required to use the different apparatus and the telescopes for day or night service, and to familiarize themselves with the duties to be expected of both officers and enlisted men in time of actual

operations. The academy has been supplied from this office with such apparatus, telescopes, &c., as have been needed.

The cadets have evidenced an interest in the duty, due in part, perhaps, to its novelty. It is suggested that when it can be done consistently with the interests of the service, this course be given a value in standing by merit marks, as an incentive to thorough study. In all its progress it has had the favor and influence of the inspector of the academy, Brevet Major General Edmund Schriver, inspector general United States army, and of the superintendent of the academy, Brevet Brigadier General T. J. Pitcher, United States army.

The study and practice in military signalling some years ago adopted, under the authority of the Navy Department, for midshipmen at the Naval Academy, has been modified in some respects during the past year, by the direction of Vice-Admiral D. D. Porter, United States navy, superintendent of the Naval Academy, with a view to make the courses at the Naval and Military Academies concurrent in as far as might be. A series of lessons and of practice drills were arranged for this purpose by Lieutenant Commander Richard J. Mead, jr., United States navy, head of seamanship, under whose charge the studies of this branch have been. The midshipmen instructed attained a general knowledge of the duty, and some of them have evidenced an especial fitness for it. At both the Military and Naval Academies there have been the little difficulties incident to an unaccustomed study, and the trouble to find time for it in the courses, already almost crowded. At both the obstacles have been overcome by the energy of the instructors, with the co-operation of their superior officers. If the courses, as now arranged, are carried out in practice, the object for which they were instituted will be attained.

The first practical illustration of the effect was given last summer, at the time of the visit of the naval practice squadron, manned by midshipmen, upon their practice cruise to the Military Academy at West Point, where the cadets were on duty. The anchors of the fleet were hardly down before questions and answers were waving back and forth with handkerchiefs, between midshipmen and cadets, on ship and on shore. Official communication by signals was soon after opened by order of the proper officers, and was maintained during the stay of the fleet. The duties were discharged by midshipmen and cadets who had never met, and who had no preconcert other than that of the same study, in the same branch, at their respective schools.

The plans for such a pre-arrangement and equipment, that the posts and commands of the army and the vessels or forces of the navy may be always so provided that telegraphic communication by signals may be had between the services, whenever such communication is practicable, and to which reference was made in the last annual report of the Chief Signal Officer of the army, have received some consideration during the past year. In has been impossible, however, in the pressure of other duties, for either the distinguished officer, to whom the details of the subject were confided on the part of the Navy Department, or for this office, to give the subject the attention its importance demands.

With the view of preparing a sufficient number of officers to act as instructors at department headquarters, and as acting signal officers, the honorable Secretary of War directed, in July last, the designation by each general commanding a department of one officer for instruction. A number of the officers so nominated have reported for duty, and have been systematically taught. Classes have been organized at the office of the Chief Signal Officer of the army, and the officers reporting have

been taught by a series of lessons, which are recited, the Manual of Signals, and the theories and practical working of the electric telegraph. They have been required to study the modes of preparing and deciphering ciphers and cryptograms, and to give practical illustrations of their skill. Much care has been given to this subject, in order that these officers may be made competent to take charge of confidential communications on any staff on which they may be, and that they may know how to guard from discovery the messages to be transmitted by them. They have been taught some duties of reconnoissance. The field practice for the classes has embraced the sending of messages by day and at night, by codes of different numbers of elements, and using different styles of apparatus, at distances ranging from seven to fifteen miles. No officer has been held to be well practiced as a signal officer until able to transmit and receive messages by day and at night, at the distance of fifteen miles from the communicating station. The officers selected for this duty have displayed a commendable zeal in its study.

The duty of this office to provide for the equipment and management of field electric telegraphs, to be used with active forces in the field, has caused especial attention to be given to the preparation of such trains, and to the organization and drill of the force to serve with them. The field electric telegraph train is one arranged to carry in its vehicles everything that may be needed for the rapid erection and working of portable telegraphic lines. The parts of the lines are so provided for that each part has its appropriate number and place of stowage in the train, and all may be moved as rapidly as marching troops can move to any point at which the lines may be required, to be extended and put in operation.

The general service code of signals known to the army is adapted to be used with the electric instruments placed upon these lines. It is easily learned for transmitting messages at low rates of speed. A force of men organized and drilled in the manœuvres appropriate to the use of the train, and of the lines, and who can operate the instruments, accompany the train and serve habitually with it. These men are armed and each manœuvre of the train is provided for in a drill in which precise orders direct each movement. Papers 1 and 2, herewith, describe a field telegraph train and the drill as at present practiced. The train complete is for use in time of war only. The section train is sufficient for all purposes in time of peace, and such only have been prepared. The speed contemplated to be attained in the erection of light lines, using the section train, is three miles per hour, for distances not exceeding six miles. It has been the aim of this office to show that no costly apparatus is necessary to furnish such trains, and that with well instructed officers and men, they may be improvised at any time. With this view, a train consisting of two common ambulances and a wood wagon has been equipped and used at Fort Greble, District of Columbia. The working force has been 23 men.

The course at the Military Academy at West Point, before referred to, has embraced practice with electric telegraphic apparatus and with field telegraph trains. Lessons in the theories of telegraphy had been previously provided in the established studies at the academy; the actual practice with the instruments and lines has been added. The cadets are required to have a general knowledge of the modes in which electricity is made available for the purposes of telegraphy, the structure of the apparatus, of the batteries, and of the line; to connect the instruments upon the wires, and to work them themselves, sending messages by their own manipulation of the key and reading the replies by sound. They have been taught to rapidly extend the lines, to put them in working

order and work them under such directions as the instructor might give, and to reel them up, repack them, and move with them to other positions, to again erect them upon receipt of the order.

In March last, First Lieutenant R. P. Strong, United States army, acting signal officer, was, by authority of the General of the army, detailed as assistant to the instructor in military signalling and telegraphy. The train used at the academy was prepared under the superintendence of this officer, and the detachment to serve with it was organized and drilled by him.

The cadets fitted for reading the signals by sound, by the teachings they had before received in the recitation room to fit them for reading the same signals when made by signs, transmitted and received messages over the electric wires after a brief practice. A drill in which the use of the electric lines was combined with that of flag signals, conveying messages to and from points not reached by the wires, was conducted in June last by the instructors before some members of the board of visitors, the inspector and the superintendent of the academy, with satisfactory results. The practice will be improved for the ensuing year by the experience now gained; and the cadets of each class, instructed in its use, will enter the army as officers with a practical knowledge of electric telegraphy, and of the modes of its employment in military operations. The report of Brevet Captain R. P. Strong, United States army, acting signal officer, with its statements, (A and B,) are herewith, (paper 3.)

Upon the organization of the classes for the instruction of officers as acting signal officers in July last, provision was made for the study of electric telegraphy. The instruction rooms at the office of the chief signal officer have been fitted with instruments and such other appliances as are needed for field telegraphs, and these are worked upon miniature lines, of which the officers are required to take charge in person. It has been required of those under instruction, that they should themselves manipulate the instruments and direct the arrangement of the batteries and wires. They have been taught to familiarize themselves by the study of text-books, by recitations, by sketchings made by themselves, and by practical use with the parts of the electric lines and of the instruments, and of the modes of erecting the one and using the other complete.

A field telegraph train has been put in operation and is drilled with at the school of telegraphs and signals at Fort Greble, District of Columbia, with an established form of drill and a detachment organized for the purpose. Each officer is expected to understand the duties of the train detachment, and each is required in turn to take command of the train and to evidence his knowledge of its use by manœuvring it in operation in the field.

The facility with which the officers have acquired the telegraphic code adopted and have used it with the instruments, has rendered their practice of peculiar interest. Some of the officers are able to receive and to transmit messages at the rate of 15 words per minute.

A camp of instruction was, with the approval of the War Department, established at Fort Greble, District of Columbia, in August last. It has been made a school of telegraphs and signals. A detachment of 50 men, selected from the general service, were put on duty at this post and have been under instruction. The course has been such as to fit them for duty as flagmen and telegraphers to serve upon signal stations or with telegraphic trains in the field. Their practice with arms and their drill as soldiers have been kept in progress. Recitations in reading, writing, and spelling have been ordered as a part of their duty, when out-door service has been impracticable, to insure a correct knowledge

of the language in which they must receive and transmit messages. The officers detailed for instruction as acting signal officers are stationed in turn at Fort Greble, where each conducts for practice drills of enlisted men in forms providing for their especial service. The officers are accompanied by details of these enlisted men as their assistants when they are sent into the field. The material designated for this detachment, under the orders of the honorable Secretary of War, is not surpassed in quality by that of any arm of the service, and the tuition the men receive cannot fail to be beneficial.

