CONTENTS

The Signal Codes herein were approved and issued for the information and government of the military forces of the United States by order of the Secretary of War under date of April 15, 1916.

HANDBOOK OF MILITARY SIGNALING

CODES

THE AMERICAN MORSE CODE

1. The American Morse Code is used by the Army in the operation of land telegraph lines, short cables, and field telegraph lines. It is written as follows:

Alphabet

A	.—	L	——
B	—...	M	——
C	—.—.	N	—.
D	—..	O	———
E	.	P	.——.
F	..—.	Q	——.—
G	——.	R	.—.
H	....	S	...
I	..	T	—
J	.———	U	..—
K	—.—	V	...—

W .— —	Z ... .
X .—..	& . ...
Y	

Numerals

1 .— —.	6 .....
2 ..—..	7 — —..
3 ...—.	8 —....
4 ....—	9 —..—
5 — — —	0 — —

Punctuation

Period		..— —..
Comma		.— .—
Interrogation		—..— .
Hyphen	(HX)	.... .—..
Dash	(DX)	—.. .—..
Parenthesis (begin)	(PN)	..... —.
Parenthesis (end)	(PY)	....
Quotation marks (begin)	(QN)	..— .— .
Quotation marks (end)	(QJ)	..— . —.—.
Dollar mark	(SX)	... .—..
Decimal point		Spell "dot."
Capitalized letter	(CX)	.. . .—..
Brackets	(BX)	—... .—..

Colon .....(KO) —.— . .
Semicolon .....(SI) .... ..
Underline (begin) .....(UX) ..— .—..
Underline (end) .....(UJ) ..— —.—.
Colon dash .....(KX) —.— .—..
Colon followed by quotation.(KQ) —.— ..—.
Exclamation point .....(!) ——— .
Fraction bar .....(/) .
Paragraph mark .....(¶) ———
Pounds, sterling .....(£) (PX) ..... .—..
Shilling mark .....(UT) ..——

Abbreviations

af .....after
ahr .....another
b .....be
bf .....before
bn .....been
ck .....check
cn .....can
da .....day
dl .....day letter
dpr .....day press rate
fm .....from
gn .....good-night

govt .....government
hr .....hear or here
hv .....have
msg .....message
nite .....night
nl .....night letter
npr .....night press rate
ob .....official business
pd .....paid
r .....are
t .....the
u .....you
ur .....your
w .....with
wrd .....word
x (in check).....get a reply to this message
5 .....Have you anything for me?
13 .....understand

CONVENTIONAL SIGNALS FOR USE WITH THE AMERICAN MORSE CODE

2. The following conventional signals are used on military telegraph lines, short cables, and field lines:

Attention, all operators.....(9) —..—
Please start me. (or) where
shall I start.....(4) ....—
Wait a moment.....(MIN) ——.. —.
Official message .....(OFM) . . .—. ——
I understand .....(OK) . . —.—
Busy on other wires.....(25) ..—.. ————
No more .....(NM) —. ——
Test, give away.....(WIRE) .—— . . . . .
Break .....(BK) —... —.—
Go ahead .....(GA) ——. .—
Error .....(DN) —..—.
Signature follows .....(SIG) ....——.

TRANSMISSION OF FIELD MESSAGES BY AMERICAN MORSE

3. The sending operator will enter the time *when the message is handed him for transmission*, in the left-hand corner at the bottom of the blank opposite the word "Received." He will enter in the proper places, at the head of the blank, the number of the message, the call letter of his station, with his personal signal, the check (number of words or groups of cipher

not anticipate what will follow from signals already given. Watch the communicating station until the last signals are made, and be very certain that the signal for the end of the message has been given.

Every address must contain at least two words and should be sufficient to secure delivery.

All that the sender writes for transmission after the word "To" is counted.

Whenever more than one signature is attached to a message count all initials and names as a part of the message.

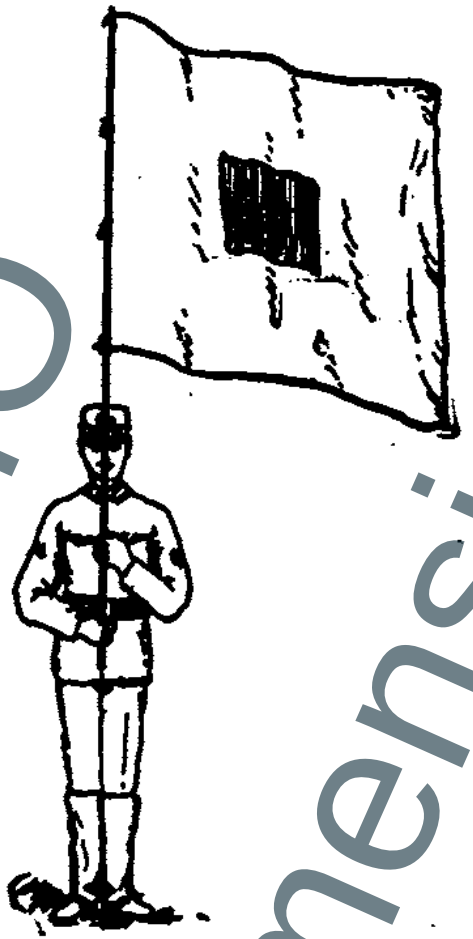
ORDER OF SENDING A MESSAGE

12. 1—Number of message.
2—Place from, and date.
3—Address in full.
4—Body of message.
5—Sig (signature follows).
6—Signature.

VISUAL SIGNALING: BY FLAG, TORCH, HAND LANTERN, OR BEAM OF SEARCHLIGHT (WITHOUT SHUTTER)

