

#### FIELD SIGNALS

1. "Signals of One Element. --- Signals of this kind, are not much used for general purposes. Their employment is almost always to convey one or a few preconcerted messages. For signals of this class, one thing or indication is to be used, and it is not to be considered as varied, though it may seem to vary, in any signal. To mark the close of each complete signal, there must of course be a pause of time, or a pause-signal.

2. A good illustration of signals of this kind, is found in the striking of a clock, when twelve different hours are indicated by the same and single sound, repeated the proper number of times to suit each hour. If in the striking of any hour, this sound varies so as to make two or three different notes even, this difference of sound effects, in no way, the meaning of the signal.

3. Signals of this kind, may be used in the field, as where one rocket is thrown up to indicate any one message, two rockets a second message, three rockets a third message; and thus on to any given number.

4. Or a light may be shown a certain number of times, as a candle shown at a window, and then removed to stand for "one" or the first message; shown twice for "two," or the second message; three times for "three," or the third message; and thus on. Or, in a field or in a boat, a lantern may be kept lighted in a pail, and hoisted out of the pail and returned to it to make each flash. Or a lantern may be shown from behind a fence, or any kind of screen. In these illustrations, the appearance of the lights is the signal. Each complete signal may be shown by a wave of the light, or any other sign, as the pause-signal. Or guns may be fired the required number of times for any signal.

5. Now, in any of these signals, which are to depend upon the number of times a light is shown, or the number of times a gun is fired, no difference is, of course, made, if the light changes, or if there is difference of sound in different reports of the gun; for it is remembered only one element is used, and that the signal depends solely upon the number of repetitions of that element; for instance a white light shown twice, would stand for message number "two." A white light shown, and then a red light, making two in all, would also stand for "two." So the preconcert being that only one element is to be used in a set of signals, they may be made to seem much varied. Signals of one element, when used in the field are generally for instances as this: to fire two guns to indicate a completion of a military movement: to throw up three rockets, or one rocket; to announce that a portion of the army is to move. Of course several such messages can be arranged in one code.

6. Signals of Two Elements. --- The army code of signals, or rather the system of signals, used in the army; for there is no code, the letter signals changing often, sometimes, in a day, is of two elements. It will now, after the preceding instructions, be readily understood by this term that, whatever the devices adopted, or to whatever sense the signals may be addressed, or however

complicated they may appear, the fact remains that, the signal exhibited, has in it no more than two elements, and if not a single signal is, when analyzed, only some arrangement of "ones" and "twos." Nearly all plans of signals of electric telegraphs, as used in Europe, are signals of two elements. The elements of the signals generally used in this country, are more numerous.

7. The systematizing of signals, using the bases of two elements, admits of such illimitable applications at once so much more simple and more numerous, than any other, that it seems best adapted to universal use. That signals could be made with two elements, has probably been known from very early antiquity by studies of the subject. The first systems recorded, seem to have been based upon this plan. To understand its practical use in the field, take an alphabet of two elements, devised by the given rule; as, for instance,

A is one, two, or 1 2.

B is one, two, two, one, or 1 2 2 1.

C is two, one, two or 2 1 2.

D is one, one, one 1 1 1;

and so on, combinations of "ones" and "twos."

8. To make Day Signals,--- there being furnished the regular set of signal equipments, a flagman standing, holds in his hands a plain signal staff, eight or twelve feet long, having a signal flag attached at its upper extremity. There are one position and two motions. These are styled the First Position and the First or Second Motion.

9. The first motion is when the flag is held vertically above the head of the flagman, the butt of the flag staff at the height of the waist, and grasped by both hands, the hands separated from each other about eighteen inches. The flag being in this position, the first motion is to wave the flag to the ground on the left-hand side of the flag-bearer, and to instantly return it to the first position.

10. The second motion is to wave the flag to the ground on the right-hand side of the flagman, and instantly return it to the first position. The first motion is known for the signal "one," and is indicated by the numeral 1. The second motion is known for the signal "two," and is indicated by the numeral 2: these motions, ordered by the command, briskly given, "one," which causes the left hand motion; and "two" for the right hand motion.

11. To make the signal 11 or "one-one," or "eleven," the flag being at the first position, the first motion is made, and instantly repeated, the flag then stopping at the first or vertical position. To make 11, or "one---one---one," or "one hundred and eleven," the first motion is thrice repeated. In this manner for any number of "ones" following each other.

12. To make 22, or "two--two," or "twenty-two," the flag being at the first position, the second motion is twice made; that is, the flag is waved quickly twice to the right. It then stops at the first, or vertical position.

13. To make 222, or "two---two---two," or "two hundred and twenty two," the flag is waved three times to the right; then stopping at the first or vertical position; and thus for any number of "twos" following each other.

14. To make 12, or "one---two," or "twelve," the flag being in the first position, the first motion is made, and is followed instantly by the second motion, without allowing the flag to pause at the vertical positions between the motions; that is, the flag is waved quickly once to the left ("one"), and without stopping, once to the right ("two").

15. On the completion of the second motion, the flag stops at the vertical position. To make 121, once to the left. It then stops. To make 1221, the flag is waved once to the left, twice to the right, and again to the left (left, right, right, left).

16. All combinations of "one" and "two" are made in this manner. The flag must not be allowed to stop between the motions of any signals. When the flag stops in a vertical position, it indicates that a signal is completed; or this is the pause-signal. Thus a pause is made at the close of each letter-signal. The end of a word is indicated by waving the flag directly to the ground in front, and instantly bringing it again to the first position. This signal is called "three" or "five" or "front." To indicate a clause of a sentence, two "fronts" are made. To indicate the close of a message, three "fronts."

17. Signals by Two Elements may be reduced to the greatest simplicity for day uses. Thus, a handkerchief or hat held in the hand above the head, waved to the left for "one," to the right for "two," and lowered for "five," is legible. A handkerchief on a stick, or any white or light cloth tied to a gun may be used; or any cloth or any kind of a pole is apparatus sufficient. Or a man, standing fast, throws out his left foot for "one," and his right foot for "two," representing these proper numbers in succession. He drops both arms for the end of a word. Or, having a fixed place to start from, a man walks a pace or two to the left for "one," as many to the right for "two," and makes a sign at a fixed point to show the end of a word. Or, standing in view, a man touches any two things with a cane --- as a drum and a barrel. He touches the drum for "one," the barrel for "two." He waves the cane to indicate the end of a word. Or men, places in line three or four at a time, may be made to represent letters. The men with coats on may be ones, those with their coats off "twos."

18. Strips of any kind of two-colored cloth may be sent up on the halyards of a common flag-staff, to represent any letter-signal or numeral-signal; and these can be arranged by being shown one after the other for messages; to be telegraphed in words; or for codes of message-signals by the rules before given.

19. Codes of signals, like the Naval flag-codes, may be thus prepared when masts or flag-staffs must be used; or, when it is desirable that a signal, as from an invested fort, should be hoisted and kept flying in order that friendly scouts, anywhere in sight, at any time of the day may be able to see and read the message, or copy the signal in numbers for the information of the relieving General, who may possess the key. Simple codes may be arranged in this manner between ships and the shore. It is as easy, however, to telegraph a message, knowing the rules, as to hoist the flags.

20. To make Night-Signals. --- The flagman is equipped with a signal staff bearing fixed at its upper extremity, a lighted torch. This torch is called the

flying-light, because the motions are made with it. At the flagman's feet, and in front of him, is a placed a second lighted torch. This is called a foot-light. This is a stationary, and is given a point of reference, or fixed point, in relation to which the motions of the flying-light are made. There are one position and two motions.

21. The first position is when the torch is held vertically above the head, the butt of the staff at the height of the waist, and grasped by both hands, the hands separated from each other about eighteen inches. The torch being in this position, the first motion is to wave it to the ground on the left-hand side of the torch-bearer, and to instantly return it to the first position.

22. The second motion is to move the torch to the ground on the right-hand side of the torch-bearer, and instantly return it to the first position. The first motion is known for the signal "one," and is indicated by the numeral 1. The second motion is known for the signal "two," and is indicated by the numeral 2.

23. The signal-letters of the alphabet, and the words of messages are then formed as for day signals. To make "front," or "three," the torch is swung to the ground directly in front, and is instantly raised again to the first position. 24.

When the torch becomes exhausted, and it is necessary to refill it, to signal message :stop to fill torch,: the flying torch is waved to the left until the staff is horizontal, and is there held. The torch is then extinguished, refilled, lighted again at the foot-light, and returned to the first position. This indicates that the sending of the message is to be continued.

25. To call attention, the torch is swung continually from side to side, passing over the head from right to left, and left to right, until this signal is seen and acknowledged.

26. To acknowledge signals as seen, or messages as received, the torch is waved to the left, two waves at a time, three times. Then once to the front; or, as the signal is recorded, "11,11,5." These signals have the advantage; they are capable of universal application. The mode of making them is very simple and is very easily learned. They are distinct, and easily read. They are very plain. Each signal is, in reality, repeated twice each time it is shown. Thus to wave to the left is read "one;" whether the torch is descending or ascending. It is only necessary to see that the torch is in motion somewhere on the left to read "one." In the same way it is only necessary to note that the torch is waving on the right to read "two." The chances of seeing the signals, are greatly increased.

27. The signals are made very simple apparatus. It is strong, portable, can be carried anywhere (on horse or on foot), is not liable to be damaged by an enemy's firing, or rough handling, and is always available and ready for use. It can be used in almost any situation. The signals can be seen at very considerable distances. Avail can be had of many devices to make them visible. Thus the flags can contrast most strongly with the back ground against which they are visible.

28. The motion of the signal is a valuable auxiliary of its visibility, this motion of the signal object or light producing a long and marked impression upon the retina of the eye. A thing in motion can always be seen and attract

attention. when a similar object resting produces no sensation. We recognize this fact instinctively when we wave a handkerchief, or other article, to attract attention. It is never held still for this purpose, and would be ineffective if it were.