No one of these men will be rendered less efficient as a soldier by the knowledge he will possess upon leaving the camp of instruction, while in the field as scouts, or wherever they may be hereafter, their services will be appreciated by officers who know how to use them. In the management of temporary lines of telegraph and signal posts of communication connecting separated commands, their employment may permit an economy in the use of couriers and of mounted men, more than compensating the expense incident to their tuition. As an incident of the past war was an occasion on which a few messages signalled, as these men will be able to do, saved to the United States, as reported by the general commanding at the time, property alone to the value of more than a million of dollars.

The carrying out of these plans for the instruction in these duties of officers and enlisted men who are detailed from the service at large, and who may be returned to regiments if occasion requires it, as now progressing under the direction of the War Department, will give in effect to the army of the United States an additional power with the least additional outlay.

The tuition in semic and symbolic telegraphy has been in charge of Brevet Captain H. W. Howgate, United States army, acting signal officer. The studies in electric telegraphy have been under J. C. Van Duzer, esq., electrician, as instructor. The camp of instruction at Fort Greble, District of Columbia, has been commanded by Captain S. C. Plummer, United States army, acting signal officer, as officer in charge. The reports, papers 4, 5, and 6, are submitted.

A series of experiments has been instituted during the past year for improving the different articles of apparatus and equipment for the signal service. For this purpose have been tested varieties of wire, plain and insulated, telegraph instruments, reels for extending and recovering wire, &c.

A portable insulator readily attachable to, and as readily detachable from trees, poles, or lances, and of which some hundreds can be carried by one man in pouches, has been devised.

There have been experiments also with signal lanterns of different models; with the signal mortar to insure its certainty of fire; and for improvements of the modes of exhibiting colored lights. These experiments are yet in progress.

A telescope, the first plans for which were taken from a glass of French construction, and which it has been attempted to so arrange as to afford for the service of the army a glass not impaired for any purposes of use as a telescope, while with it may be determined at the moment of view, and with close approximation, the distance, up to some thousands of yards, at which a man seen within its field may be from the position of the observer, has received particular attention.

The report of First Lieutenant E. H. Totten, United States army, acting signal officer, to whom experimentation with this glass has been assigned, with the accompanying illustrations, are herewith. If the

deductions of this officer are sustained in actual practice, the improvement in our means of observation will be of importance. (Paper 7.)

Within the past year several official applications made to the War Department by the representatives of foreign powers, for such information as might consistently be given in reference to the plans of telegraphs and signals used in our army, have been referred to this office. In the cases of the Danish and Swedish governments, officers were officially designated to receive at the office of the chief signal officer of the army, with the approval of the War Department, such instruction as might be directed. The officers so designated were instructed as an act of courtesy to the governments they represented, (papers 3 and 7.) The applications of this nature made to our government are indications of the thoroughness with which most military powers are organizing the telegraphic service of their armies, and of the recognition of the advantages which knowledge of this description, with organization and instruction based upon it, may give an army.

There is hardly a nation but has in contemplation some mode to secure these advantages to its service. In the case of our own army, the experience of the last war has shown how readily every branch of its organization, however extended, may be filled in the time of actual conflict by the volunteer force of the nation. It is necessary to have for each branch an established form of service on which to base the enlargement. It is another necessity that officers should have an information in relation to such subjects not hitherto attained in the ordinary courses of study. The most gifted of commanders cannot intelligently direct the management of his telegraphs, or know with what precise advantages he may use them, in battle or on the march, or what results it is his right to demand from their use, without some knowledge of what military organization can effect for this duty. The most skilful of signalists, or expert telegraphers, cannot advise without military experience. It is to arrange for such a fixed form of service, and to ascertain what it ought to accomplish, and how to accomplish it, that the duties of this office have been directed.

It has been considered with some satisfaction that the United States have been, perhaps, first to adopt at their military academy the study and practice of symbolic and electric telegraphy, as a branch of military science, and among the first to establish in their army an organized school of instruction for the service.

I am, General, very respectfully, your obedient servant,

ALBERT J. MYER,
Bvt. Brig. Gen. and Chief Signal Officer of the Army.

Brevet Major J. M. SCHOFIELD,
Secretary of War, Washington, D. C.

FIELD TELEGRAPH TRAIN.

[Organization for an army corps.]

A train consists of one (1) battery wagon, four (4) wire wagons, and four (4) lance trucks.

It will be subdivided into four (4) sections, each consisting of one (1) wire wagon and one (1) lance truck.

The train will be commanded by a captain, and each section by a lieutenant.

The battery wagon will be fitted up as an office, from which four (4) lines may be worked, and will contain the necessary batteries, instruments, stationery, &c.

Each wire wagon will be provided with ten (10) or twelve (12) miles of wire, (some insulated and some plain,) and a reel for reeling out and reeling up the wire, and will be arranged with instrument, stationery, &c., for an office.

Each lance truck will carry from three hundred (300) to five hundred (500) lances, fifteen (15) feet long, on which the line is to be erected, a supply of insulators and insulator spikes, and the equipments, consisting of crowbars, climbers, and marking pins.

The force required for the battery wagon will be one (1) driver, four (4) operators and one (1) battery man. The duty of the latter is to take charge of the batteries and other material contained in the battery wagon.

Each section requires one (1) lieutenant and thirty-two (32) enlisted men, distributed as follows:

One (1) lieutenant, in charge of section; one (1) director and two (2) markers, whose duty is to indicate the route of the line of wire to be erected; one (1) surveyor, who follows along the line indicated by the markers and points out the places where the lances are to be erected; three (3) pin men, the 1st and 2d of whom accompany the surveyor and place marking pins at the points indicated by him. The 3d pin man gathers the pins as the line is erected; thirteen (13) bar men (one being a non-commissioned officer and in charge) who, armed with crowbars, make holes large enough to receive the lances at the places marked by the pins; two (2) wire men who have charge of the handling of the wire when reeling out and reeling up; one (1) operator, who accompanies the wire wagon; seven (7) lance men, (one a non-commissioned officer, in charge,) two (2) of whom ride on the lance truck, and attaching spikes and insulators to the lances pass out a lance at each point indicated by a marking pin. The remaining five (5) follow the wire wagon and erect the line on the lances; one (1) driver for the lance truck; one (1) driver for the wire wagon.

The force required to work the whole train is five (5) commissioned officers and one hundred and thirty-four (134) men.

The capacity of the train is to erect fifty (50) miles or more of portable telegraph line, four separate lines as connecting with corps headquarters from headquarters of divisions of an army corps, being extended at the same time. (See Plate A, p. 790.)

A full train is parked as shown in Plate B, p. 791.

SECTION TRAIN.

[Form of drill for section train of field telegraph train.]

The section train will consist of one (1) battery wagon, one (1) wire wagon, and one (1) lance truck, and be manned by a chief of train, a captain, chief of section, a lieutenant, and 38 men. It will be parked in the following order: Wire wagon in line with and ten (10) paces on the left of the battery wagon, and the lance truck immediately in rear. (See Plate I, p. 791.)

At the "first call," the drivers, director, and markers will saddle and harness up.

When the "assembly" is sounded, the drivers will lead out and hitch up, the directors and markers will lead out and take position immediately in

front of the train, and with the drivers will stand at "attention," and dismounted. The drivers, when dismounted, will always stand at their horses' heads.

The men for duty with the section will be formed on the parade in two ranks, the roll called, and the detachments told off, the latter taking position in the following order: The surveyor and pin man on the right, the bar men with an interval of two paces, the wire men with an interval of two paces, the lance men with an interval of two paces, the operators and battery men with the same interval.

They will be marched in column of detachments to the ground where the train is parked, and wheeled into line by the flank previously designated, facing the train.

The section train being in park, with the detachments in line near it, the chief of train wishing to form the train in column of route, will command—

1. Form train.
2. March, (or, double time, march.)

At the first command, the director, markers, and drivers will mount, and the chief of detachments will give the cautionary commands to cause their detachments to wheel towards the front of the train. At the second command the director and markers will move twenty paces to the front. At the same command, which will be repeated by the detachment commanders, the detachments will move off and form in close column in the same relative order as before, behind the director and markers. (See Plate II, p. 792.)

The section being formed for the march, the park will be broken and it will be moved forward by the command—

1. Forward.
2. March.

When the director and markers will move forward, followed in order by the column of detachments, the battery wagon, the wire wagon, and lance truck.