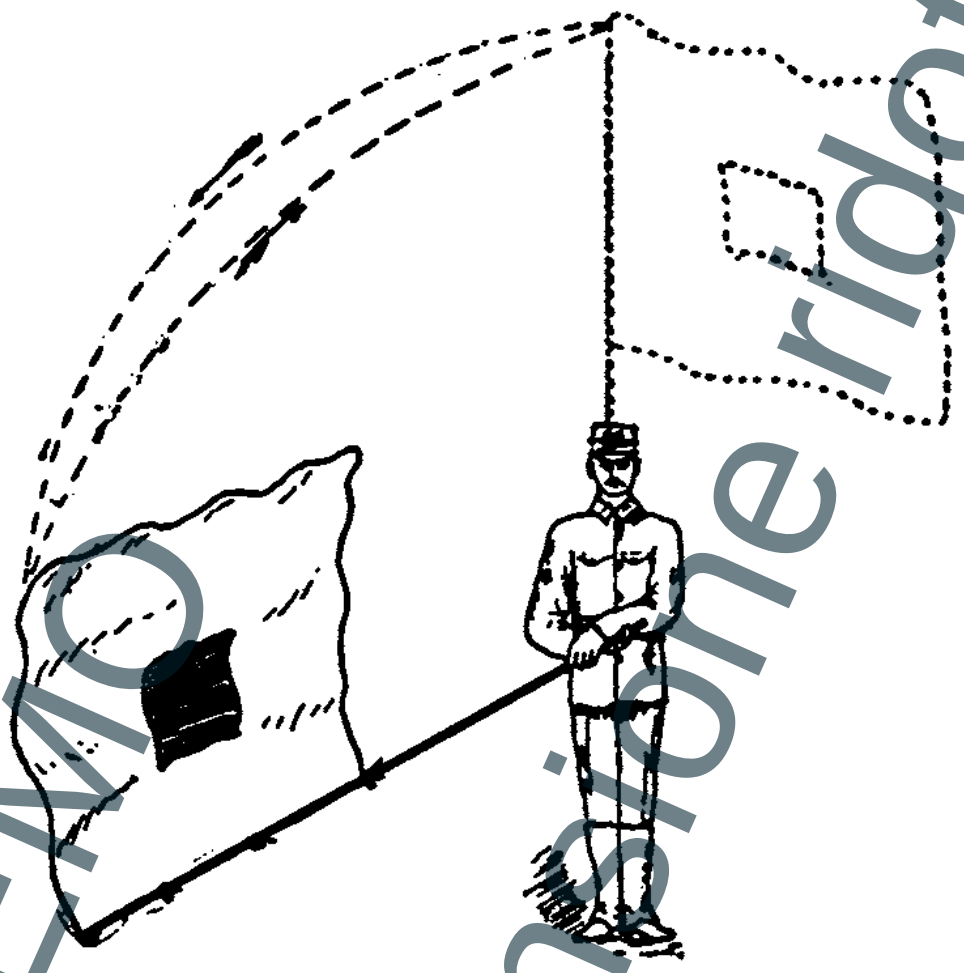
GENERAL SERVICE CODE

13. For the flag used with the General Service Code there are three motions and one posi-



Position

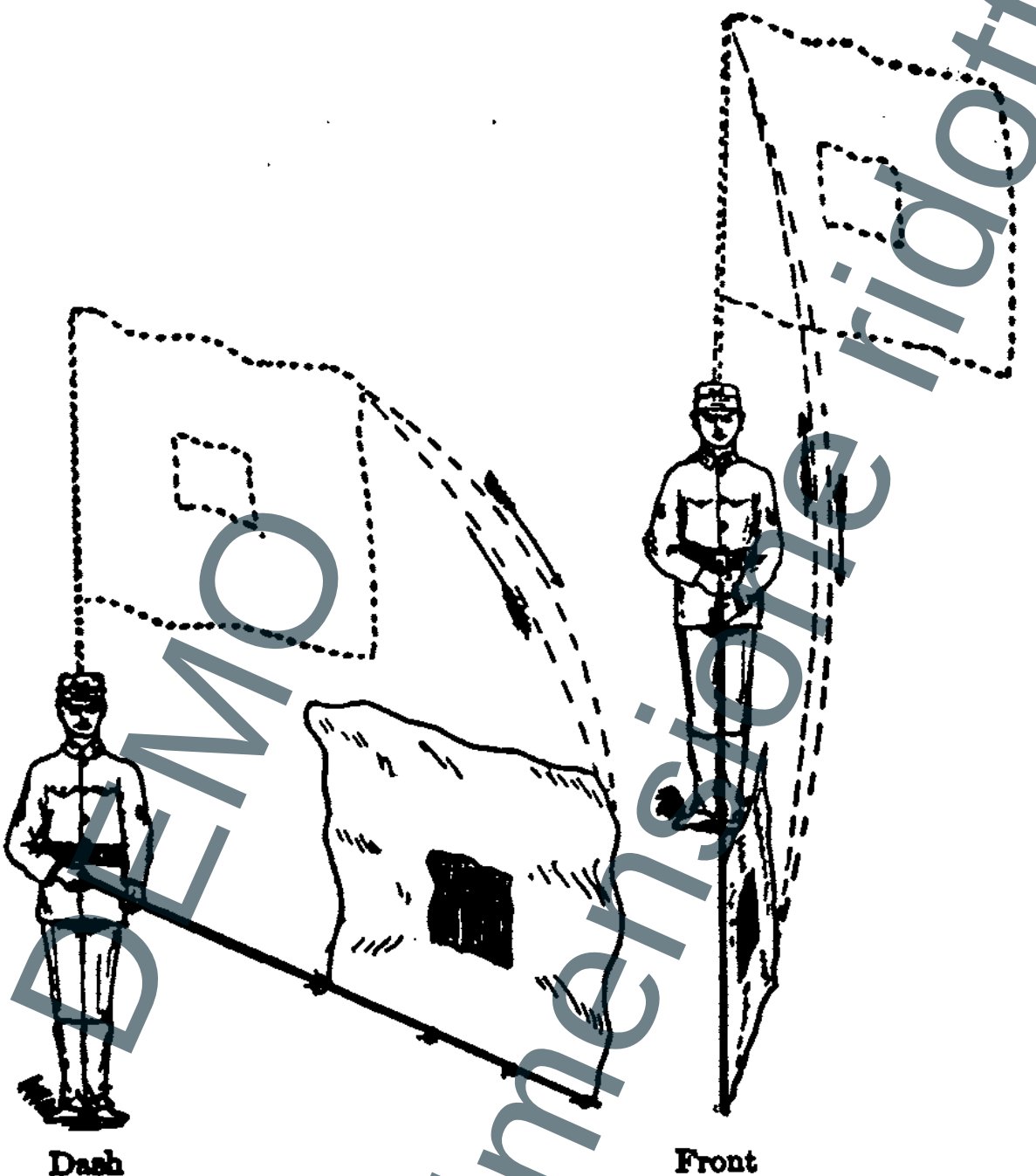
tion. The position is with the flag held vertically, the signalman facing directly toward the station with which it is desired to communicate.



Dot

The first motion (the dot) is to the right of the sender, and will embrace an arc of 90°, starting with the vertical and returning to it, and will

be made in a plane at right angles to the line connecting the two stations. The second motion



(the dash) is a similar motion to the left of the sender. The third motion (front) is downward directly in front of the sender and instantly returned upward to the first position. Front is used to indicate an interval.

14. The beam of the searchlight, though ordinarily used with the shutter like the heliograph, may be used for long-distance signaling, when no shutter is suitable or available, in a similar manner to the flag or torch, the first position being a vertical one. A movement of the beam 90° to the right of the sender indicates a dot, a similar movement to the left indicates a dash; the beam is lowered vertically for front.

To use the torch or hand lantern, a footlight must be employed as a point of reference to the motion. The lantern is most conveniently swung out upward to the right of the footlight for a dot, to the left for a dash, and raised vertically for front.

SIGNALING WITH HELIOGRAPH, FLASH LANTERN, OR SEARCHLIGHT (WITH SHUTTER)

GENERAL SERVICE CODE

15. The first position is to turn a steady flash on the receiving station. The signals are made by short and long flashes. Use a short flash for dot and a long steady flash for dash. The elements of a letter should be slightly longer than in sound signals.

To call a station make its call letter until acknowledged.

If the call letter of a station be unknown, signal A until acknowledged. Each station will then turn on a steady flash and adjust. When the adjustment is satisfactory to the called station, it will cut off its flash, and the calling station will proceed with its message.

16. If the receiver sees that the sender's mirror or light needs adjustment, he will turn on a steady flash until answered by a steady flash.

When the adjustment is satisfactory, the receiver will cut off his flash and the sender will resume his message.

To break the sending station for other purposes, turn on a steady flash.