29. The signals made with the ordinary equipment, say a staff twelve feet long, and a flag four feet square, or with the torches at night, are easily legible at a distance of eight miles at almost all times, except in cases of fog and rain. They are read at fifteen miles on days and nights ordinarily clear, and have been legible at twenty-five miles. Greater distances are reported; but it is questionable if, at those distances, there is reliability.

30. Signals of Two Elements, made with other Apparatus. --- Let a b be an upright staff projecting as through the roof of a house, or through the side on which the ball b can be moved up and down, as by halyards, or by a light iron rod sliding in a groove in an upright. Let c b, be a short fixed rod, bearing the stationary ball c, to indicate the point of rest, or reference. Then the position of the signal ball (plate XXX), is the position of rest and for signals.

31. To call attention, the ball b is moved up and down continually above and below the point of reference, until the signal is acknowledged. The acknowledgment of signals is to make the signal "11. 11. 5," and stop. To make "one," let the ball be slid up above the point of reference (b), and then instantly returned to r. To make "two," the ball is run below the point of reference (to c), and returns to r. Thus to make 121 ("one-two-one"), the ball is run up to b ("one"), then down to c (two), then up to b ("one"), and rests to indicate the close of the signal.

32. Thus is one position and two motions, as before described. The first position is with both balls stationary at r, or the point of reference. The first motion is to move the signal ball b to a certain point of reference, and then return to that point. This is the signal "one." The second motion is to run the signal ball b a certain distance below the point of reference (r), and to then return to that point. The ball resting at the point of reference indicates a pause, or stop-signal.

33. To make 221 ("two-two-one"), the ball is run down twice below the point of reference, and then, without stopping, is run up once above it. It then returns, and rests at the point of reference.

34. The signal "three," or close of a word, is made by what is called a half motion of the ball; i.e. moving it with a sudden motion above and then below the point of reference. Returning, to rest at the initial point.

35. To mark a clause, two of these half motions are made. To end a message, three are made.

36. To make night signals, lanterns may be substituted for two balls. These lanterns may be of the same color. It is better, however, if the fixed lantern be of a different color than the moving light. The signal motions for night signals, are similar to those of the day signals.

37. The general rules for making the letters of the alphabet, conventional signals, words and sentences, similarly apply to the motions and the meaning

made with these balls as to the motions and the meanings made with the signal flag.

38. The length of the movement which it is most convenient to give to the signal ball is about that of the arm above the marker ball to make the "ones," and about the same length below to make the "twos."

39. To work the ball, the signal-man, standing under the deck or roof, if that is desirable, holds grasped in his right hand, and at height of the shoulder, the handle of the signal rod, as at r, (plate XXX). This is the first position.

40. The signal ball is now at r, the point of reference. To make the first motion, "one," the right arm, the hand still grasping the handle, is quickly extended its full length above the head, and instantly returned to the first position.

41. To make "two," the hand and arm are extended the full length of the arm below the shoulder, and then returned to the first position.

42. To make "five," or "three," the pause-signal, a short, quick movement is made above and below the shoulder with the hand holding the rod.

43. To make "one-one" or 11, the hand and rod-handle is carried twice above the shoulder at arm's-length. To make "two-two," or 22, the hand and rod-handle are carried twice below the shoulder at arm's length. To make "one-two," or 12, the hand and rod-handle are carried once at arm's-length above the shoulder; then, without stopping once at arm's-length below the shoulder. They then rest at the first-position."

#### TO WORK SIGNALS IN THE FIELD

44. "To select a Signal Station.---The signals used in the field, Army of the U.S., are almost always those made with flags and the regulation signal equipment. Discs, although not visible at such great distances, may be used whenever the occasion requires it.

45. To select a signal station, choose a point perfectly in view of the communicating station; fix the exact position in which the flag-man is to stand: so arrange, if possible, that he will have behind him, when viewed from the communicating station, a background of the same color for every position in which the signals may be shown.

46. The color of the background of a station is that of the earth or sky, against which the signals made seem to be displayed when viewed from the communicating station. For this purpose take the direction of the communicating station, and by going in front of your station, examine the position from that direction; ascertain whether the communicating station is higher, lower, or on a level with your own. If it is higher, the back ground for your signals, viewed thence, will be the color of the fields, woods, etc., behind and lower than your flag-man. If it is lower, your backgrounds will be the color of grounds, etc., behind and lying higher than your flag-man. If the stations are of equal elevation, then the back ground for your signals will be that directly behind the flag-man.

47. Do not presume the back ground is of the color of the fields near you. It may be that of the woods a long distance, sometimes miles, behind your station. If your station is on a house or an eminence, it is still very possible, that there are higher grounds somewhere behind it.

48. The color of back grounds is generally dark. Sky-exposure back grounds are rare. They are not often found at long ranges on land. They cannot be had except on the exact crest of ridges or lands which bound the horizon of view from the other station, or on the precise apex of mountains, etc. At short ranges, they may, of course, be had by working on the tops of very high buildings, steeples, etc.

49. Unless certain of the color of the back ground, it is safe to presume it is not the sky, and that it is not light. It is a rule always to use the white or red flag until the color of the back ground is determined. The best back grounds are darkly colored, as green fields or woods.

50. Place the flag-man so that his signals shall appear displayed upon one of these back grounds if possible.

51. If the position is narrow, and the flag-man can be placed in no other, notice whether the back ground is broken: that is whether in part of its motion the flag, or other signal, displays on light and in part on dark back ground; as if, for instance, for half of its motion it shows against the trees, and for the other half against a white house; or if, for part of the motion, it shows against the sky, and for the rest, against trees.

52. The back ground being determined, the choice of flags is fixed. The color of the flag must contrast as strongly as possible with that of the back ground. This is important. Upon this contrast, the legibility of the signals often depends.

53. With green or dark, or any earth-colored back grounds, the white flag must be used. With a sky exposure, the black flag must be used. With broken, or mixed back grounds, the red flag must be used. The red flag, or signal, is that to be generally used at sea, as on vessels where, in part of its motion, the flag exposes against the wood work, or rigging, or sails, of the vessel; and in part against the sky or water. It is well also to try the red flag when snow may form part of the background. For general uses, the white flag, or signal, will be found best. It can be used in nine instances out of ten.

54. When the stations have commenced communicating, each can announce the color of the flag which can be best seen at the other. This can be done as soon as communication has commenced, each station telling the other to use the white, or the red, or the black flag, or to try different flags, until the best is found.

55. When it is difficult to attract attention, two flags ought to be shown on the staff at the same time. If there is doubt as to the color of the back ground on which they are displaying, these flags ought to be of different colors; as a white and a red. When the back ground is certainly dark, they ought to be both white. If the back ground is light, dark flags ought to be used.

56. Sometimes, when it is very difficult to send a message from a station, as happens occasionally, when detached clouds are passing the sun, and dark, moving shadows are thus thrown on the earth, the messages can be sent if the signals are made only while the sun is shining on the flag. This is particularly the case so long as the sun is in any part of its course only a little in front of the flag, and its light can be reflected.

57. Those days are best for the transmission of messages in which the atmosphere is clear, but the sun is covered with clouds. The light is then generally diffused. It is on such days that messages have been read at the longest distances.

58. On days of sunshine, the sun shining upon a flag, of course increases its visibility. The sun shining behind a flag, does not render it more distinct.

59. To Locate Stations.---To open a line of stations across a country, first choose some prominent position, and one well visible; and here establish the initial station. Let the party assemble here. Let them, together, select a second prominent point in view as nearly as possible in the line of direction you wish to take.

60. Upon the first station, erect some kind of beacon: as a white or other colored signal flag; or some marked object, by which it can be recognized from a distance. Take from this first point, the bearing by compass of the point selected.

61. This second point should be one not only visible from the initial point, but one also probably in view from positions beyond it. At the first point not marked with its beacon, station an officer to reply to any signals he may see, and to watch the course of the marching party. The other officers will then move, guided by compass, if need be, towards the second point selected, carrying a signal flag flying, in order that their position may be known whenever they come in view from the first station; and intently watched by the officer left at that station, the marching party will, from time to time, put itself in communication with the first station, so as to receive from it any direction as to its course the first station may wish to give, or any other information. It will also frequently verify its course by compass.

62. On reaching the point chosen for the second station, a beacon or flag will be there erected, observations will be made, and communication will be opened with the first station. Points, on either side or rear, will be examined to see if the second station can be better located than it is with reference to a third station to be next established. The second station will then be definitely established and marked, and an officer there stationed, as before at the first station, to watch the marching party. The point for the third station will be hence chosen, and the party will proceed towards it with the same general rules as before. These operations will be repeated in the case of each station, until the terminal station is reached. Attempts intermediate stations by finding other a better points at which to locate some of them.

63. Should an officer, while establishing a line, and before it is completed find, on reaching any station, that he is able to communicate over any of the

intermediate stations between himself and the first, he will notify the unnecessary station of the fact: not, however, until he has both received and sent messages over it to some other station.

64. Upon receiving this information, the officers at the needless station will, after notifying the stations near them of their purpose, abandon their own station and proceed to the station next in advance, or to that one which has given the information. The officer who has been temporarily stationed there will, on their arrival, join the marching party, which will meanwhile have been pushed forward to continue the line.

65. In locating stations, and in opening communication between them, an officer will sometimes find himself in a position whence some other station ought to be visible, but finds his view shut off by trees or bushes near him. In this case, the tallest tree should be climbed. If the other station is in view from the tree-top, its attention can be attracted, and a temporary communication be opened, by signals made by the flag, or other signal, displayed in the tree-top. The flag-man may then secure himself in the tree with a belt or rope. The officer fixes his own position at some other place in the same tree, and rests his telescope among its branches; or what is better, ascends another tree for this purpose: as the first is apt to be so shaken by the motions of the flag-man, as to disturb the vision through the telescope.