On the march the section is formed as shown in Plate III, p. 792.

The direction and swiftness of the march will be regulated by the movements of the director and markers under the orders of the captain.

The section being on the march, to halt it previous to opening station, the captain commands—

1. Section.
2. Halt.

To open station, the captain will designate the point where the battery wagon is to be placed, and will command—

1. Open station.
2. March.

At the second command, the battery wagon will move out of the column to the point indicated, and be followed by the battery man and four operators; at the same time the wire wagon and lance truck will close up to the column of detachments; the driver of the battery wagon will unhitch his horses and stand at their heads, and the battery man will make the necessary ground connection. The command will then be given—

1. Equip.
2. March, (or, double time, march.)

At the first command the chief of detachments will cause them to face about. At the second command, which will be repeated by the chiefs of detachments, the latter will separate and move in equal divisions on

either side of the train, the operator and two wire men taking position at and to the rear of the wire wagon, and the lance men, bar men, and pin men on either side of the lance truck, where they will take equipments, and face towards the front of the train.

As soon as the wire wagon is unmasked by the detachments it will move to its position in rear of the battery wagon. (See Plate IV, p. 792.)

The command will then be given—

1. To your posts.
2. March, (or, double time, march.)

At the first command the directors and markers move forward 40 paces, the bar men raise the bar to the right shoulder, two of the lance men mount the lance truck.

At the command "march," the surveyor and pin men move to the front and immediately behind the director and markers; the bar men follow the surveyor and pin men.

At the same time the lance truck will pass the wire wagon and close up upon the bar men. The lance men are marched to the rear of the wire wagon. At the command—

Prepare to reel out—

The director having been instructed by the lieutenant as to the direction and route of the line, moves forward rapidly with the markers, stationing the first marker at a point about 300 feet from the wire wagon. One of the wire men takes the end of the wire from the wire wagon, and makes it fast to the wheel of the battery wagon. (See Plate V, p. 793.)

The command is then given—

1. Reel out.
2. March.

At this command the director moves forward, taking the second marker and stationing him at a second point on the route, visible to the first marker. The distances between the markers thus placed will be necessarily regulated by the topography of the country. The lieutenant moves forward; the surveyor follows on the line indicated by the markers, and is accompanied by two pin men.

The first pin man, with 40 marking pins, (for one mile of line,) follows the surveyor, and places the first pin about 30 feet from the battery wagon. The surveyor now paces the distances of 55 steps, or 132 feet, and indicates the points where the pin man shall place the pins.

The second pin man, similarly equipped, also accompanies the surveyor and relieves the first when the pins of the latter are used up.

The third pin man takes station at the first pin placed.

The bar men (each with a crow-bar) follow the pin men, making at each pin thus placed a hole large enough to admit the foot of the lance easily and two feet deep, the length of the bar from point to shoulder being the measure and the hole being made, sticking the pin beside it to guide the lance men.

The lance truck will follow close upon the bar men, the two lance men in the truck attaching a spike and insulator to each lance and delivering a lance so prepared at each hole.

The wire wagon with operator and two wire men follows the lance truck, reeling out the wire, the first wire man in the wagon in charge of reel, and the second wire man following, carrying wire to the line of poles.

The lance men, four in number, follow the wire wagon, placing the wire in the insulators and erecting the lances, taking care to force them to the bottoms of the holes and that the insulator spikes are at right angles to the line and the insulators properly adjusted.

The third pin man now follows the lance men, and as the line is erected gathers the pins and delivers them to the pin man, who set them, and who waits at the point where he placed the last pin, when the latter pin man moves in double time to the front and relieves at the proper time the one who precedes him.

The end of the line having been reached, the wire wagon passes the lance truck, the station is opened (and ground connection made by a wire man) under the direction of the chief of section, who will command—

1. Section.
2. Halt, and take station.

The detachments of pin men and bar men take position as they come in, immediately behind the wire wagon and the lancemen behind the lance truck. The train is now arranged as in Plate VI, p. 793.

Having thus formed, the equipments of bar men and pin men are returned under direction of chiefs of detachments, and such disposition made of the men as may be advisable under directions of the lieutenant.

Some of the lance men are detailed as patrols to guard the line and make repairs when necessary. Each is made responsible for a certain portion of the line, which is assigned to him.

To cover the line, the command is given—

1. Close station.
2. March.

The wire man removes the ground connection.

1. Prepare to reel up.
2. March.

The wire wagon and lance truck wheel about on their own ground and then stand fast. The lance men, bar men, and pin men are faced about, (see Plate VII, p. 793.)

1. Reel up.
2. March.

The lance men commencing at the wire wagon, draw the lances, free the wire from the insulators, and pass the lances into the truck. The men in the truck receive lances, detach insulators, and return parts thereof and lances to their places.

The wire wagon following reels up the wire, the pin men assisting the wire men, and the bar men taking care that the wire does not run into kinks or become entangled, so as to prevent it from being readily reeled in.

Upon reaching the central station the lieutenant will command—

1. Section.
2. Halt.

At the command from the chief of train—

1. Close station.
2. March;

the wire wagon reels up to the end of the line, passing the lance truck which has been halted at the place of the first lance and moves in rear of the battery wagon. The detachments retaining their relative positions.

At the first command, "close station," the wire men detaches the line from the battery wagon and the battery man removes the ground connection. (See Plate VIII, p. 794.)

The chief of train then commands—

1. Form train.
2. March, (or, double time, march—

when the detachments will be promptly placed, as directed in the train formed for the march.

The train being in march, to park it, the chief of train will command—

1. Into park.
2. (Positions designated for park.)
3. March.

Having reached the ground intended for the park, the column of detachments and battery wagon will be at once halted, the wire wagon will take its place 10 paces to the left of and on a line with the former, and the lance truck will close up to the rear and centre of the line, formed by the two wagons. The drivers and mounted men will dismount as soon as the park is formed, and remain at "attention."

The drill being dismissed, the detachments will be marched by their respective chiefs to the parade, where they will be dismissed.

General directions for running and erection of field telegraph lines.

They should be as nearly straight as the circumstances will allow. When it is impracticable for any reason to follow a straight line, the divergence should be made with a tree, house or other firm support at the angle, and this especially if the divergence is large, approaching a right angle. Should such support be unavailable, two or three lances should be set close together to divide the strain.

When following a road or highway the line should be placed beyond the ditch, so as to be entirely out of the way of trains. When crossing country the same object should be kept in view and the line run along the edge of timber or the brink of the ravines. Avoiding ground likely to be selected for the parking of trains, or upon or across which artillery is likely to be moved.

In crossing broken country the surveyor should be careful to place lances upon the brink of the declivities and on the top of knolls, in order that no ground between lances shall be high enough to endanger the line should troops or trains pass under it.

Cross roads as seldom as possible, and when necessary to do so, select, if possible, a point where the road is lower than the banks on either side.

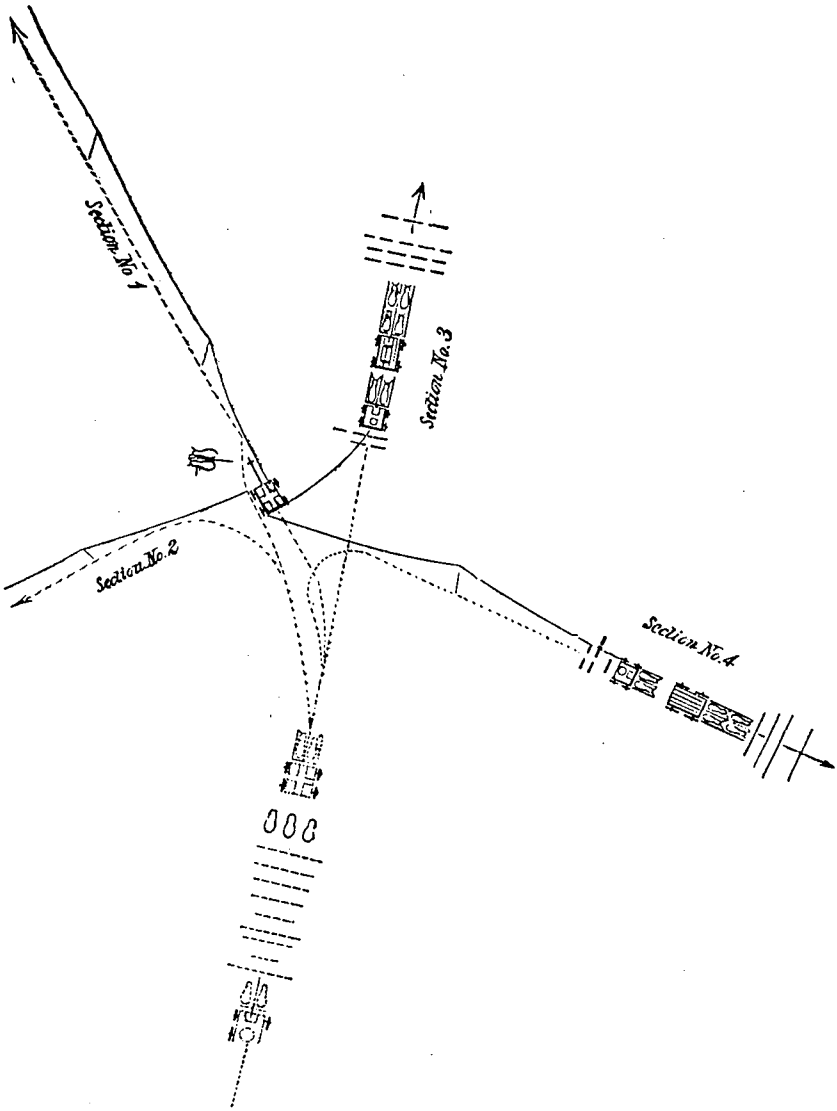
Select ground in which the lance holes can be easily and quickly made, but avoid sand. Lances should be 53 steps apart, but this distance may be varied 5 to 10 steps, to avoid bad ground, hard clay, rock or dry sand.