It may be noted that in the daytime and in ordinary weather the searchlight with shutter can be readily used for distances up to 10 miles at sea. This method of day signaling is considered of exceptional value by the Navy, and is commonly used by the Coast Artillery in target practice from the shore to the tug towing the target. It is independent of background and may be used behind armor or other shelter; it should be frequently used for signaling by day as well as by night.

THE FLAG

17. Signal flags are made of muslin or other material of light and close texture, are square in shape, and have a smaller square in the center, comprising one-ninth of the surface of the flag, of a different color from the body of the flag.

Those commonly used are: The white flag, four feet square, having a red block sixteen inches square in its center. The red flag, four feet square, having a white block sixteen inches square in its center. The white flag, two feet square, having a red block eight inches square in its center. The red flag, two feet square, having a white block eight inches square in its center.

In addition to the above, six-foot flags with centers two feet square are often used, and black flags with white centers are sometimes the most suitable, as in case of sky backgrounds.

All flags are fitted with tapes on one edge,

one foot apart, for tying them to the staff. The staff is in two, three, or four joints, each four feet in length. Two or three joints are ordinarily used, but the longer the distance the larger the flag and longer the staff.

SIGNALING WITH THE FLAG

18. The signalman is first instructed in the use of the two-foot flag, on the upper joint. He takes the position of the soldier, faces exactly toward the receiving station, with the staff vertical in front of the center of his body, holding it with either hand at the butt, which should be at the height of the waist.

An imaginary line, from a point between the feet of the sender to the receiver, is called the *line of vision.*

In swinging the flag, each motion to the right or left should be exactly at right angles to the line of vision, and each front motion should be in the line of vision. To insure this, stakes may be driven in the line of vision a short distance in front of the flagman and at right angles to it, the same distance to the right and left. The

staff should point in the direction of one of these stakes at each wave.

Expert signalmen will not need the stakes for day signaling.

The instructor should explain to the recruit how to keep the flag open and prevent its fouling with the staff, by giving the end of the staff a slight *scoop* as it reaches the lowest point in its motion.

The scoop should be made against the wind.

The importance of clean, clear cut motions of the flag in a plane exactly at right angles to the line of vision cannot be overestimated.

The staff should be kept as upright as possible, and the flag kept open, as when fouled on the staff it may become quite invisible during several motions.

In a clear atmosphere the four-foot flag may be read with the naked eye four or five miles; with a field glass or telescope about twice as far.

19. *Powers and limitations of flag signaling.* —The advantages which may be claimed for this method of signaling are portability of apparatus, adaptability to varied weather conditions,

and great rapidity of station establishment. The disadvantages are the lack of celerity of the signals, their impenetrability to dust or smoke, and the comparatively short ranges at which they can be read. These ranges vary with the background, light, vision, and power of glasses if used.

20. *Care of flag material.*—Signal flags should be examined at the close of drill or use and repairs made to any rents or loose ties discovered. Flags, when soiled, should be thoroughly washed and dried in the sun. Signals made by clean flags are much more easily read than those made by dirty ones. Staffs should be handled with care, especially when jointing or unjointing. Care should be taken not to bruise the ends of the brass ferrules. Ferrules fitting together so loosely as to permit separation of the joints in signaling must not be hammered or jammed, but should be tightened by wrapping one or more thicknesses of thin paper around the one which is inserted in the other. If a ferrule becomes loose on a staff it should be tightened without delay.

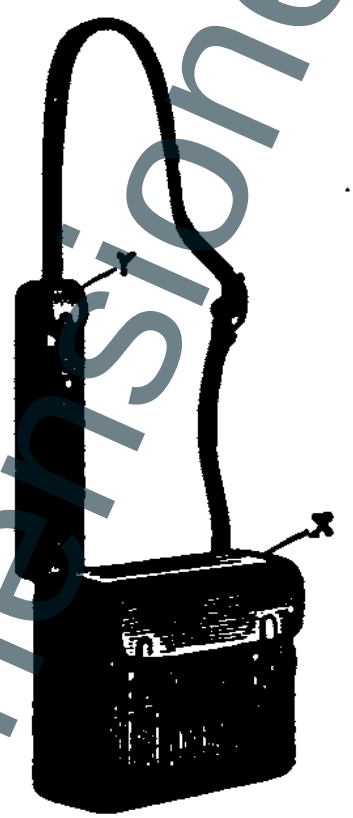
THE HELIOGRAPH

21. The field heliograph equipment consists of—

x. A sole-leather pouch, containing:

One sun mirror.
One station mirror. } Inclosed in a wooden box.

One shutter. One sighting rod. One screw-driver.



Y. A smaller pouch, sliding by two loops upon the strap of the larger, containing one mirror bar.

Z. A skeleton case, of leather, containing two tripod stands.

C. Sun mirror.

D. Station mirror.

E. Mirror supports.

F. Tangent screws for revolving mirror about horizontal axis.

G. Mirror bar.

H. Tangent screw with ball bearings for revolving mirror about vertical axis.

I. Clamp screw for attaching mirror bar to tripod.

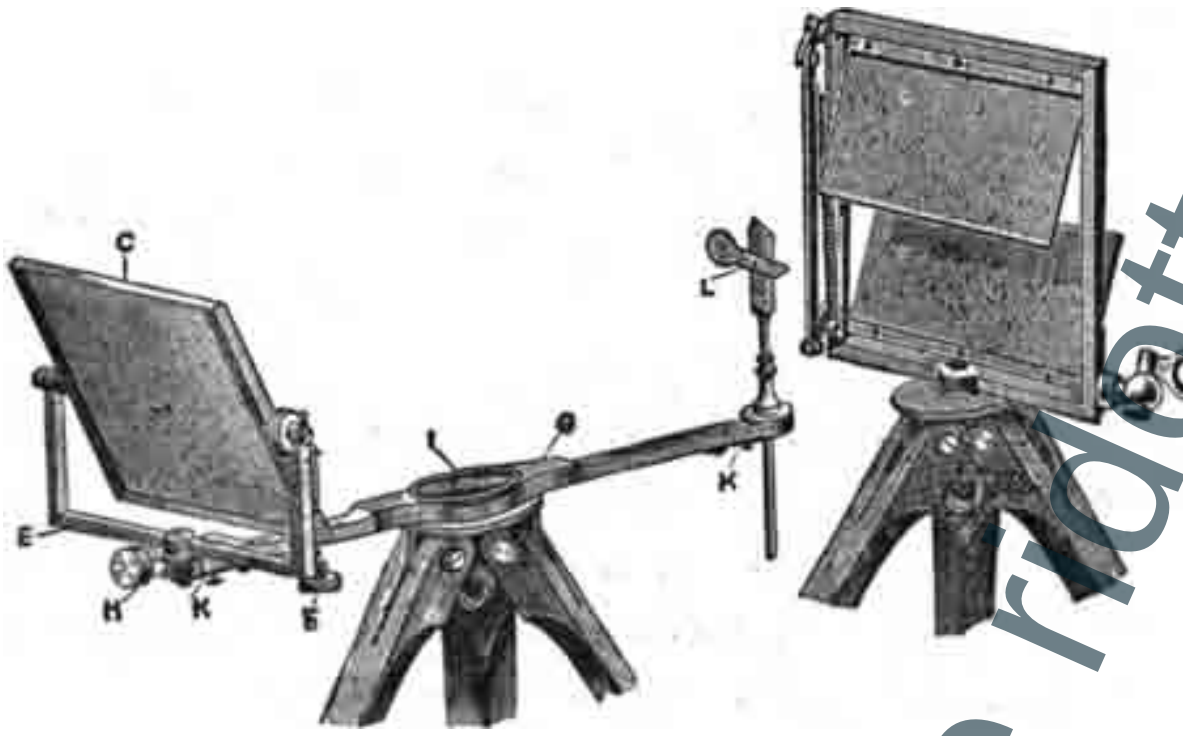
K. Spring for clamping mirrors and sighting rod.