66. It sometimes occurs in locating signal stations, that it can only be known that signal station will be opened in some part of the country overlooked from a given station; or that an officer has been sent in a certain direction, and that he will try, from some point in that direction, to open signal communication. It is well then to have some distinctive and very visible signals to attract attention.

67. To mark position anywhere in an overlooked country by day, smokes may be made. Puffs of smoke, made by firing powder loosely poured upon the ground from cannon cartridges, can be seen at very great distances. These puffs may, to be distinctive, be varied in number. There should always be a pre-arranged code as to the number of puffs to be shown.

68. A station which has difficulty in making itself visible, will be apt to be discovered if it is moved too near where artillery is firing, the attention of the observer being drawn by the report and the smoke of the guns. A dense white smoke, visible at a long distance, can be made with dampened straw or hay. A fire should first be set well burning, and then large arms' full of the dampened straw, or arms' full of leafy branches, be thrown suddenly and well spread upon it. Cannon cartridges, with which to make smoke-puffs, can be easily carried on horseback; and can be fired with a train or other slow-match. Before a smoke-puff of any kind is made, the largest white and red flags ought to be displayed upon the signal flag-staff, and kept in motion, swinging from side to side, near the point from which the smoke rises, while it is rising, and for some time after, in order that the glass, at the observing station, turned upon the smoke, may find the flag thus moving in its field of view.

69. When the attempt to attract the attention of the observing station is to be long continued, a large flag will be fastened to a second staff, and kept hoisted in some prominent position; the pole being fastened as in the corner of a fence, or to a stake driven into the ground.

70. Moving stations are those which may be opened anywhere at points not pre-determined. They are so called, to distinguish them from stations "fixed" by pre-concert. Moving stations must always be as prominently placed as is possible: as on hill-tops; in the centre of open fields; near marked houses,--the more apt to attract attention the better. It should be kept constantly in view, to always thus locate a moving station near something which is likely to attract attention from the observing station.

71. Officers upon signal stations will, if expecting signals anywhere, and habitually without especial orders, closely examine, from time to time, every prominent point within signal distance, to see if signal communication is from any quarter attempted. With this view, they will study the vicinity of all houses, spires, peaks, hill-tops, broad, open fields in the midst of woodlands (an open field commanding a view of a known fixed station, is a spot always to be selected in a forest, on which to establish a moving station); the banks of rivers, prominent trees, etc.

72. The vicinity of smokes of any kind, seen at any time, must be most carefully scrutinized. At night all fire-lights, or brilliant lights of any kind, are to be examined. A signal-fire, made like any other fire, and meant to attract attention, is sometimes flashed to distinguish it from other fires. This is done by causing two men to hold a blanket spread before it: that is, between it and the observing station, and to raise and lower this blanket every two seconds. This is ordered in this wise: "one-two-up;" "one-two-down;" and continue. The intermittent light, thus made, is easily distinguished.

73. The powder from cannon cartridges, poured loosely on the ground, and fired at night, makes an intense white flash almost certain to attract attention. Two or three cartridges may be employed together, and fired at one flash, to increase the volume of light. Rockets and roman candles are very useful. Composition lights, such as the Coston signal lights, or the common red, white, or green composition lights are also useful. They will attract attention at distances of six or eight miles.

74. Red lights are preferable to any other, for the reason that they show distinct among camp fires, or other lights, and cannot be confounded with them. The volume of light may be increased for great distances by emptying the composition from several lights together, and thus firing it. Any kind of colored composition light may be agreed upon to be shown as a pre-concerted signal by which all friendly signal officers: as, for instance, those serving with a single army or a single corps, may indicate their position at night. During the whole time that these attention signals are making, by day or by night, the calling, or moving station, must watch closely with the telescope the station called; nor should the watch be relaxed, at any time, until communication is fairly opened.

75. It can never be known at what moment the observing station may first have sight of, or be ready to reply to, the signal seen. Should the effort of the calling or moving station be successful, and attract the attention of the observing station, the observing or fixed station ought to reply at once with signals of recognition and a brief message: as "I see you," etc.; or, if it is practicable, it should make a signal similar to that seen: as answering smoke by smoke; a rocket by a rocket; composition lights by composition lights; or in fine, making some marked signal which shall announce to the moving station the fact that its position is noted.

76. The observing station should take care to keep a signal flag flying all the time, to afford a marked point to the moving station, and to indicate that an officer is on duty and at the glass. The stations having recognized each the position of the other, telegraphic communication will be had without difficulty. It should always be borne in mind by an officer on signal duty, that it is very possible his own signals may be seen and read by the officer with whom he wished to communicate, though it may be impossible for him to find the exact position of that officer; or having found it, it may be impossible for him to read the signals made to him, owing to defect of light, or smoke, or glare, or haze.

77. It is a rule, therefore, always to send any important message, or any information it is wished to convey, the sending station being in a position, as nearly as it can be judged, whence the signals ought to be seen by the other station. There is a chance, also, that some third station may receive the message, and the information be thus available. This is, or course, not to be considered as a final sending of the message, a message never being considered as sent, by signals, until it is clearly acknowledged by signals. This plan may, however, be sometimes useful.

78. There are also, sometimes, intervals of two or three hours when the position of the sun, or a peculiar haze or light, makes one of two communicating stations almost invisible, while the other is thence seen more clearly than is usual. Now the visible station ought not to waste this time, but to send forward its messages with great care and distinctness, numbering the words, etc. This should not be attempted, however, unless the sending station is, while sending, always able to see at least the signals of recognition or "to repeat," made at the close of each message by the receiving station. As soon as mutual communication is had again, full inquiry can be made as to the receipt of the messages thus sent.

79. So one officer may find himself so close to the enemy that he dare not respond to any signals, yet may perfectly read those made from another station. It may be important to send information by signals to an officer thus situated without caring to wait for his reply. There are other possible cases in which messages may be sent when it is known that they cannot be either acknowledged or answered by signals. A station may sometimes receive many messages when the messages sent by it cannot be read.

80. It frequently happens that the signal of recognition, "message understood," and of "repeat, message not understood;" which two signals are

sufficient to insure the correct reception of messages; can be seen, made by a station, when no consecutive signals made by that station are visible. Or a conventional signal, as a puff of smoke, may be agreed upon to indicate "messages understood," before the signal parties separate. Two puffs might mean "repeat;" or any other signal may be adopted.

81. On the same principle, an officer calling a station with his flag, and being without reply, or with such replies only as he is unable to read, continuing to call, may interpose messages; for his flag is as visible and as likely to attract attention while sending a message, as while simply waving for attention. Thus such a message as this may be transmitted: "I cannot see you. Am going to the top of the mountain;" or, "Can't see you. Look for me on the steeple;" or, "Can't see you. Go to open field on crest of ridge," etc.; or, "Can't see you. Enemy are coming by this," etc.

82. This rule applies to night signals when, sometimes, one station distinctly sees the signals of another, but cannot reply with signals of the same kind, because the apparatus is broken, or the supply of fluid for the lights is exhausted. It, in such a case, a station is called, it replies by burning a signal light, or by throwing up a rocket, or by making a camp fire flash, or by flashing gun-powder: the message may then be sent.

83. If it is correctly received, the disabled station shows two flashes, or throws up two rockets, or displays two lights. If the message is not correctly received, only a single flash, or rocket, or light, is shown. This indicates that the message must be repeated. A station can hardly be so disabled but that an experienced officer will be able to make this much of recognition. It is hardly possible he should be without some kind of light that can be seen, or the power to make some one of the numberless styles of signals.

84. A station should never be located in a camp, or among tents, or where the white canvas of tents can form the back ground of signals viewed from the other station. The passage of squads of men in an encampment, the smoke from the numerous cook-fires, the dust thrown up by marching troops or trains, the curiosity of persons not attached to the station, render the camp the most unsuitable locality for a signal station.

85. The difficulties are increased, at night, by the glare of the numerous fires apt to be kindled between the communicating stations, the smoke that then more heavily than in the day, rests over the quarters, and the almost impossibility of distinguishing, at great distances, the signal-torches or lights from the changing-lights of the encampment. Every precaution should be taken to avoid these annoyances.

86. The point chosen ought to be one sufficiently near the headquarters of the General Commanding, but out side of camp, and on one side of it, on some clearly visible spot, and with as few encampments between it and the communicating station as possible. It is always advisable to avoid working over an encampment, if it is near and on nearly the same level as the station. The smoke and dust which constantly arise from a camp, are serious obstacles to successful working.

87. Red lights or rockets must be kept at encampment stations, to mark the exact position of that station, if the communicating station is very far distant, and the officers at it thus liable to be confused by the number of lights and fires at the encampment. This will be found to be often the case, when the stations are located among the camps of a grand army."

#### TO WORK SIGNALS IN THE FIELD

88. "Cavalry Raids.---When the presence of a cavalry force is heard of in the vicinity of an army, or as moving through any section of the country, a signal party should at once be sent to follow it as closely as they may, to report upon its movements, and to annoy it by indicating its position to such of our troops as may be in pursuit.

89. These signal parties fire, at different times, at night, rockets or roman candles, to show the general direction in which the enemy may be. During the day, cartridge-puffs or heavy smokes should be raised, for the same purpose.

90. To this end of attracting attention and directing the march of friendly troops upon the enemy, if there is a known chance to capture or destroy them, hay-stacks, wood-piles, or out-buildings, ought to be fired (using proper judgment), anywhere they may be found in the country lying near the line of the enemy's march; the officer ordering the firing, giving a certificate to the owners, that the property was fired for Government uses.