The sergeant in charge must see that the lance holes are made proper depth and large enough to admit the foot of the lance easily.

The lance men must force the lances down to the bottom of the hole and stamp the earth about the lance to make it stand firmly, the insulator spike must stand at right angles with the course of the line and the insulators be all on one side of the lines of poles.

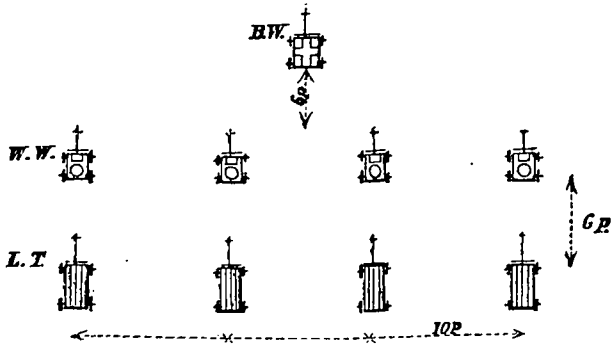
The wire men will deliver the wire from the reel only as fast as the wagon moves, allowing no slack, in order that when lifted on the lances it shall be tight and not hang in loose curves.

PLATE A.



To "open station," using four sections or the full train.

PLATE B.



TRAIN IN PARK.

Explanation of signs used.

B. W. Battery wagon. W. W. Wire wagon. L T Lance truck.

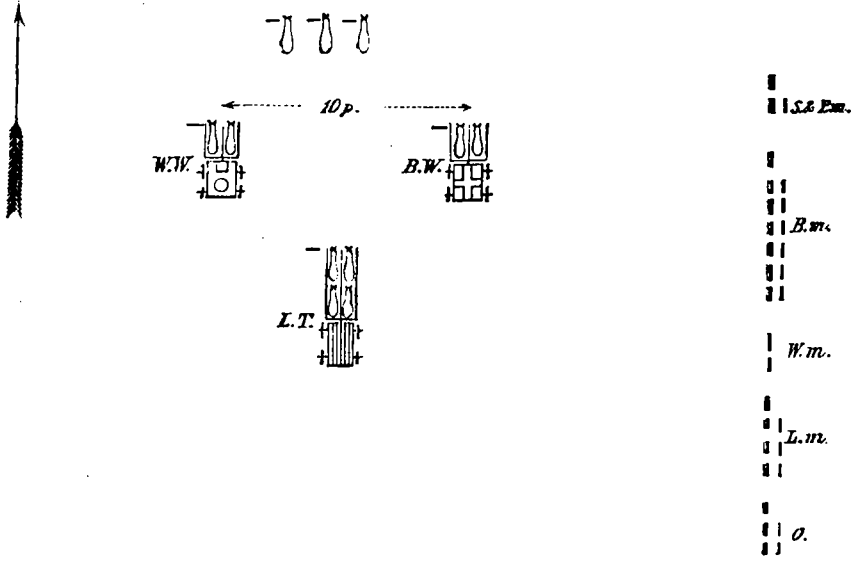
PLATES

DRILL WITH SECTION TELEGRAPH TRAIN.

Explanation of signs used in plates.

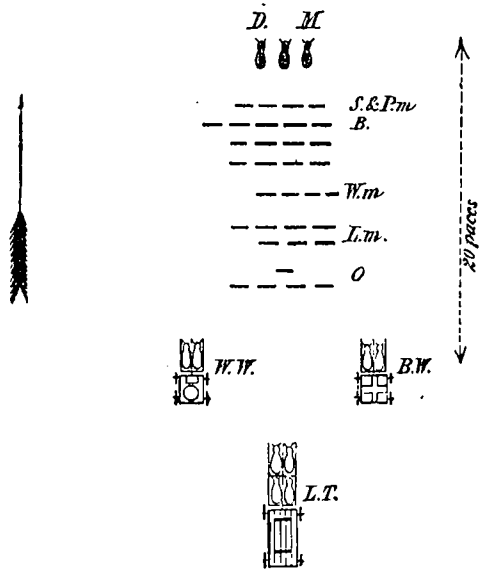
B. W. Battery wagon.
W. W. Wire wagon.
L. T. Lance truck.
M. Markers.
D. Director.
S. & P. m. Surveyor and pin men.
B. m. Bar men.
W. m. Wire men.
L. m. Lance men.
O. Operators.
..... An intermediate position.
Arrow, direction in which the plates should be seen.
— A single man.

PLATE I.



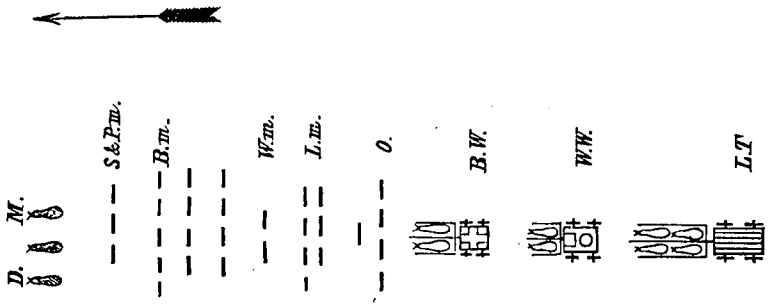
Section train "in park," and prepared to "form train."

PLATE II.



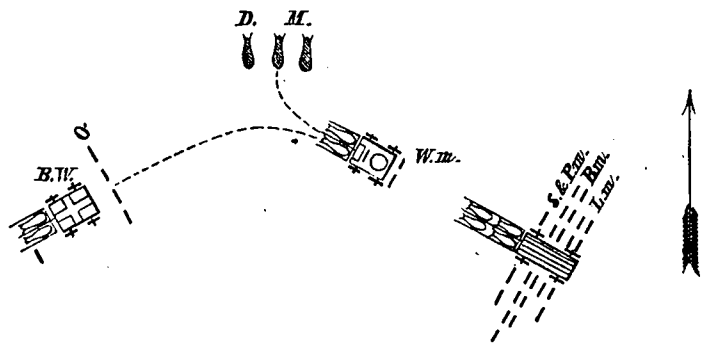
"Form train."

PLATE III.



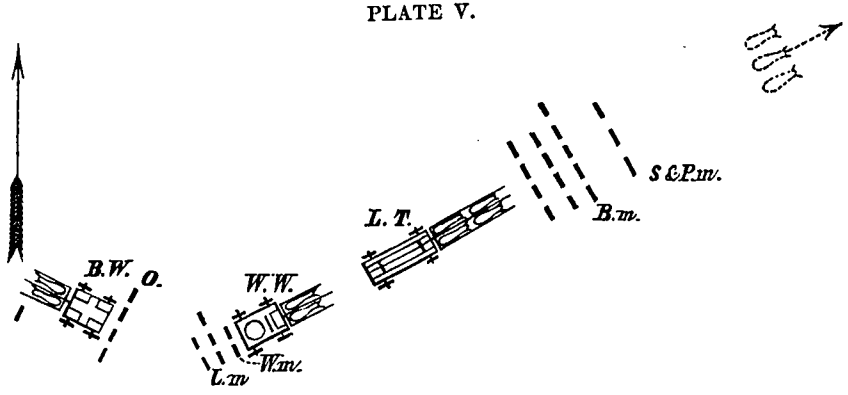
"Train on the road."