L. Sighting rod with movable disk.

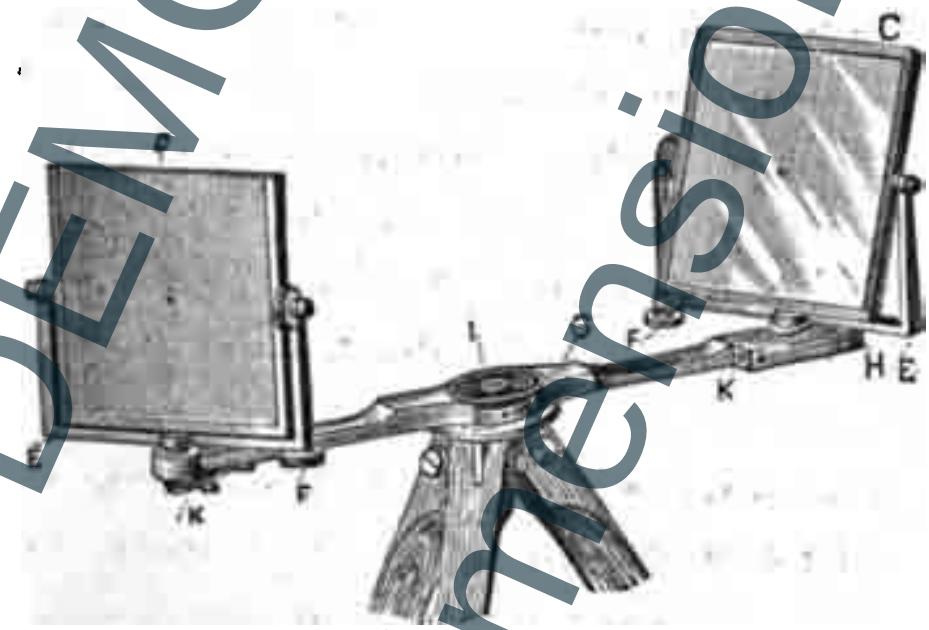
M. Shutter.

N. Key for shutter.

22. The sun mirror has an unsilvered spot at its center, the station mirror a paper disk. In other respects they are similar. The tangent-screw attachment to the frame affords the means



(Latest style shutter has six leaves)



of revolving the mirror about a horizontal axis.

The support to the frame has a conical projection accurately turned to fit the socket of the mirror bar and grooved to receive the clamp spring.

The shutter has leaves, operated by means of a key.

The base of the frame carries a female screw for attachment to the tripod.

23. The sighting rod is fitted to the socket of the mirror bar, and is clamped in the same manner as the mirrors. It carries at one end a movable disk, which when turned down reveals the front sight. A piece of white paper should be slipped into the disk to receive the "shadow spot," and a slight puncture made therein, coincident with the point of the front sight, as guide in adjustment. Vertical adjustment of the disk is made possible by loosening the milled slide.

24. The mirror bar is provided with a clamp threaded to fit the screw of the tripod. The release of the clamp permits movement of the bar independent of the screw. At one end is at-

tached the tangent screw for revolving mirror about a vertical axis, and it should be remembered that *under all circumstances the sun mirror is to be clamped to this end,* while the socket at the other extremity is designed to receive the station mirror or the sighting rod. A movable spring is placed under each end of the bar for clamping mirrors and sighting rod.

25. The tripods are similar, the screw of either serving equally well for the attachment of mirror bar or shutter.

Both are provided with a hook for the suspension of a weight, to give great stability when required.

SETTING UP AND ADJUSTING

26. The position of the sun is the guide for determining whether one or two mirrors should be used. When the sun is in front of the operator—that is, in front of a plane through his position, at right angles to the line of vision—the sun mirror only is required. With the sun in rear of this plane both mirrors should be used, although a single mirror may often be worked to advantage with the sun well back of

A station should not, if avoidable, be located in a camp, or where the white canvas of tents is liable to form the background. The maneuvering of troops in an encampment, the passage of individuals, the smoke from the kitchens, and the curiosity of persons not attached to the station, make a camp the most unsuitable locality for a signal station.

The point chosen should be near the headquarters of the commanding officer, but outside of the camp and on one side of it. If no natural height presents, a platform may be built in the top of a tree, or a scaffold erected from the ground.

46. Stations should invariably be on the most elevated ground accessible, and should never, if avoidable, be placed on low land. The undulation of the atmosphere noticeable on a hot summer day is always less at a distance from the earth's surface, while in the cool night air the smoke and dust of the day and the heavy moving mists lie close to the ground, obscuring the lowlands.

Stations on the tops of city buildings should,

when possible, be so located as not to be visible from the street.

47. Signal officers should always be supplied

Flag station, parapet of high building.

with the best obtainable maps of the district in which they may be working.

The maps should have altitudes indicated in figures. In selecting stations from a map and calculating the height of intervening elevations, due allowance should be made for the curvature of the earth.

48. The following table shows the extent of horizon for different heights above the sea

level; that is, it shows how far an object at the sea level can be seen.

Height of the eye above sea level (in feet)	Distance (in statute miles)	Height of the eye above sea level (in feet)	Distance (in statute miles)
10	4	115	14
15	5	130	15
20	6	150	16
30	7	200	18
40	8	230	20
50	9	300	23
60	10	350	25
70	11	500	30
85	12	700	35
100	13	900	40

Hence, an observer whose eye is 30 feet above the sea can distinguish an object 7 miles distant, providing it is at the sea level; but if the object is itself 15 feet above the sea he can make it out $7 + 5 = 12$ miles off.

Officers should enter in the field books, provided for the purpose, sketches and minute descriptions of the location of stations upon which they have worked, showing upon the sketch,

lines leading to other stations with which communication may be held, with magnetic courses to the same, and any notes or information which might aid in quickly locating the station at some future time.

49. In signaling with the flag, *the background is of vital importance.*

It should be of one color, and the flagman should be so placed that all the motions will be outlined against it when viewed from the communicating station. Dark colored backgrounds, such as green fields or woods, are the most satisfactory. Sky backgrounds are excellent, but are difficult to obtain.

The background may be a long distance, sometimes many miles, behind the station. To determine what the background will be, move along the line of vision in front of your station, the head accurately in line with the distant station, and observe your background from that position.

The flag used must be of the color which contrasts most greatly with the color of the background. In the case of landscape backgrounds

the white flag should be used. With sky backgrounds use black flags. With mixed backgrounds, red flags. In nine cases out of ten the white flag will be found best.

50. It is important that every motion and position of the flag be visible at the receiving station. It is possible that trees or bushes may hide the flag in one of its motions, although they be a long way off.