91. The firing of these signals, of any kind, must follow the track of the enemy from place to place. It is the object to thus mark his course, that preparations may be made in his advance to intercept him, or that troops in pursuit may know in what direction to march or to concentrate. So in front of an enemy, presumed to be advancing on any roads, small signal parties should be sent out on every road. These parties are to fall back, firing signals, raising smokes, or kindling fires, as the enemy advances.

92. Some of the parties ought to conceal themselves near the roads, to gain all the information they can before reporting; others to wait, with the signals ready to be fired, and only light them when the foe drives them from their position. Thus a cartridge-puff may be raised at the last moment it is safe to remain at a station.

93. A few daring men can thus cause infinite annoyance to an enemy, whose success is often depending on the secrecy of his movements. In all cases of this kind, a dominant station or stations, must be chosen somewhere, from which the signals made, in any part of the country, can at once be noted and reported, and whence reports must frequently go to the senior commander in the vicinity, and to the General Commanding. A constant watch must be kept from this position; and signals seen, in any part of the country, must be at once reported as to the distance, kind, and direction.

94. If communication is to be between ships in a bay or river, the officers will consult together, if possible, before parting, as to the place at which the ships will probably be, the color of the flags it will be best to use, and in what direction, by compass, the vessels will be from each other. They will consider,

also, whether signals will be preferably made from the decks or the rigging, as the "tops," and whether the make of the land or river bank, is such that it is likely the hulls of the vessels will be hidden from each other, as by rising grounds or by trees. It is possible this will be the case. It will be considered, also, whether the masts will show above the trees, and how much of them will show. To ascertain this point, the officers should, together, ascend the rigging and estimate the height of the obstacles in the direction in which it is supposed the signalling will be necessary.

95. When vessels, co-operating with land forces, are to go into action, the post of the signal officer is on the "fore," or in the "maintop." A signal flag should always be kept flying from some prominent position on every vessel carrying a signal officer. Signal officers, serving with troops, or on other vessels, can thus know with what ships it is possible to have verbal communication.

96. The officers at each signal station must take care that a look-out through the glass, is kept at each station so constantly that no signal can be shown, at any time, at the communicating station, for more than ten minutes without receiving an answer. For this reason, when not at the glass himself, he will cause his men, or any one on duty at the station, to keep a regular "glass-watch," assigning the men by turns, and fixing particular hours for each, that responsibility for neglect may be easily traced. These details will relieve each other every two or four hours, day and night.

97. The watchmen on duty must be seated at the glass; and before assuming his station must, with the aid of the soldier last on duty, make certain that he knows the exact position of the observed station, and that it is plainly in the field of the glass. This precaution is particularly necessary at night, when the least movement of the glass may have thrown the station out of view. All land marks being then invisible, there is nothing by which to detect the error; and signals might be long shown in vain at one station, while the glass not bearing upon them is attentively watched at the other.

98. Torches.---As a general rule, if stations are not more than ten miles distant, the regulation torch-light, shown in motion at one, will be seen with the naked eye, or the marine glass, at the other, as a light sufficiently strong to attract attention.

99. Establishing Signal Stations.---When high winds interfere with the proper display of flags, or other signals, at any position, the signal station there ought to be established in the lee of a grove, or sheltered by a house or hill. It will sometimes happen that, signals made from a given position, cannot be seen; while, near that position, is a point at which a sky-exposure, or other advantage, can be had, which will make the signals there visible. In such case, the receiving station should direct the sending station where to place the flag man. This may be done by the usual signal of the codes prepared for the purpose, or by an especial message.

100. When the color of a signal flag to be used at any station has been determined upon, and the flag-man has been placed, it may yet be necessary to

decide, whether there are any obstacles to a clear vision existing between the stations. For this purpose, view the station to which communication is to be had, from the sending station, with a telescope; first from a position close to the ground, at the feet of the flag-man, and then from two other points, close to the ground: one on his right, and one on his left, and at a distance from him, equal to the length of the signal staff to which the flag is attached. If, from these three points, the position of the telescope at the other station, or the whole position on which the flag-man there stands, can be seen, it is certain that every signal made at the first station can be seen at the other.

101. Similar precautions to determine this point, should be had at both; such precautions are particularly called for at night. The foot-torch, lying close to the ground, is often hidden by bushes or high grass near it, and night-signals are thus made unintelligible. Signalling should never be commenced at night, at any station until, with the head as near the ground and in the place at which the foot-torch will be, the receiving station has been observed, and made sure, that the foot-light shown at the first, will be plainly visible there.

102. When a station is occupied and worked during the day, all preparations for night signals, such as filling the torches, properly placing them, determining that, when lighted, they will be in view of the other, etc., should be made before dark. When this is impossible, as when the station is first reached at night, it may be held, that it is fair to presume, that any point at one station from which fires or foot-lights known to be at the other are visible, is in proper view from that station.

103. Glasses--When a signal station is to communicate with two or more stations, a telescope should be firmly fixed, bearing on each, and so far apart that the reader at one will not be in danger of disturbing the reader at the other by his movements. At permanent stations, the fixed telescopes should not be removed from their supports when signalling has ceased for a time, unless it may be necessary to clean them; but they should be kept in position carefully covered to protect them from the weather.

104. When the atmosphere is laden with moisture, the object and other glasses of the telescope being cold, sometimes condense it, and become covered with a thin film or mist; this is especially likely to happen at night. It should always be suspected when, while the night seems clear and lights can be seen with the naked eye, they are seen with difficulty with the glass.

105. To remedy this, the glass ought to be thoroughly warmed at a fire, or with a lamp, and made so warm as to retain its heat while it is being used to receive messages. The eye-glass of the telescope is sometimes obscured by the moisture of the breath condensing upon it while the eye is at the glass; this ought to be carefully guarded against.

106. Telescopes ought never be allowed to fall into the hands of the enemy. Officers, on dangerous stations, ought to conceal their glasses when not in use. When a glass is to be hidden for precaution, the object lens, or one joint of the telescope, should be hidden separately from the body of the telescope. A single joint or one lens is so small an object, that it can be concealed almost beyond the

possibility of discovery. If an officer is in danger of capture, and there are no means of concealment, the telescope glasses must be shattered or rendered worthless rather than surrendered.

107. If, for any reason, telescopes have not been fixed on communicating stations during the day, they must be fixed and adjusted before dark. After dark, land-marks are lost to view, and distant stations are discovered with difficulty. The glass must have in its field the exact point at which night signals are to appear, and must so remain, properly sheltered, until morning. The neglect of this care, often causes much trouble.

108. The telescope should always, when possible, be first placed in rest and properly adjusted in some sheltered or shaded position, and in one as convenient as attainable, before communication is opened, for after communication is opened, important messages may come so rapidly, that the glass cannot be abandoned, and the station must be worked for hours with much of discomfort and even of suffering, on the part of the reading officer.

109. To adjust a telescope to its proper focus, view with it some object with well defined outlines at a distance of about half a mile, lengthening or shortening the eye-glass joint until the object is seen with the sharpest distinctness. To adjust a glass at night, fix it upon some brilliant star.

110. Glasses which are to be used in the field, should have plainly marked upon one of the eye-glass slides a focus mark, so that they may be adjusted at any time without an especial adjustment in every case.

111. Telescopes, as a general rule, absorb light in proportion as their magnifying power is great. The most powerful glasses are therefore to be used for minute observations on the clearest days, or where there is a strong light upon the observed object. When the light is fading, or there is little light upon the observed object, the clearer view will be had by those glasses of low magnifying power. When telescopes are fitted with a double adjusting focus, the short focus is to be used, where the light is dim, the long focus where the light is strong.

112. Old newspapers furnish the best material with which to clean lenses. The pieces to be selected, should be free from grit or anything to scratch the glass. Soft paper is better than chamois skin. The telescope glasses ought to be kept scrupulously clean. If the glass is to be carried in the rain, a leather cap must always cover the eye-piece end. Without this precaution, the glass will be filled with water, and may be ruined.

113. Binocular glasses (marine glasses) have, with a low magnifying power, an extensive field of view, and give much light. They are for use in observation of extensive movements, where large tracts of country must be taken in one field of view, or in sweeping the landscape in view, to find the tents of the enemy, his wagons, etc., or other objects to be afterwards more closely examined with the telescope. They are employed on ship board, or in boats, where the rolling motion interferes with the use of the telescopes. They are used for observations to be made on horseback, or in hasty examinations made on foot or in trees, and

generally for all observations not critical, or those to be made under circumstances where the telescope cannot be conveniently handled.

114. The marine glass ought to be held by both hands when in use; and to steady it, the arms ought to be kept close to the body. In following a moving object, to keep it in the field of view, the head ought to be turned with the glass. For reading signals at short ranges, as say, up to five miles, these glasses are better than the telescope. Signals have been frequently read with glasses of this description at the distance of ten miles.

115. When reading messages through the telescope, or observing any object intently in bad weather, cover the head with a blanket, or the cape of an overcoat, or any dark covering, extending this covering over all the telescope except the object glass: particularly do this when exposed to a dazzling light, or the sun's heat, or in windy weather. The covering shuts out from view all objects near the observer, and thus enables the faculties to be concentrated, and, at the same time, it protects the eye from the disturbing light, the winds, particles floating in the air, etc.

116. It should be practiced to use both eyes open at the telescope. This can be readily done. The method is more comfortable than to use but one eye, and by it is prevented much of that weariness and injury to the eyes that often follow if they are overstrained, or too much labor is thrown upon them.