PLATE IV.



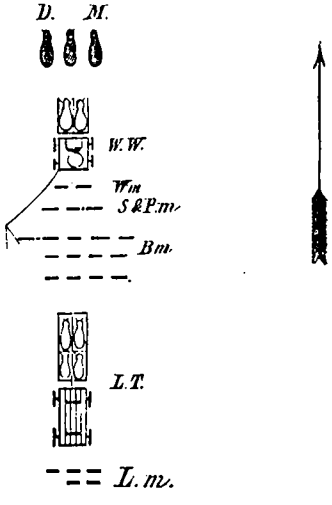
"Open station and equip."

PLATE V.



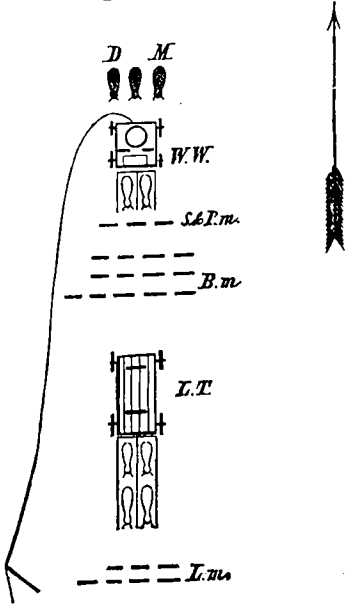
"Prepare to reel out."

PLATE VI.



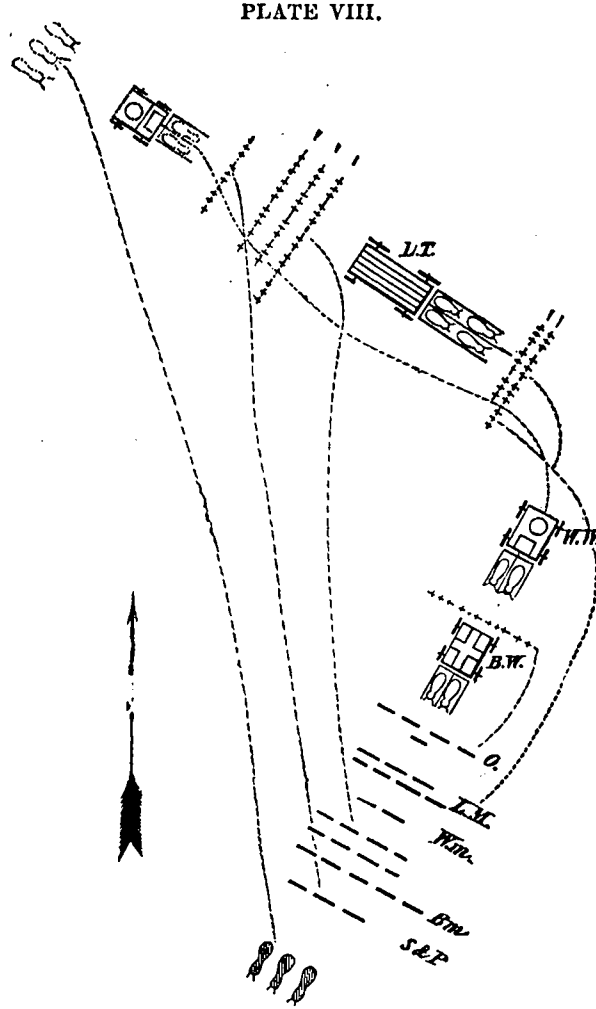
"Section halt" and "open station."

PLATE VII.



"Prepare to reel up."

PLATE VIII.



"Close station" and "form train."

WASHINGTON, D. C., *October* 10, 1868.

GENERAL: In obedience to Special Orders No. 3, current series, from your office, I proceeded to West Point, New York, and reported for duty to Brevet Brigadier General T. G. Pitcher, superintendent United States Military Academy, March 31, 1868. The next day I was assigned to duty as assistant instructor in military signalling and telegraphy, and ordered to report to Brevet Lieutenant Colonel P. S. Michie, instructor in that branch. After consultation with him I was ordered to New York to carry out the instructions received from you relative to the construction of a field electric telegraph train.

I was engaged in New York in determining upon and arranging the plans for the train from the 2d to the 10th of April, and at the latter date returned to West Point and reported myself ready to commence instruction.

It was represented to me that the class to be instructed understood fully the chemical and philosophical portions of the course marked out for electric telegraphy, and it was decided that the instruction in this branch, so far as under my direction, should be limited to the management and manipulation of the instruments and the erection of lines, using the field train for the purpose.

I was informed that no definite times could be assigned for drill with the train until "encampment," but that, until then, the drill could take place at such times as the weather would preclude battalion drill.

Under this arrangement, which was partially carried out, I was enabled to give six lessons, comprising 10½ hours, during the period of four months; three of these lessons were given to only a portion of the class, at their own request and during their hours of recreation.

The class had been previously practiced in reading by sound in the recitation room, under the charge of Brevet Lieutenant Colonel P. S. Michie and his assistant officer of engineers.

The results of the above instruction were witnessed by Brevet Major General E. Schriver, inspector general, and yourself, at the exhibition drill on the 19th of June last. They have also been fully referred to in my weekly report of the operations of that date.

The combination of the flag and electric signals was a success, and its practicability and importance fully demonstrated on this occasion.

I would here state that the class had been quite thoroughly instructed in the flag signals by Brevet Lieutenant Colonel P. S. Michie, previous to my arrival at West Point, which fact will account for the success then attained.

Besides the drill mentioned, two other opportunities were afforded the cadets to display their skill in signalling.

Signal communication was opened with the practice squadron of the navy during the recent visit at West Point on the 15th of June, and was maintained until the 21st of June, when the fleet took its departure.

All official business between the squadron and the academy was transacted by this means. The practice was excellent, both on the part of the cadets and midshipmen, and showed that their instruction had been carefully conducted.

On the 19th and 21st of August, portions of the class visited Newburgh, New York, and located stations at an estimated distance of eight miles fron West Point, communication by flag signals was established and the line was worked successfully.

The telescope and marine glass were both used, and on the first day the messages were read under trying circumstances, the atmosphere

being very hazy, and the telescope being shaken considerable by the high wind. All the messages were, however, correctly received at the stations. Some messages were in the general service code and others in cipher.

For details of operations, from the 11th of April to the 27th of August, 1868, I would respectfully call your attention to my weekly reports, on file in your office.

During the month of May I was occupied in arranging and adapting a drill for the field train. The manuscript of the drill, with the drawings illustrating it, have been recently forwarded to your office.

Statement A, herewith enclosed, exhibits the results of the labor of the engineer's department using this drill.

The aggregate time occupied by me in instruction of cadets, during the period of 5 months, was 40 hours.

Statement B gives the dates, times, and subjects of such instruction.

On the 31st of August I was relieved from duty at the Military Academy by Special Orders No. 101, current series, and in accordanced therewith reported to you at Washington on the 5th of September last.

The first class of the corps of cadets is at the present time well instructed in the theory of flag and electric signals. With the instruction which could be given them during the coming spring they should be capable of performing all the ordinary duties of a signal officer in the field. A few of the class are already quite proficient in the subject, but they are the ones who have devoted leisure hours to study and practice.

If the subject is to be thoroughly taught, a fixed value in marks ought to be given to each recitation. A single instructor would be sufficient to conduct the course successfully, as prescribed at present by the academic board; but it is requisite that definite hours and times be set apart for this instruction in order that he may arrange the lessons to proper advantage. During "encampment," when the field-practice occurs, an assistant would be required to accompany detachments to distant stations.

Very respectfully, your obedient servant,

RICHARD P. STRONG,
First Lieut. 7th Infantry, Brevet Captain U. S. A.,
Acting Signal Officer.

Brevet Brigadier General A. J. MYER,
Chief Signal Officer of the Army.
Washington, D. C.