To determine that the flagman is so placed that nothing obstructs a view of the flag in any of its motions, when viewed from the receiving station, go to the points to the right, left, and front of the flagman, and, stooping down, with the face at about the height of the flag at its lowest point, see if the farther station be visible from there. If so, then rise, and see if the farther station is visible as you rise.

The above precaution should always be taken.

51. When signaling with the heliograph, it will often be necessary, in opening communication, to find the direction by compass. After the course has been found the instrument should be sighted as nearly as possible on the point

where the distant station is supposed to be, and the flash swept by the slow motion screws slowly back and forth in a small arc, occasionally changing it to a little higher or lower plane.

Attention may often be attracted by taking a spare mirror and flashing it toward the distant station. The flash may be directed by selecting some near object nearly in line with the distant station, as a reference point.

THE ARDOIS SYSTEM

GENERAL SERVICE CODE

52. The Ardois system, used in the United States Army and Navy, is a display of four lights, each of which may be made either red or white. These lights are incandescent lamps, operated by a keyboard conveniently placed at the station. The red light indicates a dot and the white light a dash, so that the characters of the General Service Code are made by combinations of red and white lights.

If the lights are arranged vertically, as when swung from a staff or spar, they are read from the top downward. If the lights are placed horizontally, they are read from the sender's right to his left.

Example: Red-white, or dot-dash, represents the letter A; and white-red-red-red, or dash-dot-dot-dot, represents the letter B.

For numerals in the Ardois system, second-

ary meanings (as numerals) have been assigned to the last 10 letters, Q being 1, R being 2, and so on, Z being 0. These secondary meanings are not used in communicating with the Navy; when communicating with the Navy the numerals of the International Morse Code must be spelled out in full.

RULES FOR USING THE ARDOIS SYSTEM OF SIGNALING

53. In signaling by the Ardois system the Cornet, WWWW, is a general call to attention. A station desiring to exchange signals will display the call letters of the station wanted, which will be answered by a similar display from the station called, or from each station successively called.

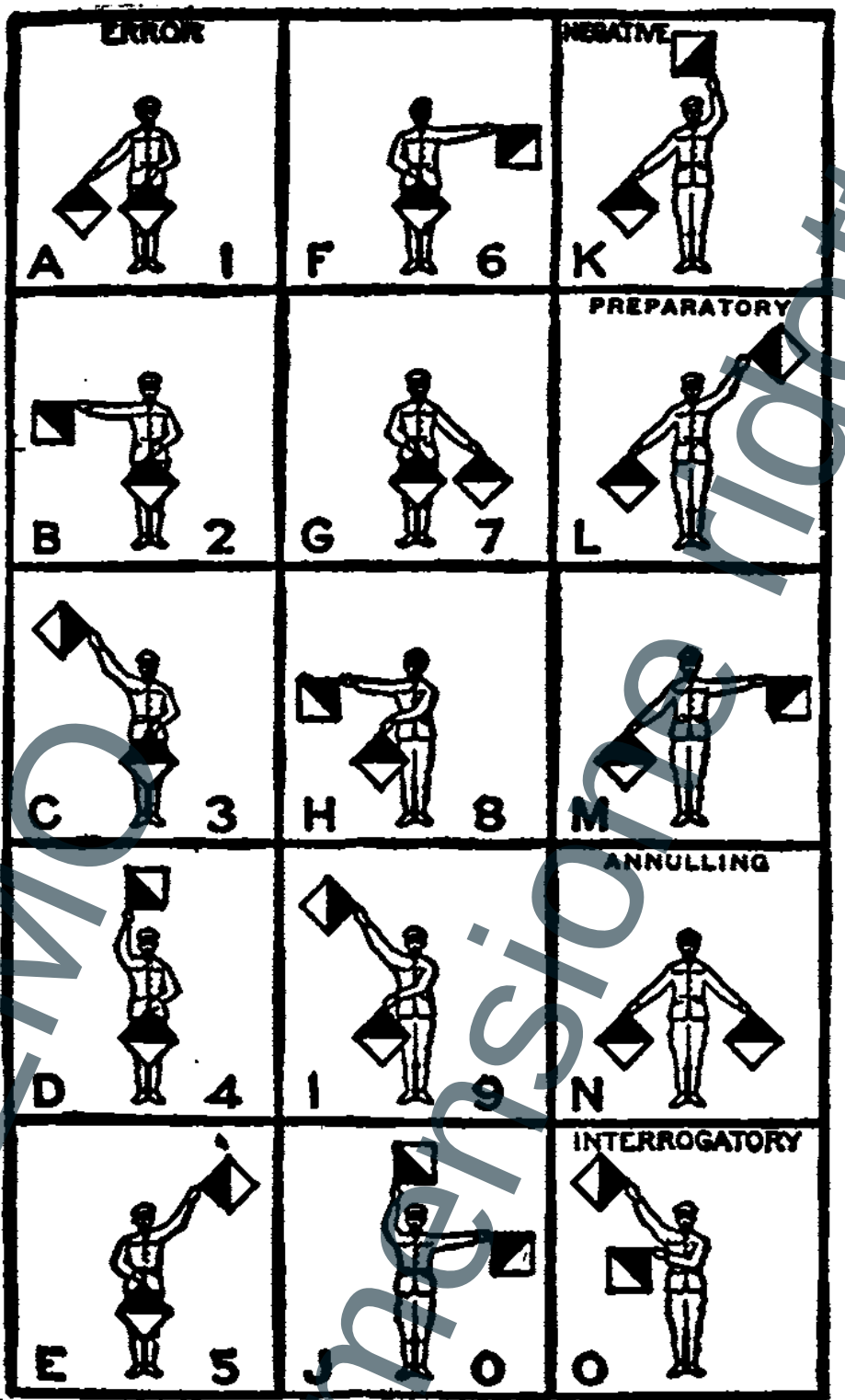
If the call letters of a station be unknown, display the Cornet.

