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UNITED STATES ARMY

TRAINING MANUAL No. 22

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TELEPHONE SWITCHBOARD OPERATOR

STUDENTS MANUAL
FOR ALL ARMS

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PREPARED UNDER THE DIRECTION OF
THE CHIEF SIGNAL OFFICER

1923



Washington
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TELEPHONE SWITCHBOARD OPERATOR, STUDENTS MANUAL FOR ALL ARMS.

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TELEPHONE SWITCHBOARD OPERATOR.

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UNIT OPERATIONS.

PREPARING CABLE FOR MONOCORD SWITCHBOARD.

Equipment.

- 1 four-line monocord switchboard, type BD - 9.
- 1 terminal strip, type TM - 84.
- 1 pair pliers.
- 1 knife.
- 1 small screw driver.
- 50 feet field wire, twisted pair, type W - 40.
- 20 feet stout cord.

Information.

The object of this Unit Operation is to illustrate the methods used in the preparation of a monocord switchboard, so that it will be ready for installation in the field. While learning how to prepare such switchboards for installation, the student should also learn the technical names of those parts of the switchboard most frequently used.

Monocord switchboards are primarily designed for the use of such combat units as require a small amount of telephone communication, and where the apparatus for making connections between various subscribers must be carried by hand by soldiers to positions where temporary or permanent shelter can be obtained from enemy shells and enemy observations.

The smallest switchboard used by American troops is a four-line monocord switchboard. For ease in making requisitions this switchboard is given a shorter name, BD - 9. It is called a monocord switchboard because only one cord is used in connecting one subscriber to another. Commercial switchboards and large army switchboards ordinarily use two cords to connect two subscribers.

The switchboard type BD - 9, illustrated in Fig. 2, has arranged along the top two terminals for each of its four units, to which the line wires, or cable pairs, are fastened. These terminals are known as line binding posts. Just below these binding posts are fuses, drops, jacks, and switchboard cords in the order named.

The operator's cord is red in color to distinguish it from the switchboard cords, which are usually green in color. At the end of each of the five cords is a plug.

For ease in locating trouble and for general neatness and convenience the four pairs of line binding posts are connected by wires about 10 feet long to a terminal strip, Type TM - 84. These wires are laced together into a cable.

Directions.

1. Mount the switchboard and the terminal strip in convenient locations about 8 feet apart. Measure off four lengths of twisted-pair field wire each 10 feet long. See Information Topic No. 3.

2. Connect one pair of wires to the upper left-hand contacts on the terminal strip; connect the same pair to the left-hand terminals of the switchboard as you face the switchboard, exercising care that the terminals are not shorted by loose strands. Connect the other three circuits in order from left to right on switchboard, and from top to bottom on the terminal strip, in the same manner as the first pair, so that the cable is formed to the left of the switchboard.

Questions.

(1) *What other method could be used to identify the pairs of wires in the cable besides attaching them to binding posts on the terminal strips?*

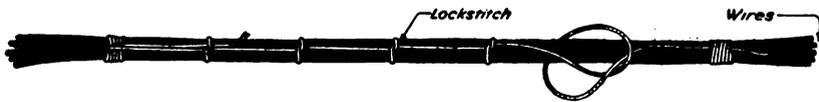
(2) *What is likely to happen if the terminals are shorted by loose strands?*

(3) *Why form the cable to the left rather than to the right of the switchboard?*

(4) *Why should the wires go from No. 1 drop on the switchboard to No. 1 terminals on the terminal strip?*

3. Take a piece of stout twine and lace the cable together neatly and securely with a lock stitch as shown in Fig. 1. This leaves a cable about 10 feet long with the switchboard on one end and a terminal strip on the other. When lacing the cable, start at the switchboard and work toward the terminal strip, spacing the stitches $1\frac{1}{2}$ inches apart and working the slack in the wires ahead of the lacing, so as to leave a neat compact cable under the portion which is placed up. After the cable is entirely laced up, the ends of the wires at the terminal strip will probably show different amounts of slack due to

the difference in the length of the wires. The long wires or the wires showing slack should be disconnected from the terminal strip and cut off, so that when formed out and reconnected they will appear as in Fig. 2.



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Fig. 1.—The lock stitch.

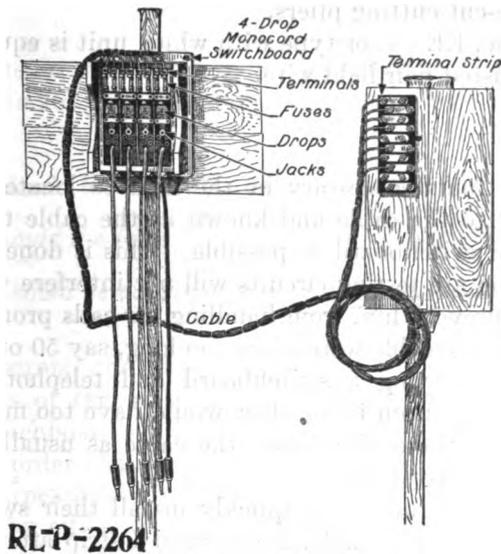


Fig. 2.—Cabling monocord switchboard to a terminal strip.

Questions.

- (5) *Why is the cable laced together?*
- (6) *Why not twist together the wires of the cable instead of lacing them?*
- (7) *Why make the cable 10 feet long rather than 4 or 15 feet long?*
- (8) *Is there a better way of lacing the cable than with the lock stitch?*
- (9) *If there is no cord with which to lace the cable, what could be done?*

4. To prepare a cable for a 12-line monocord switchboard, the same process is followed except that the cable consists of 12 pairs of wires instead of 4 pairs. The reason for this is that whenever a cable is formed there must be 1 pair of wires for each drop on the switchboard.

INSTALLATION OF MONOCORD SWITCHBOARD WITH CAMP TELEPHONE FOR OPERATOR'S SET.

Equipment.

- 1 four-line switchboard with 10-foot cable and terminal strip attached.
- 1 terminal strip.
- 1 knife.
- 1 screw driver, if knife does not have screw-driver blade.
- 1 pair side-cut cutting pliers.
- 1 telephone, EE-4, or type with which unit is equipped.
- 40 feet twisted pair field wire.
- 4 tags.

Information.

It has been found necessary in the field to locate the terminal strip, attached to the cable and known as the cable terminal strip, as far from the switchboard as possible. This is done in order that the linemen who are testing circuits will not interfere with the operator and thus prevent him from handling his calls promptly. If, on the other hand, the cable were made too long, say 50 or 100 feet, the operator when carrying a switchboard and telephone forward in battle, from one position to another, would have too much weight to carry. To avoid these difficulties, the cable as usually constructed is made about 10 feet long.

In order that operators can quickly install their switchboards in battle, the switchboard, cable, and terminal strip after having been once connected together are not afterwards separated.

When the switchboard is installed for use at a headquarters or command post, if the location is out in the open, the cable is securely fastened at the switchboard end to a tree or post, and the terminal strip end is also securely fastened to some similar object. If this precaution is not taken, operators, linemen, or other soldiers may stumble against the cable, especially at night, and tear one end or the other loose. This will interrupt traffic by delaying subscribers who wish to use the telephone system. In order to prevent such interruptions to the service it is sometimes possible to lay the cable on the ground, or even to bury it. (See Information Topic No. 3.)

Whenever linemen install trunk circuits between two points where switchboards are to be installed they terminate both ends of their circuits in a terminal strip known as the "line terminal strip." An operator installing a switchboard places his "cable terminal strip" alongside the line terminal strip, if it has already been installed, and

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connects the circuits on the two terminal strips by means of pieces of wire called "jumpers." Such circuits are said to be "jumped."

As soon as an operator installs a switchboard he tests the operator's telephone, the operator's cord, the talking circuit of each unit of his switchboard, and the signaling circuit of each unit.

Directions.

1. Make sure that the battery in the camp telephone is good, and examine the fuses if an old type switchboard is used, to see if they are in good condition. (See Information Topic No. 4.)

Questions.

(1) *How should the battery in the camp telephone be tested? (See directions 9 and 10, Unit Operation No. 7, Basic Signal Communication Manual.)*

(2) *What should be done if the battery is not good?*

(3) *How should the fuses be tested? (See Information Topic No. 4.)*

(4) *What should be done if a fuse is bad and there are no new fuses available?*

2. Pass a strong cord or piece of wire through the holes in the upper corners of the switchboard, allowing enough slack so as to hang the switchboard at a convenient height on a fence, wall, tree, or pole. In order that the drops will readily fall, the switchboard should be perpendicular or tilted slightly to the front. Fasten the switchboard by either nailing or tying the four corners down firmly.

Question.

(5) *Suppose it was necessary to set up and operate a switchboard in combat in a country without fences, poles, or trees. How would it be done?*

3. Fasten the terminal strip vertically to some object such as a tree, fence, or board, using nails or screws. It should be as distant from the switchboard as the length of the cable will permit without throwing a strain on the cable.

4. Similarly hook or tie another terminal strip for the line wires, parallel to and about a foot from and to the right of the cable terminal strip.

5. Take four dummy line circuits each about 10 feet long, leaving sufficient slack so that they may be fastened to a post or tree, and bring the terminals to the right-hand binding posts of the terminal strip installed as in Par. 4 above. Place tags with the designation of the circuit on each line circuit. The line wires should be connected

from top to bottom on the line terminal strip in the same order as on the switchboard terminal strip, in order that connections may be properly made between terminals.

6. After the line wires have been connected to the terminal strip securely fasten them to a post or tree, or other strong object, leaving a little slack in order that they will not be pulled loose from the terminal strip in the event of any strain being placed on the circuits.

Question.

(6) *Just how should the line wires be fastened to a post or tree so that they would be secure and not pull loose easily from the terminal strip?*

7. Cut four pieces of twisted-pair wire each about 14 inches long and connect the right binding posts of the switchboard terminal

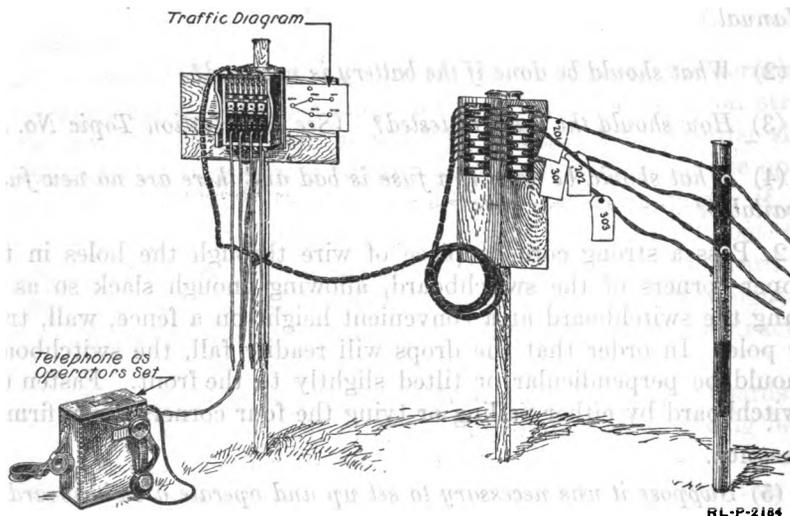


Fig. 3.—Installation of monocord switchboard with a camp telephone for operator's set.

strip, installed as in Par. 3, to the left-hand binding posts of the line terminal strip installed as in Par. 4. This connects the drops on the switchboard to the different line circuits.

8. If an old type of switchboard of type EE-2 units is installed, connect the binding post L_1 of the camp telephone to the clip binding post L_1 on the bottom of the switchboard; similarly connect L_2 of the telephone to L_2 of the switchboard.

9. See that all plugs and cords are hanging free, and move the drop-locks to a horizontal position, so that the drops will fall when a call comes in. (See Fig. 3.)

10. See that the switchboard is vertical.

11. If the new type of switchboard, of type EE-2A units, is installed, a two-conductor cord with plug must be provided for an operator's answering cord. The two terminals of the wires in the

cord should be connected to L₁ and L₂ binding posts of the camp telephone. (See Fig. 4.)

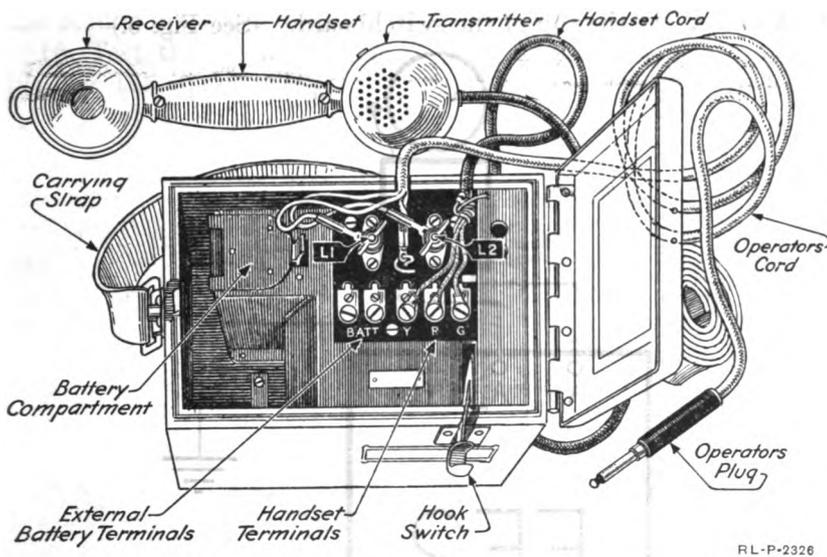


Fig. 4.—Camp telephone, type EE - 4, with operator's cord attached.

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12. The complete installation is shown in Fig. 5.

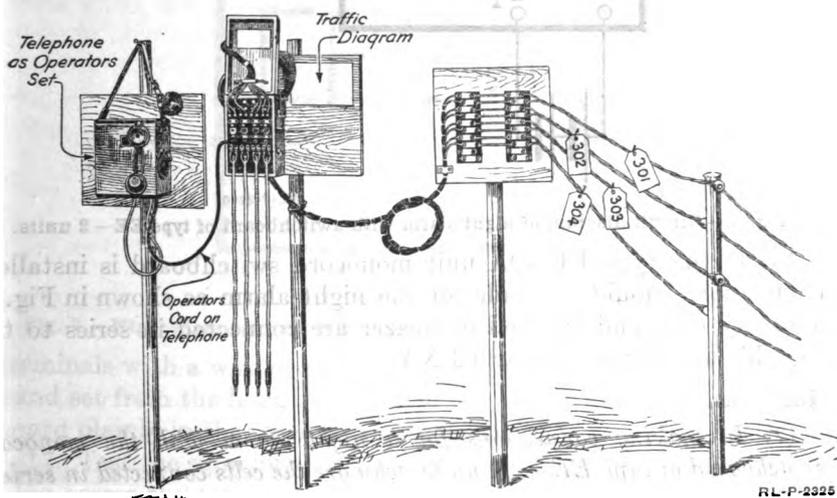
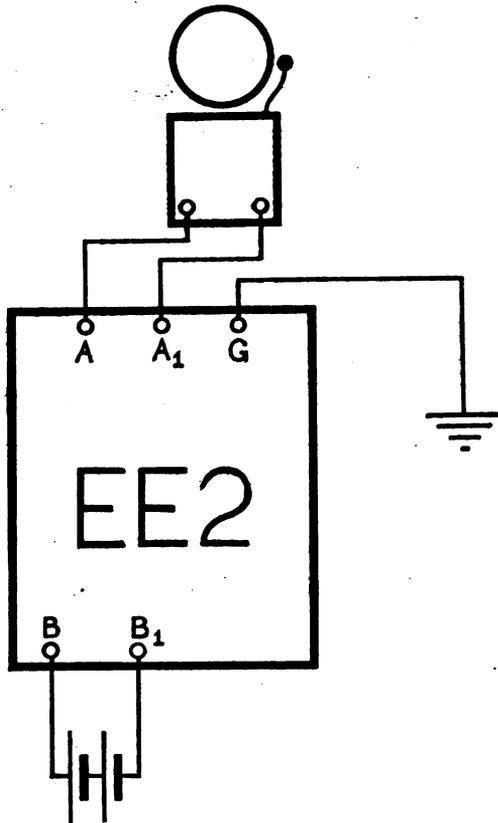


Fig. 5.—A telephone with monocord switchboard of type EE - 2A units with camp telephone as operator's set.

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13. To install a night-alarm circuit to the type EE - 2 unit switchboard, connections are made as in Fig. 6. Two dry cells are con-

nected in series to the binding posts B and B₁, at the bottom of the switchboard, and the terminals of the bell or buzzer are connected to A and A₁, at the top of the switchboard. (See Fig. 6.)



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Fig. 6.—Circuit diagram of night alarm with switchboard of type EE - 2 units.

14. If the type EE-2A unit monocord switchboard is installed, connections should be made for the night alarm as shown in Fig. 7. Two dry cells and the bell or buzzer are connected in series to the switchboard terminals marked NA.

Questions.

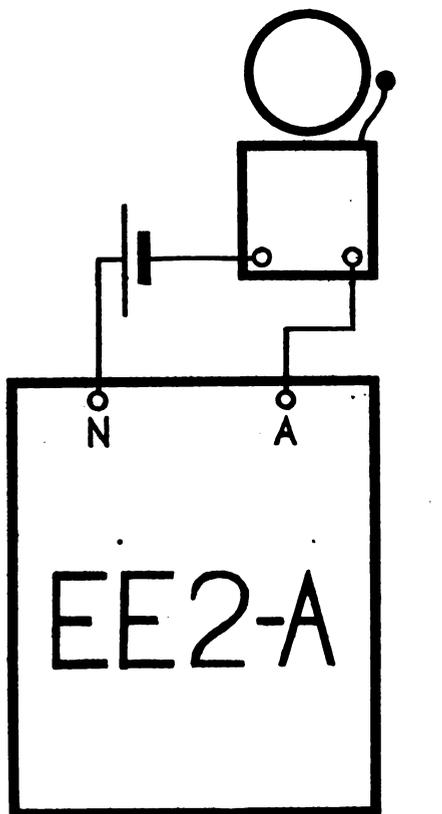
(7) *In making connections for a night alarm with the monocord switchboard of type EE - 2A units, why are the cells connected in series?*

(8) *What advantage is there in using two cells?*

(9) *Why connect the battery and the night-alarm bell in series when using the new type switchboard?*

15. Test the operator's cord by holding the tip and sleeve of the plug between the fingers; then turn the generator crank of the operator's telephone slowly, and if the current is felt in the fingers the cord is in good condition.

16. Test the talking circuit of each unit in the switchboard by placing the operator's plug in the jack and short circuiting the



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Fig. 7.—Night-alarm circuit with monocord switchboard of type EE - 2A units.

terminals with a wire or pliers; then remove the operator's telephone hand set from the hook and blow in the transmitter. If the sound is heard plainly in the receiver, the unit is in good condition for talking.

17. Test the signaling circuit of each unit by placing the operator's plug across the terminals. Place the tip of the plug on one binding post and the sleeve on the other binding post; turn the generator crank of the operator's telephone, and if the drop falls the signaling circuit of that unit is in good condition.

INSTALLATION OF MONOCORD SWITCHBOARD USING AN OPERATOR'S SET, TYPE EE - 64.

Equipment.

- 1 four-line monocord switchboard with cable, terminal strip, tools, wire, and tape, as in Unit Operation No. 2.
- 1 monocord operator's set, type EE - 64.

Information.

When a monocord switchboard operator uses a telephone as an operator's set he is handicapped in answering calls by the fact that he has to hold down the hook of his telephone and at the same time hold the hand set with one hand while ringing the called party with the other hand. He is further handicapped in plugging and ringing because he has a hand set instead of a head set. These facts require that he make a half dozen extra movements with both hands which it is possible to obviate.

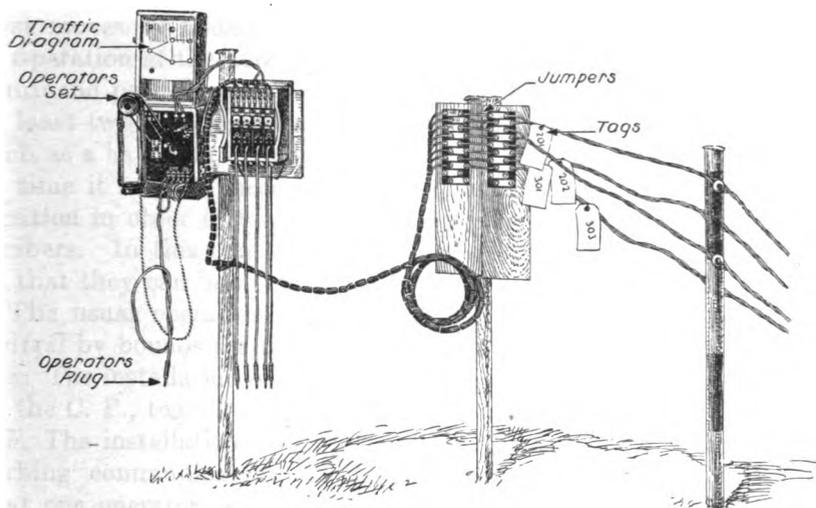
Operators at busy centrals, at regiments, and at brigades lose a considerable amount of time in handling calls through such equipment. To remedy this defect an operator's set was designed, which would save the operator much time in handling calls. This results in another undesirable feature, however, since it adds an additional piece of equipment which has to be carried around, and which operators must learn to use. However, it is safe to assume that in another emergency more communication between all units will be required than in the World War, and that some improved method, whereby an operator will have both hands free to handle plugs, linedrops, and ringing equipment, will be necessary, especially at brigades and larger units. (For description of the operator's set see Information Topic No. 4.)

Directions.

1. Make switchboard, cable, and terminal strip installation as in Unit Operation No. 2. (See Information Topic No. 3.)
2. Before installing an operator's set the following tests should be made, to determine its serviceability:
 - a. Test the battery in the set by holding the receiver to the ear with a piece of wire or metal across the plug terminals. Blow in the transmitter and note if the sound is reproduced in the receiver.
 - b. Test the night alarm by placing a wire or piece of metal across the terminals marked NA, and see whether the buzzer operates when the ringing and listening key under the transmitter arm is thrown to the upper position. The battery switch must be on position 1 or 2.

c. To test the generator and the operator's cord, place tip and ring of the operator's plug across the two line terminals of a switchboard unit. Turn the generator crank on the operator's set and the drop should fall if the operator's cord and generator are in good condition.

d. To test the operator's cord in case the drop does not fall when the test is made as in (c) above, hold the end of the operator's plug between the fingers and turn the generator crank. If a current is felt, it indicates that the cord and generator are in good condition and that the trouble is in the switchboard. If a current is not felt, the trouble may be either in the cord or the generator. In this case remove the T terminal of the cord, put the fingers across all three terminals, and again turn the generator crank; if current is felt, it



RL-P-2183

Fig. 8.—Telephone central with monocord switchboard, of type EE - 2 units, using operator's set.

indicates that the generator is all right and that the trouble is in the cord; if a current is not felt at the terminals, the trouble is in the generator.

e. If the trouble is within the switchboard unit, the cord, or the operator's set, the particular piece of apparatus should be replaced with a new one. If the trouble is due to defective connections, it should be cleared by the operator.

3. Mount the operator's set immediately to the left of the switchboard by means of the carrying strap. (See Fig. 8.) See Information Topic No. 4 for method of preparing the operator's set for use with switchboard of type EE - 2 units.

4. Connect the night-alarm circuit by means of a short length of twisted-pair wire, from NA on the operator's set to A and A₁ on the monocord switchboard of type EE - 2 units. A piece of wire should be connected from B to B₁ at the bottom of this switchboard. When using the monocord switchboard of type EE - 2A units, the only connection necessary is to connect NA on the switchboard to NA on the operator's set.

INSTALLATION OF TWO FOUR-LINE MONOCORD SWITCHBOARDS AS A SINGLE UNIT USING CAMP TELEPHONE AS OPERATOR'S SET.

Equipment.

- 2 four-line monocord switchboards with cable and terminal strips attached.
- 1 camp telephone, type EE - 4.

Information.

Monocord switchboards are manufactured and issued to troops in 4-line, 8-line and 12-line, sizes, known as BD - 9, BD - 10, and BD - 11 switchboards, respectively.

All headquarters frequently move by bounds. When a command post moves by bounds, communication has to be installed and put in operation at the new location of the command post before the old command post closes. This requires that centrals be equipped with at least two switchboards. When a command post of a small unit, such as a battalion, remains at one location for a considerable length of time it may be necessary to use both switchboards at the one location in order to take care of the increased number of local subscribers. In this case it becomes necessary to connect the boards, so that they can be operated as a single unit by one man.