A.—*Operations of an engineer detachment drilling with the field electric telegraph train at the United States Military Academy, West Point, New York.*

Dates.	Time of instruction.	Time of running out one mile and opening communication.	Time of erecting one mile of wire on lances.	Time of taking down line and reeling up the wire.	Line removed and train reformed and on the march.	Remarks.
May 11, 1868	3½ hours. ..	Time not noted.	Time not noted	Time not noted	Time not noted	Experimenting with the train.
May 12, 1868	2½ hours. ..	....do	22 minutes ...	16 minutes...	....do.....	Do.
May 13, 1868	2 hours.....	11 minutes.....	19½ minutes..	Time not noted	13 minutes ..	The time on each item can be reduced by 2 minutes.
May 15, 1868	3 hours	13 minutes.....	16 minutes...	16 minutes...	18 minutes...	Do.
May 16, 1868	2 hours.. ..	Time not noted..	Time not noted	Time not noted	Time not noted	Adapting the movements of the train to a drill.
June 1, 1868	4 hours	....do.....	....do.....	....do.....	....do	Do.
June 2, 1868	1½ hour	....do.....	....do.....	....do.....	....do.....	Drilling the detachment according to an adopted drill.
June 5, 1868	1 hour.	....do.....	....do.....	....do.....	....do.....	Do.
June 10, 1868	2 hours	....do.....	....do.....	....do.....	....do.....	Do.
June 18, 1868	1 hour.	....do.....	....do.....	....do.....	....do.....	Do.
June 19, 1868	2 hours ...	7 minutes,(¼ mile)	....do.....	....do.....	....do.....	Exhibition drill of train before Major General Schriver, inspector general.

B.—*Instructions of 1st class, United States corps of cadets at the Military Academy, West Point, New York, May 13, 1868, to August 27, 1868.*

Dates.	Time of instruction.	Subjects of instruction.
1868.		
May 13.....	1 hour	Manipulation of the telegraph instruments. Sending and receiving messages by sound, with code of two elements by the same.
May 14.....	1 hour	Mode of attaching instruments to battery. Sending and receiving messages by sound, with code of two elements by telegraph instruments.
May 18.....	1 hour	Manipulation of telegraph instruments. Sending and receiving messages by sound, with code of two elements by telegraph instruments.
June 4.....	2½ hours ...	Practical working over a line from Fort Putnam to Roe's hotel. Sending and receiving messages by sound with the telegraph instruments.
June 5.....	2½ hours ...	Practical working over a line from Fort Putnam to Roe's hotel. Sending and receiving messages by sound with the telegraph instruments.
June 8.....	2½ hours ...	Practical working over a line from Fort Putnam to Roe's hotel. Sending and receiving messages by sound with the telegraph instruments.
August 11...	½ hour	Flag signals. To call a station: to send and receive messages correctly. The importance of the conventional signals;—"assent," "error," "repeat," "cease signalling," &c.
August 12...	2 hours	Same instruction as on August 11, also instruction in "selecting," establishing, and working signal stations in the field. To open stations without pre-concert, to memorize a code and to communicate.
August 13...	2 hours	A review of all the subjects treated of thus far in the course with practical applications.
August 14...	2 hours	The signal kit: the uses of the various articles of signal equipment, to pack and unpack kit, to carry equipments, to fill torches, the use of telescope and marine glass. How to arrange the glasses for work. Coston lights used to illustrate "code of two elements," chronosemic signals by flag and sound explained. Candle bombs and Coston lights as used for chronosemics. How to arrange chronosemic code and how to record the signals.
August 15...	2 hours	Naval signals using naval signal flags, sending and receiving messages. Coston lights as used for the same. To arrange arbitrary codes for work between land and naval forces. Signalling in cipher. The signal disc explained and uses illustrated. The modes and laws of adjustment. To send message in cipher, to change cipher while sending, to receive and decipher a cipher message. The use of "countersign words." Enciphering certain words, only using numbers as cipher.
August 17 ..	2 hours	Selecting, establishing, and working stations in the field. Three stations on Fort Putnam, A, B, and C, communicating with stations D, E, and F, on the opposite side of the river and about one and one-half mile back of garrisons. Range about two and one-half miles. Code of two elements used without cipher.
August 18...	2 hours	Three stations located on Cavalry plains communicating with three stations on opposite side of the river. Range about three and a half miles.
August 19...	4 hours	Code of two elements used without cipher. Working flag stations from West Point, New York, to Newburgh, New York, distance eight miles, using code of two elements without cipher.
August 20...	2½ hours ...	Sending and receiving messages by chronosemic signals, using candle bombs for the purpose, six (6) stations on the "plain," from 9.45 p. m. till midnight.
August 21...	4 hours	Working flag stations from West Point, New York, to Newburgh, New York, using cipher disc, and changing cipher while sending messages.

B.—*Instructions of 1st class, United States corps of cadets, &c.*—Contin'd.

Dates,	Time of instruction.	Subjects of instruction.
August 24...	1 hour.....	Field evolutions with flying telegraph train, opening stations, running out and erecting lines and opening communications. Taking down lines and closing stations.
August 25...	3½ hours...	Field drill of telegraph train. Same practice as on August 21. Practice with torches at night one and one-quarter hours; six stations on "plain." Code of two elements used.
August 27...	3½ hours...	Field drill of telegraph train. Erecting and removing telegraph lines, using the new portable insulator and spike. From 10 to 12 p. m. practice with torches and Coston lights with code of two elements.

OFFICE OF THE CHIEF SIGNAL OFFICER.
Washington, D. C., October 31, 1868.

GENERAL: I have the honor to submit the following report of operations in that portion of the instruction department of the signal bureau, devoted to semic and symbolic signals, since it has been under my charge.

I was assigned to duty as "instructor commandant" August 1, 1868, and entered upon the discharge of my duties immediately. At that date there were two officers present who had been partially instructed in the theoretical course prescribed in the Manual of Signals, under the supervision of Brevet Major L. B. Horton, acting signal officer.

These officers, Captain S. C. Plummer, 26th United States infantry, and First Lieutenant E. H. Totten, 34th United States infantry, were at once placed in the field for practice and remained out during the whole month, when not prevented from practicing by unfavorable weather. Five other officers reported during the month and commenced the regular course of study. Their names and date of reporting are as follows:

Robert Craig, 1st lieutenant 4th artillery, August 1st; George A. Garretson, 2d lieutenant 4th artillery, August 12th; Francis H. Ross, 1st lieutenant 25th infantry, August 15th; John E. Hosmer, 1st lieutenant 16th infantry, August 15th; Nat. Wolfe, 2d lieutenant 34th infantry, August 24th.

In addition to the above two officers of the Swedish army, 1st Lieutenants C. T. Nordstrom and L. R. Nystrom, having obtained from the War Department, at the official request of the Swedish minister near this government, permission to study the signal system employed in the United States army, reported to the chief signal officer of the army for this purpose on the 10th of August, and commenced on the same day the usual course of instruction. I was ordered by the chief signal officer to make them thoroughly acquainted with the system, both theoretically and practically, with the exception of the cipher; but to do this in a satisfactory manner required more time than the officers had at their disposal. By close application, however, during the three weeks they were here, they mastered the theoretical part and received sufficient field practice to enable them to give a fair exposition of the system to their government, and to complete the course at their leisure. One of the officers, Lieutenant Nordstrom, worked at a station successfully at a range of seven and a half miles, receiving and sending messages without difficulty. The field practice of Lieutenant Nystrom was very limited on account of his continued ill health.

During the month of September only one officer reported for instruction, as follows: A. H. Merrill, 2d lieutenant 1st artillery, September 10.

On the 9th of September a "school of instruction" for enlisted men was established at Fort Greble, D. C., and Captain S. C. Plummer placed in charge. The course of instruction differs from that for the officers only in the subject of cipher, and embraces a thorough knowledge of the general service and homographic codes, the manner of using skilfully and rapidly flags, torches, signal disks, and all other apparatus employed in the transmission of signals, including telescopes, and in the general management of stations in the field when cipher is not used. Enlisted men thus instructed will be qualified to work stations in the absence of officers, and the available strength and usefulness of a signal detachment be proportionately increased.

As men of ordinary capacity and intelligence can work with the general service code after a few days' instruction, it is possible to extend the instruction to this extent as far as may be desired. The advantages of such a general dissemination of the system under certain circumstances are too obvious to require especial mention here.

Much time was necessarily consumed at Fort Greble in preparing quarters for the men and fitting it for the purpose of instruction.

Since the completion of this work the practice has been constant and the progress of the men good. Captain Plummer is entitled to credit for the zealous and able manner in which he has performed his duties.

The charge of the telegraphic instruction devolved upon me from September 1st to September 20th, owing to the temporary absence of the regular instructor, I. C. Van Duzer, late lieutenant colonel United States volunteers. As I simply carried out the course of instruction marked out by Colonel Van Duzer, it is unnecessary to make any special mention of services in his department.

In the month of October the following officers reported:

William M. Wallace, 1st lieutenant 8th infantry, October 5th; V. M. C. Silva, 1st lieutenant 21st infantry, October 5th; A. W. Greely, 2d lieutenant 36th infantry, October 26th.