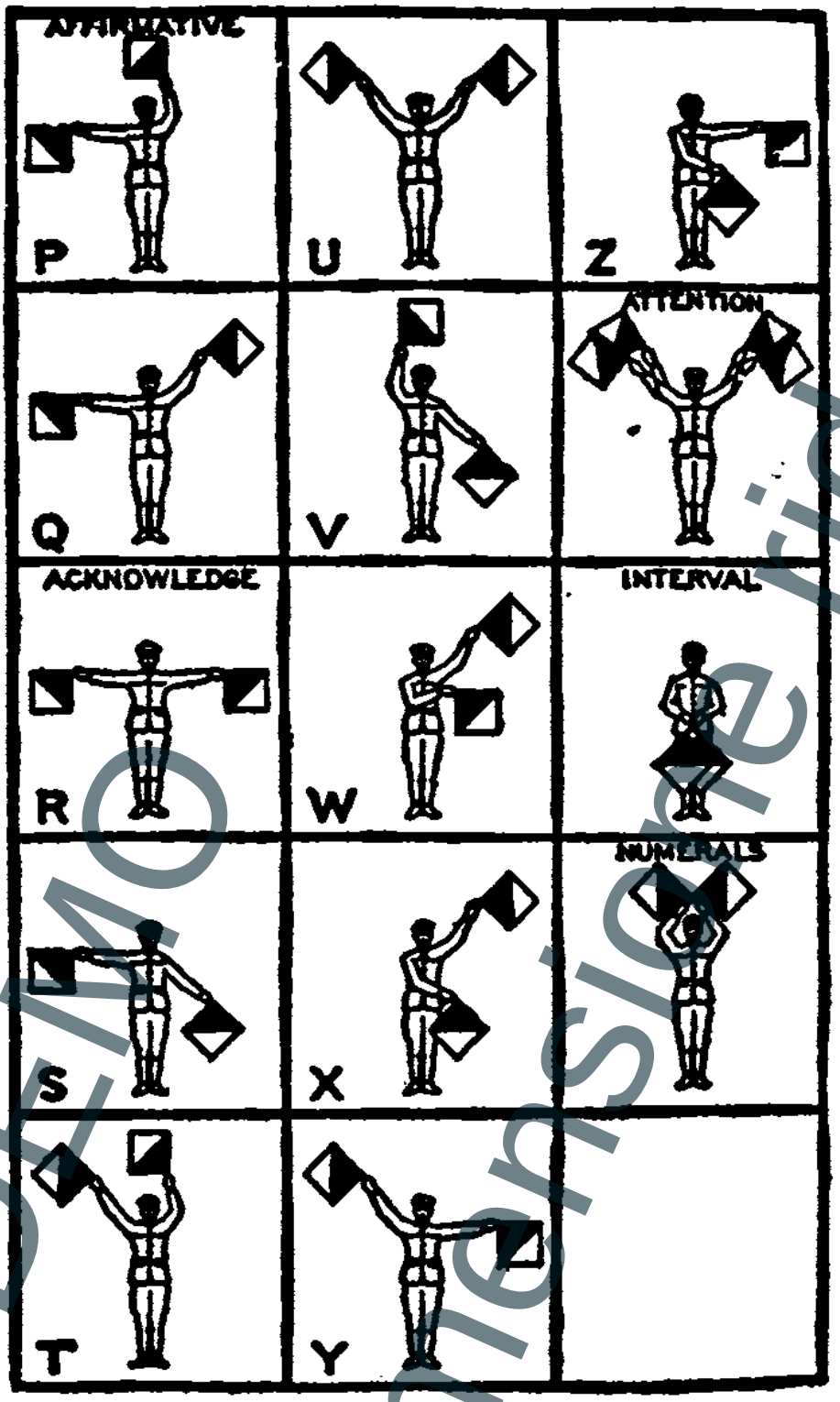
The calls having been answered, proceed with the message, or if a special or preconcerted code is to be used, so indicate, and when answered proceed with the message.

If it becomes necessary to put a signal message into cipher, the marking of the Ardois keyboard is on no account to be changed to accomplish this object.

HAND FLAGS

54. Hand flags are authorized for general use by the Army, though on account of their small range they are of limited application, and are chiefly serviceable for use within organizations, within fixed positions, or for incidental signaling. The range with flags of the usual size is of course dependent upon light and background, but is seldom more than one mile with the naked eye. This system of signaling has been highly developed in the Navy, and on account of its rapidity and simplicity is of use to the Army and should be familiar to all soldiers. It is limited to visual signaling work and not adapted to general signaling, as is the General Service Code. It will be found useful under many circumstances and is adapted to special work when rapid communication for short distances is needed. This method is also used to advantage for interior signaling within batteries of the field





MESSAGES IN CIPHER

69. In active service all messages should be transmitted in cipher. The United States Army cipher disk consists of two disks fastened concentrically together in such a way that they may be revolved one upon the other.

Around the edge of the larger disk the alphabet is written from left to right; on the smaller one, from right to left.

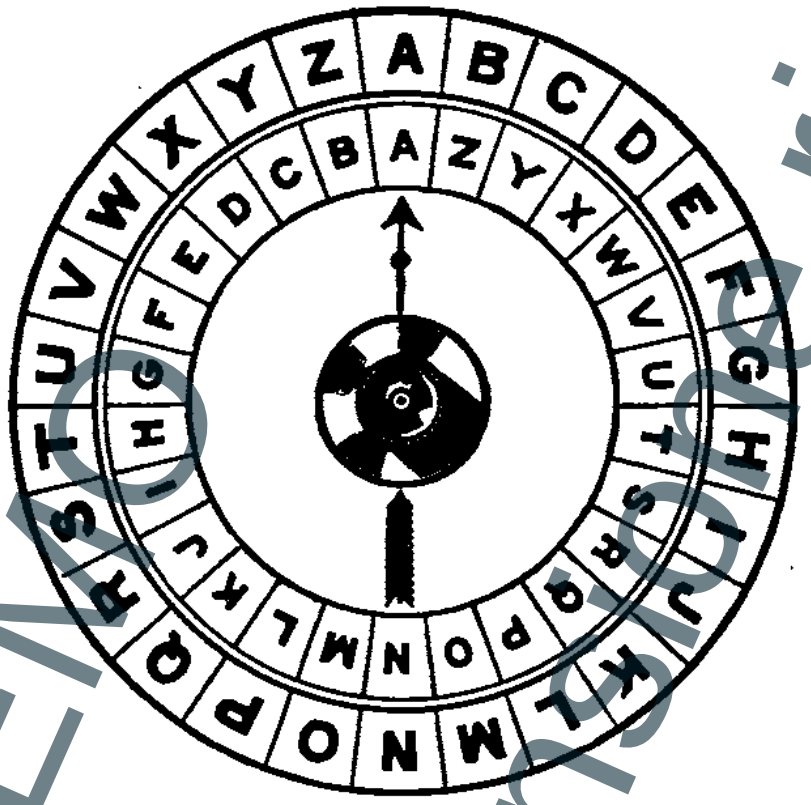
If there be no previous agreement, "A" on the inner circle will be set opposite "A" of the outer circle.

The letters of the message, which is written in plain English, are found on the one circle, and the letters opposite them on the other circle signaled.

The operator at the receiving station writes the message down as it is sent, and afterward translates it by using his own disk, which should be adjusted the same as that of the sender.

70. It is usual to agree on a cipher word in

advance. The message is divided into groups of five letters each. The first *group* is enciphered by setting the arrow on the inner disk at the first letter of the cipher word on the outer circle. The second group is enciphered by setting the arrow at the second letter of the cipher



word, and so on. When all the letters of the cipher word have been used in turn, commence at the first letter again.

In signaling, a front or space signal is made after each group.

In enciphering or deciphering a message, it makes no difference which disk the letters are found on. The result is the same whether one finds a letter on the outer circle and records the letter opposite it on the inner circle, or finds the letter on the inner circle and records the letter opposite it on the outer circle. The circles may be used indifferently.

71. Messages sent in cipher should, to prevent errors, be repeated back by the receiving station. This should be done group by group—i. e., as soon as a group of four letters is received, it should be repeated back before the next group is sent.

Cipher dispatches to which the key is unknown may often be deciphered by the rule of frequency of occurrence of letters.

The order of precedence among the letters, according to the frequency of their occurrence, is as follows: e, a, o, i, t, d, h, n, r, s, u, y, c, f, g, l, m, w, b, k, p, j, q, x, z.

The most frequent compounds are: th, ng, ee, ll, mm, tt, dd, and nn.

72. Important dispatches by courier should

not only be written in cipher, but may be written in invisible ink made as follows:

Chloride of cobalt..... 50 grains;
Distilled water ..... 1 fluid ounce;
Glycerin ..... 10 minims.

Dissolve the chloride of cobalt in the distilled water and add the glycerin.