117. To find any small object, as a signal-man or flag near any known position, or to fix the telescope upon it, mark, with the naked eye, some prominent land-mark, or object near which the smaller object is supposed to be, place that telescope carefully adjusted in rest, then sight over the glass upon the marking object near which the smaller object is supposed to be, place the telescope carefully adjusted in rest, then sight over the glass upon the marking object, as sight is taken over a gun-barrel; if the eye, the object being thus covered, is now placed at the eye-glass of the telescope, the prominent or marking object will be found in the field of view. It will be easy then to scan the country near the marker until the smaller object is found. This practice is often necessary at night, when only a point of light is seen, far off through the darkness, and the telescope must be turned upon it.

118. When the compass-bearing of the object to be sought for is known, the telescope, adjusted and placed in rest, may be aligned by a line drawn with the proper compass-bearing. Commencing then with the view at the horizon, the telescope is moved lightly from side to side, taking in, each time, fresh fields of view a little nearer the observer, until the whole country shall have been observed from the horizon to quite near the station.

119. When the general direction only of an object can be given, and it is to be sought for, the whole landscape in that direction to the horizon, is to be divided into sections by imaginary lines, the limits of these sections being bounded between visible land marks through which the bounding lines are supposed to pass. Each section is then to be scrutinized, little by little, until the glass has been passed over every spot. The search can hardly fail to be successful. It must be systematic.

120. Practice should be had in the use of the telescope held in the hands without rest, in rapidly bringing objects in the field of view, and in the habit of examining an object or point thoroughly, yet quickly. Observations can often be made with such rests as the shoulder of a man, over the back of a saddled horse, or with a cane resting on the ground and held in the hand that steadies the telescope. Very great quickness in the bringing of objects within the field of view can be soon acquired. The eye becomes educated to a remarkable keenness of vision by continual practice.

121. When observations are made with the telescope, or when messages are being received by it by signals, nothing must be taken for granted, and nothing considered as seen, until it has been positively in view, and so clearly as not to admit of doubt. Never presume to anticipate what signals will follow from those already made. A signal must never be considered, or announced as read, until it has been actually seen. Carefully watch the communicating station, until the last signals are made, and be very certain, before ceasing to watch, that the signal for the end of a message has been distinctly given.

122. The telescope on a signal station should always be fixed. The glass stand or support may be a heap of stones, two saddles lashed together, a temporary tripod of sticks, a post, a stump, fence, anything furnishing a steady rest. Blankets, thickly folded, or any cloth, as an overcoat, a cushion or a pillow, placed under the glass, almost entirely prevents vibration. Stones, or other heavy bodies, ought to be placed on and about the glass, in order to secure it in its place and to steady it. The brass telescope holder, fitted to screw into trees or other wooden supports, is very useful.

123. Trees, having branches and leaves, are apt to be shaken by the wind; for this reason, a fence corner, a stump, or solitary post, or rock should be chosen in preference. It is important so to construct a support, as to allow the person at the glass a comfortable position when reading, and it should be firm enough to withstand any ordinary gust of wind, or other slight disturbing cause. At a post or fixed station, it is well to construct a permanent glass-stand, and to shelter it with a good tent or sentry-box."

#### CARE OF SIGNAL APPARATUS

124. "Whenever particular sets of apparatus are to be habitually used for signals in the field, that apparatus should be cared for with scrupulous exactness. Defects in the apparatus not only annoy the signallist himself, sending the message, but they more annoy the person to whom messages are, for this cause, imperfectly sent. A decent, courteous regard for the rights of others ought, of itself, to prevent any person from inflicting on another the consequences of his own carelessness.

125. Neglect of apparatus is a matter for discipline. Daily inspections should insure that the telescopes, etc., are clean and in perfect order. If the common field sets of the army are to be used, the torches must be each morning cleaned: they can be scoured with ashes, or washed with turpentine. The torch wicks must be examined, trimmed, and renewed. They must be made tighter by

adding new threads to them, if they seem too loose; and this can be judged to be the case, if there is even a slight dropping of turpentine; or they must be loosened by lessening their size, if so tight that the fluid cannot readily flow through them, to feed the flame. The torch screws and catches must be examined, and the torches prepared, in every part, for the labor of the coming night. The torch is not to be filled, however, during the day.

126. The flags must be examined, each by itself. If there are rents or loosened ties, they must be washed and dried. A clean-washed flag is seen and read with ease, where flags, dusty and dingy with use, are invisible. Signal flags in use, should be habitually washed each week. The joints and bands of the staff must be scoured and tightened if loose, or carefully fitted again if any shifting or springing has been noticed. Rivets must be reclined if started. The staff itself ought to be cleaned and scraped.

127. The copper cans and the service canteens, are to be examined and filled. They must be cleaned; and if there is a leakage, it must be temporarily stopped. Steps should be taken to turn in any article thus damaged to the depot. If the leather in the top screws of either the canteens or cans is worn or loosened, it must be replaced. The carrying straps and buckles of the canvas case and of the canteens, must be examined, and the binding-straps counted to render certain that none are lost.

128. The senior officer on a station, or with any party, is primarily responsible for the condition of all the apparatus; and it is his duty to see, each day, that the whole equipment is ready for instant service. Officers should be held responsible with their commissions for the proper discharge of this duty; and each set must be placed in charge of an enlisted man who will be held responsible with his pay for its condition; precisely as in the case of other branches of the service, each soldier is responsible for the proper condition of his equipment's.

129. When the apparatus is to be packed, the torches must be perfectly emptied of any fluid they contain, or the flags and other portions of the set may be ruined by its leakage.

130. To carry Apparatus in the Field.---On marches, the whole set of apparatus, packed, may sometimes be carried in an ambulance. This ought never to be done, however, unless the officer is dismounted and traveling in the ambulance.

131. A signal officer, mounted, and serving with troops, ought never to permit himself to be, at any time, without his glasses and signal equipment's, his compass, message book, or map. No matter for what purpose he is moving, or how little chance there may seem for his particular duty, the occasion may, at any instant arise, when the power to communicate a few sentences would be invaluable. On reconnaissance's, or when examining a tract of country for signal points for stations, this precaution is to be always observed.

132. The following is a convenient way in which to carry the equipment on horseback: the large or first joint is taken from the set and is not carried; the three other joints of the staff, jointed together, are carried, like a lance, the butt

of the staff resting in a lance-socket at the stirrup; the staff being carried on the right side of the body of the horseman, mounted, and slung behind the right arm, with the arm passing through the leather strap or lance sling which accompanies each set. The torches, flags, and the remaining articles of the signal set, neatly rolled together, and placed in the canvas case, and strapped across the horse, either in front of or behind the saddle. This package bends easily to fit itself to the saddle. The canteen is carried on the left side of the horse, strapped close to the saddle, and the bottom of the canteen is strapped down, so that it can have no motion.

133. To carry a flag flying when mounted, as in changing stations, or at any time when it is desired the progress of the party should be watched, attach the four-foot flag to the staff, and have the staff then carried, slung as a lance, as described above; or let it be carried upright, the staff held in the hand, and the butt placed in the lance rest.

#### REPEATING SIGNALS TO VERIFY MESSAGES

134. It may happen, that very important messages received by signals must be verified by repeating, at the receiving station, signal by signal, each signal used by the transmitting station in conveying the message. There can be no error in signals thus verified, and the correct reception of the message is made certain.

135. In the verification, each signal must be repeated by the receiving station, as soon as it is made at the sending station.

136. The signallists and their signal men, at each station, face each other, the signal men, standing each with his flag and staff in the first position for signals. The chief of each of the corresponding stations has his glass fixed upon the opposite station, and takes his post at the glass. The sending of the message is commenced. As the chief, at the receiving station, notices each signal completed by the sending station, he orders that signal at his own station. The chief, at the sending station, pauses after each signal of the message made at his own station, until he has noted that signal repeated correctly at the receiving station.

137. The signal-element numbers, made at each station, must be identical. The signals used may be different, provided their value is understood. Thus, if "one-two" is made at one station, "one-two" must be repeated at the other, though the elements "one" and "two," may be indicated at one station by different signals from the indications of the same numbers at the other station. The messages thus transmitted, signal by signal, the sender pausing after each signal, until he sees a similar signal shown, complete and correct, at the receiving station. That his own signal has been seen and noted, is then certain.

138. A record is kept at each station of the signals shown at the other. This record must agree with the record of message sent. This practice of repeating signals was habitual when semaphores were much employed for telegraphing. It is used with advantage in many instances with field signals, particularly with all those kind of signals which are made by position.

139. There are three styles of repetition: one is to repeat each elementary signal of each letter combination as it is made. Thus, to transmit and repeat the signal combination "one-two-one" (121), one is made and is seen repeated at the other station; then two is made, and this is seen repeated; then one is made, and is seen repeated. In this case, no signal element is made until the repetition of the preceding element is certain. The second style is to repeat each letter combination complete. As in the instance of "one-two-one", this combination is made without stop, and is then repeated.

140. Both of these modes are applicable to field uses. The first is tedious and rarely ever used. Correctness is sufficiently insured by repeating the letter combinations complete, letter by letter, or a message may be repeated word by word, or sentence by sentence, or the whole message sent is remembered as to its words, and repeated back from the receiving station, showing the same number of words. The occasions for such exactness as requires the trouble of repetition, must be determined by the commanding officers, or by the chiefs of stations dispatching the message."

#### TO DEVISE SIGNAL CODES

141. "Two parties, each perfectly conversant with the principles of signals, coming in view of each other, can converse by signals, though there may be no pre-concert as to any particular code, or even as to the number of elements to be used in the code they will then devise, and none as to the particular signals they will use.

142. This is done as follows: one party, having attracted the attention of the other, as by waving his handkerchief or his arms, or running continually to the right or left of a fixed position sees, by an answering signal, that he is noticed. This answering signal is made by repeating some sign in couplets, as by waving the handkerchief twice to the left at a time, for a number of times, or by making short runs, two at a time, to the left of any fixed position, or by any sign; only it must be repeated twice at a time, with a pause between each repetition.