On the 1st of October Lieutenants Ross and Garretson, who had been at Fort Greble since the organization of the camp of instruction there, were ordered in, and Lieutenants Totten, Craig, and Wolfe assigned to temporary duty there. The two latter officers still remain, while Lieutenant Totten was ordered in on the 13th October to perform special duty that required his presence in the office of the chief signal officer.

The theoretical course prescribed in the Manual of Signals has been thoroughly carried out, and every officer is required to master all its details before going into the field for practice. The practical course adopted has been made to conform as nearly as possible with the demands of active service in the field, and consists in working stations at ranges varying from two and one-half ($2\frac{1}{2}$) miles to fifteen and one-quarter ($15\frac{1}{4}$) miles, using flags, torches, signal disks, and the various appliances for making chronosemic signals. No officer is considered well practiced until he is able to transmit and receive messages readily, by day or night, at a distance of fifteen (15) miles from the communicating station.

The officers have also been required to locate and establish working stations under the various circumstances likely to arise in actual service, using for transmission of messages the general service and homographic codes, and the cipher disk.

Especial attention has been given to the subject of cipher and its practical application to military purposes. Not only have the officers

been instructed in the use of the ordinary cipher disk, and required to transmit messages enciphered from it in every practicable manner until they have become familiar with its application, but they have taken up the whole subject of cipher from the remotest historical period to the present time. This plan of instruction, if fully carried out, will supply our army with an educated corps of cipher experts capable of transacting all business of a confidential nature.

I have the honor to remain, very respectfully, your obedient servant,

H. W. HOWGATE,
Brevet Captain United States Army,
Acting Signal Officer and Instructor Commandant.

Brevet Brigadier General A. J. MYER,
Chief Signal Officer, United States Army.

OFFICE OF THE CHIEF SIGNAL OFFICER,
TELEGRAPH INSTRUCTION ROOMS,
October 31, 1868.

GENERAL: I have the honor, obeying your direction, to submit the following report of the work of instruction in telegraphic signalling in this office. I reported for duty as instructor on July 12, and the remainder of the month was occupied in procuring the necessary apparatus and text-books, and in making myself acquainted with the general service code. Instruction may therefore be said to have commenced at the time of the occupation by you of your present office, on the 5th of August.

The plan adopted was to instruct in the building and maintenance of telegraph lines; the construction and management of batteries; and the use of instruments for both permanent and field lines; taking Prescott's work as text-book, and using, as books of reference, all the publications, English and American, bearing upon the subject. The course of study is arranged as follows:

Part 1: 1st. Batteries; 2d. Conductors and connections; 3d. Supports and insulators; 4th. Instruments; 5th. Means of transportation and tools.

Part 2: 1st. Field train; 2d. Erection of lines; 3d. Recovery (or taking down) of lines; 4th. Working of lines; 5th. Combination of circuit practice.

For the reason that the officers have been under the tuition of Brevet Captain H. W. Howgate, United States army, acting signal officer, in the manual of signals, and employed in practice in the field whenever the weather was favorable, it has not been possible to make the instruction in telegraphing continuous, and the progress has been slower in consequence.

The telegraph instruction rooms are arranged with tables, instruments, batteries, &c., to represent different stations or offices, are connected by lines of wire representing telegraph lines, and have facilities for the instruction of eight (8) persons at the same time.

My efforts have been mainly directed to familiarizing the sound of the general service code when transmitted by telegraph, and instructing in the method of making or transmitting that code by telegraph, the signal numerals being represented, "1," by a single stroke or blow, and, "2," by a double stroke or blow, deferring instruction in the course of study until the officers should have completed the course in signalling and been relieved from practice in the field.

The following are the names of the officers under instruction in signal telegraphy: L. B. Norton, first lieutenant 30th infantry and brevet major United States army; H. W. Howgate, second lieutenant 20th infantry and brevet captain United States army; R. P. Strong, first lieutenant 7th infantry and brevet captain United States army; J. P. Story, first lieutenant 34th infantry, United States army; S. C. Plummer, captain 26th infantry, United States army; E. H. Totten, first lieutenant 34th infantry, United States army; R. Craig, first lieutenant 4th artillery, United States army; F. H. Ross, first lieutenant 25th infantry, United States army; J. E. Hosmer, first lieutenant 16th infantry, United States army; W. M. Wallace, first lieutenant 8th infantry, United States army; V. M. C. Silver, first lieutenant 21st infantry, United States army; G. A. Garretson, second lieutenant 4th artillery, United States army; A. H. Merrill, second lieutenant 1st artillery, United States army; N. Wolfe, second lieutenant 34th infantry, United States army.

Of the officers under instruction, one (1) in one (1) month from commencing practice was able to transmit and receive at the rate of ten (10) or twelve (12) words per minute, and can now attain to fifteen (15) or more words per minute—could build and direct the working of a line, or act as instructor; two, (2,) who have had scarcely any instruction or practice since August 30, can work at from ten (10) to twelve (12) words per minute; and nine (9) others, who have had, respectively, from five (5) to thirty (30) days' practice, can work at from five (5) to fifteen (15) words per minute.

By your direction a class of twelve (12) enlisted men, from the force at Fort Greble, was put at practice with the instruments on Monday, October 5, and on the following Monday, five (5) of the twelve (12) were able to receive messages transmitted by the instructor at the rate of ten (10) words per minute.

The men of this class had been previously instructed in the general service code, and one (1) of them had learned, and for a short time used, the Morse telegraph alphabet, but not by sound. The regular hours for practice of this class were from 4 to 5.30 p. m. of each day, but, being interested in the work, the men usually gave from one (1) to two (2) hours per day to practice in addition thereto. The officer in command now reports the whole class competent to transmit and receive messages at the rate of ten (10) words per minute, and four (4) or five (5) individuals as able to exceed that rate.

I think I am safe in saying that men of average capacity, able to read quickly and to write a legible hand at the necessary rate of speed, can, having first been instructed in the formation and use, by wand or flag, of the general service code, be taught to transmit it by telegraph at the rate of five (5) words per minute in three (3) days; ten (10) words per minute in fifteen (15) days, and fifteen (15) words per minute in thirty (30) days. The latter rate I think the best that can be expected; some individuals especially qualified by nature may, by long practice, attain to twenty (20) words per minute, but such cases must be considered exceptional.

The code is very simple and very easily used at low rates of speed, the difficulty of using it increasing with the increase in speed, so that persons who reach ten (10) words per minute easily in a few days' practice find weeks of application necessary to increase that rate to twelve (12) or fifteen, (15.)

To illustrate the adaptability of this plan of field telegraphy to any emergency of the service, a field train, improvised from two (2) ambulances and a wood wagon, has been fitted up, and the board named by yourself to prepare a drill therefor has experimented therewith on three

(3) occasions, upon the last of which the erection, upon lances, and recovery or taking down of one (1) mile of line, over rough ground, was accomplished within fifty (50) minutes. When the drill shall have been adopted and the men exercised therein, I have no doubt that a single mile of line can be erected upon lances in fifteen (15) minutes, and a speed of three (3) miles per hour maintained for two (2) hours, with a force of twenty-two (22) men, exclusive of non-commissioned officers and drivers, and that the line can be taken down at the same or a quicker rate, without loss of material.

Very respectfully, your obedient servant,

JOHN C. VAN DUZER,
Instructor.

Brevet Brigadier General ALBERT J. MYER,
Chief Signal Officer, U. S. A., Washington, D. C.

SCHOOL OF MILITARY TELEGRAPHS AND SIGNALS,
Fort Greble, D. C., November 3, 1868.

GENERAL: In compliance with instructions received from your office, dated Washington, D. C., November 3, 1868, I have the honor to submit the following report:

Pursuant to Special Orders No. 33, dated Office Chief Signal Officer, Washington, D. C., September 7, 1868, I assumed command of a detachment of fifty (50) recruits, assigned to the acting signal corps of the army, per Special Orders No. 199, par. 14, dated War Department, Adjutant General's Office, August 20, 1868, at the depot in Washington, on the evening of September 8, 1868, and immediately marched to this post, arriving at 9 o'clock p. m.

I found the fort and surroundings in an almost ruinous state; the parapet broken and covered with the remnants of gabions and other *debris*, and the ditch, parapet, parade, and magazine covered with a rank growth of weeds. Immediately after my occupation of the fort I commenced repairs, putting the place in order and fitting up quarters for the men. The parapet was repaired, the gabions removed, weeds cut from the whole work, gates and other wood work thoroughly whitewashed, the old well covered, and all steps taken that could conduce to the better appearance of the fort and the comfort of the men.