Writing executed with this ink is invisible on paper, but, on warming, the writing turns blue. On exposure to damp air it becomes invisible again.

THE COMPASS AND HOW TO USE IT

73. In long range signaling with a heliograph and in much other signal work it will often be necessary to use the compass, especially when the line and stations are selected by the map. In finding the course from one station to another by the map it must be remembered that the meridian lines run toward the true north while the compass needle points to the magnetic north. A compass is of no assistance unless its use is thoroughly understood. It is not as simple to use as a watch and in itself does not point a course as a weather vane points into the wind.

74. The best compass for military work is that called the "Box Compass" mounted in a square wooden box about three inches on a side. It is graduated to degrees and reads from zero around to 360 degrees, zero being the north point. The north and south line is at right angles to the side to which the cover is hinged, and the cover has a sighting line cut in its underside,

so that when open the line is in prolongation of the north and south line of the dial.

In this compass the west is on the right-hand side of north, and east on the left hand, so that when the needle points to the given bearing the sight line will point in the desired direction. This saves calculation and confusion; but when *taking* a bearing with the compass it must be borne in mind that the east and west are reversed.

75. In using a compass it should be borne in mind that the needle always points in a known direction, but that direction is not north, at least the needle points to true north only in a few places. The needle points to the magnetic north pole, which is nowhere near the geographical pole. The difference in direction between the magnetic north and true north is called the "declination" or "variation" of the compass and is measured by degrees. The variation for the locality in question must be known or you will go far astray. For example, the declination in East New Brunswick is 25 degrees west, in Central Michigan 0, and in Vancouver Island

25 degrees east (see table of magnetic declination in the United States).

76. To illustrate the declination of the com-

pass, take the map of the United States, draw a line from Mackinac Island, in Lake Michigan, to Savannah, Georgia. At all points on this line, roughly speaking, the compass needle points

to true north. At all points east of this line, which is called the Agonic line or Zero Curve, the north end of the needle points to the west of true north and at all points west of the line to the east of true north. The farther you are away from the Agonic line the greater the declination of the needle. The declination increases east or west from the line at about the rate of one minute per mile—one degree in sixty miles.

77. In finding the magnetic course on a map with a protractor, allowance must be made for the variation of the needle. If the protractor reading between two points be on that side of north to which the needle varies, the amount of the variation must be *subtracted* from the prctractor reading to get the magnetic course. If the protractor reading between the points be on the opposite of north from that to which the needle varies, then the variation must be *added* to the reading to get the magnetic course.

78. In using a map spread it out flat and lay the compass on it with the N-S line parallel to the N-S line of the map. Revolve the map until the needle points to the proper amount of dec-

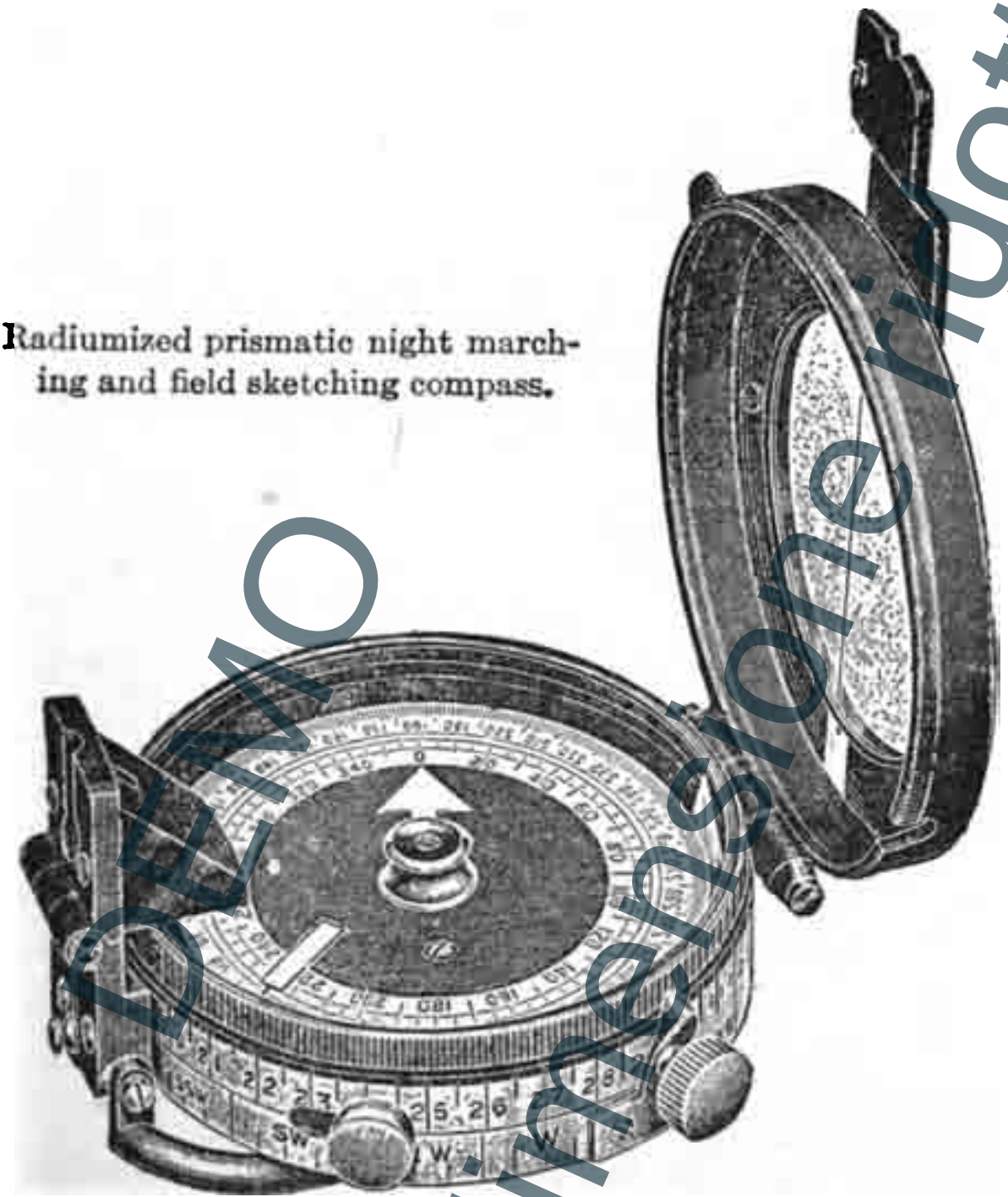
lination and all lines on the map *will be parallel with the lines they represent* on the ground.

79. Look out for local attraction; a rifle or other iron or steel may deflect the needle. Rubbing of the exposed glass of the compass may magnetize it and attract the needle. This attraction may be dissipated by touching it with a wet finger.

80. The amount of declination at a given point is constantly changing as the Agonic line is moving west quite rapidly. All west declinations are increasing and all east declinations decreasing. A chart showing the Agonic line and lines of equal magnetic declination may be obtained from the U. S. Coast and Geodetic Survey, but it is unnecessarily complicated for ordinary use. None of the lines are straight. They are irregular and in places tortuous, resembling topographic contour lines. For ordinary use the table of magnetic declinations is sufficiently accurate.