The usual operations involved in the movement of a telephone central by bounds for the command post of a small unit are:

- a. The installation of one BD - 9 switchboard at the new location of the C. P., together with a telephone or operator's sets.
- b. The installation of a second BD - 9 switchboard, without disturbing communication, on the first BD - 9 switchboard in order that one operator can operate both switchboards.
- c. The removal of one BD - 9 switchboard and of part of the local telephones preparatory to a forward movement of the command post.

Directions.

1. Mount the two switchboards side by side, close together, and the two terminal strips on the cables one immediately above the other at a convenient location about 8 feet to the right of the switchboard. The terminal strip which is connected to the left-hand switchboard should be above the terminal strip attached to the right-hand switchboard. (See Information Topic No. 3.)

2. Connect the terminals designated A at the top of switchboard No. 1 to A of switchboard No. 2, and A₁ of switchboard No. 1 to A₁ of switchboard No. 2.

3. Similarly connect the terminal B of switchboard No. 1 to B of switchboard No. 2, and B₁ of switchboard No. 1 to B₁ of switchboard No. 2.

4. Connect the L₁ of switchboard No. 1 to L₁ of switchboard No. 2, and L₂ of switchboard No. 1 to L₂ of switchboard No. 2, and run a piece of wire from L₁ of one switchboard to L₁ of the camp telephone, and another piece of wire from L₂ of the same switchboard to L₂ of the telephone. (See Fig. 9.)

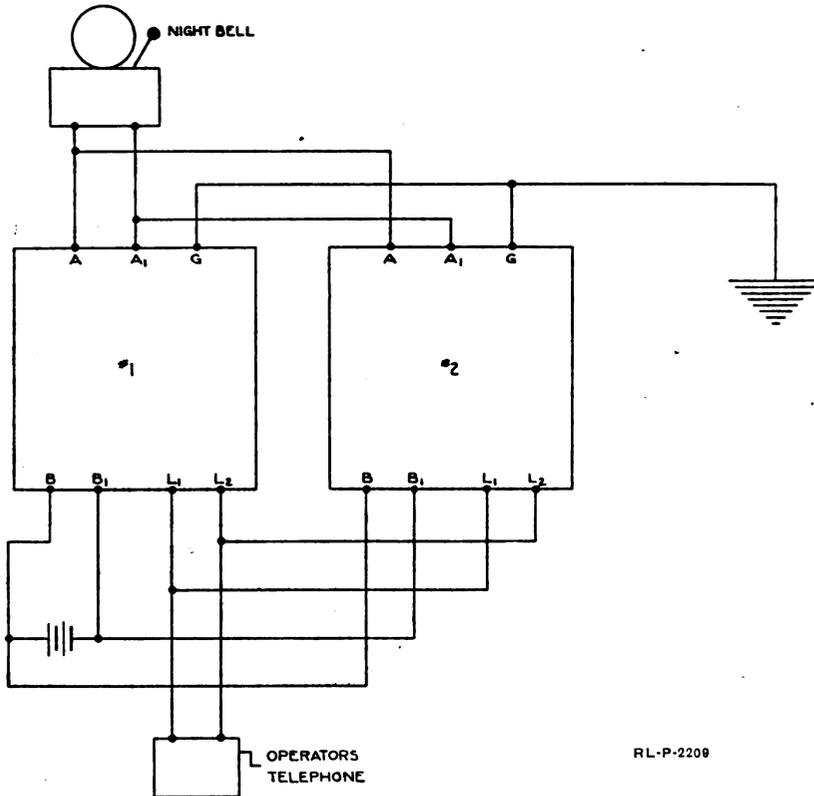


Fig. 9.—A diagram of the connections between two monocord switchboards of type EE - 2 units installed as a single unit.

Questions.

- (1) *What is the purpose of making the connections specified above? What is this type of connection called?*
- (2) *What should be done in order to provide central switchboard accommodations for 12 lines when only four-line monocord boards are available?*

- (3) *How could 16 lines be provided for under similar conditions?*
- (4) *What is the limit to the number of four-line boards that can be installed and operated as one unit?*
- (5) *In Fig. 9 some wires are shown intersecting each other without a dot, and some with a dot. What does each mean?*
- (6) *What are the principal differences between the installation with the operator's set and the installation with the field telephone?*
5. To install two switchboards of type EE - 2A units as one unit, the switchboards are mounted as above. The only connection necessary between the boards is to connect NA of one switchboard to NA of the other switchboard. Connect NA of the left-hand switchboard to NA of the operator's set.

OPERATION OF MONOCORD SWITCHBOARD.

Equipment.

A four-line monocord switchboard installed complete with operator's set or camp telephone, with four lines and telephones.

Information.

The previous Unit Operations have been concerned with the installation of monocord switchboards, together with the simple tests made by operators to determine whether the circuits of their equipment are in working order.

Beginning with this Unit Operation the operation of monocord switchboards will be taken up.

After an operator has installed his switchboard and cable terminal strip, and a line terminal strip (if one is not already in place), he connects the line terminal strip to the cable terminal strip. The Message Center and commanding officer's telephone are usually the first local circuits that are installed by the other members of the wire section. These two local circuits are usually followed by the trunk circuits to the next superior and next subordinate units.

The code names of these circuits are written on the strips above the drops as soon as a circuit is connected. For convenience the commanding officer's telephone is ordinarily placed on the left-hand unit of the switchboard, and the Message Center telephone on the extreme right-hand unit. Although this scheme of installation is not strictly necessary, its use will be found a great convenience.

In handling calls there are a number of movements to be made by an operator. To increase speed and accuracy of these movements approved methods of manual operation in handling calls are given below.

Directions.

1. The instructor will assign names to the various local telephones connected to the switchboard. These names will be written on the celluloid strips above the drops. (See Information Topic No. 6.)

Question.

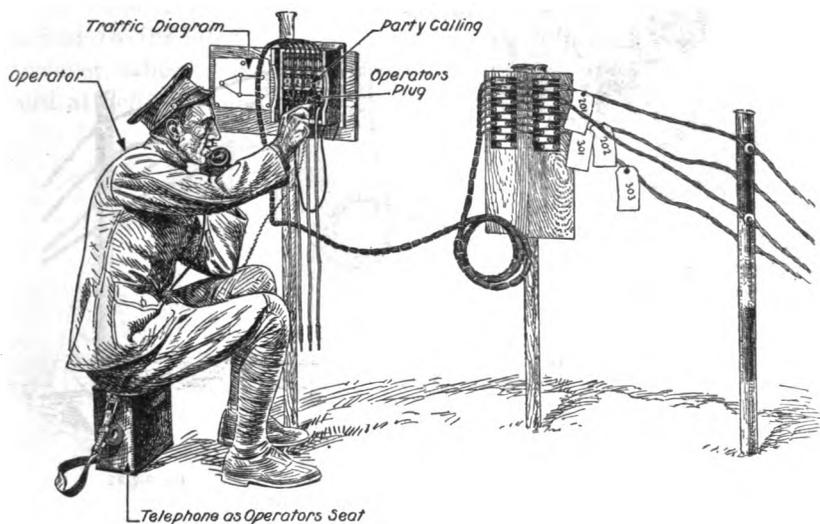
(1) *With what should the names be written on the celluloid strips above the drops?*

2. It is to be borne in mind that except in certain special cases, which will be discussed in detail later, the operator's duty is to connect one party with another. In this capacity he does not originate calls; therefore after his switchboard is installed and in working order

he waits for drops to fall, with the answering cord in his hand (see Fig. 15) in order that he can make connections with the least delay.

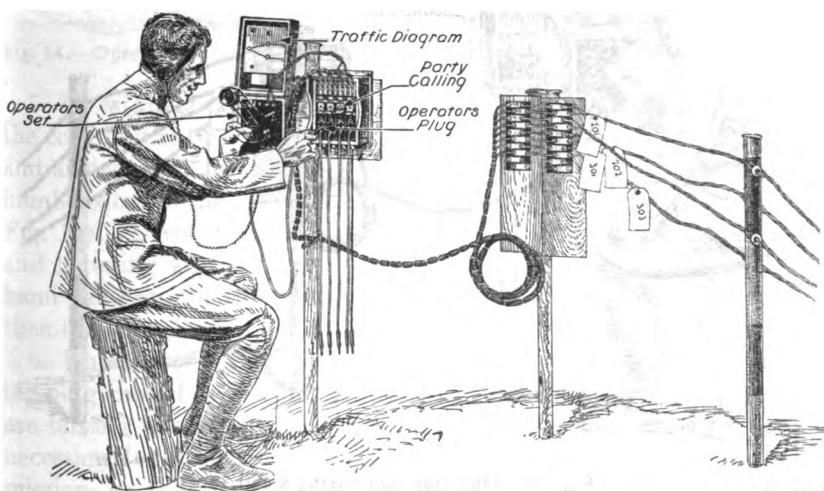
Question.

(2) Suppose that some one came to a switchboard operator and asked him to transmit an important message. What should the operator do?



RL-P-2185

Fig. 10.—Operator answering a call on the monocord switchboard.



RL-P-2181

Fig. 11.—Operator preparing to call the called party on a monocord switchboard.

3. Suppose that the number 3 drop falls. The operator inserts the operator's plug into the number 3 jack (see Fig. 10) and answers,

giving the code name of his central followed by the word "operator," as "MUTTON operator."

Suppose the call is for "MUTTON-1" (battalion commander) and that MUTTON-1 is on the No. 2 jack of the board. The reply is

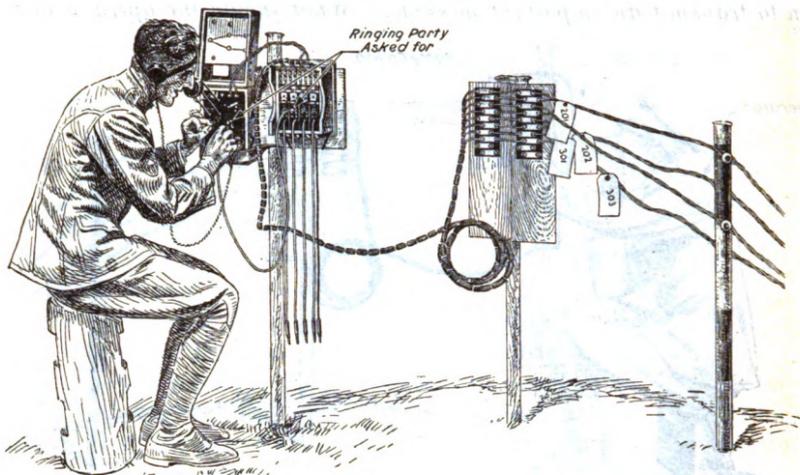


Fig. 12.—Operator ringing a called party.

RL-P-2182

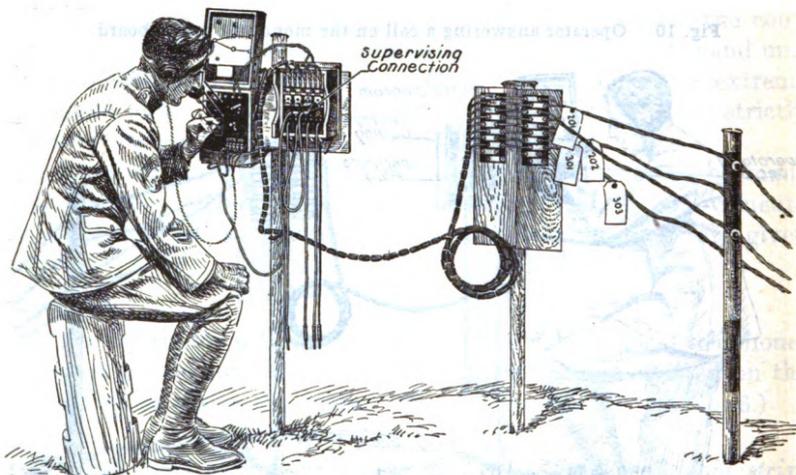


Fig. 13.—Operator supervising a call.

RL-P-2182

"MUTTON-1?" Then the operator removes the operator's plug from No. 3 jack (see Fig. 11) and inserts it into the No. 2 jack, giving the generator handle three or four vigorous turns (see Fig. 12). Then he takes the cord of No. 2 unit and inserts the plug into the jack of

the No. 3 unit and restores the drop. He does not remove the operator's plug from No. 2 jack until conversation is started and the connection appears to be satisfactory. (See Fig. 13.)

4. The operation of the switchboard of EE - 2A units using either a camp telephone as operator's set or the regular operator's set EE - 64 is the same as above, the operator's cord in each instance being attached to the operator's set. In the switchboard of EE - 2 units, however, when using a camp telephone as an operator's set the red cord attached to the switchboard is used as the operator's cord.

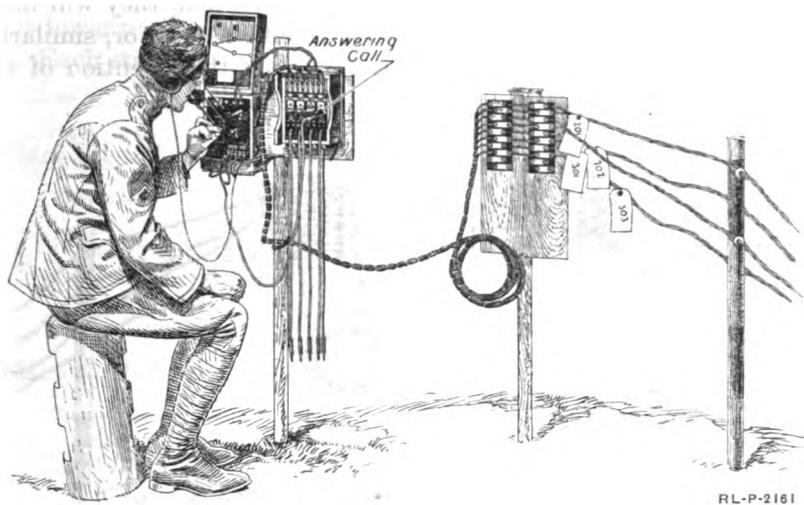
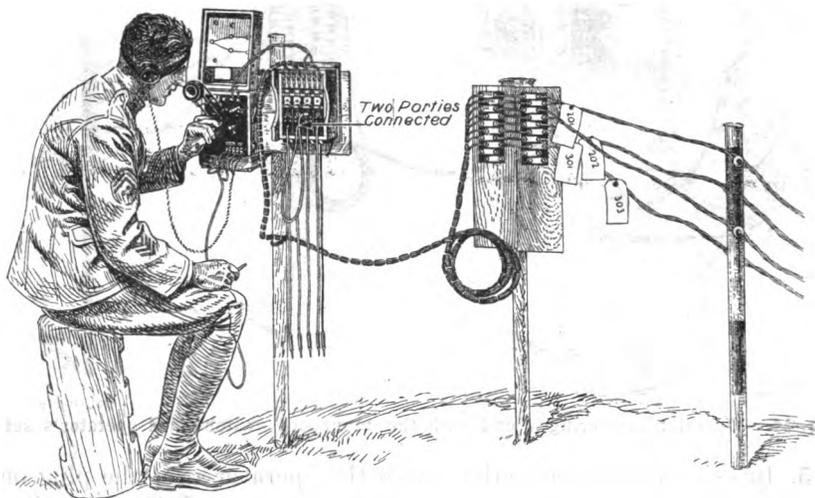


Fig. 14.—Operator answering a call with the monocord switchboard operator's set.

5. In establishing connections with the operator's set the plug on the cord on the operator's set is inserted in the jack of the calling line and answered as in Par. 3 above. (See Fig. 14.) After receiving the number desired the operator removes his plug from the calling line (see Fig. 11), inserts it in the jack of the called line, throws the ringing and listening key to lower nonlocking position, and rings with the hand generator of the operator's set (see Fig. 12). The procedure is then the same as in Par. 3 (see Fig. 13).

6. Unless it is necessary to answer other incoming calls, the answering plug should be left in the jack until the calling and called parties are talking to each other. (See Fig. 13.) The answering plug is not necessary for conversation between the parties, and it impairs transmission, so that it should be removed as soon as the operator has satisfied himself that the connection is satisfactory. (See Fig. 15, where operator is waiting for another call.) If it is necessary to use the answering plug to answer another incoming call before the called party has answered, it is permissible to remove it and proceed with

the other call. The drop is left unrestored as a reminder to the operator that the call is uncompleted. When the second call is complete, however, the operator must insert the answering plug into the free jack of the first connection to find out if the called party has answered. If the called party has not answered, the operator removes the called party's plug from the calling party's jack, and rings as before, immediately replacing the called party's plug in the calling party's jack. *The operator must never ring on a line that is connected through to a calling subscriber.* When the two persons on a connection or line have finished their conversation, they will hang up, and ring off by giving the generator handle a turn, or, similarly, if either of these two persons desires to attract the attention of the



RL-P-2178

Fig. 15.—Operator waiting for calls.

operator, he will hang up and ring. In either case this ringing will cause the drop above the free jacks to fall. In such cases the operator will insert his answering plug into the free jack of the two and challenge with "Waiting?" spoken with a rising inflection, as if asking a question. If no response is received when this challenge has been repeated, he is safe in assuming that the two persons have completed their conversation. He therefore clears the switchboard of the connection and restores the drop. (Procedure in case there is an answer to the challenge "Waiting" will be taken up later.)

Questions.

- (3) Suppose that two drops fall at the same time. What should be done?
- (4) How can an operator tell whether both parties ring off or not?

7. When the operator's set is used with the switchboard of type EE - 2A units, the following procedure is necessary: The operator answers the call by inserting the plug on the operator's cord in the jack of the calling party and answers as in Par. 3 above. He then places the calling party's plug in the called party's jack and with the key of the operator's set in its center or normal position turns the generator crank vigorously. He listens in to see that the conversation is started and then removes the operator's plug. In case it becomes necessary to ring the calling party, the operator, with his plug in the calling party's jack, throws the key of the operator's set to its lower position and rings.

8. Each student subscriber will make calls as follows:

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-1.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0..... | Magic-11. |
| 0+10..... | Magic-3. |
| 0+20..... | Magic-30. |

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-3.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0+3..... | Magic-11. |
| 0+12..... | Magic-1. |
| 0+22..... | Magic-30. |

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-11.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0+5..... | Magic-3. |
| 0+15..... | Magic-30. |
| 0+25..... | Magic-1. |

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-30.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0+8..... | Magic-1. |
| 0+18..... | Magic-11. |
| 0+27..... | Magic-3. |

Students will place the calls as shown on their traffic-load tables. When the party called answers "Magic-30, telephone orderly speaking," the calling party replies "Magic-1, telephone orderly speaking; ring off." Then both orderlies ring off.

USE OF THE VOICE.

Equipment.

Two telephones and two lists of numbers, two lists of telephone code names and numbers, and two messages in code for each pair of students.

Directions.

1. Two students, each with a telephone and a list of numbers, will connect their instruments to opposite ends of a line. One will then call the other in the usual way and repeat to him 20 numbers from the list furnished by the instructor. The other will copy the numbers on a sheet of paper, repeating them back at the same time. When 20 numbers have been sent, the operator who was copying will call 20 numbers to the other, who will copy them in a similar manner.

2. The following will give the correct pronunciation of the numbers:

- 0 to be pronounced as "ZERO"..... With long O.
- 1 to be pronounced as "WUN"..... With a strong N.
- 2 to be pronounced as "TOO"..... With a strong T and OO.
- 3 to be pronounced as "TH-R-R-EE"..... With a slightly rolling R and long E.
- 4 to be pronounced as "FOUR"..... As one syllable with a long O.
- 5 to be pronounced as "FIVE"..... With a long I and strong V.
- 6 to be pronounced as "SIX"..... With a strong X.
- 7 to be pronounced as "SEV-EN"..... As two syllables.
- 8 to be pronounced as "ATE"..... With a long A and a strong T.
- 9 to be pronounced as "NIEN"..... As one syllable with a strong N on the end.

3. When words are misunderstood they should be spelled out, using the following phonetic alphabet.

| | | |
|---------------------|---------------------|---------------------|
| A pronounced Ack. | J pronounced Jig. | S pronounced Esses. |
| B pronounced Bough. | K pronounced K. | T pronounced Toc. |
| C pronounced Caw. | L pronounced L. | U pronounced U. |
| D pronounced Don. | M pronounced Emma. | V pronounced Vic. |
| E pronounced E. | N pronounced N. | W pronounced W. |
| F pronounced F. | O pronounced O. | X pronounced X. |
| G pronounced Gogo. | P pronounced Pip. | Y pronounced Yoke. |
| H pronounced H. | Q pronounced Quash. | Z pronounced Zed. |
| I pronounced I. | R pronounced R. | |

For example, take the word "Table," which is not understood by the distant operator. Phonetically it is spelled "TOC-ACK-BOUGH-L-E."

Learn this alphabet. The student should begin by learning to spell his full name in the phonetic alphabet.

4. In calling a number, speak the name of the central deliberately and distinctly, making a pause between the name and the first digit. Speak each digit separately, giving a slight pause between each digit.

STUDENTS MANUAL FOR ALL ARMS.

The following examples will illustrate.

| | | |
|-----------|--------------------------------|------------------------|
| TABLE | 44; repeat "TA-BLE....." | FOUR-FOUR." |
| TURKEY | 80; repeat "TUR-KEY....." | EIGHT-ZERO." |
| TOWN | 136; repeat "TOWN....." | ONE-THREE-SIX." |
| TABLE-X | 1478; repeat "TABLE-X....." | ONE-FOUR-SEVEN-EIGHT." |
| TARTAR | 2222; repeat "TAR-TAR....." | TWO-TWO-TWO-TWO." |
| TARRYTON | 200; repeat "TARRY-TON....." | TWO-HUNDRED." |
| TURNSTILE | 5000; repeat "TURN-STILE....." | FIVE-THOUSAND." |
| TRACK | 6100; repeat "TRACK....." | SIX-ONE-HUNDRED." |

Each series of dashes represents a pause of about one second. The single short dash indicates a slight pause. Remember, "The voice with a smile wins." Use the rising inflection, as though asking a question, when answering calls, supervising, or repeating numbers.

5. The instructor will furnish each member of the two-men groups with a list of telephone code names and numbers to transmit.

6. The instructor will furnish each student group with two code messages. Transmit the messages without using the phonetic alphabet; the instructor will check these messages for errors. Each student will then be furnished with another code message to be transmitted using the phonetic code; the instructor will check these for errors and compare the two methods for accuracy. The student receiving a message in code should repeat each group back as he receives it to avoid errors.

PHRASES USED IN ROUTINE SWITCHBOARD OPERATING.

Equipment. For each group of five students.

1 monocord switchboard, type BD - 9 (four line).

5 field telephones.

Twisted pair field or outpost wire.

Information.

Supervising calls consists essentially in using every available effort to connect the calling party with the called party; in seeing that uninterrupted connection is maintained during conversation; and in clearing the lines promptly when the conversation is completed. It is a combination of watchfulness and courtesy.

When a drop falls on the BD - 9, BD - 10, or BD - 11 switchboard, indicating to the operator that a subscriber is calling, the operator answers by plugging into the jack of the calling subscriber, using the operator's cord and plug, and saying, for example, "MAGIC OPERATOR." When the calling party has given the number he desires the operator acknowledges by repeating the number. The operator then removes the operator's plug and places it in the jack of the called party and rings, thus ringing the called party's telephone.

Connections made on the Type BD - 9, BD - 10, and BD - 11 switchboard must be supervised by the telephone operator to insure that the calling party gets into communication with the called party or that the calling party is notified that the called party does not answer. If the traffic through the switchboard is light enough it will be possible for the operator to remain cut in on the connection to ascertain whether the called party does answer.

Should the called party fail to answer in about thirty seconds the operator will inform the calling party, "I'LL RING THEM AGAIN," and proceed to do so. In the event that the called party fails to answer the second ring, the operator will repeat the operation again. If, after the third ring, the called party fails to answer the operator will inform the calling party that the called party does not answer. After the calling party "hangs up" the operator may cut out of the circuit. The calling party may, however, order the operator to ring the called party again, in which case the operator will do so. He will repeat the operation as many times as ordered by the calling party.

If the operator should receive another signal from another calling party before communication over the first connection is established it will be necessary for him to cut out of the first connection in order to answer the second call. In this case he should *leave the drop unrestored* to remind him that the connection requires supervision.

STUDENTS MANUAL FOR ALL ARMS.

At the first opportunity the operator should again cut in on the connection and listen. If he hears conversation he will know that the called party has answered and that communication is established. If he does not hear conversation it may be that the called party has answered and one of the parties is temporarily away from his telephone and that the other party understands about it, or it may be that conversation has been completed. The operator should therefore say, "DID YOUR PARTY ANSWER?" If communication has not yet been established the calling party will so inform the operator, in which case he will proceed as described in third paragraph.