143. These double signals are always signals of recognition. The first party seeing this answer, acknowledges it by making signs of some kind of twos. These signs must be of the kind he intends to use in the conversation to follow. He then makes, slowly and very distinctly, six times, the signal, whatever it may be, he wishes to have read as "one," or the first element, and stands at rest. This is carefully noted by the second party, as the signal he is to read as "one," or the first element. The first party then makes, slowly and distinctly, six times, the signal he wishes read as "two," or the second element, and again pauses and stands at rest. This is noted by the second party, as before, to be read as "two," or the second element. The first party now makes, three times, the signal he intends to use for the "pause-signal," or end of a word, and stops. It will be seen, that two elements and a pause-signal have been indicated.

144. These are sufficient with which to construct a code. The second party, having distinctly seen and noted these signals made, now makes the signal of recognition as before, then pauses and stands at rest, then makes, in his turn, six

times, the signal he intends to use as "one," or first element, then pauses, then makes, six times, the signal he intends to use as "two," or second element, then pauses, then makes, three times, the signal he intends shall be his pause-signal. If possible, the signals made by the second party must be, for each, some numbered element-signals, similar to those used by the first party. When this is not possible, any other signals may be used.

145. The more simple and distinct the signals the better. Each party now knows the number of elements the other party proposes to use, the elementary signals by which those elements are to be indicated, and the pause-signal. In this case of illustration, two elements have been indicated. The parties can now converse by an alphabetic code of two elements mutually known to them, using these indicated signals in their proper places for the elements of that code. But if there has been no agreed alphabetic code, then to converse, these further rules are used. The first party shows a signal alphabet; that is, he makes slowly, with pauses between them, any twenty-six different combinations of the signal elements he has shown. These combinations are to stand for the twenty-six letters of the alphabet.

146. If the combinations are to be of motion-signals, the motions must follow each other without perceptible pause between them, until each letter combination is complete: there must be a pause of time to evince that this letter is finished. If the combinations are to be of stationary signals, each letter-combination must be a pause of time to evince that this letter is finished. If the combinations are to be of stationary signals, each letter-combination must be indicated as completed by making the pause-signal before commencing the next letter. Time must, in any case, be allowed for each letter, to permit it to be noted by the observer. The second party notes down these twenty-six letter-combinations, one by one, with his pencil, each in the order in which it is made, writing for each element signal shown its proper number, as the twenty-six letters of the alphabet follow each other in their usual sequence. So the record might stand as thus: a is 21, b is 22, c is 12; and so on, to the letter z.

147. If the receiver doubts the signal for any letter, he makes signals for the sender to stop, and then makes, with his own signals, as they have been before agreed upon, the element-numbers of last letter correctly received. The sender now commences again at this last letter, and repeats that of which there has been doubt. The first party having thus sent the whole alphabet which it is his intention to use, makes the signal for completed message; that is, three pause-signals together, and awaits the reply. The second party, having clearly seen and correctly noted, in figures, each letter signal of this alphabet, now makes the recognition-signal, to indicate that he has understood it; and then, in his turn, using his own signals, he makes the twenty-six combinations he has received, and in the same order he has received and noted them; that is, in the usual order of sequence of the letters of the alphabet. He closes with the signal for completed message. To this, the first party replies with the signal for "signal seen and understood," and the word "correct." The second party, noting this

message, replies with signals for "signals seen and understood," and the word "correct."

148. The parties have now exchanged the alphabet, and have verified it. They have given to each other the combinations to be used for each letter, and the signals to indicate these combinations. Of course messages, of any kind, can now be transmitted.

149. In this illustration, the alphabetic-code has been supposed to be of two elements; for the reason that this is most commonly used, is the most simple, and can be so invariably applied. If the parties are to use the ordinary signal flag, it will be now readily understood how they can, without any alphabet, code, or pre-concert open, at any time, communication.

150. Alphabetic-codes, of any number of elements, may be formed whenever skilled signallists are visible to each other, by processes similar to the one described. This being the rule: that, so long as the signallist makes each signal six times, he is indicating the elementary signals he intends to use; and these elementary-signals are designated by the observer as the first, second, third, fourth, and so on, elements, according to the order of the sequence in which they are exhibited one after the other. The alphabets are then devised, to consist of two, three, four, or more elements, as the case may be. The pause-signal alone is made three times; and when it is made, it indicates that all the elementary-signals, to be used in the alphabet it is proposed to devise, have been shown.

151. Thus, if two different signals are shown, each six times, and are followed by a pause-signal, made thrice, it is indicated that the alphabet to follow will be of two elements. If three distinct signals are shown, each six times, and are followed by a pause-signal, made thrice, the alphabet is to be of three elements; if four distinct signals are made, each six times, and are followed by a pause-signal, made thrice, the alphabet is to be of four elements; and thus on for any number of elements.

152. This power of extemporizing alphabetic-codes of signals, of any order, and with any kind of signals, without pre-concert, other than acknowledge of general rules, and the possibility of so opening, at any time, anywhere, telegraphic communication between persons who may never have met, and may never meet more nearly than they are when thus conversing by signals, may be of use in a thousand contingencies of the service. For military uses, it has this advantage: that, if the parties are in sight of each other and at liberty, and can be protected, no human power can prevent their communication. It is available for beleaguered forts or cities, or vessels in distress, when communication cannot be had by boats, between any persons who, for duty or for pleasure, may wish to communicate at a long distance. Of course, it can be used with any apparatus or any mode of making signals, which has been described, or is conceivable. It can be used with day or with night signals, or with signals by sound.

153. With these rules known, the alphabet, and the dictionary of any language, given messages may be sent, and those may converse whose different nationalities would render conversation, by speech, impossible. The signal

alphabets being once agreed upon, by the rules just given, each signallist finds, in the signals seen by him, and standing for letters and words, the letters and phrases of his own language; and when he signals in return, he makes, with his signals, the letters and the words of the language of his correspondent. An American, in distress, might thus signal intelligible messages on the coast of Russia, or of France, to the natives of those countries. Or two foreigners, coming in sight of each other, might converse, understandingly, by messages thus written in the air: for to signal by aerial signals, is virtually to write letters in the air, when neither of them would be able to comprehend the spoken pronunciation of the words that had been thus transmitted. The dream of a universal language is perhaps as nearly realized by these simple devices, as in any way hitherto suggested.

#### STATIONARY AND PERMANENT SIGNALS

154. It is sometimes necessary to use permanent instead of transient signals, or signals made by placing objects in positions instead of in motion. This may be done to deceive an enemy who, having some clue to signals by motion, is entirely thrown off by permanent signals, or signals by position, though the signals made may be in reality identical when reduced to their elements and their combinations; or the change may be to rest men who are wearied by the labor of motion-signals; or the position may be such that signals of position are, for some reason, preferable.

155. The rules for making signals by position, are the same as those which have been given for making signals by motion; only instead of 2, 3, 4, 5, etc., motions, each of which stands for an elementary-signal, there are 2, 3, 4, 5; and so on, positions which may stand for an elementary-signal, the signal object being to make each element placed in that position which indicates the proper number for that element, and there held until it has been recognized. In making signals by position, it is customary for each receiving station to repeat each position-signal as soon as it is observed, and at the sending station each signal, when made, is kept in position until it is thus recognized.

156. In rapid working, it is not absolutely necessary that this should be done. It is sometimes the case, that signals, by position, can be better hidden from the enemy, than those by motion, and that, for this reason, the signallist is less exposed to an enemy's fire while making them. A practiced signallist, should accustom himself, by considering supposable emergencies, and by devising plans of signalling for each emergency, and by practice in the field, when this is possible, to render available for signalling, all kinds of common things by which he finds himself surrounded; and to practice, using these things and conversing with signal codes of different numbers of elements, orders, and classes of signals, with transient and permanent signals, and in the use of ciphers, until he has made himself so skillful that he can, at any time, devise a mode of conversation, and carry on that conversation in such a way, that an enemy cannot decipher it.

157. Permanent signals may be used with semaphores, made on a flag-staff, or with the most simple structure and of work. The human figure, light clad, so as to show prominently on a dark ground, or when exposed against the sky, makes, with its movable arms, one of the best semaphores. Thus a man, with his coat off, is an upright with two movable and jointed arms. There is hardly any kind of position-signals, but can be made by placing the arms of this man in different positions. This human semaphore is visible, and the signals made by it are legible, with a good telescope, for a number of miles. To make the signals more distinct at a great distance, white discs, or flags, brilliantly colored staves, or any showy object, may be held in the hands."

#### POSITION OF FLAGMEN

158. The position of a flagman, transmitting a message, must be exactly facing the point to which the message is being sent; and this must be the case, whatever the style or character of the signal he is using. Signals, of whatever description, made by the flag man, must also be exactly shown on his right and left. In other cases, they will not be clearly displayed to the observer. To determine this exact position, a line, direct to the other station, should be sighted, as over a straight rod for instance, and a line following this direction should be marked on the ground in front of the signal man. A line drawn at right angles with this line should extend on each side of the signal-man. If the common signal equipment is to be used, a marking stake should be drawn on the line in front of the flagman, and twelve feet distant from him; and a similar marker should be placed at the same distance on the side lines on either side.

159. All signals must be made with reference to the directions indicated by these stakes. These lines must be established by daylight, if possible. The use of the markers, secure the most perfect display of the signals by day, and is even more manifestly valuable at night, when the communicating station becomes invisible. The flagman has three other guides, by which to determine the proper direction in which his signals must be shown.

160. A signal-man, transmitting messages, should always be placed a little in advance of the person at the glass, in order that errors made in forming any signal may be noticed and corrected.