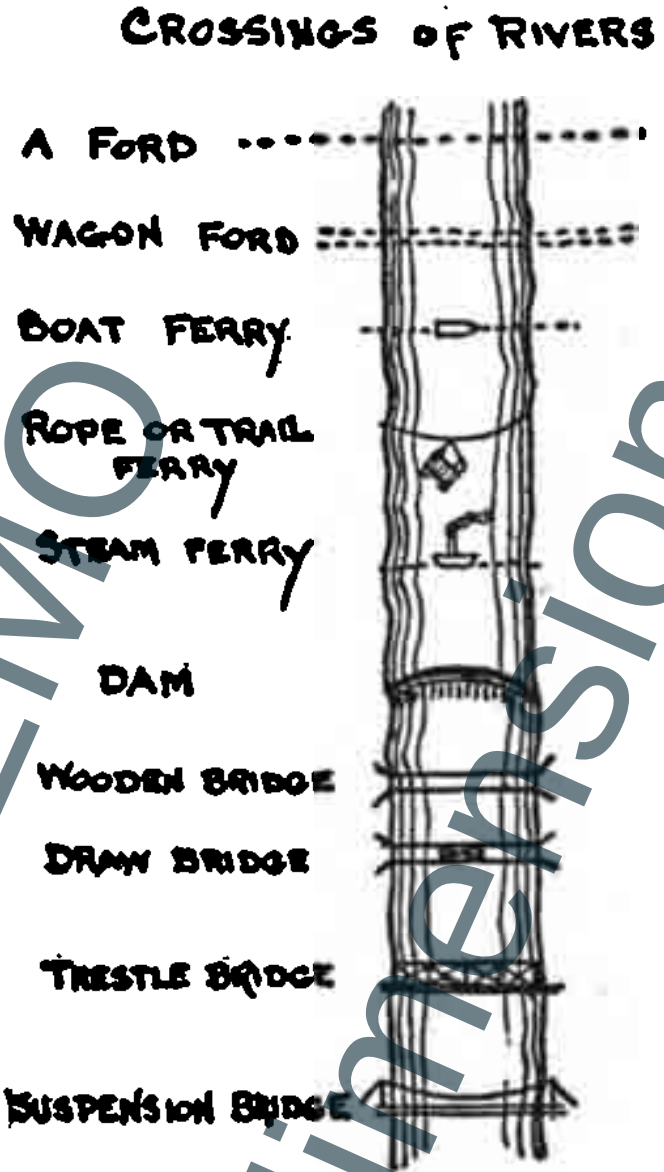
Military compasses are of many patterns and some of them very complicated. They are extremely accurate in expert hands, but are for

the use of trained officers, topographers and engineers rather than for soldiers.

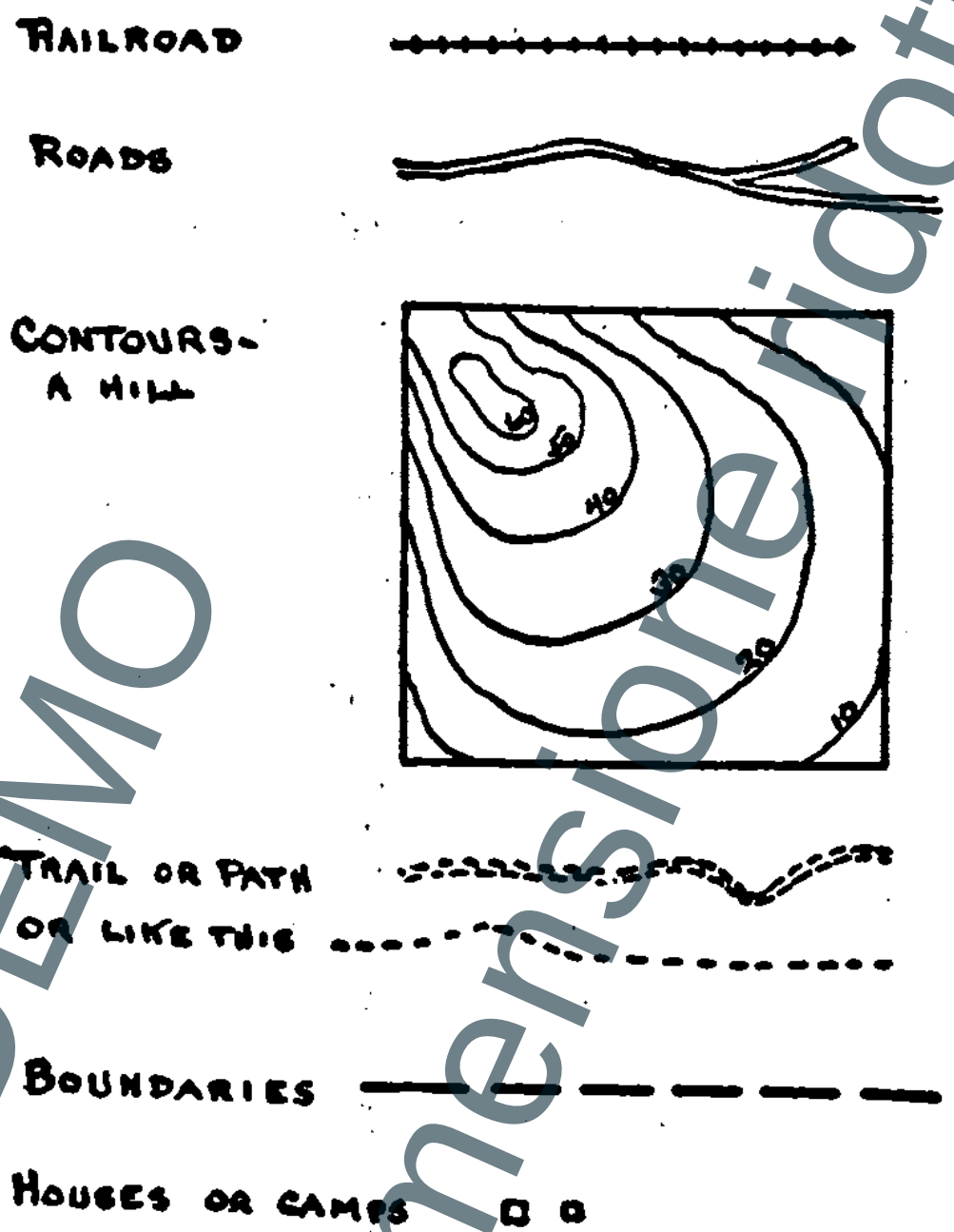


Radiumized prismatic night marching and field sketching compass.

maps is that they may not be corrected up to date and time may be lost in trying to find roads and other features that have ceased to exist, or to locate on the map new features that have been constructed since it was drawn. For this



reason always obtain the latest possible map of any region in which you are operating.



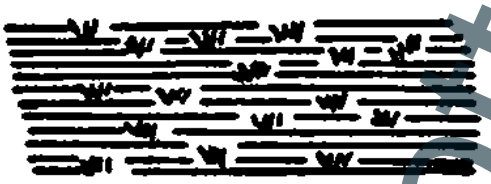
CANAL AND LOCK

SURVEY STATION ⊙

TRIANGULATION STATION △

CULTIVATED LAND

SWAMPS OR MARSH



A GULLY

TELEGRAPH OR
TELEPHONE LINE

WIRE FENCE

FORREST