If either of the connected parties should "ring off," the drop of the unit whose jack remains unplugged will fall. The parties may, however, have concluded their conversation and either the calling or called party may desire connection with another subscriber. Therefore, before taking down a connection after what may appear to be a "ring off" the operator will always cut in on the connection and challenge by saying "WAITING." If he receives no reply, he will take down the connection. If a new number is ordered, he will repeat it and ask "WHAT NUMBER IS CALLING?" and then proceed to make the desired connection. It may be that parties concluding a conversation will neglect to "ring off," therefore the operator will supervise all connections at intervals of about three minutes in order to clear the switchboard of unused connections.

The following is a summary of the phrases the use of which are discussed above:

a. "MAGIC OPERATOR."—Used by an operator in answering a calling subscriber or other central.

b. "MAGIC-11?" Used by the operator when repeating back a number to a calling party as an acknowledgment of having understood.

c. "WAITING?" Used by the operator when challenging on a connection.

d. "WHAT NUMBER IS CALLING?"—Used by an operator when he has challenged on a connection and has been given a new number to call, by one of the two connected parties, and he desires to know which of them is calling for the new number.

Directions.

1. Each group of five students will install a switchboard with four local telephones Nos. 1, 2, 11, and 30. The name of the central will be designated by the instructor.

2. The students in each group will be assigned as switchboard operators or at a local telephone and will be changed from one duty to another from time to time by the instructor.

3. Students at local telephones will be issued Students' Traffic Load Tables and will place calls according to these tables, commencing when directed to do so by the instructor.

Questions.

(1) *What precautions should an operator take in order to avoid breaking a connection over which conversation is going on?*

(2) *What should an operator do in order to make certain that the switchboard is promptly cleared of connections when the conversation over them is completed?*

(3) *Under what circumstances should an operator leave a connection before the called party has answered?*

(4) *What should an operator do when the called party does not answer the first ring?*

(5) *When it is necessary to leave a connection before the called party has answered, what does the operator say when he listens in again on that connection and hears no conversation?*

(6) *If a drop falls on one of two connected units, what is it an indication of?*

(7) *If a drop falls on one of two connected units, and the operator challenges on the connection and gets the reply, "I want MAGIC-3," what must he do?*

(8) *How does an operator answer a call coming in over a trunk line? How does he answer one on a local line?*

ROUTING CALLS AND USE OF THE TRAFFIC DIAGRAM.

Equipment. 1 net installed for each group of 15 students. (See Fig. 16.)

6 monocord switchboards, type BD - 9 (four line), with terminal strips attached. (Two switchboards are for CANFIELD.)

10 field telephones.

Twisted pair, field or outpost wire.

Information.

In order that operators can handle calls promptly in a telephone net which furnishes service to combat units in the field, they are provided with a traffic diagram and a telephone code. The traffic diagram shows the operator at any central the circuits over which any other central in the net can be reached. The telephone code provides abbreviated names for units, officers, and offices, and is used in order to increase the simplicity, accuracy, and speed of handling calls.

To train operators to handle calls rapidly and accurately, a telephone net composed of several centrals is established. For training purposes these centrals are close together in order that the instructor can supervise the operations. In the field, however, these same centrals may be a mile or more apart. The centrals set up for practice are assumed to represent centrals at the headquarters of the student's own branch of the service, and will include the headquarters of this particular unit together with subordinate and superior units.

When it is necessary that a call be routed through one or more other switchboards in order to establish communication with the called party the operator refers to the circuit diagram and routes the call by the most direct working circuit to the first intermediate central. He calls the next central and upon being answered, repeats the order he has received to this next central and then connects this next central through to the calling party. This concludes his responsibility with the exception of supervision. When the operator receives a call over a trunk line for a number that is one of his local lines the procedure and supervision responsibility is the same as in local to local connections.

Suppose the student operator is at TABLE (see Fig. 16). A call comes for "LARBOARD-11." A glance at the traffic diagram shows that the call would normally go through "CANFIELD." He calls "CANFIELD" and when that operator answers, he asks for "LARBOARD-11," and when the "CANFIELD" operator has repeated this

order, then places the plug of the called party into the jack of the calling party. He does not remove the operator's plug from the connection until conversation is started.

In the case of a busy switchboard, it may not be possible for the operator to wait until "LARBOARD-11" has answered. In that case, after having given the order "LARBOARD-11" to the "CANFIELD" operator he will remove the operator's plug, but will leave the calling party's drop unreturned to remind him that the connection requires supervision, and he will proceed to answer other calls, returning, however, at the first opportunity to see that "LARBOARD-11" has answered.

Using the same situation as before, suppose a call comes in for "LARBOARD-11." All trunks to "CANFIELD" are busy. A glance at the traffic diagram shows the secondary routing to be through "CANTEEN." The operator at "TABLE" calls "CANTEEN" and when that operator has answered, asks for "LARBOARD-11." The procedure is as before from this point.

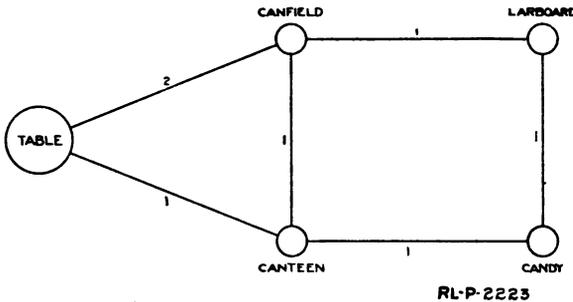


Fig. 16.—Traffic diagram.

Directions.

1. The traffic diagram (Fig. 16) shows an Infantry brigade with its two regiments on the front line. Each regiment has one battalion in the front line. The other battalions of each regiment are in support or reserve and are not in this problem. Each group of three students will be assigned to a station and directed to install that station and certain trunk lines by the instructor. See information Topic Nos. 4, 5, and 6.

2. The students in each group will be assigned to duty as switchboard operators or at a local telephone and will change from one duty to another as directed by the instructor.

3. The instructor will issue Students' Traffic Load Tables to the students, at local telephones, who will place calls in accordance therewith, starting when directed to do so by the instructor.

Questions.

- (1) *In what manner is a traffic diagram of assistance to an operator?*
- (2) *Do subscribers have any use for a traffic diagram? Why?*
- (3) *In what manner does the telephone code assist operators and subscribers?*
- (4) *Of what does a telephone net consist?*
- (5) *How much of the routing of a call is an operator responsible for?*
- (6) *When should an operator use a secondary routing for a call?*
- (7) *When it is necessary for an operator to leave a connection before the called party has answered, what precautions should he take to insure that he does not forget to return and again supervise the connection?*

PHRASES USED IN SPECIAL CASES IN SWITCHBOARD OPERATING.

Equipment. For each group of five students.

1 monocord switchboard, type BD - 10 (8 line) with terminal strip attached.

5 field telephones.

Twisted pair field or outpost wire.

Information.

It is the duty of switchboard operators to be courteous and accommodating but at the same time to be as brief as possible in their dealings with subscribers. When calls are put through and connection established between the called party and the calling party without any difficulty, there is little that the operator is required to say. There will be many occasions, however, when the called party can not be reached, or else can be reached only by special handling of the call. It is also impossible to avoid a certain amount of errors, such as the breaking of a connection before the conversation over it is complete, giving a subscriber the wrong number, etc. These cases may require a certain amount of conversation between the calling subscriber and the operator. To prevent as far as possible confusion or misunderstanding, operators are required in these special cases to be polite, avoid argument, and accommodate the subscriber in every way possible and use the prescribed phrases where there are any.

The following phrases are prescribed for use by switchboard operators when answering and supervising calls and must be strictly adhered to:

a. "MAGIC OPERATOR."—Used by the operator in answering a calling subscriber.

b. "MAGIC-1."—Used by the operator when repeating a number to a calling party as acknowledgment of having understood.

c. "HERE'S YOUR PARTY."—Used by the operator whenever it is necessary for him to start the conversation over a connection. For example, if the called party should answer before the operator had connected him through to the calling party the operator after completing the connection would start conversation by using this phrase.

d. "MAGIC-11 IS BUSY."—Used by the operator when reporting to the calling party that the called party's line is busy.

e. "MAGIC-11 DOES NOT ANSWER."—Used by the operator when reporting to the calling party that the called party does not answer.

f. "MAGIC-11 HAS NO TELEPHONE."—Used by the operator when reporting to the calling party that the party called has no telephone.

g. "MAGIC-30 HAS NO TELEPHONE, BUT I WILL GIVE YOU MAGIC-11. I THINK YOU CAN GET HIM THERE."—Used by the operator when the called party has no telephone but can be reached through another telephone.

h. "DID YOUR PARTY ANSWER?"—Used by the operator when he listens in on a connection to determine whether or not the called party has answered and he hears no conversation.

i. "I'LL RING THEM AGAIN."—Used by the operator when he has cut in on an uncompleted connection and has been told that the called party did not answer.

j. "WAITING?"—Used by an operator when he cuts in on a connection after a drop has fallen on one of the two connected units.

k. "JUST A MOMENT, PLEASE. WHAT NUMBER WERE YOU CALLING?"—Used by the operator when a party calls and reports that he has just been given a wrong number. In case a connection between two subscribers is broken before they are finished and either party rings the operator and tells him that they were cut off from the party they were talking to the same phrase is used. If the operator knows what party the complaining subscriber was talking, he need not ask "What number were you calling?"

l. "WHAT NUMBER IS CALLING?"—Used by an operator after he has challenged on a connection on which a drop has fallen and as a result he has been given a new number by one of the two parties, and he does not know which of the two connected parties is calling.

m. "HELLO MAGIC" or "HELLO MAGIC-3."—Used by the operator when there is confusion or interruption on a connection through two or more switchboards and he is trying to get a distant operator or called party back on the line.

n. "WHO IS CALLING, SIR?"—Used by the operator when a calling party who can not get the number he desires on account of a busy line asks the operator to call him back to the phone when the party desired can be reached. Also used in any other case when the operator desires to know who the calling party is.

o. "I CAN GIVE YOU THE MESSAGE CENTER."—Used by the operator when, after reporting that the called party's telephone is out of order, or that the called party has no telephone. If the called party has no telephone but answers over another number, this phrase does not apply.

p. "CAPTAIN SMITH'S CODE NUMBER IS MAGIC-4. I WILL CONNECT YOU."—Used by the operator when a call comes in for a subscriber by name or some designation other than his telephone code number.

Directions.

1. Each group of five students will be required to install and operate a central with a number of local lines as follows:

TABLE-1.

TABLE-2.

TABLE-3. (Dummy. No telephone connected.)

TABLE-4. (Dummy. No telephone connected.)

TABLE-11.

TABLE-30.

TABLE-3 and TABLE-4, it will be noted, have no telephone connected. They will be marked with their proper designation on the celluloid strip on the switchboard but will be considered as "out of order." The switchboard units will be so marked with a slip of paper.

2. Students will be assigned to duty as switchboard operator or at a local telephone and will rotate from one duty to another as the instructor directs.

3. This is primarily an exercise in answering and supervising and the prescribed phrases will be used in every case for which there is a phrase given.

4. The instructor will issue Students Traffic Load Tables to students at local telephones who will place calls in accordance therewith, starting when directed to do so by the instructor.

Questions.

(1) *Why is it necessary that operators be required to use certain definite phrases in particular situations?*

(2) *When does an operator use the phrase "MAGIC OPERATOR?"*

(3) *How does the operator answer on a trunk line? On a local line?*

(4) *Are there any occasions when an operator might be required to give a subscriber a number other than the one asked for?*

(5) *What is the difference in the procedure used by an operator when listening in on a connection to find out if the called party has answered, and when listening in after a drop has fallen on one of two connected lines?*

(6) *In what cases, if any, should an operator use the word "HELLO?"*

(7) *How should calls for subscribers who have no telephones be handled?*

(8) *When a call is made for a subscriber by name, what should an operator do to try and prevent the calling subscriber from again calling for the same person by name?*

(9) *If a subscriber accuses an operator of giving the wrong number, when the operator is certain he gave the number asked for, what should the operator do and what phrases should he use?*

ANSWERING, SUPERVISING, AND ROUTING CALLS.

Equipment.

| Central. | Number of students. | Monocord switchboards. | Field telephone. | Wire. |
|-------------|---------------------|---------------------------|------------------|---------------------------------------|
| TABLE..... | 4 | Type BD-11 (12-line)..... | 4 | Twisted-pair, field or out-post wire. |
| TOY..... | 3 | Type BD-11 (12-line)..... | 3 | Twisted-pair, field or out-post wire. |
| TAR..... | 4 | Type BD-11 (12-line)..... | 4 | Twisted-pair, field or out-post wire. |
| TARRY..... | 3 | Type BD-10 (8-line)..... | 3 | Twisted-pair, field or out-post wire. |
| TRAVEL..... | 4 | Type BD-10 (8-line)..... | 4 | Twisted-pair, field or out-post wire. |

Information.

This Unit Operation is a review of Unit Operations Nos. 7, 8, and 9. The students should carefully review the information given in those Unit Operations and the Information Topics referred to. This exercise covers all the cases commonly met with by an operator of a monocord switchboard in a wire net and it requires the use of the rules for routing and the phrases given in the previous three Unit Operations.

Directions.

1. The class will be divided into groups and assigned to centrals as indicated above under the heading EQUIPMENT. They will be required to install the net shown in Fig. 17. This figure represents a telephone net pertaining to the 1st Brigade (TABLE). The 1st Brigade (TABLE) has both regiments in the assault echelon, i. e., 1st Infantry (TOY) and 2d Infantry (TAR). Each regiment has one battalion in the assault echelon, i. e., 3d Battalion, 1st Infantry (Tarry) and 2d Battalion, 2d Infantry (TRAVEL). The other battalions are in reserve and are not shown as connected by telephone.

2. Each student will be assigned to duty as switchboard operator or at a local telephone and will rotate from one duty to another, as directed by the instructor.

3. Students at local telephones will be issued Students Traffic Load Tables and will place calls according to these tables, commencing when directed to do so by the instructor.

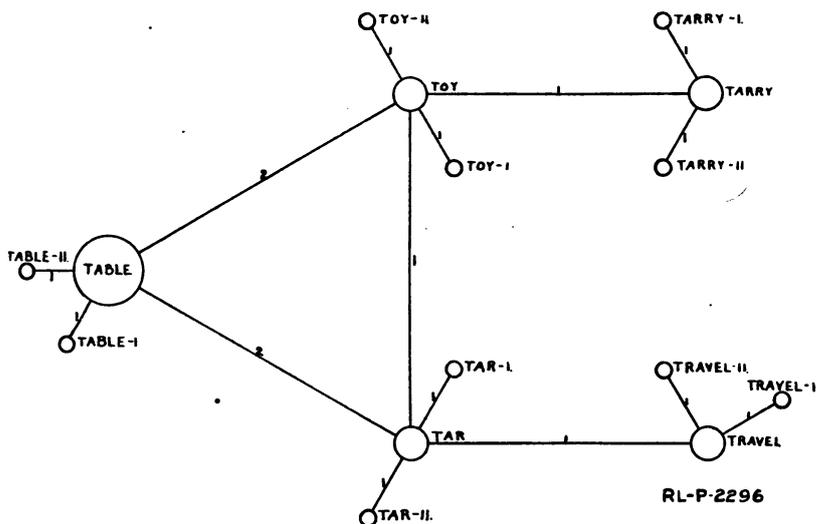


Fig. 17.—Traffic diagram showing subscribers.

Questions.

- (1) In Fig. 17 what centrals would a call have to go through if it were given the direct route from TABLE-4 to TARRY-11?
- (2) Describe a possible secondary routing for the call mentioned in question (1).
- (3) Suppose the connection was completed for a call from TABLE-4 for TRAVEL-1 by the secondary routing. Could TABLE-11 call and get TARRY-1? (See Fig. 17.)
- (4) Why is it necessary for operators to know the organization of their own, superior, and subordinate units?
- (5) How and from what information is a traffic diagram made?
- (6) What is a telephone code and what is its purpose?

HANDLING TRAFFIC.

Equipment.

A telephone net installed with a switchboard and several local telephones at each central; a traffic diagram; and a telephone code.

Information.

Up to this Unit Operation, the student operator has handled only calls. When conversations or messages are to be handled it easily becomes possible to pull the wrong plug and thus to cut off a conversation. Besides this, calls will come in for circuits that are busy. In order to familiarize operators with such conditions, a traffic load providing a situation in which actual messages are to be transmitted will be applied to the telephone net.

Directions.

1. A student will be assigned as telephone orderly at each local telephone. This station will bear the code designation of his central and office, as, for example, "Daylo-5" or "Table-5." Daylo or Table is the code designation of the central, and 5 is the code designation of the officer, viz, intelligence officer. Each local telephone will be given messages by the instructor to transmit to other stations, and the time each message is to be transmitted.

2. The switchboard operator will handle this traffic in accordance with the rules and routine procedure covered in the preceding Unit Operation, supervising all calls.

3. Students assigned as telephone orderlies will have a message issued to them similar to the following:

MESSAGE

No. 8 DATE 1 Jan 22

To CO 3d Inf AT _____

Your regiment will be relieved tomorrow.

Details later

CO 2d Brig 8:05 AM
SIG. TRANSMITTED -- TITLE AND ORGANIZATION HOUR SIGNED

C.C. Brown Brig Gen AT
SIG. -- NAME AND RANK

SPACES BELOW FOR SIGNAL COMMUNICATIONS PERSONNEL ONLY

| <small>OD</small> <small>CLASS</small> | <small>TP</small> <small>HOW SENT</small> | <small>SPECIAL INSTRUCTIONS</small> | | |
|---|--|-------------------------------------|--|--|
|---|--|-------------------------------------|--|--|

| | | | | |
|--|--------------------------------|--|--------------------------------------|----------|
| <u>2d Brigade</u> <small>MESSAGE CENTER</small> | <u>5</u> <small>NO.</small> | <u>1 Jan 22</u> <small>DATE</small> | <u>8:10 A</u> <small>HOUR</small> | <u>M</u> |
|--|--------------------------------|--|--------------------------------------|----------|

| | | | | | |
|---|----------------------|------------------------|----------------------------|---------------------|----------|
| <u>8:45 AM</u> <small>TIME FILED</small> | <small>CHECK</small> | <small>SENT BY</small> | <small>RECEIVED BY</small> | <small>HOUR</small> | <u>M</u> |
|---|----------------------|------------------------|----------------------------|---------------------|----------|

TSO -1

4. The instructor will insert in the space marked "Time filed" the time at which the student is required to make the call and transmit the message.

5. The student who is acting as telephone orderly at a local telephone will proceed as follows:

a. Look up in his telephone code the code name and number corresponding to the CO 3d Inf. (NOTE.—This message would normally be sent by to the message center, but for practice in training switchboard operators in handling calls for different numbers the student at each number acts as a telephone orderly would act at a message center.)

b. Enter 8 in the space "Check." This is the number of words in the body of the message.

c. Enter name in the space "Sent by."

6. Establish connection with the 3d Infantry as follows:

a. Ring the switchboard operator and ask for "MOUNTAIN-11."

b. The telephone orderly at the 3d Infantry message center should answer "MOUNTAIN-11, SMITH SPEAKING."

c. Enter the name Smith in space "Received by."

d. Then say "MOTIVE-11, JONES SPEAKING, TAKE THIS MESSAGE."

e. Mountain telephone orderly should say, "GO AHEAD."

7. Transmit as follows, reading from the message blank.

a. "Number: Eight."

b. "Date: One, January, two, two."

c. "To: CO, 3d Infantry."

d. "Your regiment will be relieved to-morrow. Details later."

e. "Signature transmitted: CO 2d Brigade."

f. "Hour signed: Eight, zero, five a. m."

g. "Class: 'OD'."

h. "Message center: 2d Brigade."

i. "Number: Five."

j. "Date: One, January, two, two."

k. "Hour: Eight, one, zero, a. m."

l. "Check eight words."

m. "End of message, repeat back."

8. The receiving telephone orderly should then repeat the message back, correcting any errors he has made.

9. When the receiving operator has repeated the message back correctly, say: "Correct, I have nothing further."

10. Ring off.

11. Enter the time that transmission was completed in the space marked "Hour."

Questions.

- (1) *Why are the number of words in the body of the message entered under "CHECK" on the field-message blank?*
- (2) *After having obtained connection with the called party what would the operator say if he had more than one message to transmit?*
- (3) *When transmitting a message, why is the name of the person receiving the message entered on the message blank?*
- (4) *What is meant by the body of the message?*
- (5) *Is the actual signature and rank of the writer usually transmitted?*
- (6) *Does a switchboard operator on duty ever transmit messages?*

TESTS AND TROUBLES.

Equipment.

A telephone net installed with a switchboard and several local telephones and a chief operator's telephone at each central; a telephone code; a test and trouble record; a station log. (See Information Topic No. 8.)

Directions.

1. *Tests.*—All circuits to the switchboard, both trunks and locals, should be tested at periodic intervals unless circuits are in continuous use; in such cases the fact that they are in use will show that there is no trouble on the circuits. The operator at the specified time should test all circuits and make suitable entries on the operator's test and trouble record. Entry should not be made on the test and trouble record unless a circuit is found defective. A test consists of plugging into and ringing on a line. When the party at the other end answers, the operator says, "Test, thank you," and clears the line. Each operator will also keep a station log under the supervision of the chief operator. (See Information Topic No. 8.)

Question.

(1) *Why is it necessary to test all circuits periodically?*

2. *Trouble.*—When a circuit is reported out of order, or when it shows up as out of order under test or traffic, it is entered on the test and trouble record. The chief lineman is notified and the jack of that line is marked "Out of order." The operator is notified when the trouble has been found and the repairs made; he then tests the line and completes the entry on the test and trouble record.

Question.

(2) *Should a connection between two parties be broken in order to test the circuit?*

3. The students acting as switchboard operators will handle calls and make tests at such times as may be specified by the instructor. Students acting as telephone orderlies will transmit messages in accordance with the student's traffic load as issued by the instructor.

Question.

(3) *What is the purpose of the chief operator's telephone? (Refer to Information Topic No. 5.)*

PROCEDURE DURING TROUBLE.

Equipment.

A telephone net installed with a switchboard and several local telephones, including a chief operator's telephone at each central; a traffic diagram; a telephone code; a station log; and a test and trouble record.

Information.

Up to this Unit Operation, student operators have handled traffic without being purposely impeded by having trouble intentionally placed in the net.

In the field, however, troubles always occur. These are caused by circuits being cut by vehicular traffic or enemy fire, by mistakes or errors of wire construction, by incompetent or careless personnel, or by defective equipment.

In order to give students experience with the sort of troubles that are likely to occur in the field, a "trouble load" will be applied to a telephone net in addition to the traffic load.

Directions.

1. *Telephone or line out of order.*—As soon as a line or telephone has been found to be out of order, it is reported to the operator. He records it on the test and trouble record and notifies the chief lineman or, in his absence, one of the trouble men assigned to that station. The operator then places a slip of paper with the words "Out of order" printed on it in the jack of the faulty line and reports the line "out of order" to anyone calling that party. As soon as the trouble is repaired the trouble man or chief lineman will report the fact to the operator, who then tests the line. The test consists of plugging into and ringing that line. When the party at the other end answers, the operator says "Test, thank you," clears the line, and removes the "Out of order" designation from over the line or jack.

Questions.

(1) *What would be indicated if the operator rang on one line and got a party on another line?*

(2) *If two parties, who are connected through the switchboard and conversing, are disconnected, whose fault is it?*

2. *Complaints and inquiries.*—Complaints or inquiries about the telephone service should be referred to the chief operator. If it becomes necessary for the chief operator to leave the office, he will leave a competent operator to act in his place.