161. When signals are made with torches and the ordinary apparatus, at night, the signal-man must stand immediately behind the foot-light, a relates to the other station, and the flying-light be so handled that when brought to the front and lowered to the ground, as to make pause-signals. Its flame, observed from the communicating station, will seem to mingle with the foot-light. When large, common fires are burning at or near the station at night, care must be taken that they are so placed as not to confound the view of the torch-signals, or other lights that may be shown. The signal-man must be placed well to one side of the fire, and his signals must be displayed out of the line of sight from the fire to the communicating station.

162. The light of large fires, burning near, will often interfere, at night, with the use of the glass. The best location for the glass is, in these circumstances, in

advance of the fire. The signalman; making either day or night-signals, ought to be placed a little in advance of, and to one side of the officer at the glass in charge of the station.

163. Care must be taken to so place the signal-man that the glare of the torches or lights will not interfere with the use of the telescope.

#### ATTEMPTS TO ATTRACT THE ATTENTION OF A STATION,

164. In order to be persistent, should never be abandoned, until every device has been exhausted; and they should be renewed and continued at different hours of the day and night. It must always be remembered, that attempts which have failed, may have failed because the observer's attention has been drawn in another direction, and that the effort may, at any other moment, be a success, if the observing glass chances to bear on the calling signals.

165. When a station is found, fix the telescope steadily upon it, and keep it observed while signals are made for its attention. As soon as it is perceived, and the attention is gained, signal its number, or call or answer any signals it may make.

166. Communicating stations should always arrange a few pre-concerted signals for either day or night use. These signals should be of such character as this: "Wait a moment." "I see you, but cannot reply." "Cease signalling: will call you soon." This will prevent the sometimes occurring annoyance of calling a station for hours when the signals, though seen cannot, for some reason, be answered.

167. A signallist, observing from an elevated station, and finding his own view of the communicating station uninterrupted, may be led to imagine that the station on which he stands, is more prominently visible, from the communicating station, than is the case in fact. Thus a person viewing, from the top of a house, may think the whole house is in view from the observing station, when in fact nothing but the roof can be thence seen. To determine whether any station is clearly in view from any other, the observing station must be viewed from the ground, and from different positions close to the station. If the station can be well seen from these different points, that form which the observations are made must of course be plainly visible.

168. When any station has signalled all the messages on hand, the signal to cease signalling must invariable be made. When nothing more is to be for the time sent from either station, both will make the "cease signalling" signal. The observer, or officer, must never leave his station, or cease to watch the communicating station, until this signal has been exchanged by both stations. It must never be presumed that a station has ceased to work until it has announced this fact by signal.

169. Stations ceasing to work for a short time only, will display a flag flying, and stationary. This is a signal that the communicating station may be called at any moment. So long as this signal is made, an observer will be kept at the glass.

170. When a number of stations are in view from one dominant station, some preconcerted signal, as a rocket, a red light, or some peculiar flag or torch-signal, or cartridge-puff, should be agreed upon as a signal for general attention. Upon noticing this signal, all the stations reply, and then observe the dominant station. This plan is useful when two or more stations can at the same time read the signals from the prominent station, and thus together receive any information to be transmitted from it.

171. When a number of stations are working in concert, certain fixed hours of the day and night should be named by proper authority for the especial exchange of messages; at which hours, each station may be certain that those on duty at every other station will be observant and ready for business.

172. All persons on duty should make it a point to be faithfully at their posts at these hours, even if communication may seem to be impossible.

173. It will be found sometimes possible to signal between elevated peaks, when all the landscape of the lower country is deeply buried in fog; and, conversely, a peak will sometimes be wrapped in clouds, when lower down the view is unobstructed. In the former case, messages may be sent by ascending to mountain summits and in the latter case, by descending so as to be below the cloud stratum.

174. When two stations are communicating at dusk, or when it is growing dark, and a light is shown at the receiving station, it is a signal to the sending station to use thereafter torches, or lights instead of flags. A light similarly shown at dawn and then extinguished, or a flag then displayed, indicated to the sending station, to cease using lights and to commence using day signals.

175. While the message is being transmitted by signals, the sending station should constantly observe the receiving station with the telescope, in order that any signals there made to stop the transmission of the message may be instantly seen. These stop signals may be made necessary by any accident at the receiving station. For instance, the telescope there may be thrown out of adjustment, or the connection of the message may have been lost, or by numerous other causes which will render a brief cessation of the signalling desirable.

176. A signal to stop, should be at once recognized by the sending station, and the further sending of the message must be suspended until the receiving station again announces its readiness for work. Stop-signals, of this character, cause much loss of time, and should never, unless absolutely necessary, be made by a receiving station. If part of a message is lost, it is better to receive the remainder, and to then ask for the repetition of the missing portion.

177. In sending very lengthy messages, the precaution should be observed to cease signalling from time to time, and to inquire from the receiving station, if the forgoing has been correctly received. This inquiry may be made by any signal, to which the receiver replies by the usual signal, of message understood, or by other preconcerted signal, as the case may be.

178. Signals in the field, are generally made by a signal-man who, previously drilled, makes each signal by order. These orders, "calling off

signals," must be uttered with careful distinctness and precision. A pause is made after each letter combination. When a message is lengthy, a longer pause is made at the end of each sentence, to allow the sentence to be written down by the receiver. Messages must be grammatically correct, and be correctly spelled. The receiver is sometimes confounded by signals made for a word so spelled that it is not recognizable.

179. The presence of visitors, other than official, should not be encouraged at signal stations of any importance. In an enemy's country, visitors are generally spies, who come under various pretenses, the most innocent, to gather information as to what precise points are in view from the station in order that the enemy may avoid them, and such other items of useful intelligence as they may glean from unsuspecting officers. Visitors should never be allowed to tamper with glasses, to examine messages, or to do any act by which the enemy may gain unnecessary knowledge.

180. It is sometimes necessary for stations to change positions while working. In this case, the observing station should carefully watch the flag of the moving station, which must be carried flying, in order that it may be readily traced to the new situation. A movement of a station sometimes becomes necessary at the request of a communicating station, to improve the back ground, or the view of the moved station. These movements are often for a few yards only. In such case, the moving station, carrying its own flag flying, must carefully watch the flag of the observing station, which is kept in view in order that it may be so watched, and the movement must be instantly stopped at a signal from the observing station, which indicates when the moving flag has reached the precise position desired.

181. When stations are certainly in sight of each other, preparations for continued work should be carefully made before the transmission of official messages is commenced.

182. Officers will always avail themselves of proper precautions to locate their men and themselves in unexposed positions. When in an exposed position, officers and men will lie down, except while transmitting messages. The flag will be kept flying, to indicate the position of the station to those who may be seeking for it, and to the other signal stations with which it may be in communication.

183. When there is danger of capture, all messages or important papers must be destroyed.

184. When there is any trouble about the visibility of signals, the largest and brightest flags, or other signals, should at once be used. It will often happen, that after working thus for a short time, the signallist, becoming accustomed to the range, will work successfully with smaller signals.

185. When, at the receiving station, it is noticed that a change in the color of the signals shown at the sending station would render them more visible, the fact should be immediately stated. When there is any question as to the color of signals to be shown at the different stations, each station should indicate to the other that color most distinctly visible from its own point of view.

186. Each signallist should have a particular signal by which he can be known.

187. This signal may be that for any letter or letters of the alphabet. It is known as the "officers signature, or call." It serves to distinguish him, and any message sent by him, and for the correctness of which he is to be held responsible.

188. By it is also designated the station at which the officer commands. A call, or particular signal, is in like manner generally assigned for each station, to distinguish that station from others.

189. Whenever these particular calls are seen signalled, it is known that the attention of the officers or the station is desired. The officer or the station should at once respond, making at the close of the response, this same particular signal by which they are identified. The calling station, or officer, should give his own call or signal. There is thus established between the parties a mutual knowledge as to the parties with which each is in communication.

190. There are times when it will be necessary to read messages, while it is known that the signal-man is facing away from the reader. In this case, the messages will be easily legible, if it is remembered that each signal will appear to the reader to be precisely the reverse of that which is made by the signal-man; thus all those signals displayed on the right will seem to the reader to be shown on the left, while those actually made on the left of the signal-man, will seem to be made on his right. Recalling this fact, it will be as easy to read the signals made at any station from the rear of that station as it is from its front.

191. When working at night with the common signal equipment of the army, the foot-torch is to be filled as often as it becomes exhausted, without stopping signals or extinguishing its light. While transmitting a message, if it becomes necessary to fill the flying torch, drop the torch to the left, extinguish and fill it in that position, and then light it again a the foot torch; bring it, thus lighted, vertically above the head, which is the signal that the message is to proceed and go on as before. To thus drop the flying-torch at any time to the left and there extinguish it, is a signal that the working has been stopped in order to fill that torch. When a stop is made to fill a torch, it should be at the end of a word or a sentence.

192. It should be observed with care that the wicks of the signal torches are properly adjusted. If the wicks are too tight, the torch will not burn well. If they are too loose, the turpentine will escape, and it will burn too violently. The wick of a flying-torch is properly trimmed when the flame of the burning torch seems to be about three inches in diameter.

193. When a flying-torch becomes too much heated while working--a fact which will be known by the singing sound and increased size of the flame---the working must stop for a few minutes, and the torch be held up, the signal staff being kept perpendicular until the flame has diminished to a proper size. A flying-torch should be filled, on the average, every fifteen minutes. If the torch is not kept well filled, it will continue to burn, but the wick will be reduced to a

cinder; one wick, properly managed and with care to keep the torch well filled while in use, will last for a week.

194. When the wind blows from such a direction as by driving back the flame of the foot-torch to render the light of that torch indistinct when viewed from the communicating station, so place the torch as to bring the wind-shade upon it in direct opposition to the wind; and if this should not suffice, build behind the torch a screen, about two feet high and two feet long, of stones, earth, boards, or any other material, so that while the foot-torch is in front of the screen, and in view of the communicating station, its flame will be in the dead air, caused by and in front of the screen.