The detachment was encamped on a plan previously submitted to you by Lieutenant E. H. Totten and myself; seventeen (17) wall tents have been erected in a substantial manner upon wooden frames, and the base of each thoroughly sodded, with a crib or frame surrounding the sodding to prevent displacement by frost or rains; a system of drainage has been established which effectually conducts all surface water from the work. A street has been built, running from the gate to the covered way, and also one from the main street through the encampment, and both thoroughly gravelled. There has been erected (in the same manner as stated in relation to the quarters of the men) two (2) hospital tents for use as recitation rooms; two (2) for the storage of property, and one (1) for use as a hospital. Also, two wall tents for the practice of electric telegraphy, which are in communication with each other by means of a line of telegraph. There have also been erected, outside of the fort, eight (8) wall and two (2) hospital tents for use as officers' quarters. A road has been built and thoroughly gravelled, running in front of them, and the tents are all well sodded and whitewashed.

Immediately following the arrival of the command at this post, I established a course of theoretical instruction in signalling, together with practical use of flag and torch. This I continued until, owing to the great amount of work to be done, all instruction was temporarily suspended by instructions from your office a few days after the occupation of the post; but by this time the whole command had become well versed in the alphabet of the general service code, and had thoroughly learned sixty-three (63) pages of the "Manual of Signals."

After the work was about completed, the instruction was resumed both in signalling and telegraphy, and has been attended, thus far, with the most gratifying results. Every man in the command has become well conversant with the drills, with signal equipments and duties of flagmen, as prescribed in General Orders Nos. 8 and 11 from your office. The non-commissioned officers have been instructed in sabre exercise, and also in cavalry tactics, including the school of the company.

Practical and theoretical instruction has been given daily in electric telegraphy. Nearly the whole of the command have received this instruction, and one class of twelve (12) men have become so proficient as to be able to take charge of a field station. The course of instruction has been in both signalling and telegraphy very comprehensive and thorough, and no pains have been spared to give every man a complete understanding of the principles of each.

In connection with my duties as officer in charge, I have, until within the past two weeks, acted as instructor of the whole command, teaching each class personally; and since receiving assistance from other officers, the whole has been under my personal supervision. Being under instruction myself, I have frequently been called upon to take charge of the signal station in communication with the office, and to work the station for several successive days.

There has been since the establishment of the school from one to five officers here on duties of instruction, under the immediate control of the instructor commandant, and they have been at all times prompt and faithful in the discharge of their duties, and have rendered every assistance in their power to the officer in charge in conducting the different duties devolving upon him.

I have the honor to be, general, very respectfully, your obedient servant,

S. C. PLUMMER,

Capt. 26th U. S. Inf., Acting Signal Officer U. S. A., in charge.

Brevet Brigadier General A. J. MYER,

Chief Signal Officer U. S. A.

OFFICE OF THE CHIEF SIGNAL OFFICER,

Washington, D. C., October 30, 1868.

SIR: I have the honor to submit the following report upon th · arrangement adapted to one of the field telescopes of the signal service, by which the distances from the observer of a man or any other object, for which a scale has been prepared, may be very accurately shown:

The principle and construction of this improvement are very simple, and it may be readily adapted to the instruments now in use with comparatively small expense, and with no material increase of bulk or weight. The spider lines do not interfere with the ordinary use of the glass, and as their proper use is only limited by the obscurity of the atmosphere, I think the new instrument will prove of great service in the field for pur-

poses of reconnoissance. This arrangement (as shown by the accompanying drawing) consists of two spider lines placed in the focus of the eye-piece, which have a vertical motion from the centre of the field, this being regulated by a gradually increasing scroll or spiral cut in a plate, and which, when revolved about two projections upon the plate in which the spider lines are set, depresses them, or allows the spring to act, which throws them apart. The drawing will show the working of the different parts. The scale, which is graduated by experiment, is shown upon the cylinder containing the spiral and movement. It is made at this office by the use of the graduated staff shown in Fig. "D," which is placed at 300 yards from the glass, and the spider lines being made to successively contain the parts of the staff between the top and the several marked divisions, the scale is made actually correct. The scale upon the staff is graduated upon the principle that the apparent size of the object is inversely proportional to its distance.

The idea of this improvement is taken from a French glass, which, however, has been very much improved upon—a double motion being given to the spider lines instead of having one of them fixed; the whole instrument is simplified, and the parts made mathematically correct.

I think these instruments may be considered as sufficiently reliable for the height of a man (five feet six inches) as far as 8,000 yards, and would respectfully recommend that a limited number of them be made and given a thorough trial.

I am, sir, very respectfully, your obedient servant,

EDWARD K. TOTTEN,

First Lieutenant 34th Infantry, Acting Signal Officer.

The CHIEF SIGNAL OFFICER OF THE ARMY,

Washington, D. C.

OFFICE OF THE CHIEF SIGNAL OFFICER,

Washington, D. C., November 1, 1868.

GENERAL: I have the honor to report that, in accordance with the previous official request of the Danish government, First Lieutenant F. Buckwaldt, general staff royal Danish army, was, on February 4, 1868, placed under instruction in the United States system of military signalling; that by the 4th of March following he appeared to have acquired a sufficient theoretical knowledge of the system, and was accordingly relieved from further attendance here.

In addition to the instruction of Lieutenant Buckwaldt, the Danish government was furnished, on February 27, 1868, by order of the War Department, with a complete set of the United States signal apparatus.

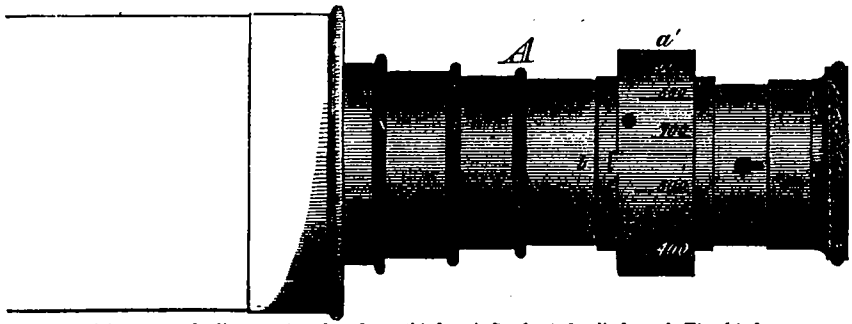
I am, general, very respectfully, your obedient servant,

L. B. NORTON,

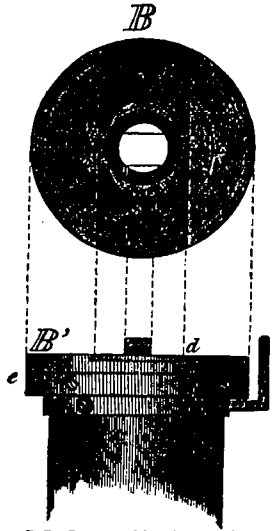
Brevet Major U. S. A., Acting Signal Officer.

The CHIEF SIGNAL OFFICER OF THE ARMY,

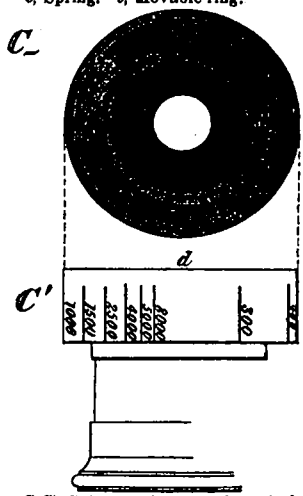
Washington, D. C.



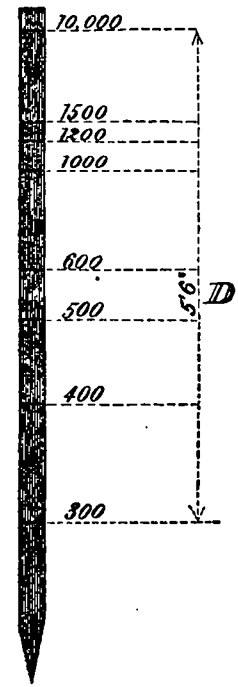
A, Telescope and adjustment, reduced one-third. *a'* Graduated cylinder. *b*, Fixed index.



B B', Immovable plate, holding spider lines.
b b', spider lines set in the plate *d d'*, which move in the grooves *d*.
c, Spring. *e*, Movable ring.



C C', Cylinder showing the spirals *a d* and scale *d*.



D, Staff graduated for use at 300 yds. and for the height of a man, (5' 6".)