3. Students will carry out the instructions they receive for the training required under this Unit Operation.

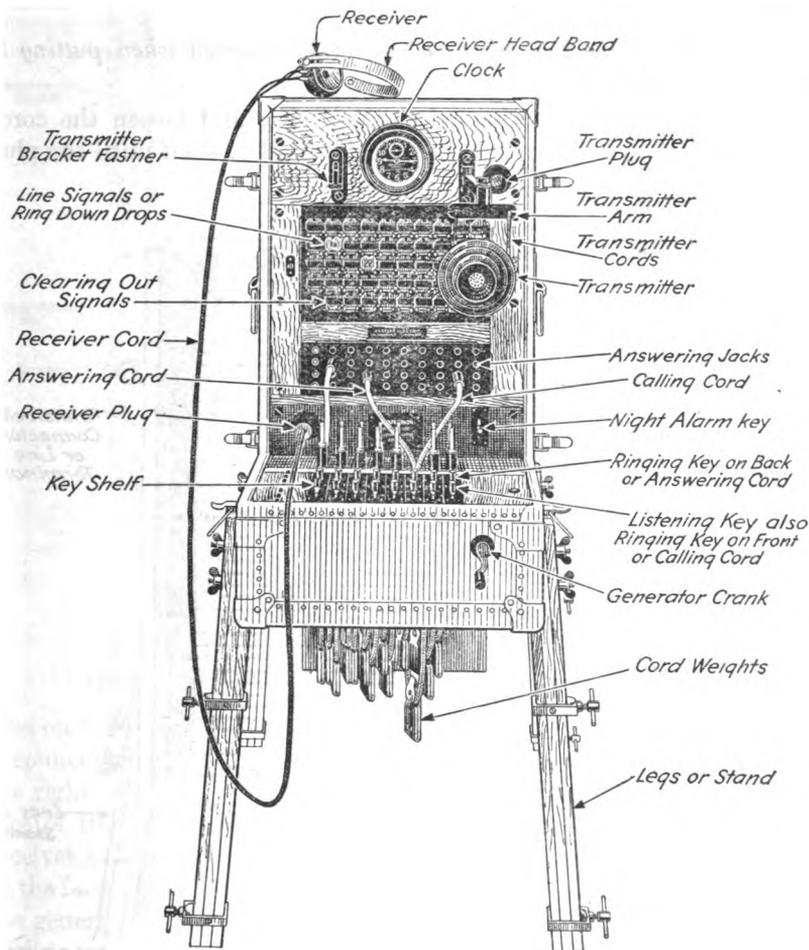
INSTALLATION OF THE CAMP SWITCHBOARD.

Equipment.

- 1 camp switchboard.
- 8 terminal strips, type TM-84.
- 400 feet field wire, twisted-pair.
- 40 feet lacing twine or cord.
- 10 feet switchboard cable.

Information.

Unit Operations No. 14 and No. 15 are furnished in this text for such units as are equipped with the camp switchboard type BD-14-5 and type BD-14-6.



R: P-2487

Fig. 18.—Front view of the camp-type switchboard.

Directions. (See Information Topic No. 9.)

1. Open the rear of the switchboard case and take out the four telescopic legs. Fasten the legs to the switchboard case by means of the wing nuts on the legs and the corresponding slots on the case of the switchboard. Adjust the distance above the ground or floor by loosening the wing nuts which control the telescopic action of the legs. (See Fig. 18.)

Questions.

(1) *What are the points which determine how high the switchboard should be above the ground?*

(2) *Could the switchboard be operated if it were placed flat on the ground?*

(3) *What are the points which should be observed when putting the legs on the switchboard?*

2. Open the front of the switchboard case and loosen the cords, working them down through the holes in the key shelf until the plugs

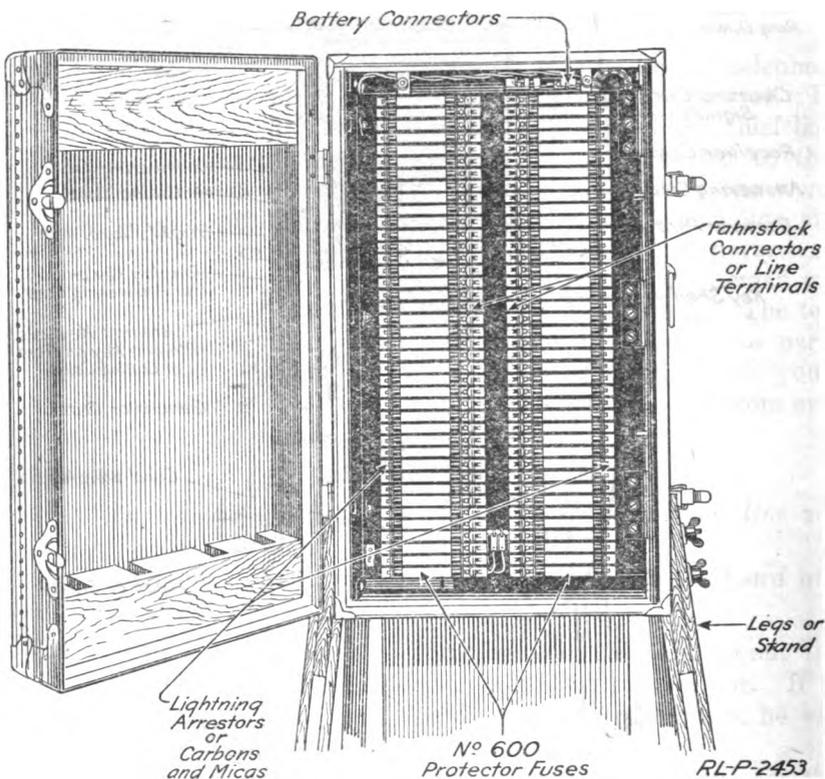


Fig. 19.—The protector panel of the camp-type switchboard.

seat on the rims of the holes. Loosen the swinging transmitter arm located at the top of the switchboard panel. The transmitter, head set, and generator crank are in the front of the switchboard case, which was removed when the case was opened. The transmitter cord is now suspended from the transmitter arm by separating the twisted pair cord, near the transmitter, and placing the two conductors of the cord in the holes on the crosspiece of the transmitter arm. The cord is suspended under the transmitter arm by the two

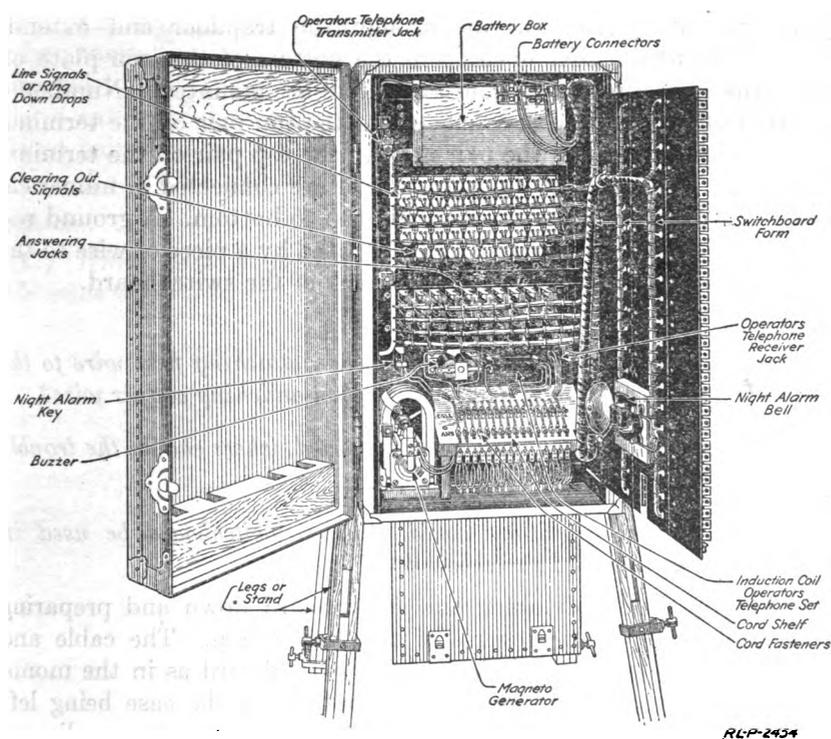


Fig. 20.—Rear view of the interior of the camp-type switchboard.

eyes on the underside of the arm and the plug on the end of the cord is connected to the switchboard by inserting it in the jack located to the right of the point where the transmitter arm is fastened to the face of the switchboard. The plug on the cord to the head set or receiver is inserted in the jack located in the lower left-hand corner of the face of the switchboard and the generator crank is screwed on the generator shaft through the hole in the lower right-hand corner of the case. Batteries for the operator's set and night alarm are placed in the battery box behind the face of the switchboard. (See Figs. 19 and 20.)

Questions.

(4) *How could the battery and operator's set in the camp switchboard be tested?*

(5) *How is the clock on the camp switchboard wound and set?*

3. Mount eight terminal strips on a board in a vertical row, about 8 feet from the switchboard, and connect the terminal strips and the Fahenstock clips at the back of the switchboard with a 40-pair cable prepared as in Unit Operation No. 1. The cable enters the switchboard case from the bottom through the trapdoor and extends through the rectangular opening in the bottom of the iron plate on which the Fahenstock clips and protectors are mounted. Number 0 pair on the switchboard is connected to the top pair on the terminal strips, number 1 pair to the pair next to the top pair on the terminal strip, etc. The pairs on the switchboard are connected in numerical order to the terminal strip pairs, from top to bottom. A ground rod is then driven into the ground and connected by a piece of wire to the ground clip on the iron plate, on the back of the switchboard.

Questions.

(6) *Why must greater care be taken when attaching field wire to the terminals of the camp switchboard than when attaching copper wire?*

(7) *If it was found that the line was shorted, where should the trouble be looked for first?*

(8) *Under what condition would a camp switchboard be used in preference to a monocord switchboard?*

4. The operation of taking the switchboard down and preparing it for movement is the reverse of the installation. The cable and terminal strips are left attached to the switchboard as in the monocord installation, the trapdoor in the bottom of the case being left open. The transmitter, receiver, and generator crank are disconnected and placed in their proper place in the cover of the switchboard. The cords are pulled up until the cord weights are well up in the switchboard case; then they are bunched and a piece of string is wrapped around the bunch of cords as close to the key shelf as possible and tied. This will prevent the weights falling through the hole in the bottom of the case. The legs are removed and placed in the space provided for them in the rear of the case. The rear door is fastened and the front of the case placed in position and fastened. When the switchboard is prepared for shipment or storage, the cable is detached from the rear of the switchboard. (See Par. 3, Information Topic, No. 9.)

Questions.

(9) *What might happen if the generator crank is not removed when moving the switchboard?*

(10) *Is there any method for mounting the terminal strips which would simplify matters when it is necessary to move the installations?*

5. The cable to connect the switchboard and terminal strip is often made up from twisted pair wire, cabled as in Unit Operation No. 1. On account of the number of drops on the switchboard and the difficulty in making up a cable, okonite cable, if available, should be used to make the installation. If the switchboard is located in a protected location, standard switchboard cable may be used. This type of cable becomes shorted from dampness and water. Okonite twisted pair wire can be used without any more trouble developing than in the twisted pair wire.

Question.

(11) *Which would be preferable for use with this type switchboard—a cable made up of field wire or standard switchboard cable? Why?*

OPERATION OF THE CAMP SWITCHBOARD.

Equipment.

A telephone net installed with a camp-type switchboard and several local telephones at each central; a traffic diagram; and a telephone code for each central.

Directions.

1. The operation of the camp switchboard differs from the mono-cord switchboard in that calls are completed by using two cords instead of one. (See Information Topic No. 9.)

2. The switchboard is equipped with eight pairs of cords. The cord next to the face of the switchboard is designated the "rear cord" or "answering cord" and is used to plug into the calling jack to answer calls. The cord nearest the operator is designated the "front cord" or "calling cord" and is used to complete the connection of the calling party to the called party. Any pair of the eight pairs of cords can be used to make a connection, but the rear cord of one pair can not be used to answer a call and the front cord of another pair used to complete the connection; in other words, they must be used in pairs.

3. On the key shelf are eight pairs of keys, one pair for each pair of cords. The rear key can be moved in only one direction, toward the operator; and when released the key returns to a vertical position. This key, when pulled toward the operator connects the generator to the rear cord of the pair corresponding to the key. This permits ringing back on the calling party in case he hangs up.

4. The front key has two movements. The one toward the operator is the ringing position. When in this position it connects the generator to the called party on the front cord; when released the key returns to the vertical position. If the key is pushed away from the operator, it locks and remains in that position until the operator releases it by pulling it toward him. This rear position of the key is designated the "listening position," as it connects the operator's transmitter and receiver to the line for the purpose of answering calls and supervising connected lines. The key should not be kept in the listening position any longer than required to make or supervise a connection, for if left in this position while another listening key is operated, the two keys will connect the two pairs of cords together, and the four parties will be connected.

5. Each pair of cords is provided with a "clearing-out" drop, located on the face of the switchboard immediately below the line drops. When the parties connected are through talking, the opera-

STUDENTS MANUAL FOR ALL ARMS.

tion of the generator in the telephone of either party will cause the shutter of the clearing-out drop, corresponding to the pair of cords used, to fall. This calls the attention of the operator to the fact that the connection can be taken down.

6. The operator, after his switchboard is installed and in working condition, waits for a drop to fall, with the rear cord of any pair of cords in his right hand, the left hand being used to operate the keys and restore drop shutters.

7. Suppose that No. 10 drop falls. The operator inserts the plug of a rear cord into No. 10 jack, at the same time moving the front key, corresponding to the cord being used, to the rear or listening position and restores the drop shutter. He answers the call as in the procedure outlined in Unit Operation No. 5, giving the code name of his central followed by the word "operator," as "Magic operator." After ascertaining the number desired, for example "Magic-30" (radio station) which is on No. 22 jack of the switchboard, the operator's reply is "Magic-30?" The operator will then take the front cord of the pair of which the rear cord was used to answer, insert it in No. 22 jack, pull the listening key toward him as far as it will go to the ringing position, and give the generator handle several turns, to ring the called party. The listening key is then pushed to the rear, as far as it will go to the listening position, and the operator supervises the connection until conversation is started and the connection appears satisfactory, unless it is necessary to answer other incoming calls. In the latter case the operator restores the listening key to a vertical position and proceeds to answer other calls, returning, however, at the first opportunity to see whether the called party has answered. If the operator can not hear any conversation on the line he will challenge with "Did ——— — (giving code name and number) answer?" If the calling party says, "No," the operator replies, "I will ring them again," and proceeds to ring again, using the front key. The call is supervised as in Unit Operation No. 8.

8. As soon as the clearing-out signal is observed, the operator will clear the lines after challenging, restoring the clearing-out drop.

9. The night alarm is connected by throwing the night-alarm key, on the lower right-hand side of the face of the switchboard, to the upper position. Any shutter on the switchboard that falls, with the night alarm on, will ring the bell and attract the attention of the operator.

10. Each subscriber of the various centrals will place calls in the net in accordance with instructions issued by the instructor.

INSTALLATION AND OPERATION OF A CENTRAL IN A WIRE NET IN THE FIELD.

Equipment.

A 12-line monocord switchboard; operator's telephone or operator's set; short lengths of wire (for any necessary splicing); roll of friction tape; and a roll of rubber tape will be furnished to each group.

Directions.

1. Proceed to the location to which you have been assigned. Get from the instructor the necessary information, i. e., code name of central, traffic diagram, the distribution of local telephones, telephone code, etc.

2. Install the switchboard and the local telephones. Connect the trunks from the other centrals to your terminal strips. These trunks are laid by the construction section and should not be accepted by an operator until they are properly tagged and tested.

3. Test all local telephones and all trunks that go into the switchboard. Then report to the next higher unit, "Daylo (or whatever the code name of the central is) is in order" or report any trouble that can not be repaired 10 minutes after the installation, as "Circuit No. 104 out of order between Daylo and Daybreak."

4. Stand by to handle traffic.

INFORMATION TOPICS.

INFORMATION TOPICS.

DEFINITIONS.

NOTE.—The definitions given below are the common meanings of words as used in this manual.

Bass wood.—Light soft wood used for furniture, carrying cases for equipment, etc.

Bridge.—To connect an apparatus from one side of a circuit across to the other side.

Buzzer, series.—A buzzer which is placed in series in one side of the circuit; not bridged across the circuit.

Cable, standard switchboard.—A cable composed of silk and cotton covered wires, usually coded to facilitate making connections.

Called party.—The person who is called by the operator when making a telephonic connection.

Call, completed.—One where the calling party obtains an answer from the called party's telephone.

Call, uncompleted.—One where the switchboard operator is unable to get an answer from the called party's telephone.

Challenge.—An operator's inquiry by saying, "Waiting" on a connection to determine whether or not the connection is in use.

Circuit diagram of a telephone net.—A diagram which shows graphically the various circuits in a telephone net, the actual connections, the code names of centrals, and the numerical designation of each circuit.

Circuit diagram.—A diagram showing graphically the course traversed by an electric current.

Circuit, signalling.—The path followed by the signalling current in a telephone circuit.

Circuit, talking.—The path followed by the talking currents in a telephone circuit.

Code, names.—An arbitrary series of names given to various headquarters for the purpose of obtaining speed and accuracy in the handling of telephone calls.

Cord.—An insulated cord containing one or more conductors.

Cord, answering.—The rear cord on a camp switchboard, type BD - 14, which is used for plugging into the line of a calling subscriber.

Cord, calling.—The front cord on a camp switchboard, type BD - 14, which is used for plugging into the line of a party to be called by the operator.

Cord, operator's.—The cord on a monocord switchboard or an operator's set used by the operator for answering and supervising. It is usually a different color than the switchboard cords.

Cord, switchboard.—Those cords on a switchboard which are used in connecting two parties together.

Cord, three-conductor.—The cord on the operator's set, type EE - 64.

Cord, two-conductor.—An insulated cord containing two conductors. For example, the operator's cord on a monocord switchboard.

Cord weights.—Weights attached to the cords on a switchboard to pull the cords automatically, so that when released from a jack a cord returns to its proper place on the key shelf.

Corrode.—To wear away by degrees, such as by rusting.

Drop.—*a.* The electromagnet with its armature and catch which permits a shutter to fall for the purpose of attracting the attention of an operator.

b. Sometimes used to mean the shutter.

Drop, clearing out.—The drop on any cord circuit of a magneto switchboard which falls when one of two connected subscribers rings off.

Drop lock.—A spring clip or latch for holding the drop up securely when a switchboard is being transported.

Drop magnet.—The electromagnet which actuates the drop armature, releasing the shutter.

Drop shutter.—The shutter which falls when the drop armature is lifted.

Exchange.—Switchboard; central.

Fahnstock clips.—Patented spring clips used for attaching wires.

Fuse.—A safety piece of fusible metal in an electrical circuit which melts when the current is too strong.

Ground rod.—A rod which is driven in the earth to obtain a ground connection.

"Handle traffic."—Term used to mean making the necessary connections to complete calls through a switchboard.

Induction coil.—An apparatus for transforming currents by electromagnetic induction, consisting usually of two concentric cylindrical coils of insulated wire inclosing an iron core.

Key shelf.—The part of a switchboard on which are mounted the operator's keys and cords.

Key switches.—Compact form of switches made to fit into a flat mounting plate which are operated by keys.

Line circuits, dummy.—Circuits which have no apparatus connected on one end.

Line signals, gravity type.—See Drop.

Line route map.—A map which shows the geographical location of the centrals in a telephone net, the number of circuits and the route of each.

Night alarm.—An alarm so connected to a switchboard so that it will be automatically operated when any drop on the switchboard falls.

"Nonlocking position."—A position to which a switchboard key on the camp type switchboard may be operated and from which the key returns to a normal position when released.

Phonetic alphabet.—An alphabet for use in telephone conversation in which certain letters having similar sounds are given names which have different sounds.

Plug.—A special form of terminal for attachment to a flexible conductor (switchboard cord) in order to make an easy and quick connection to a jack.

Priority.—*a.* The order in which calls are answered by an operator.

b. The right to interrupt an established connection between two parties.

c. The order in which telephones are installed at a command post.

Protectors.—Two fuses and lightning arrester, used in combination to protect equipment from lightning and other foreign currents.

Protector panel.—The panel or board on which protection devices are mounted. (See Fig. 41.)

"Restore the drop."—To place the shutter of a drop back in its normal or original position after the shutter has fallen.

Ring and listening key.—A key on a camp type switchboard which has two positions; one for ringing and one for listening.

Secondary routing.—A routing for a telephone connection other than the most direct routing.

Sleeve.—*a.* The cylindrical contact or barrel of a switchboard jack.

b. The contact of switchboard plug which makes connections with sleeve of jack.

Supervising.—Using every available effort to connect the calling party to the called party; seeing that uninterrupted connection is maintained during conversation; and in clearing the lines promptly when the conversation is completed.

Switch.—A device for making and breaking a circuit.

Switching central.—A switchboard located at the junction of two or more wire lines at a location which is not at any headquarters or command post.

Telephone, central.—A switchboard with lines, telephone, and related apparatus, for the purpose of enabling any subscriber to talk with any other subscriber.

Telephone, common battery.—A telephone used in a system in which the battery is located at the central or exchange.

Telephone, magneto or local battery.—A telephone used in a system in which the battery is located in the subscriber's instrument.

Telephone net.—A wire system in which a number of switchboards, to which are connected local telephones, are connected together by wire lines called trunks.

Test and trouble record.—A record kept at a switchboard of tests made and troubles occurring on any circuits connected to the switchboard.

Tip.—*a.* The forward contact of a telephone switchboard plug.

b. That terminal of a switchboard jack with which the tip of plug makes contact.

Traffic.—Telephone calls.

Traffic load table.—A schedule for placing calls in a telephone net for training purposes.

Trouble.—A fault on a circuit such as short circuit, open circuit, or ground.

Trunk.—A telephone circuit connecting two centrals.

Wing nuts.—Nuts provided with winglike extensions to facilitate turning by hand.

Wire line.—One or more circuits of the same type of construction along a given route forming an integral portion of a wire system.

Wire lines, junction of.—A point where two or more wire lines terminate.

Wire net.—A system in which a number of switchboards, to which are connected local telephones, are connected together by wire lines.

ARMY ORGANIZATION.

The United States Army is made up of different branches or arms of the service, such as Infantry, Cavalry, Field Artillery, and others that will be mentioned later.

In order to create a fighting team, these branches must be divided up into units of different sizes for purposes of training, feeding, clothing, and so on, that they may be efficiently directed on the battle-field.

The Infantry is the basic arm, and upon its success depends the success of the Army. All other branches are organized, equipped, and trained to assist the Infantry in its needs, functions, and methods in war.

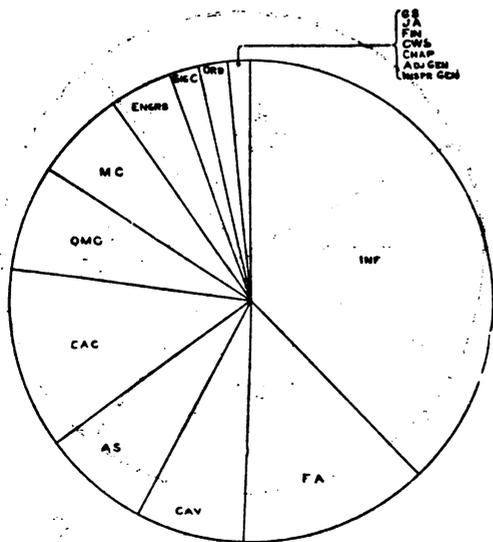


Fig. 1.—Branches of the United States Army.

Fig. 1 shows the various combat arms, departments, and corps of the Army. This big organization, the Army, is composed of 17 parts, and each part has its particular duties which help the other branches to function more efficiently.

INFANTRY.

Since the Infantry is so important, and since most of the combat-ant branches are divided up into parts that correspond nearly to the parts into which the Infantry is divided, a study of the Infantry

organization is important. All communication men in their everyday work, in maneuvers, in battle, or in training have to deal with units of the other arms, and they must therefore be familiar with the names and composition of the parts of organizations and know the rank and duties, in general, of the officers that command these parts. A study of the Infantry will teach this, so that a similar knowledge of the other branches can be quickly learned.

The smallest Infantry unit is a squad, consisting of 7 men commanded by a corporal. Three squads make a section of 26 men commanded by a sergeant and two sections make a rifle platoon

of about 60 men commanded by a lieutenant. The symbol 

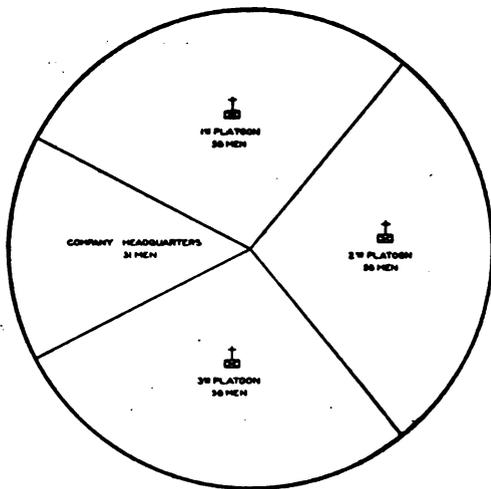


Fig. 2.—Rifle company, Infantry. 

represents an infantry rifle platoon. The next higher unit is the rifle company of about 200 men divided into three rifle platoons and

commanded by a captain. (See Fig. 2. The symbol  will be

noted and will always mean an Infantry rifle company. The cross in the rectangle represents two crossed rifles and means Infantry troops. The three bars indicate that the company has three platoons.)