195. In cases of emergency, torches may be constructed of pitch pine, old cordage, canvas, rags, or other material, saturated with tar, or with any combustible fluid. Fire-brands, or any lights, will answer the purpose. With the preceding instructions of the manual, the signallist need hardly have in question the devices to be used. Any light that can be visible with any other as a point of reference, will afford sufficient means by which to transmit signal messages in any variety of code of signals.

196. Communicating stations ought not, when it can be avoided, to be located exactly on an east and west line, or the line of the apparent course of the sun. That station which is in the direction from which the sun shines in any part of its course, is very liable to seem to be enveloped in a haze, and the telescope, if turned upon it, is filled with a dazzling light.

197. The landscape is often seen as perfectly clear and signals are plainly visible in every direction, excepting towards the rising or setting sun. There is a bright haze. It is better, therefore, that the line of the stations should obliquely cross the apparent course of the sun, and care should be taken to so arrange them. If that cannot be done, the stations lying in the apparent course of the sun, should be so located that they may have a sky exposure when viewed from the communicating station. This obviates, to a very great extent, the difficulty of sun haze; and wherever that difficulty exists, resort should at any time, be had to secure such an exposure for the obscured station.

198. In the same way, when there are temporary interruptions, as often happens from clouds passing the sun, a sky-exposure secured for the obscured, will render all signals, there displayed legible.

199. Signal stations should always be chosen as much elevated from the ground as possible, when there is difficulty about smoke or haze or dust. The vibration of the atmosphere, noticeable on a hot summer's day, is always less at a distance from the earth's surface. Thus it is sometimes practicable to read, from a tree or house-top, when it is almost impossible so to read from the ground. This undulation is less also over spots well shaded, than in the glare of the sun. This should be borne in mind in all telescopic examinations. Permanent stations should never be placed in hollows, or on low land, when high ground is attainable.

200. The greatest elevation should invariably be sought. In the cool night air, the smoke and dust of the day lie close to the ground, filling the hollows and

obscuring low lands, while the higher points emerge in view like islands. So, too the elevated points are free, to a great extent, from heavy moving mists and the malaria of unhealthy locations. There are these advantages, aside from their better location, for working. By careful selection of high ground, stations can often be worked when signals on the lower fields would be invisible; for these reasons, it is well to have, sometimes, a station for night work on a house-top or in a tree, while during the day the station is worked from the ground."

#### REPEATING MESSAGES

201. Transient signals are so rapidly made, that they are repeated with difficulty. Permanent signals are repeated with precision. Where repetitions is to be habitual over long lines, some of the simple semaphores, once of common use, afford perhaps the most rapid and available means for communication. They have been improved by long experience to a degree which renders them almost perfect. For ordinary ranges, and for common military uses, any of the different manual codes, heretofore described, are always available. Permanent semaphores need not be used except for convenience, or when a long line is to be worked continuously with a feeble force.

202. When a message is to be repeated over a line of stations, either by transient or permanent signals, a warning signal is first given, in order that there may be proper attention at the intermediate stations before commencing the message. This warning may be a message as thus: "repeat to" (naming the town). This warning is sent, from station to station, until it reaches the station named; this station replies by a concerted signal of "ready, " and each immediate station, repeating this signal back to the first station, stands ready to repeat the message which the first station commences to forward, signal by signal, at once on receiving the ready signal.

203. The intermediate stations repeating each signal letter and number as fast as they are received, as, for instance, was a message about to be sent from Washington to Frederick, the officer at Washington would first send over the signal line the warning "repeat to Frederick." This warning is repeated from station to station. On receiving it, the officer at Frederick, makes the ready signal, which signal is repeated back, from station to station, to Washington. Each station then stands ready to repeat the signal message which is to follow. On securing the ready signal, the officer at Washington sends forward the communication, each station repeating each letter and number in its turn as it receives them.

204. When a message is being thus repeated through a number of signal stations, the officer at each station will call the proper number for each letter, and pause as he receives them, to his flagman, who, placed facing from the sending station and towards the station next in line, makes each signal in its proper order. Each officer, after signalling from his station each letter and pause, waits until he sees it repeated at the next station before he signals another.

205. The advantage of permanent signals have become apparent, for a permanent signal may be kept in view until it is repeated with certain

correctness. All signals made at the repeating station will appear to the observers at the sending station reversed. When permanent signals are used, each sending station keeps its signal in view until that signal has been repeated at the next station, when it resumes the position ready, and waits the next signal from the station of departure.

206. Long lines of signal stations, with a small military force at each, being thus each in communication with the other, may constitute picket lines of great length and importance for holding and keeping under observation lines of communication, rivers, or extensive tracts of country liable to incursion or to be ravaged by predatory bands of the enemy, each station, having the power of communicating with those on either side of it, has virtually thus the advantage of their support, and no one can be attacked without the enemy being exposed to the concentration of forces called for by signals from different stations.

207. On river lines, where the protection of commerce is of importance, such stations afford at once shelter to the moving vessels, are able to warn them while at a distance of danger as of the location of the enemy upon the banks, or in case of attack to call to their assistance the vessels of war assigned to the duty of patrolling the stream. In the great river courses of this county, the advantage of picket lines of this description, guarding our rivers passing hostile territory, cannot be over estimated."

#### TRANSMISSION OF REPORTS

208. "It is essential that the reports of signal officers should be transmitted with rapidity. To gain time should be a chief consideration. The reports are generally of a character relating to facts actually transpiring, and if they are not known to the proper authorities at once, they are useless. For this reason, minute arrangements ought always to be made beforehand, that the report may come by signals, from the post of observation, at once to the headquarters of the General commanding, if possible. The reporting officer must also, at his discretion, dispatch written reports, with maps giving full information. There should never be delay. The report should go by messenger at any time, rather than incur the risk of losing value by detention.

209. When, as on the field of battle some times happens, or in minor advances, etc., the report is of local importance only, and action on it would probably be taken by immediate commanders, copies of the report ought to be sent quickly to the nearest regimental, brigade, division, and corps commanders. Care must be taken to sign the report clearly, with the name and rank of the sender.

210. A copy of each report should be kept. The chief signal officer of the army at general headquarters, must be furnished daily with a copy of each report for the information of the Generals commanding. It is the duty of these officers to make, every evening, from all the detached reports which have reached them, a consolidated report from all information of any kind which has been received at their offices during the day, the chiefs with the corps, basing their reports on those of their subordinate officers, and the chief at headquarters consolidating

for his reports those received from the chiefs of corps. The corps chief, submits his report to the corps commander, and sends a copy to general headquarters. The chief with the army, submits his own to the chief of staff, or to the General commanding.

211. All chief signal officers, in submitting their reports, give their views in reference to the accuracy of its parts. The reliability of the reporting officer, the concurrence of statements coming from officers observing at different parts of the line; the opportunities for correct observation had at different signal stations, and reporting other facts within their knowledge, by which the value of the report may be judged.

212. The consolidated report from each chief signal officer of corps should be sent in to general headquarters before the chief signal officer of the army makes his general report, and should be accompanied by outline maps, if possible. In this manner, the General commanding has before him, each night, a summary of all the information gained by the Signal Corps during the day, and can estimate its value by comparison with information from other branches of the service.

213. To render his reports accurate, complete, and really valuable, should be the aim of every officer, and to this end, the hours of leisure which come so often on stations of observation, should be devoted to the reading of works on general reconnaissance, the practice of map-sketching, and those companion studies of the military art which must go to make the education of any really valuable officer. The student will soon find his reward in the satisfaction to himself with which he renders his reports, and the higher satisfaction of the approval they are certain to elicit from his superior officers. There are open to none, broader fields to usefulness, than to the signal officers of the army.

#### LINES OF SIGNALS

214. At the beginning of the war, the use of signals was almost unknown. Telegraphs were novel in armies, not practically well understood by our soldiers, and not provided for in organization. Very little was known of the principles of telegraphic communication. It was not known how simply signals could be made, and at what great distances they were legible. The duty was experimental.

215. This want of general knowledge was simply because attention had not been directed to the subject. In the progress of the war, the use of signals has greatly developed itself. Signal stations may be really picket posts on long lines. If each little post is fortified, a line may thus be held in the immediate presence of the enemy.

216. A river passing through an enemy's country, with commerce upon it liable to interruption by guerrilla attacks, or by forces of the enemy can, by the establishment of small fortified signal stations, garrisoned and communicating, say at a distance of nine or ten miles apart, be virtually picketed and be made safe for commerce. This has been proposed in case of the Mississippi.

217. So when an army has for its duty only to watch a certain line, by a judicious arrangement of signal posts upon that line, it can be made almost impossible for the enemy to pass it without encountering concentrated forces. A heavy force lying back of the line of signal posts, and ready to move in whatever direction it may be notified, it would be impossible to destroy one of these little posts before information could be given to the others neighboring.

218. The uses of signals upon the field of battle, daily develop themselves. All the dominant points near a field of battle should be occupied by signal officers. Combined land and naval operations should never be undertaken without properly instructed signal men.

219. When the Generals of our armies, and the officers commanding fleets, shall have become acquainted with the power of signals, the facility they give to operations, and the ease with which they can be used, thousands of applications will be found which are not now thought of. Each chief signal officer should consider it his duty to cause the subject of those duties, and their value, to be comprehended by the general officers with whom he is serving, and each chief should see that every post in his department, which might be liable at any time to be isolated, is furnished with equipments, code, and instructions to use it.

220. The issue of these notes will render this easily practicable. Similar provisions ought to be made for co-operating naval vessels, and the chief of each department, under instructions from the central office, should be held responsible that no detriment happens to the service from any want of communication between the different branches. It is to give general knowledge of this kind that these notes are partially intended."