The rifle company is the smallest self-sustaining unit in the Infantry capable of replacing its losses in battle.

Three rifle companies plus one machine-gun company and headquarters company constitute a battalion of about 850 men commanded by a major or lieutenant colonel. (See Fig. 3. The symbol

 will be noted in Fig. 3 and will always mean an Infantry battalion.

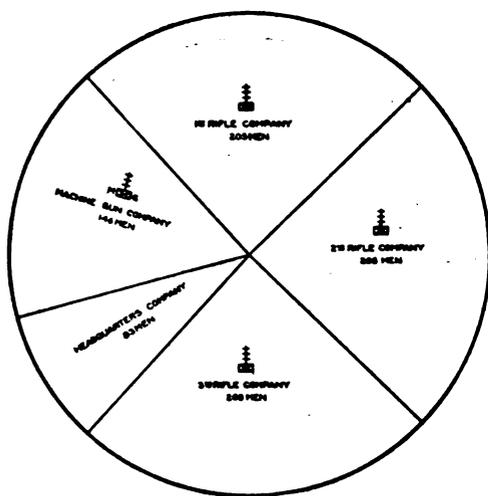


Fig. 3.—Infantry battalion. 

Three battalions plus a headquarters company, howitzer company, and service company constitute a regiment of about 3,000 men com-

manded by a colonel. (See Fig. 4. The symbol  will be noted and will always mean an Infantry regiment.) The three dots in this symbol indicate that the regiment has three battalions.

The service company is the company that furnishes food, supplies, and equipment for the regiment.

The howitzer company is the company which contains certain auxiliary infantry weapons and is under the direct command of the colonel, to be used as needed.

The headquarters company furnishes the communications personnel for the regiment, and has other smaller platoons for particular duties

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at regimental headquarters during combat. Fig. 19 shows the various platoons of this company. In addition to the communications platoon are the pioneer platoon, which constructs sufficient shelters, wire entanglements, etc., to insure the safe operation of regimental headquarters during combat; the intelligence platoon, which discovers, collects, and prepares for the use of the colonel all information that can be found out about the enemy; and company headquarters, which contains the personnel necessary for the administration of the company and sufficient personnel to perform the clerical work at regimental headquarters.

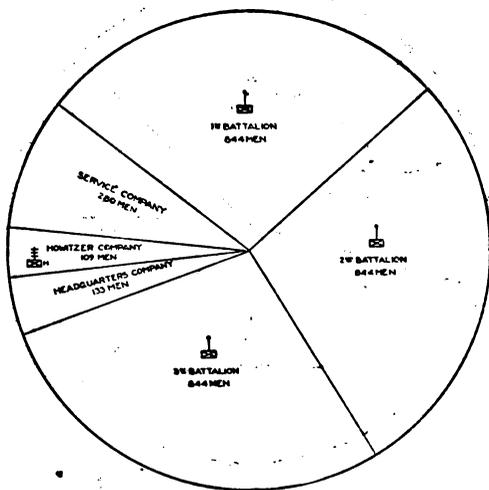
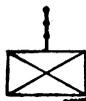


Fig. 4.—Infantry regiment.



Two Infantry regiments plus a brigade headquarters company constitute an Infantry brigade of about 6,000 men commanded by a

brigadier general. (See Fig. 5. The symbol  will be noted and will always mean an Infantry brigade.

Two Infantry brigades plus the Artillery brigade and certain auxiliary organizations constitute one Infantry division of about 20,000 men commanded by a major general. (See Fig. 6. The

symbol  will be noted and will always mean an Infantry division. A flag with one star is the flag of a brigadier general. A flag with two stars is the flag of a major general.)

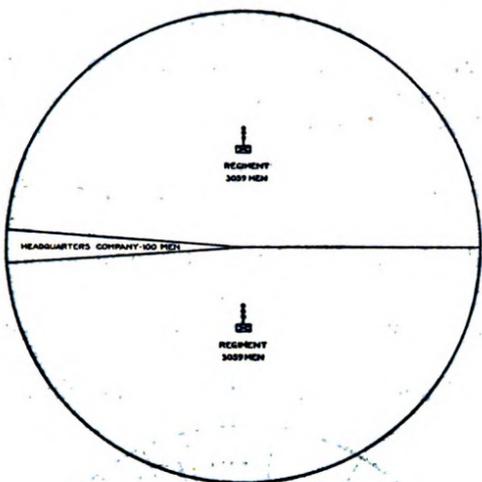


Fig. 5.—Infantry brigade. 

The auxiliary troops that, in addition to the Infantry and Artillery, make up the whole division of about 20,000 men are: Engineers, Air Service, Medical, special troops, and trains. These will be mentioned later.

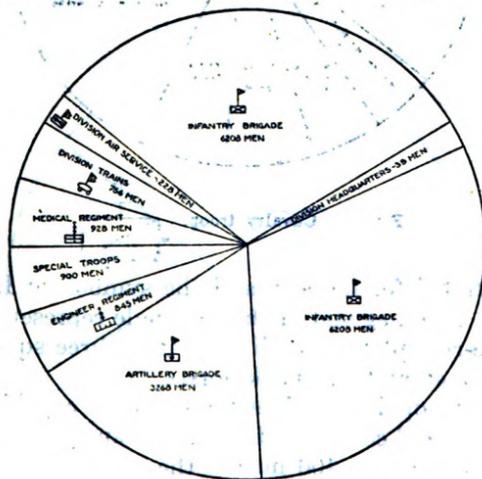
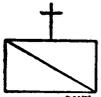


Fig. 6.—Infantry division. 

CAVALRY.

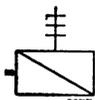
In the Cavalry the smallest unit is the rifle squad, consisting of seven troopers commanded by a corporal. Three squads make a rifle platoon of 28 men, commanded by a lieutenant. The symbol



denotes a Cavalry rifle platoon. Three rifle platoons and

one machine-rifle platoon constitute a troop of about 130 men com-

manded by a captain. (See Fig. 7. The symbol



will be noted and will always mean a troop of Cavalry. The difference

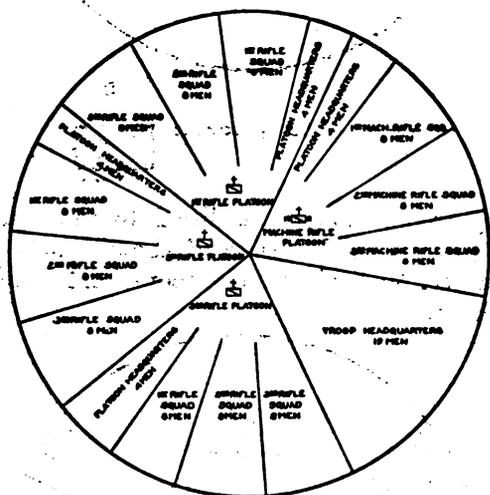


Fig. 7.—Cavalry troop.

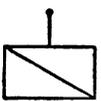


between the symbol for Cavalry and the symbol for Infantry troops will be noted. The diagonal in the rectangle represents a saber.)

The machine-rifle platoon is divided into three squads, each consisting of eight men and two pack horses.

The Cavalry troop is a self-sustaining unit capable of replacing its losses in battle and corresponds to the Infantry rifle company.

The squadron of about 400 men is the next higher unit and consists of three troops plus a squadron headquarters and headquarters detachment commanded by a major. (See Fig. 8. The symbol



will be noted and will always mean a squadron of Cavalry.)

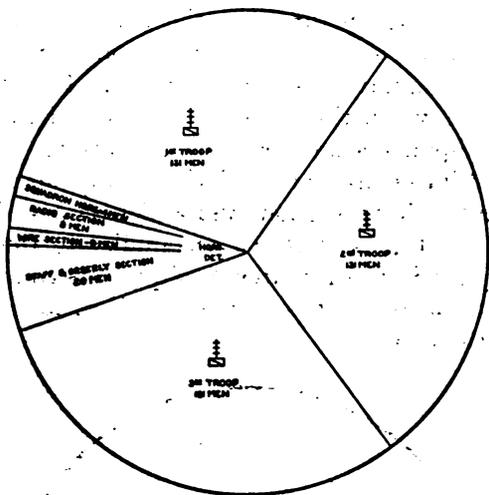


Fig. 8.—Cavalry squadron.

Two squadrons plus a headquarters troop and service troop equal one regiment of about 1,100 men commanded by a colonel. (See

Fig. 9. The symbol will be noted and will always mean a regiment of Cavalry.)

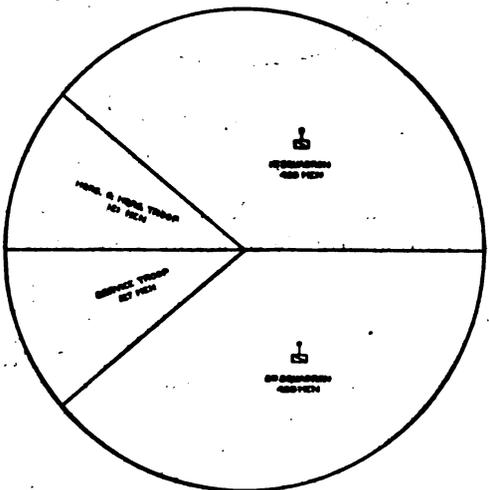


Fig. 9.—Cavalry regiment.

The headquarters troop furnishes the communications personnel for the regiment and has other smaller sections for particular duties at regimental headquarters during combat. Fig. 20 shows the various parts into which this troop is divided. These sections are: Regimental headquarters and troop headquarters; a staff platoon, which is divided into a staff and orderly section; an intelligence section; a plans and training section; and a pioneer and demolition section. The duties of these sections are similar to the duties of the corresponding units in the Infantry headquarters company.

The service troop is the troop that furnishes food, supplies, and equipment for the regiment.

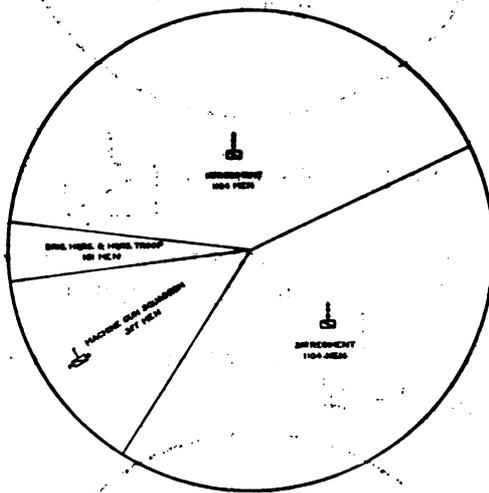


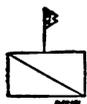
Fig. 10.—Cavalry brigade.



Two regiments plus a brigade headquarters troop and machine-gun squadron equal one brigade of about 2,800 men commanded by a brigadier general. (See Fig. 10. The symbol  will be noted and will always mean a brigade of Cavalry.)

The machine-gun squadron, of about 400 men, is divided into three troops of about 100 men each. Each troop is further divided into three platoons of about 30 men and each platoon into two squads of 8 men and five pack horses.

Two Cavalry brigades plus one separate battalion of horse artillery and certain auxiliary organizations constitute a Cavalry division of about 7,500 men commanded by a major general. The auxiliary troops that, in addition to the Cavalry make up the whole division of about 7,500 men, are: Engineers, Medical, special troops, and trains. These will be mentioned later. (See Fig. 11. The symbol



will be noted and will always mean a division of Cavalry.)

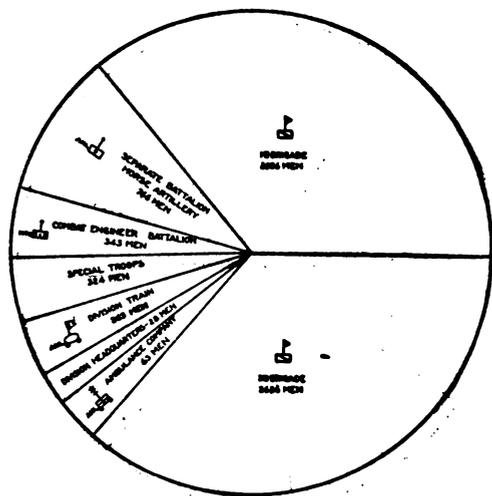
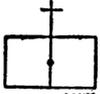


Fig. 11.—Cavalry division.



FIELD ARTILLERY.

In the Field Artillery the smallest unit is the section which comprises from 15 to 21 men. Two sections form a platoon of about 35

men commanded by a lieutenant. The symbol  denotes a

Field Artillery platoon. Three platoons make up a battery of about 150 men commanded by a captain. (See Fig. 12. The symbol

 will be noted and will always mean an Artillery battery.

The difference between the symbol for Infantry, the symbol for Cavalry and the symbol for Artillery will be noted.)

The battery is a self-sustaining unit capable of replacing its losses in battle and corresponds to the Cavalry troop and Infantry rifle company.

The next larger unit is the battalion, which is composed of three batteries plus a headquarters battery, and is commanded by a

major. (See Fig. 13. The symbol  will be noted and will always mean an Artillery battalion.)

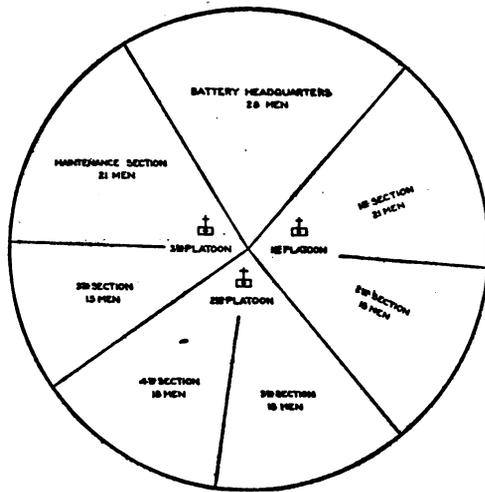
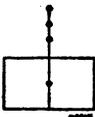


Fig. 13.—Field Artillery Battery.



The total number of men in an Artillery battalion is about 650 men as compared to about 850 men in an Infantry battalion and about 400 men in the corresponding cavalry unit (squadron).

The Artillery regiment of about 1,600 men is made up of two battalions plus a Headquarters battery and service battery. (See

Fig. 14. The symbol  will be noted and will always mean an Artillery regiment.)

The service battery is the battery that furnishes food, supplies, and equipment for the regiment.

The headquarters battery furnishes the communications personnel for the regiment and has other personnel to perform particular

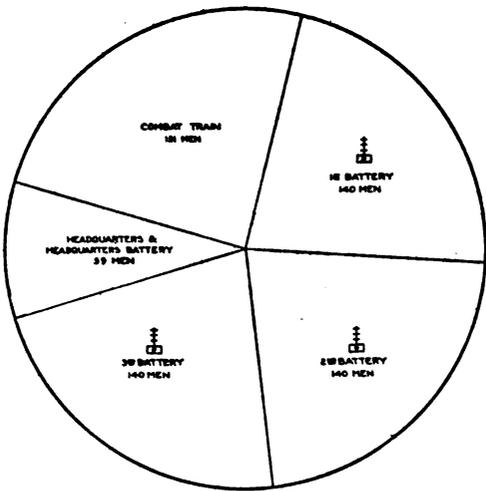
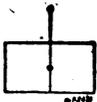


Fig. 13.—Field Artillery battalion. 

duties at regimental headquarters. This battery is not divided up into various platoons as is done in the corresponding unit in the infantry and cavalry.

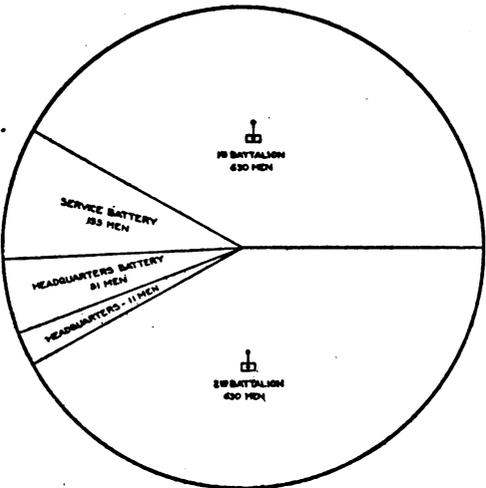
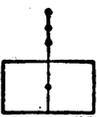
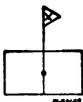


Fig. 14.—Field Artillery regiment. 

Two regiments plus a headquarters battery comprise a brigade of 3,400 men commanded by a brigadier general. (See Fig. 15. The

symbol  will be noted and will always mean a brigade of Artillery.)

The Field Artillery brigade is the largest artillery unit in an Infantry division. Its use is to help the basic arm (the Infantry), and occasionally it may be called upon to support other arms of the service, like the Engineers when they are building bridges or when used as Infantry troops, or as part of a Cavalry division.

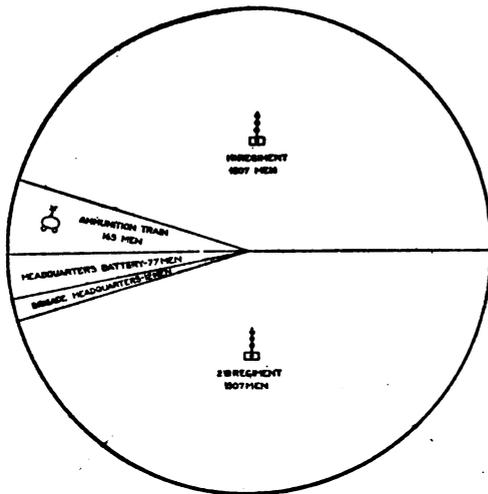
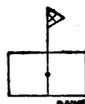


Fig. 15.—Field Artillery brigade.



SPECIAL TROOPS.

There are troops called special troops in the Infantry division to carry out particular duties, necessary to make the division as a whole function more smoothly. (See Fig. 16. The symbols that designate the various companies will be noted. These special troops contain about 900 men and are divided into one headquarters company of 213 men, which does the administrative work and furnishes messengers for division headquarters; one signal company of 156 men, who furnish communications from division to brigades and such other units as require it; one light-tank company of 151 men, which is equipped with 25 light tanks and is used by the commanding

general of the division whenever necessary to assist the Infantry's advance in the attack; one military police company of 155 men to regulate traffic and maintain discipline; one ordnance company of 112 men, to repair any ordnance equipment within the division; one service company of 102 men, to be used for general Quartermaster Corps duties, such as unloading and loading supplies.

There are also troops in a Cavalry division called special troops. These special troops contain about 300 men and are divided into one headquarters troop of 161 men to do the clerical work and furnish messengers for division headquarters; one signal troop of 78 men, which furnishes communication from division to the brigade and

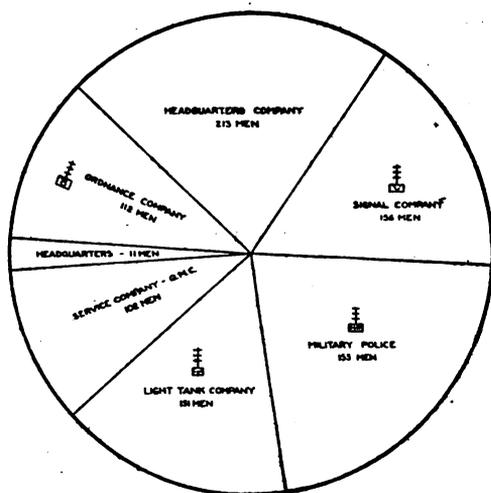


Fig. 16—Special troops Infantry division.

looks after the signal supplies of the division; one ordnance company of 36 men to repair any ordnance equipment within the division; one veterinary company of 38 men to care for the horses.

TRAINS.

Another very important part of any division is the trains.

Each headquarters, each regiment, and each unit not part of a regiment has assigned to it a field train.

A field train is one which is employed to transport baggage, rations, and forage.

Each battalion and each unit not part of a battalion has either assigned or attached to it a combat train.

A combat train is one carrying reserve ammunition and special equipment required during combat, and in addition it includes roll-

ing kitchens, water carts, and those vehicles required for the technical service of Engineers, Signals and Medical troops. Combat trains usually follow the units to which they pertain into action.

In addition to the field and combat trains as shown above, the Artillery brigade has an ammunition train and the division has a division train. The ammunition train is used to transport reserve artillery ammunition for the Artillery brigade. The division train is used to transport reserve rations, grains, infantry ammunition, gasoline, and oil; the division train of an Infantry division includes motor and wagon transportation, while that of Cavalry division includes pack and wagon transportation.

AUXILIARY TROOPS OF AN INFANTRY DIVISION.

The medical regiment of the division is divided into a hospital battalion, an ambulance battalion, a sanitary battalion, a veterinarian company, a medical supply section, and medical laboratory section. This fully equipped medical regiment takes care of the sick and wounded of the division.

The Air Service of the division might be called the eyes of the division. It can observe the movements of the enemy, locate dumps, carry messages between the various headquarters of the division, and in general help greatly in keeping all headquarters informed of enemy movements and to keep headquarters in touch with one another.

This Air-Service squadron of about 200 men in an Infantry division is composed of one observation squadron, one photograph section, and one branch intelligence office.

The combat Engineer regiment of about 900 men in an Infantry division is composed of two battalions of three companies each. The engineers are the bridge and road builders of the division.

COMMUNICATIONS.

One of the most important things within the division and probably the most difficult to maintain is the communication system. This communication system means the exchanging of messages and information between the various headquarters. Many different ways exist of enabling a headquarters to talk to or tell another headquarters something. A few of these means are telephone, telegraph, radio, runners, airplane, pyrotechnics, and visual (signal lamps and flags).

To coordinate these methods of communication between headquarters and keep them working efficiently during combat is a tremendous task and only skilled operators can do it.

At the headquarters of all units message centers are located to handle the distribution of incoming and outgoing messages. The message center will have at hand nearly all the means of sending messages, so that in case one method or system is not working another system can be used.

In order to establish this large network of the various means of communications within the Infantry of a division a certain platoon at each headquarters has been provided. This platoon, called the communications platoon, is one of the platoons of the headquarters company, troop, or battery and is in command of the communications officer, usually a first lieutenant. This platoon furnishes all the installers, operators, and maintenance men necessary to furnish communications to all neighboring units.

COMMUNICATIONS PLATOONS, INFANTRY.

There is a communications platoon in the Infantry battalion, regiment, and brigade. This platoon is composed of the following sections:

- Wire section.
- Radio and panel section.
- Messenger (courier and runner) section.
- Message center.
- Visual section.

Fig. 17 shows the relative sizes of the sections of the communications platoon of an Infantry regiment:

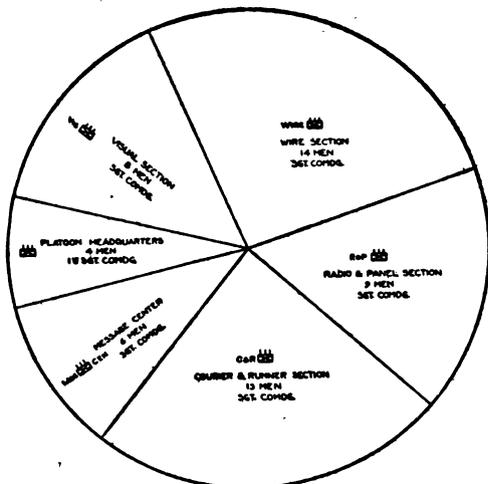
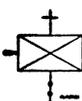


Fig. 17.—Communications platoon, Infantry regiment.



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The message center, in general, receives, forwards, or delivers all official communications passing through its own headquarters.

The messenger section supplies the messengers, so that messages can be delivered by the message center promptly. The radio and panel section operates the radio sets and also the panels by which messages are sent to airplanes. The visual section operates the signal lamps and signal flags.

The communications platoons of the Infantry battalion and Infantry brigade are similar, except the number of men in the various sections is different.

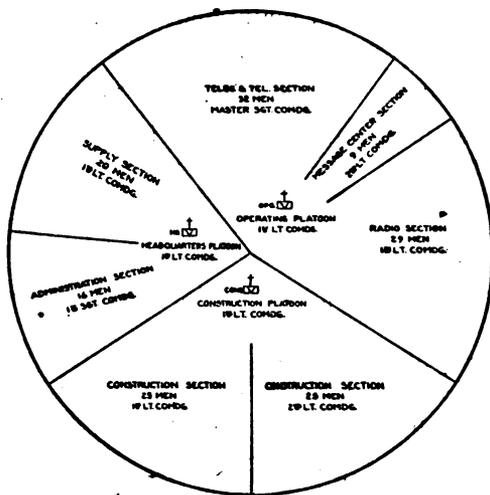
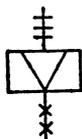


Fig. 18.—Division signal company.



These sections must work smoothly together to insure perfect communication. A headquarters without good communications is like a deaf and dumb man.

The Infantry division has at its headquarters a signal company, which establishes and maintains communications forward to the brigades and such other units as require it. This signal company is a company of the Signal Corps. (Fig. 18 shows the signal company of an Infantry division.)

Fig. 19 shows the headquarters company of an Infantry regiment. The five sections into which the communications platoon is divided are shown in Fig. 17. The duties of the platoons of this company are discussed under Figure 4.

These parts into which a communications platoon is divided, as given above, are the same throughout the Infantry, but differ slightly for the Cavalry. The Field Artillery has not divided its headquarters battery into platoons or communications sections, but possesses in this battery sufficient personnel to perform the necessary communications work.

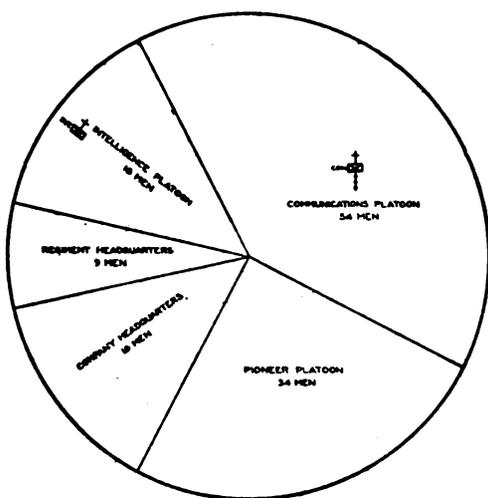
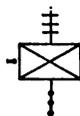


Fig. 19.—Headquarters company, Infantry regiment.



COMMUNICATIONS PLATOONS, CAVALRY.

There is a communications platoon in the Cavalry squadron, regiment, and brigade. This platoon is divided into three sections instead of five sections, as in the Infantry. These three sections are: A wire section, a message center section, and a radio section. Figure 20 shows the headquarters troop of a Cavalry regiment and its communications platoon. The duties of these communications sections are the same as the duties of the corresponding Infantry sections.

The communications platoons of the Cavalry squadron and Cavalry brigade are similar except that the number of men in the various sections is different.

The Cavalry division has at its headquarters a signal troop, which establishes and maintains communications forward to the brigades and such other units as require it. This signal troop is a unit of the Signal Corps. Fig. 21 shows the signal troop of a Cavalry division. The other sections of this troop are discussed under Fig. 9.

TELEPHONE SWITCHBOARD OPERATOR.



Fig. 20.—Headquarters and headquarters troop, Cavalry regiment.

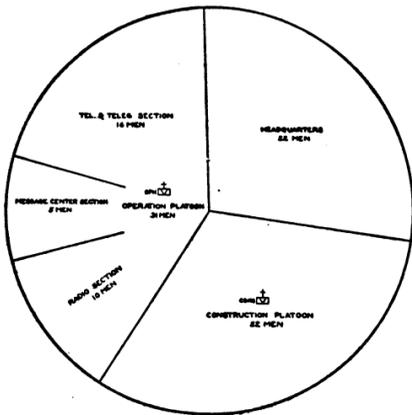


Fig. 21.—Signal troop, Cavalry division.



CONVENTIONAL SYMBOLS.

Often it is necessary for some officer to draw a map and mark on it the location of the various headquarters. Since there are so many different kinds of troops within a division, if it were necessary to write out the name of each unit the map, if small, would soon be

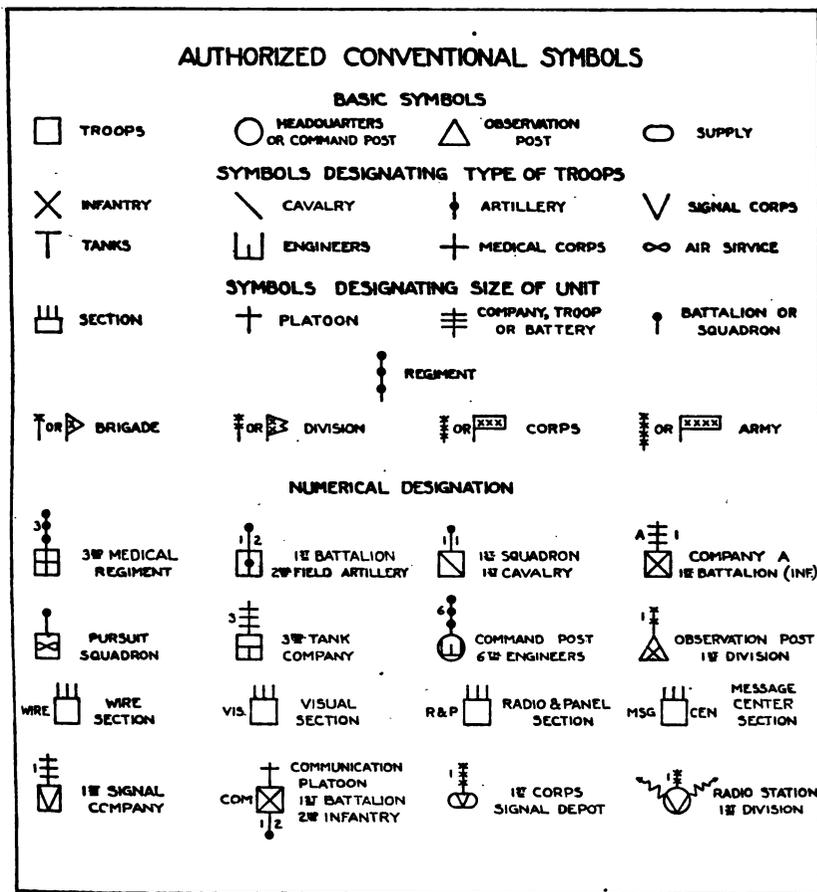


Fig. 22.—Authorized conventional symbols.

unreadable. Therefore, symbols have been adopted to be used instead of names. These symbols are called conventional signs and Fig. 22 shows the most important symbols.

COMMANDING OFFICERS.

In order for a large body of soldiers to be fed, clothed, trained, and directed in combat, they have leaders called *commanding officers*. Just as there are various sizes of units, so there are officers of different

TELEPHONE SWITCHBOARD OPERATOR.

rank who command these units. The rank of the several officers who command the various units is shown below:

| Unit. | Title. |
|-------------------------------|------------------------------|
| Platoon..... | Lieutenant. |
| Battery troop or company..... | Captain. |
| Battalion squadron..... | Lieutenant colonel or major. |
| Regiment..... | Colonel. |
| Brigade..... | Brigadier general. |
| Division..... | Major general. |

The officers commanding units from a battalion up have officers as assistants to help them. These officers make up what is called the *staff* of the organization commander, and are designated according to the duties they perform in the different units.

The division commander has a staff composed of a chief of staff, "C. of S.," who in smaller units is called the "executive officer," an assistant chief of staff for personnel, who is called in the case of a division "G - 1," an assistant chief of staff for intelligence, who is called "G - 2," an assistant chief of staff for operations and training who is called "G - 3," and an assistant chief of staff for supply who is called "G - 4." The executive officer is abbreviated and spoken of as "Ex."

The division is the only organization that has been discussed, but there are higher units, in which the division is only a smaller part. These higher units are the Army Corps and Armies. These units have headquarters, at which message centers and other agencies for transmitting messages are maintained, that function exactly like those within the division, but because of more message traffic have a larger personnel.

In Fig. 1 can be found all the various parts into which the United States Army is divided. The Infantry, Cavalry, Field Artillery, Air Service, Engineers, Signal, Medical, and Ordnance troops have been mentioned. Other branches are the Coast Artillery, which guards our coasts with long-range guns; the General Staff Corps, which carries out the policies directed by the War Department; The Adjutant General's Department, which carries out the administrative work of the Army; the Inspector General's Department, which has the task to discover errors and recommend improvements in the functioning of the Army; the Judge Advocate General's Department, which takes care of the problems in law that arise; the Quartermaster Corps, which furnishes food, clothing, and shelter to the Army; the Finance Department, which handles the finances of the Army; the Chemical Warfare Service, which takes care of all matters that pertain to poisonous gases, and the chaplain who takes care of all matters pertaining to religion.

TELEPHONE CENTRALS.

1. The most vital part of a telephone system is the telephone switchboard. Great care should be exercised in its location, operation, and maintenance. A switchboard is established at important junctions of wire lines and at each headquarters where two or more local telephones are installed.

2. A switchboard serves the following purposes:

- a. To afford local telephone subscribers a means of intercommunication and to afford these local telephone subscribers access to trunk lines leading from their own centrals to other centrals.
- b. To furnish a place from which lines and telephones can be tested and repair parties sent out.
- c. To afford a switching central at important junctions of wire lines.

3. The location for the telephone switchboard must be carefully chosen. It should be protected from shell fire and dampness and should be out of the way of traffic and noise as much as possible. Privacy is required to enable switchboard operators to concentrate their attention upon their work. As far as possible the switchboard should be centrally located with regard to its local subscribers.

4. The wire section is in charge of installing, operating, and maintaining the telephone system. The operating detail of the wire section is in charge of installing and operating the telephone switchboard and installing the telephones under the immediate direction of the chief operator.

5. In units below a division, the monocord switchboard is used on account of its simplicity, lightness, ruggedness, and the ease with which it can be installed. It may be hung on a tree, on a fence, a stake, or any place wherever it is necessary to install a switchboard and it is ready to operate immediately.

6. When monocord switchboards were first used in the field, they were used without any cable, terminal strip, or other devices. The line wires were simply brought in to the switchboard and attached directly to the terminals.

7. During the World War it was found that where lines entered in the above manner there was a jumble and mess of wires around the switchboard. Consequently anyone approaching or passing in that vicinity might stumble over the wires and often jerk them out of the switchboard terminals, thereby interrupting the service.

8. To correct the above conditions it was decided that it would be advisable to attach one end of a cable about 10 feet or more in length to the switchboard and the other end to a terminal strip; this cable and terminal strip to remain a part of, and always attached to, the switchboard. Therefore whenever a switchboard is installed the terminal strip with cable attached is put up near-by on a tree, board, fence, or other object and the line wires brought into another terminal strip located to the right of and about 14 inches away from the cable terminal strip, the circuits being jumpered across by means of short lengths of wire.

9. Where the switchboard is located in a building, room, or dugout, the terminal strip with the cable attached is installed in a protected location outside the building.

10. Where the switchboard is installed in the open, the cable terminal strip is installed at the point where the line circuits come together, so that no tangled jumble of lines interferes with movements of personnel around the headquarters and the switchboard. If the cable is not long enough to provide for this, the line circuits are cabled to the point where they separate. Line circuits will always be neatly arranged wherever there is traffic around them.

11. By using the method described above, the switchboard has no loose wires around it, there is less chance of interruption of service, and the installation becomes much neater in every way.

QUESTIONS:

(1) *What are the points to be taken into consideration when deciding on where a switchboard is to be placed? (Pars. 1, 2, 3, and 5.)*

(2) (a) *Under what circumstances should the monocord type of switchboard be used?*

(b) *What are its particular good points? (Par. 5.)*

(3) *Why is it worth while, especially in the field, to take the extra time and trouble to include a cable and terminal strip with the switchboard equipment? (Pars. 7 and 8.)*

(4) *What consideration should govern the choice of a location for the terminal strip? (Pars. 8, 9, and 10.)*

INSTALLATION AND OPERATION OF MONOCORD SWITCH-BOARDS.

1. Telephone intercommunication between Army units is frequently such that a temporary, quickly installed, and flexible type of small telephone central is essential. The switchboard which has been designed to meet this requirement is called the monocord switchboard. Monocord switchboards are made up to accommodate 4, 8, and 12 lines. They are small, light, and readily portable. Two of these switchboards may be installed at one central in such a way as to make one switchboard if it is necessary to accommodate more lines than can be handled by one board. Monocord switchboards are made up of units, there being a unit for each line. These units are easily removable, and if defective can be replaced by another unit without disturbing the rest of the switchboard. There are two types of monocord units, EE-2 and EE-2A, which are described below. A type EE-2 unit is shown in Fig. 23.

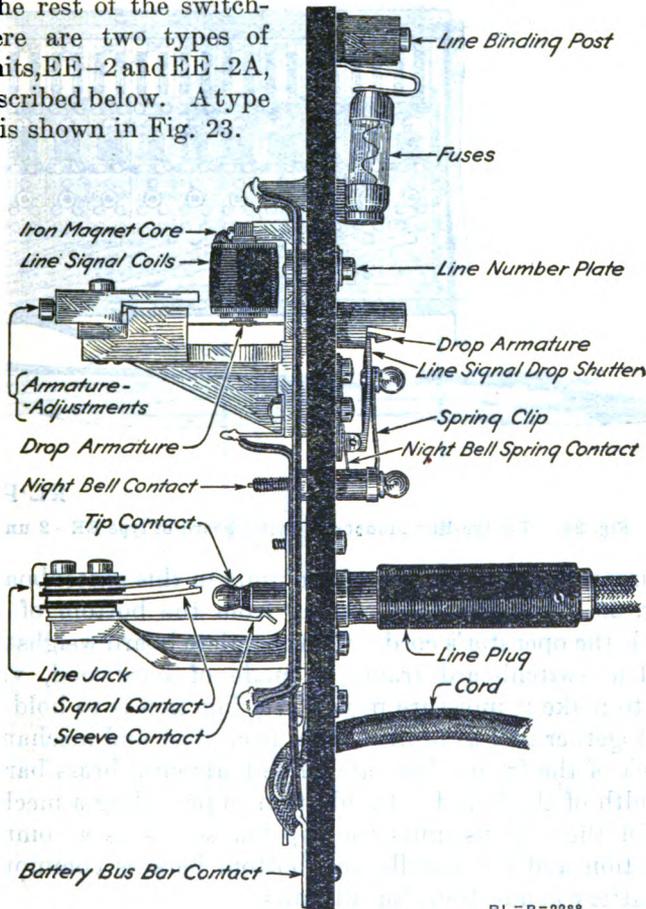
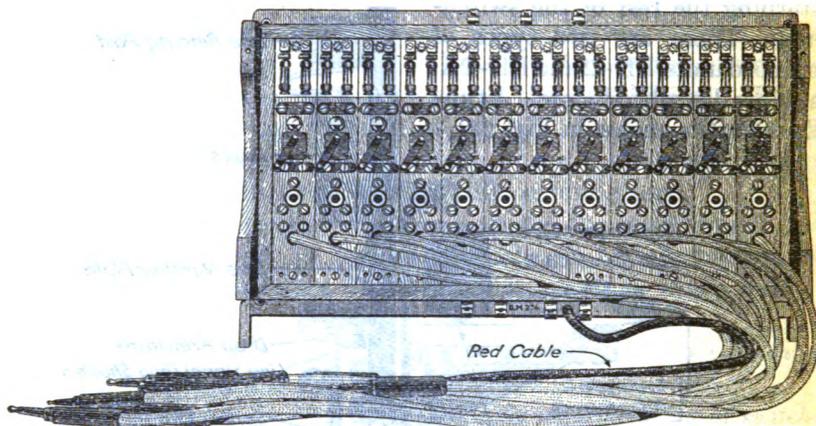


Fig. 23.—Monocord switchboard unit, type EE-2.

MONOCORD SWITCHBOARDS OF TYPE EE-2 UNITS.

2. The monocord switchboard is made up of unit panels, on each of which is mounted all the apparatus necessary for one telephone line. These panels are made of insulating material and are mounted in special wooden frames in groups of 4, 8, or 12 units, thus making a 4 or 12 line switchboard. Each unit is removable from the frame, thereby lending flexibility to the board and facilitating repair and replacement. Generally this type of board is used only for a small number of lines, as the operating facilities do not permit speedy connections. It is good practice to use only 3 lines on a 4-unit board and 11 lines on a 12-unit board in order to have a spare unit immediately available. A 12-unit board is shown in Fig. 24 and a 4-unit board in Fig. 25.



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Fig. 24.—Twelve-line monocord switchboard of type EE-2 units.

The circuit diagram for one of the units in this switchboard is shown in Fig. 26. The red cord coming from the bottom of the switchboard is the operator's cord. The complete board weighs $17\frac{1}{2}$ pounds.

3. The switchboard frame is made of hardwood, varnished in order to make it moisture proof. Its function is to hold the various units together and to protect them from dust and mechanical injury. In back of the frame there are three horizontal brass bars extending the width of the board. In addition to providing a mechanical support for the various units the top bar serves as a common ground connection and the middle and bottom bars as common night bell and battery connections for all units.

4. Carrying cases made of fiber and provided with hand straps are furnished with monocord switchboards to provide a convenient means of carrying them and to protect them from damage during transportation. These cases are so made that they will hold not only the frame with assembled units but also the switchboard cords. When transporting the monocord switchboard the cable with

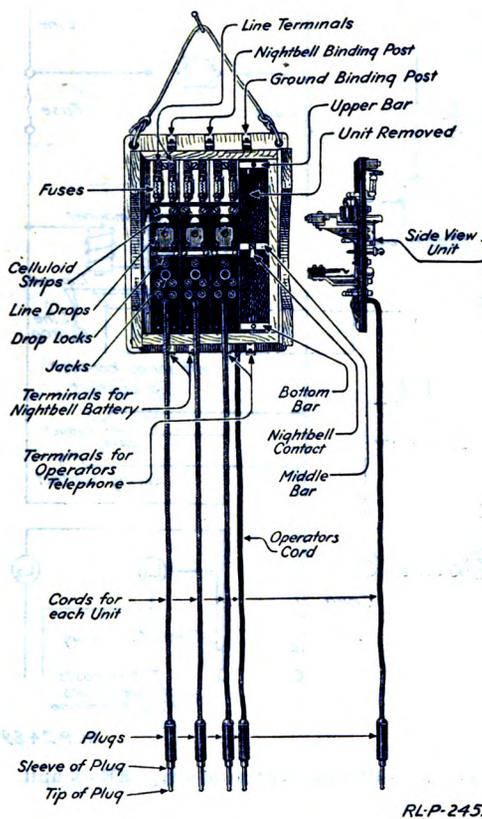


Fig. 25.—Four-line monocord switchboard of type EE - 2 units.

terminal strip attached is left fastened to the switchboard. It is wrapped around the outside of the fiber case and securely tied.

5. In installing a switchboard, it should be hung from a suitable support in a dry place. The bottom of the switchboard should be securely fastened so that the plugs can be easily removed without disturbing the position of the switchboard or shaking down the drops. The line wires should be run direct to the line terminal strip, jumpered to the cable terminal strip, and extended to the switchboard units through a cable.

TELEPHONE SWITCHBOARD OPERATOR.

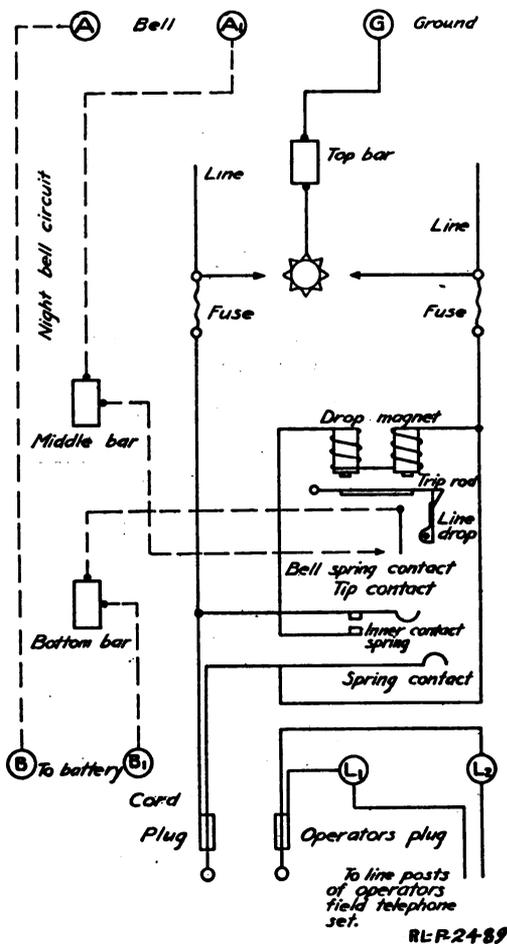


Fig. 26.—Circuit diagram of a type EE-2 unit.

INSTALLATION OF MONOCORD SWITCHBOARD, TYPE BD-9, OF TYPE EE-2 UNITS, WITH CAMP TELEPHONE AS OPERATOR'S SET.

6. Any material needed at the central, not a part of the monocord switchboard as described in this Information Topic, is called the operator's equipment. This material consists of any complete local battery telephone set, night bell with its battery and wire for connections.

7. The night bell is connected by independent wires to the upper clips marked A and A₁. A good ground should be made and connected to the upper clip marked G. The night-bell battery con-

sisting of two dry cells in series, is connected to the lower clips marked B and B₁. The line terminals L₁ and L₂ of the camp telephone are connected to the two lower clips marked L₁ and L₂ on the switchboard. The circuit diagram of the camp telephone is shown in Fig. 27.

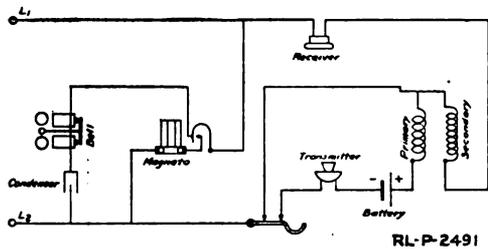


Fig. 27.—Circuit diagram of the camp-type telephone, type EE - 4.

The EE-5 telephone, commonly known as the Field Artillery telephone, may also be used as an operator's set for the monocord switchboard. The connections are the same as described above. The circuit diagram of this telephone is shown in Fig. 28.

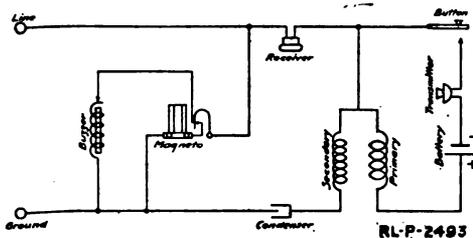


Fig. 28.—Circuit diagram of the Field Artillery telephone, type EE - 5.

8. If it is desired to use two or more monocord switchboards at one central, they may be connected so as to use only one night bell, one battery, one ground, and one operator's telephone for the whole installation. This is done by connecting the corresponding clips of each switchboard as shown in Fig. 29.

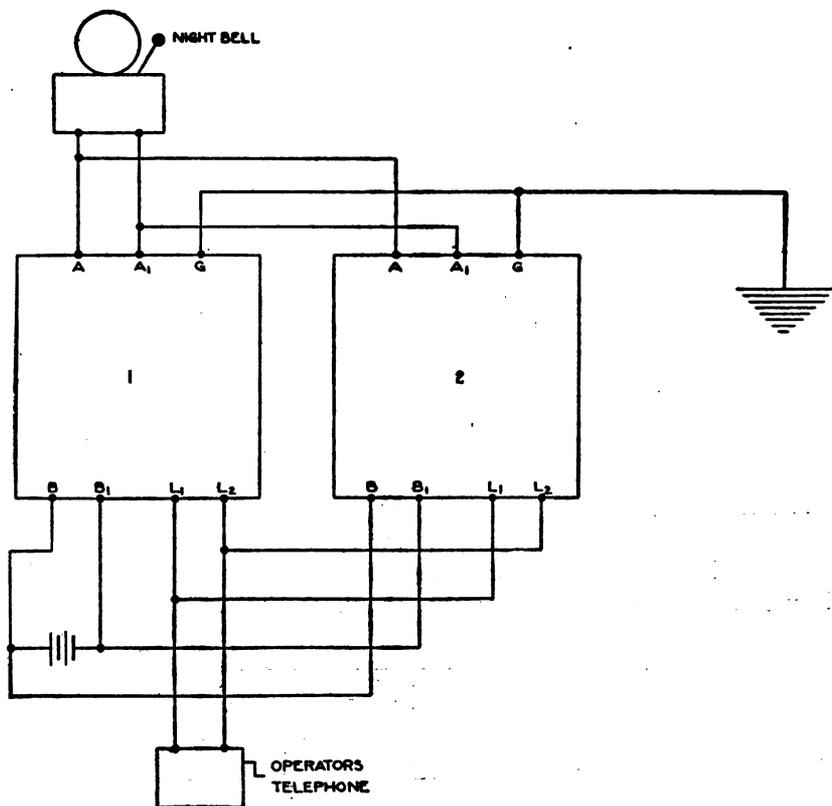


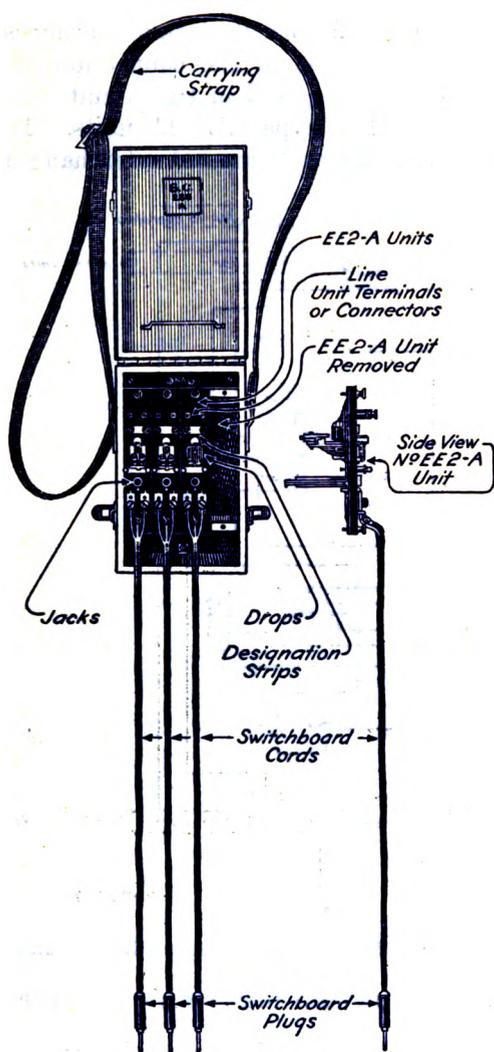
Fig. 29.—Diagram of the connections between two monocord switchboards of type EE-2 units installed as a single unit.

MONOCORD SWITCHBOARDS OF TYPE EE-2A UNITS.

9. In monocord switchboards of type EE-2A units each unit is mounted so as to be removable without the use of any tools. A hinge cover with a carrying strap has been added to the containing case so that it can be closed for transportation. No outside carrying case therefore is necessary. Only two horizontal brass bars are used, one at the top and one at the bottom. There is no operator's cord attached to this switchboard. There are no fuses, lightning arresters, or ground connections provided.

10. Monocord switchboards of type EE-2A units are made in the 4-line and 12-line sizes. The 4-line switchboard weighs 9 pounds and its dimensions are $10\frac{1}{2}$ by $5\frac{1}{2}$ by $6\frac{1}{2}$ inches. The 12-line switchboard weighs 22 pounds, and its dimensions are $17\frac{1}{2}$ by $10\frac{1}{2}$ by $5\frac{1}{2}$ inches. A 4-unit switchboard of type EE-2A units is shown in

Fig. 30. The circuit diagram for one of the units of this switchboard is shown in Fig. 31.



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Fig. 30.—Four-line monocord switchboard of type EE - 2A units.

11. The monocord switchboard unit of type EE - 2A is a development of the type EE - 2 unit. There are no fuses nor arresters in the new design. Stock clips are replaced by spring type binding posts. Knurled-head screws are used to fasten the units in place in the

switchboard, so that no tool is required to replace one unit with another. The cord terminals are on the front of the unit, so that it is not necessary to remove a unit from its board to replace a defective cord. The line drop signal with its locking spring is not changed, but changes have been made in the connection of the night-bell contact, in the jack and plug, and in the circuits. Fig. 30 shows a view of the switchboard of type EE-2A units. The type EE-2 units and the type EE-2A units are not interchangeable.

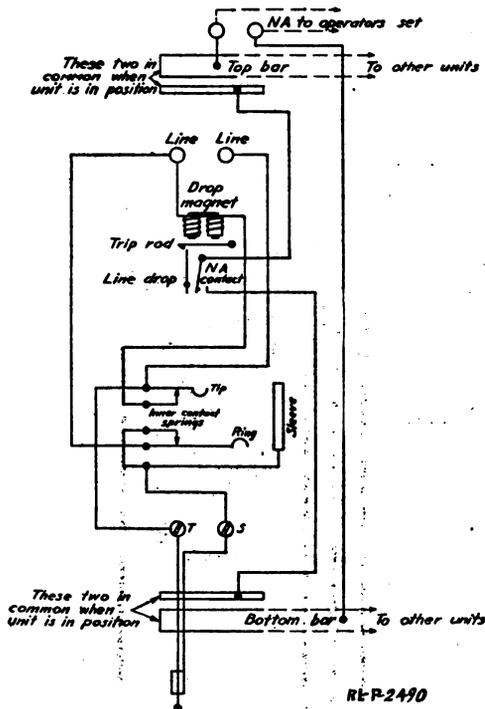
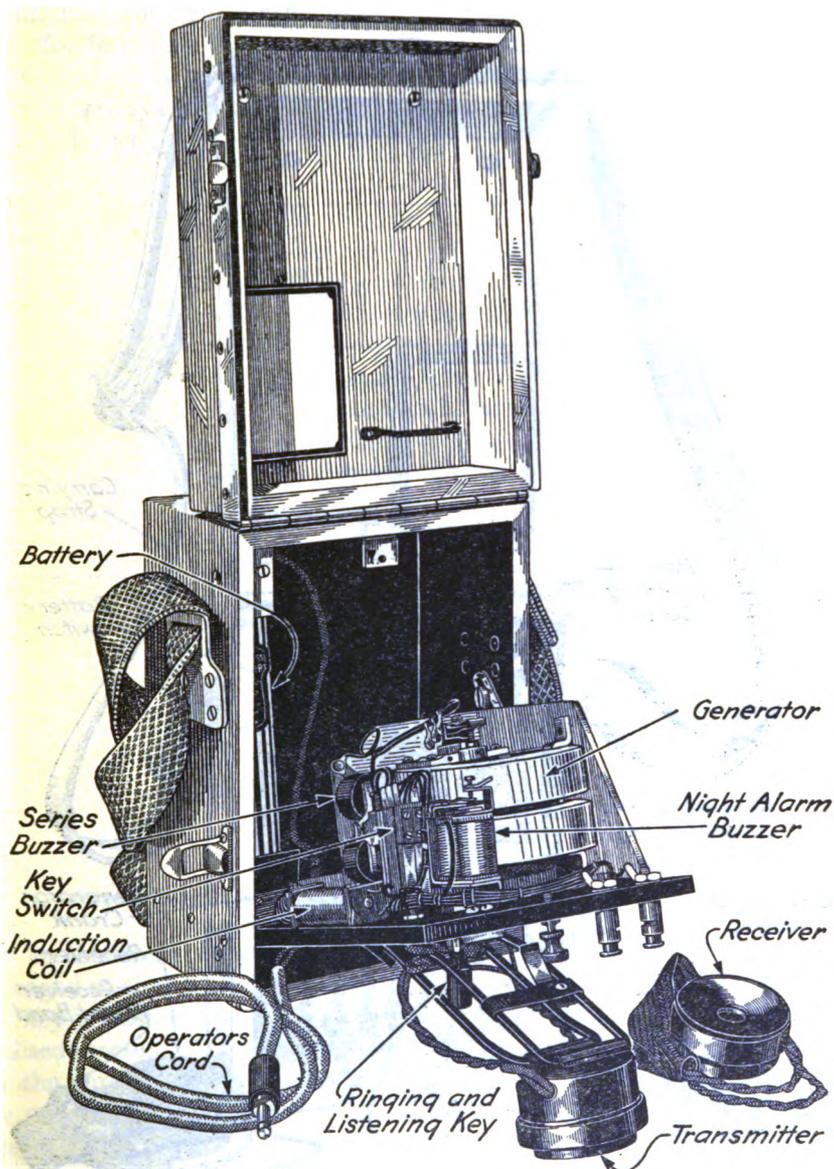


Fig. 31.—Circuit diagram of a type EE - AS unit.

MONOCORD-SWITCHBOARD OPERATOR'S SET, TYPE EE-64.

12. The monocord-switchboard operator's set contains all the auxiliary apparatus necessary at a telephone central employing a monocord switchboard. This apparatus is all mounted in one container which has a cover and a carrying strap. It consists of a telephone receiver, transmitter, induction coil, hand generator, series buzzer, night-alarm buzzer, two type BA-1 batteries, the necessary switches, and connecting cord and plug. The series buzzer is similar in action to a polarized bell. The night-alarm buzzer is a loud-sounding buzzer of approximately 4 ohms resistance. The set

weighs 15 pounds, and its dimensions are 6 by 7½ by 10 inches. Views of the set are shown in Figs. 32 and 33. The circuit diagram is shown in Fig. 34.



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Fig. 32.—View of the interior of a monocord-switchboard operator's set, type EE - 64.

13. In Fig. 32 the induction coil is in the foreground. Immediately behind the induction coil from left to right are the series buzzer, the key switches, and the night-alarm buzzer. The two-bar magneto-generator with its automatic contact mechanism lies to the

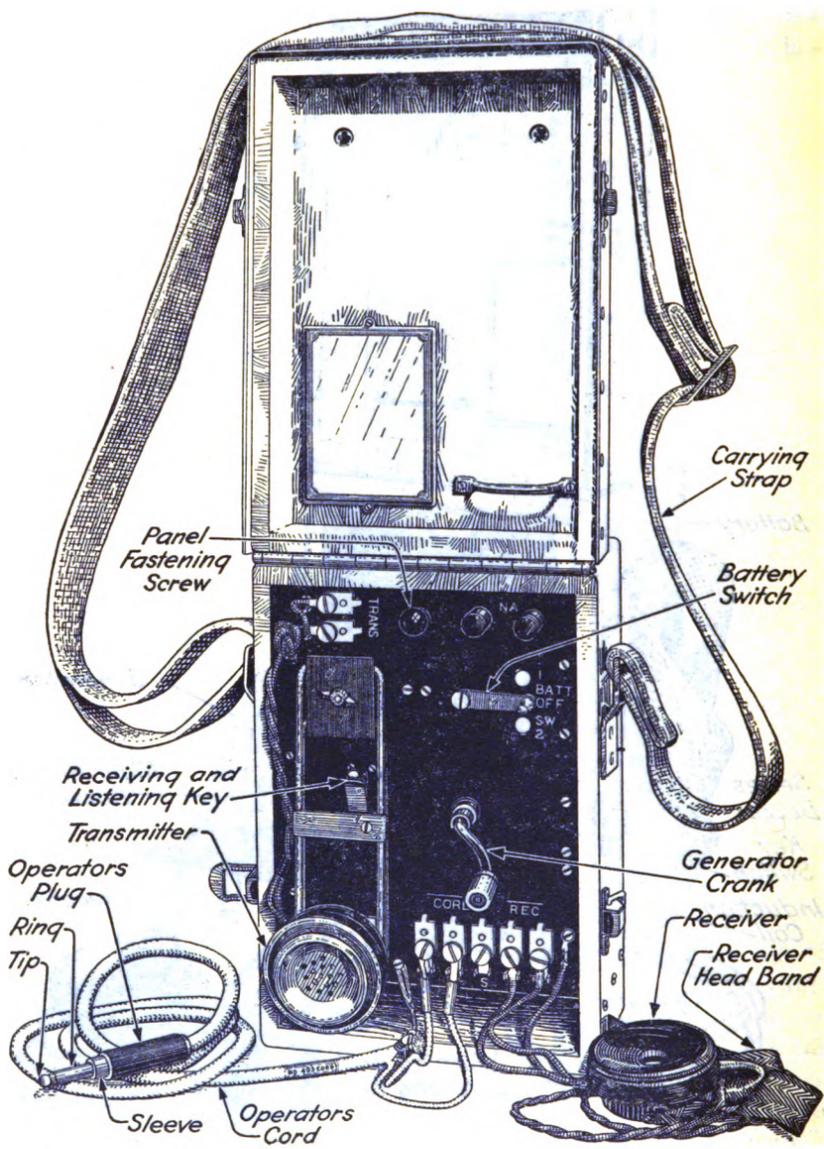


Fig. 33.—Front view of a monocord-switchboard operator's set, type EE - 64.

rear of the apparatus. The BA-1 batteries with their clips are not visible.

14. Fig. 33 shows the exterior of the set and Fig. 34 shows the circuit diagram of the set. The binding posts marked NA are the terminals of the night-alarm circuit. The knob to the left of these is a screw for fastening the panel in its closed position. The transmitter is mounted on a movable arm which is so arranged that the transmitter is always held in the correct vertical position for good operation. The ringing and listening key is just below the mounting of

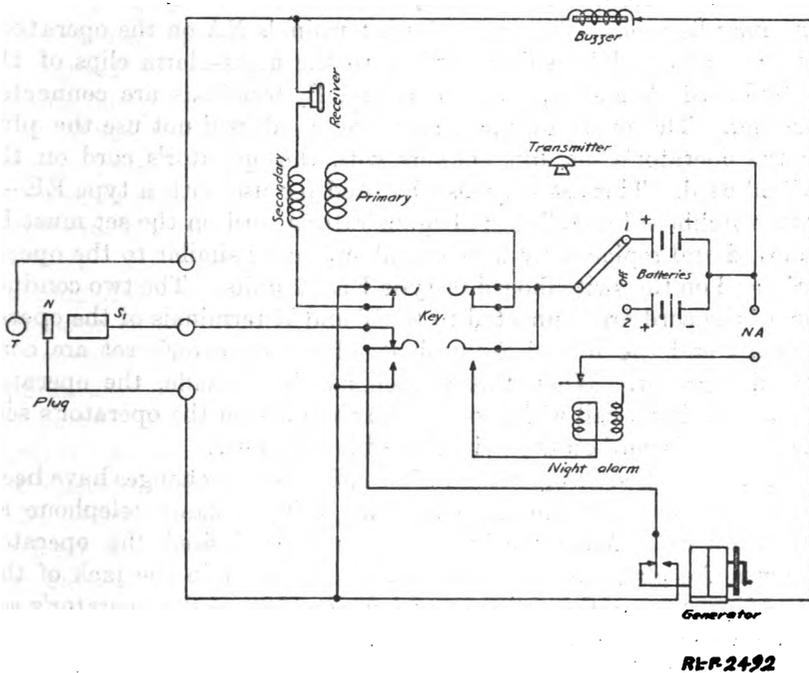


Fig. 34.—Circuit diagram of a monocord-switchboard operator's set, type EE-64.

the transmitter. A metal projection on the transmitter arm is arranged so that when the transmitter is put down for transportation, the key is pushed up. In this position of the key the battery circuit is disconnected. The binding posts at the bottom of the panel are for the cord, with its plug, and the receiver. The three to the left are marked T, R, and S and are the terminals of the tip, ring, and sleeve, respectively, of the cord and plug, which has three contacts. The watchcase receiver has a band to extend around the head, thus making it unnecessary to support the receiver with the hand while in use.

INSTALLATION AND OPERATION OF MONOCORD SWITCHBOARDS OF TYPE EE-2 UNITS, USING THE OPERATOR'S SET.

15. The general directions given in Par. 5 should be followed. The operator's sets are wired for use with the new unit, and a few changes must be made in the sets when they are to be used with the type EE-2 unit switchboard. The ring and sleeve terminals, R and S, at the bottom of the panel must be electrically connected by a short length of wire. The tip terminal T must be electrically connected to the line terminal L_1 of the switchboard, and the sleeve terminal S connected to the line terminal L_2 of the switchboard. Any flexible wire may be used. The night-alarm terminals NA on the operator's set are connected by suitable wires to the night-alarm clips of the switchboard, A and A_1 and the B and B_1 terminals are connected together. The operator upon receiving a call will not use the plug on the operator's set, but answers with the operator's cord on the switchboard. This set may also be used for use with a type EE-2 unit switchboard as follows: The operator's cord on the set must be removed and replaced by a two-conductor cord similar to the operator's cord on the switchboard of type EE-2 units. The two conductors of the cord are connected to the T and R terminals of the operator's set and the R and S terminals of the operator's set are connected together. When this change has been made, the operator upon receiving a call will answer with the plug on the operator's set; the operator's cord on the switchboard is not in use.

16. The method of operating, after either of the changes have been made, is practically the same as when using a camp telephone as operator's set. After receiving the number desired the operator removes the plug from the calling line, inserts it in the jack of the called line, throws the ringing and listening key of the operator's set to the lower nonlocking position, and rings with the hand generator of the operator's set. Having received an answer from the called party, connections are made by inserting the plug of the called line into the jack of the calling line. On ascertaining that the two parties are conversing the operator's plug may then be removed.

INSTALLATION AND OPERATION OF MONOCORD SWITCHBOARDS OF TYPE EE-2A UNITS, NOT USING THE OPERATOR'S SET.

17. The general directions given in Par. 5 should be followed. It is necessary to provide operator's equipment consisting of a small vibrating bell or buzzer, one or two standard dry cells, an additional cord and plug, and a complete magneto-telephone. The plug and cord may be taken from a unit not in use if there are no extra ones on hand. The bell and dry cells are connected in series

with the terminals on the switchboard marked NA. The terminals of the cord are connected to the terminals of the operator's telephone. The tip is connected to one terminal and the ring and sleeve to the other terminal. The method of operating is identical with that used with the type EE-2 unit switchboard.

**INSTALLATION AND OPERATION OF MONOCORD SWITCHBOARDS OF
TYPE EE-2A UNITS, USING THE OPERATOR'S SET.**

18. The general directions given in Par. 5 should be followed. The only necessary connection to be made is to connect by suitable wires each of the terminals of the operator's set marked NA to the corresponding terminals on the switchboard also marked NA. Proper outside line protection should be used when necessary.

19. When the calling party turns the crank of his magneto, the current passes through the line drop and the drop falls. The operator inserts the plug of his set in the jack of the calling line and ascertains the party desired. The key is in the normal (center) position. The operator, upon ascertaining the party desired, inserts the plug of the calling line into the jack of the called line and turns his generator crank. The series buzzer should sound. If it does not, the circuit is broken either on the line to the called party or in the apparatus of the central. If necessary, the operator may ring the calling party. To do this, he throws the key to the lower position and turns his generator crank. When connections have been established, the operator removes his plug.

20. When it is desired to use the night alarm, the key of the operator's set is thrown to the upper position. This breaks the circuit of the battery through the telephone transmitter and connects the battery to the top and lower brass bars of the switchboard through the night-alarm buzzer. The falling of any shutter on the switchboard closes the circuit from the top to the lower brass bar of the unit and the night-alarm buzzer sounds. When summoned by the night alarm, the operator must throw the key to the center position before answering the call.

CARE OF MONOCORD SWITCHBOARD OF TYPE EE-2 UNITS.

21. Care must be exercised when a board is installed to make sure that the frame is in a vertical and level position. When assembled at the factory, all adjustments are made with the board in a vertical position, and all operations conducive to satisfactory service depend on this prerequisite being observed.

22. The line signals of monocord switchboards are of the gravity type and require careful adjustment. Any adjustment further than that done at the factory should be made by an expert who is thoroughly familiar with this work. During transportation and installation of the board the line-drop shutters should be held closed by the flat spring provided.

23. The burning out of a fuse when excessive current comes in on a line is detected by an open circuit on that line. A bad fuse generally shows up plainly against the white background on the panel. However, if it is not possible to see whether or not the fuse is burned out, the line may be short circuited momentarily by means of a piece of bare copper wire placed across the two line terminals. The operator's plug is then inserted in the jack of the unit under test and the magneto crank turned. If the fuse is burned out, the crank will turn over easily; if not, it will turn hard, indicating that the open circuit is elsewhere on the line. A burned-out fuse should be replaced immediately in order to keep all lines working. Several spare fuses should be kept on hand at all times, but in case no fuse is available a strand of small copper wire may be connected between the upper and lower fuse clips. To remove a fuse, take the bottom metal cap of the fuse between the thumb and finger and push upward against the spring holder on the line terminal block, at the same time pulling outward. To install a fuse, hold it in the same manner and put the upper end of the fuse in the upper spring contact, forcing it upward until the bottom end will slip into place.

24. Care should be taken to keep the small air gap between the toothed lightning arrester and the line terminals clean. If this precaution is not taken, and the air gap is allowed to clog up with dust and dirt, it will introduce a leak to ground or between wires with resulting poor transmission.

25. All mounting screws and all wire connections should be kept tight. Whenever a unit is damaged, it should be replaced by another one, the damaged unit being sent for repair. To remove a unit from the frame, it is only necessary to disconnect the line terminals and remove the top and bottom screws which engage the brass bars behind the board.

26. In handling the switchboard cords they should be grasped by the plug, not by the cord. The connection of the wires to the tip and sleeve of a plug will break if subjected to undue strain or abuse, and by taking hold of the plug when inserting it and pulling it out, the likelihood of breaking the internal connections and wearing out the wires will be reduced to a minimum.

**CARE AND ADJUSTMENT OF MONOCORD SWITCHBOARDS OF TYPE EE-2A
UNITS AND OF MONOCORD-SWITCHBOARD OPERATOR'S SET.**

27. Many parts of the discussion of the care and adjustment of Type EE-2 units in Pars. 21 to 26 are applicable, and these paragraphs should be read in this connection. Care should be taken to see that the operator's sets are equipped with fresh batteries at all times. If the set is packed for any length of time, both batteries should be removed, as local action very often sets up in these cells. This is liable to corrode the terminals and possibly other parts of the instrument.

28. Periodical tests should be made to ascertain if the operator's set is in proper working order. If it is found that the conversation cuts off from time to time, it may be due to a broken operator's cord, which can be tested by means of short circuiting the end of the plug, listening in the receiver, shaking the cord, and if it is a swinging "open" a grating noise will be heard. The receiver cord may be tested by disconnecting the cord and receiver from the set and connecting the cord terminals to a cell and shaking the cord throughout its length. If the receiver cord is partially broken, there will be a grating noise in the receiver. If the receiver cord is entirely broken, there will be no click in the receiver when the connection of cord and battery is made or broken. The transmitter circuit may be tested by short circuiting the T and R cord terminals and tapping lightly on the transmitter. This will be distinctly heard in the receiver if the talking circuit and battery are in good condition. The night alarm may be tested by short-circuiting the binding post marked NA and throwing the switch to the upper or locking position. This should cause the buzzer to operate. The generator circuit may be tested by short circuiting the R and S cord terminals, leaving the key in the center position. If the generator circuit is in proper condition, turning the generator crank should cause the series buzzer to respond, and it can also be heard in the receiver.

29. When packing the operator's set for storage or transfer, the batteries should be removed, the transmitter should be folded down against the front of the switchboard, the battery switch should be turned to the off position, the operator's cord and receiver should be stored in the lower compartment of the case, and the case closed and locked.

Questions.

(1) *What are the more important advantages of a monocord switchboard, type EE-2A over type EE-A? (Pars. 9 and 11.)*

(2) *What are the principal items included in the monocord-switchboard operator's set? (Par. 12.)*

- (3) *What special care should be taken of the drop shutters both when installing the board and when transporting it to a new position? (Pars. 21-22.)*
- (4) *How are the fuses tested? (Par. 23.)*
- (5) *How is a bad fuse replaced? (Par. 23.)*
- (6) *What should be done if there are no spare fuses available? (Par. 23.)*
- (7) *Why is it important to keep the air gap between the lightning arrester and the terminals clean? (Par. 24.)*
- (8) *What should be done in case one unit only is damaged? (Par. 25.)*
- (9) *What special care should be taken in handling the switchboard cords? Why? (Par. 26.)*
- (10) *How is the operator's set tested to see if it is in good working order? (Par. 28.)*
- (11) *Just how should the operator's set be packed for storage or transportation? (Par. 29.)*
- (12) *If a number of switchboards and operator's sets were being issued for field work, just what points should be specially examined and in what order?*

TELEPHONE NETS.

1. One telephone central alone would simply give service between local subscribers; that is, officers around the same headquarters. Therefore a telephone central is merely one part of a whole telephone system. At each headquarters there is a central with trunk lines connecting to other centrals, and local lines extending to various officers at that headquarters. This enables any local subscriber to call any other subscriber in the telephone net. Fig. 35 illustrates what an Infantry brigade telephone net might be during a battle. The circles indicate centrals and the dots indicate local telephones. Trunk lines are the lines between centrals, and local lines are the lines from a central to local telephones.

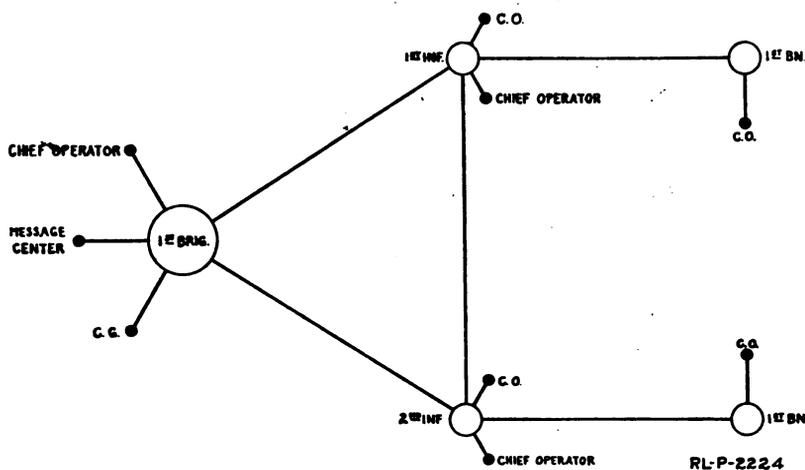


Fig. 35.—Diagram of an Infantry brigade telephone net.

2. The operating section installs the switchboard at a central and also installs such local telephones as are necessary at that headquarters. Monocord switchboards are used at all centrals below division headquarters; at a brigade headquarters a 12-line monocord switchboard is usually installed; at a regimental headquarters a 12-line monocord switchboard is also usually used; at a battalion headquarters a 4-line monocord switchboard is used. All units must have additional switchboards to use when advancing in order that the continuity of telephone service can be maintained. The installation of a monocord switchboard is prescribed under Unit Operations.

3. The chief operator's telephone is for the use of the switchboard chief operator, or any other member of the communication personnel;

it is used as an information and service telephone so that the operator's telephone or operator's set will not have to be used for service matters. The chief lineman will also use this telephone when issuing orders or instructions to his linemen. This telephone should be located far enough from the switchboard so that in giving orders to and directing linemen the use of this telephone does not interfere with the switchboard operator.

4. The installation of local telephones consists of running a properly protected line from the central to wherever the subscriber is located and attaching a telephone to the end of the line.

5. *a.* The priority in which telephones are installed at a command post varies with the situation and with the orders of the commander. The message center is the first office connected by telephone. Other telephones are installed normally in the following order of priority:

- (1) The commander and his chief of staff or executive.
- (2) The signal officer.
- (3) The plans and training officer.
- (4) The intelligence officer.
- (5) The supply officer.
- (6) The adjutant.
- (7) A general utility telephone for the use of officers whose offices are not connected by telephone.
- (8) Other staff officers and activities as necessity requires.

b. In small commands, such as battalions, regiments, and brigades, one telephone may serve two or more staff officers.

c. At the rear echelons of units telephones are installed as necessity requires.

Questions.

(1) *What is the chief operator's telephone? Where is it located and by whom is it used? (Par. 3.)*

(2) *What is the order of priority for installing telephones at a command post? (Par. 5.)*

CODE NAMES AND TRAFFIC RULES.

1. In a telephone net there are a number of centrals as noted in Information Topic No. 5. These centrals are almost always located at or near a headquarters and are therefore known by the name of that headquarters. For example, the central at the First Brigade is known as the First Brigade central, etc.

2. It can be seen that there would be some rather long names, as for instance; First Battalion, First Infantry. Also there are local lines to subscribers at each station. Suppose a subscriber wanted the message center at the Second Battalion, Second Infantry; he would have to give all that long title to the operator. Therefore for simplicity, accuracy, and speed, a telephone code is usually used. This code is not for purposes of secrecy.

3. A telephone code has two parts, code names for organizations and code numbers for officers and offices at each headquarters. For example, suppose the code name for the First Brigade is Mobile, then the commanding officer of that brigade is Mobile-1, the brigade adjutant is Mobile-2, and so on, each officer being given a number which is added on to the code name of his organization when calling for him. These code names and numbers are used exclusively by both subscribers and operators when calling for other centrals or subscribers.

4. An example of a telephone code for a division is shown below.

Telephone code—First Division.

ORGANIZATIONS.

| Unit. | Code name. | Unit. | Code name. |
|-------------------------------|------------|------------------------------|------------|
| Headquarters, 1st Division. | Magic. | 1st Field Artillery Brigade— | |
| Special troops, 1st Division. | Magpie. | Continued. | |
| Headquarters Company, | | 1st Field Artillery..... | Metal. |
| 1st Division..... | Makepeace. | 1st Battalion..... | Meteor. |
| 1st Military Police Com- | | 2d Battalion..... | Middy. |
| pany..... | Mallet. | 2d Field Artillery..... | Minute. |
| 1st Ordnance Company. | Mandate. | 1st Battalion..... | Mirror. |
| Service Company, 1st | | 2d Battalion..... | Mitten. |
| Division..... | Maple. | 1st Brigade (Infantry)..... | Mobile. |
| 1st Signal Company.... | Market. | 1st Infantry..... | Modern. |
| 1st Tank Company.... | Mason. | 1st Battalion..... | Mogul. |
| Division Air Service, 1st | | 2d Battalion..... | Mohawk. |
| Division..... | Massive. | 3d Battalion..... | Molar. |
| 1st Engineers (combat).... | Master. | 2d Infantry..... | Moment. |
| 1st Battalion..... | Maxim. | 1st Battalion..... | Monarch. |
| 2d Battalion..... | Mecca. | 2d Battalion..... | Mortar. |
| 1st Medical Regiment..... | Medford. | 3d Battalion..... | Moses. |
| 1st Ambulance Batta- | | 2d Brigade (Infantry)..... | Motive. |
| lion..... | Melon. | 3d Infantry..... | Mountain. |
| 1st Hospital Battalion.. | Memphis. | 1st Battalion..... | Murmur. |
| 1st Sanitary Battalion.. | Mentor. | 2d Battalion..... | Muscle. |
| Division train, 1st Division. | Mercy. | 3d Battalion..... | Mustang. |
| 1st Field Artillery Brigade. | Mermaid. | 4th Infantry..... | Muster. |
| Ammunition train..... | Mess-Kit | 1st Battalion..... | Mutton. |
| | | 2d Battalion..... | Myron. |
| | | 3d Battalion..... | Myrtle. |

TELEPHONE SWITCHBOARD OPERATOR.

Telephone code—First Division—Continued.

OFFICERS AND OFFICES.

| Name. | Code No. | Name. | Code No. |
|--|----------|---|----------|
| Commanding officer..... | 1 | Chaplain..... | 19 |
| Adjutant (not G-1)..... | 2 | Postal officer..... | 20 |
| Chief of staff, C. of S., or executive officer..... | 3 | Quartermaster (not the supply officer) | 21 |
| G-1, administrative officer..... | 4 | Chief of artillery, or artillery officer. | 22 |
| G-2, intelligence officer..... | 5 | Contact officer..... | 23 |
| G-3, operations officer, or plans and training officer..... | 6 | Gas officer..... | 24 |
| G-4, supply officer..... | 7 | Liaison officer..... | 25 |
| Ordnance officer..... | 8 | Munitions officer..... | 26 |
| Inspector..... | 9 | Pigeon loft..... | 27 |
| Signal or communication officers.... | 10 | Provost marshal, commanding officer, special troops or headquarters commandant..... | 28 |
| Message center..... | 11 | Radio station..... | 28 |
| Machine-gun officer or machine-gun and howitzer officer..... | 12 | Reconnaissance officer..... | 30 |
| Aid-de-camp..... | 13 | Telegraph officer..... | 31 |
| Aviation officer..... | 14 | Telephone chief operator, "trouble" or "complaints" or "service phone"..... | 32 |
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5. The switchboard operator must be a specially trained man. His work requires his constant attention. Accuracy, speed, and courtesy are his chief requirements. His attention must not be taken from his work by unauthorized conversations.

6. The switchboard operator should not hold unnecessary conversations with subscribers. The operator's duty is to connect subscribers with the least possible delay. If he stops to hold a conversation with a subscriber, some other calling subscriber will be delayed. Any inquiries about the central or the telephone service should be referred to the chief operator and other inquiries to the message center. There are always a number of unwarranted complaints that will be made to the operator. He may even be reprimanded by some officer subscriber when he does not deserve it. In every case he should refrain from argument and unnecessary conversation. He should be courteous and give the subscriber the connection desired as quickly as possible. If he has been treated unfairly by any subscriber, he may report this to his next superior.

7. Normally the operator answers calls in the order that they come in and does not disturb a connection until the subscribers are finished with their conversation. There are cases, however, when this procedure can not be strictly followed. One case is when several drops fall at the same time; another is when an urgent call is placed for

a busy line. It is evident that some set rule must be followed. In the first instance given above, the priority goes to the higher unit calling. For example if three drops at a division central fall at the same time, one from corps, one from a subscriber at division, and one from one of the brigades, the operator answers the corps call first. The second instance in priority is when it is necessary to put through urgent calls for certain officers. Normally the officers allowed priority in a division are:

Commanding general.

Chief of staff.

Operations officer.

Likewise, the same priority exists for the corresponding officers of brigades and lower units.

8. In each case the operator will interrupt a call to put through an urgent call for one of the above officers only after he has notified that officer that the line wanted is busy and has received instructions to put the call through immediately. He will then interrupt the conversation by saying, "I must interrupt—priority call." The persons using that line will immediately hang up, and the operator will proceed with the connections for the priority call.

9. If one priority call is to interrupt another priority call, the operator will first ascertain if the second officer calling has authority to interrupt the first call. If so, he will interrupt in the same manner as before, adding after the words "priority call" the code designation of the officer calling, as "Table-1."

Questions.

- (1) *Why is a telephone code used in the field? (Par. 2.)*
- (2) *What is the system by which such a telephone code is constructed? (Pars. 3 and 4.)*
- (3) *What order of priority should the operator observe in answering calls? (Par. 7.)*
- (4) *When is an operator justified in beaking in and interrupting a telephone conversation? (Pars. 8 and 9.)*

TRAFFIC AND CIRCUIT DIAGRAMS.

1. It is necessary in order to install a telephone system in the field to have a line-route map and a circuit diagram; the line-route map simply shows the geographical location of the centrals, the number of circuits laid, and the route taken without giving the electrical connections. The circuit diagrams show the actual connections, the number of circuits, and the code names of the centrals; also the numerical designation of the circuits. An example of a circuit diagram shown in Fig. 36.

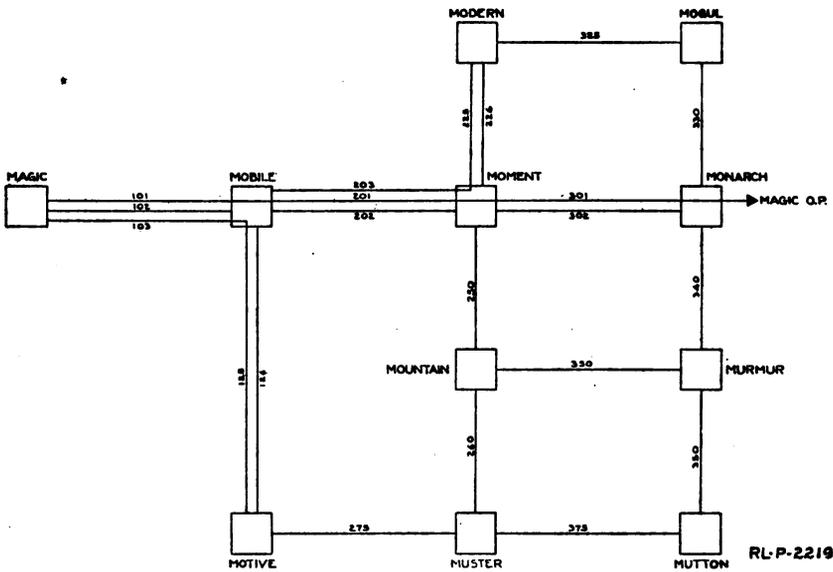


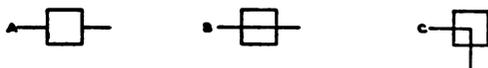
Fig. 36.—Circuit diagram of a division telephone net.

2. It can be seen by examining Fig. 36 that where a circuit goes into a switchboard it is shown like A in Fig. 37; where it simply goes through the line terminal strip and does not go into the switchboard it is shown like B or C in Fig. 37. Each circuit that comes to a terminal strip should be tagged with its number as given on the circuit diagram.

3. It is the duty of the operator to connect one subscriber to another when the first calls, in the shortest possible time and by using the least length of the axis. It is not always possible to get prompt service over the shortest circuit as this circuit may be busy, so it then becomes necessary to route the call over a different circuit or set of circuits. To assist the operator in handling a large volume

of business, he has before him a sheet showing the circuits over which the various centrals and organizations can be reached. This may show the circuits graphically, or it may be in the form of a tabulation, or it may be both. Such a sheet is called a traffic diagram.

4. The traffic diagram is made up from the circuit diagram for the convenience of the operator so that he can readily see how many circuits he has to other centrals and thereby route his calls by the



RL-P-2221

Fig. 37.—Conventional symbols for the circuits entering and passing through centrals.

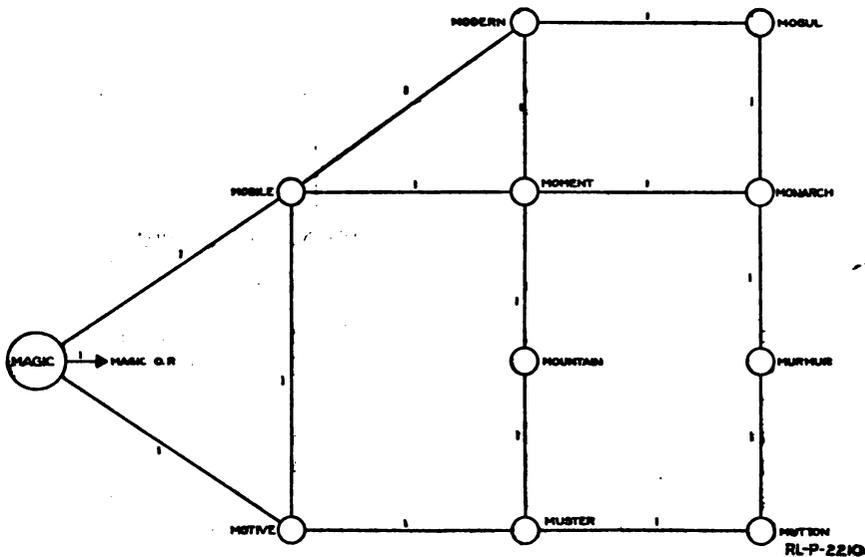


Fig. 38.—Traffic diagram of a division telephone net.

most direct route, or in case of circuits being busy or out of order, by alternate routes. The traffic diagram of the above circuit diagram is shown in Fig. 38. There is one mistake in Fig. 38; see if you can find it.

5. Refer for a moment to the traffic diagram shown in Fig. 39. Magic-11 calls Motive-11. The usual routing would be direct to Motive, but at the time this line is busy. The Magic operator then calls Mobile and says "Motive-11." The Mobile operator calls Motive on the lateral; and repeats "Motive-11." The Motive operator calls Motive-11, and when they have answered, says "Here's your party," and the connection is completed.

6. The method outlined above makes each operator responsible for the route to be followed only as far as the next central. Of course, he is responsible that the call goes through and that the circuit is held until the call is completed or a report is received that all lines are busy; but it does not put excessive routing plans on any one individual person.

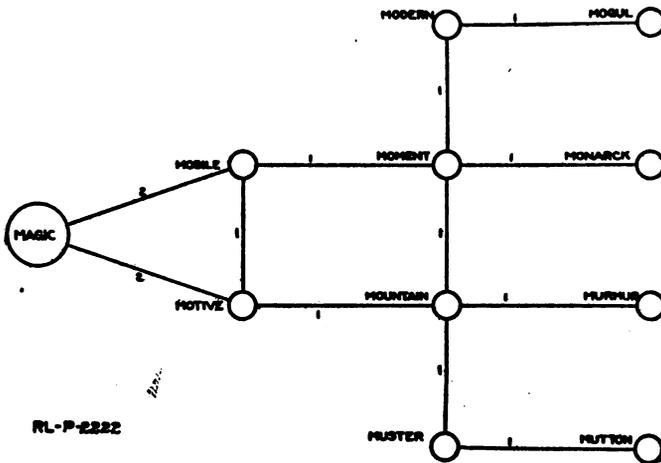


Fig. 39.—Traffic diagram of a division telephone net.

7. It is the duty of the operator to handle calls promptly, and the more satisfactory the service he renders the better operator he is.

Questions.

(1) *How will the circuit diagram be of assistance in installing a telephone system in the field? (Pars. 1 and 2.)*

(2) *Just how can the operator decide upon the best method of routing messages over a busy and congested system? (Pars. 3, 4, 5, and 6.)*

THE STATION LOG AND THE TEST AND TROUBLE RECORD.

1. At each telephone central a record is kept which is known as the station log. This record is kept by the switchboard operator under the supervision of the chief operator. The station log should cover the following points:

- a. Time station opened.
- b. Time station closed.
- c. Time of connecting or removing a circuit.
- d. Interruptions and how long circuits are out of order.
- e. Schedule of operators.
- f. Signature, with name of chief operator.

A sample blank form for a station log is shown below:

STATION LOG.

Station.....

| | |
|---|---|
| Opened: .....(Place.).....(Date.).....(Hour.) | Closed: .....(Place.).....(Date.).....(Hour.) |
| | |
| | |
| | |

Schedule of operators:

.....

.....

.....

| Circuit No. 1. | Time connected. | Time removed. | Interruptions of service. | | Nature of trouble. | Remarks. |
|----------------|-----------------|---------------|---------------------------|-------|--------------------|----------|
| | | | From— | To— | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

.....
Signature of chief operator.

2. In addition to operating, it will often be necessary for the operator to make tests on the lines from his switchboard; this is especially true at lower units. Each circuit should be tested every half hour or less, as orders require. The operator when he is in charge of testing, keeps the test and trouble record. The operator (for example, at "Magic") tests each circuit simply by ringing the next station; when the next station answers, the operator testing simply says, "Magic testing," and goes on to test the next circuit. If conversation is going on over a circuit at the time for a test, nat-

usually the circuit is all right, and the operator does not test it. The operator should never interrupt a conversation to make a test. In case of trouble, he notifies the chief operator, or if the chief operator is not present he notifies the man in charge of the linemen. When the trouble is cleared, it is reported to the operator who records time cleared, by whom, and the nature of the trouble. The operator does not enter anything on the test and trouble record unless there is trouble of some kind. A sample blank form for a test and trouble record is shown below:

TEST AND TROUBLE RECORD.

Station Date
Circuits tested every minutes.

| Circuit in trouble. | Time tested. | Test by | Time cleared. | Cleared by | Remarks (nature of trouble, etc.). |
|---------------------|--------------|---------|---------------|------------|------------------------------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

.....
Chief operator.

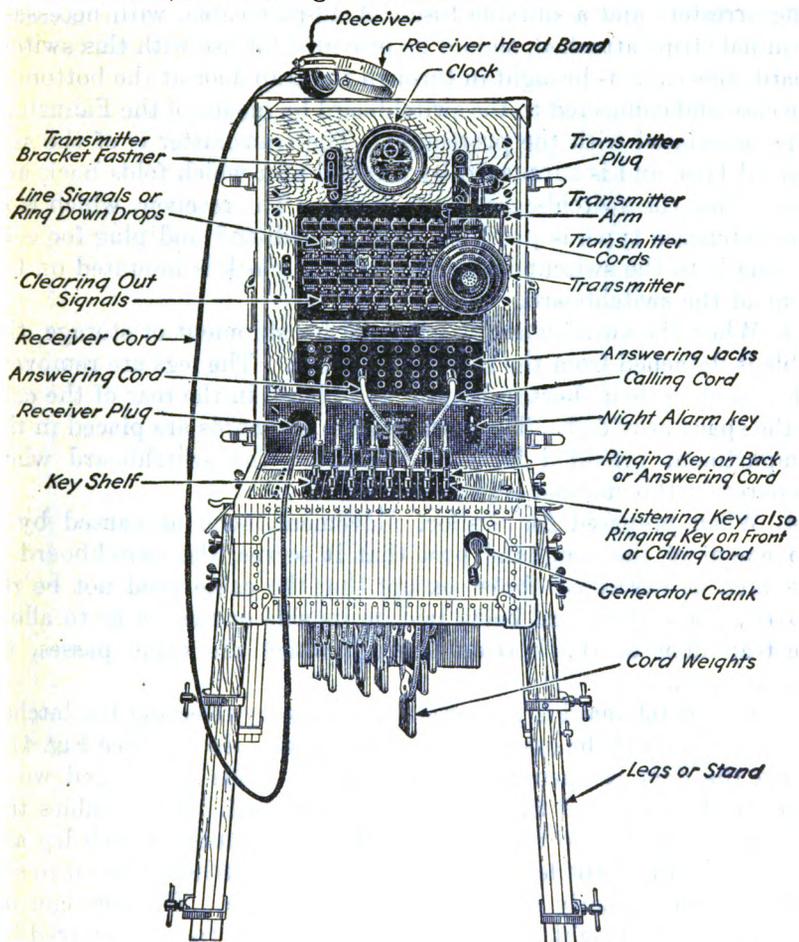
3. The troubles that occur on field lines are usually very simple. In active operations lines in forward areas are frequently broken by shell fire and traffic, which, of course, makes it necessary to keep up a constant testing and repairing of the circuits. This may be partially obviated by trying to avoid shelled areas and putting wires out of the way of traffic; special care should be taken at road crossings to either bury the circuits or put them overhead. Troubles may sometimes occur, especially in rainy weather, from faulty insulation of the wires. In that case it is best, if possible, where much trouble occurs, to lay new circuits of good wire.

Questions.

- (1) *What is the station log? What items should be entered therein? (Par. 1.)*
- (2) *When and by whom should circuits be tested? (Par. 2.)*
- (3) *What record should be kept of tests? (Par. 2.)*
- (4) *What should the operator do in case of trouble? (Par. 2.)*
- (5) *What precautions should be taken to avoid trouble? (Par. 3.)*

INSTALLATION AND OPERATION OF THE CAMP SWITCHBOARD.

1. The camp switchboard (Fig. 40) is intended for use at division headquarters or at other centrals where the monocord switchboard would not give satisfactory service on account of the number of lines, local and trunk, terminating at the switchboard.



RC-P-2437

Fig. 40.—A front view of the camp-type switchboard.

2. The case which contains the switchboard is of basswood, lined inside and out with fiber. All of the component parts of the switchboard proper are mounted upon an iron frame, which may be withdrawn from the case by removing four screws. When this switch-

board is set up for operation, it is supported by four legs which are telescopic and consequently adjustable. The cord weights and cords are allowed to hang through an opening in the bottom of the case, in the usual position of the cords of the ordinary commercial switchboard. The rear of the switchboard case is hinged, which when opened permits access to a very compact form of telephone line protectors. Each protector consists of two carbon block lightning arresters and a suitable fuse. A 40-pair cable, with necessary terminal strips attached, should be provided for use with this switchboard; this cable is brought in through the trap door at the bottom of the case and connected to the switchboard by means of the Fahnstock clips associated with the protectors. The transmitter is of the suspended type and is supported by a metal arm which folds back and locks when the switchboard is not in use. The receiver, which is of the watchcase type, is provided with a headband and plug for connecting it to the switchboard. A rim wind clock is mounted on the front of the switchboard.

3. When the switchboard is prepared for shipment or storage, the cable is detached from the rear of the board. The legs are removed, telescoped to their shortest length, and placed in the rear of the case in the space provided. The cord weights and cords are placed in the compartment provided for that purpose. The switchboard when prepared in this manner resembles a chest.

4. When prepared for a short movement, such as caused by a movement of the command post that it serves, the switchboard is prepared as described above, except that the cable need not be removed, the switchboard being laid on its side or rear so as to allow the trap door at the bottom, through which the cable passes, to remain open.

5. The switchboard is prepared for service by releasing the latches on the left side of the case and opening the rear door. (See Fig. 41.) When the door is opened, the hook which holds the hinged wood cover on the inside of the door must be released. This enables the four telescopic legs to be removed. The wing nuts on each leg are then released and the legs placed in position, care being taken to see that they fit properly into the slots in the case. The legs can be adjusted to any height desired. The front of the case is removed by releasing the four snap latches; this exposes the face of the switchboard and the key shelf. The trapdoor in the bottom of the case is then opened, and the cords and weights are pulled down so as to hang in a vertical position. A ground rod is driven into the ground and connected to the clip provided on the protector panel.

6. When attaching the cable to the switchboard, it should be brought up through the trapdoor at the bottom of the case and through the opening at the bottom of the protector panel to the Fahnestock clips associated with the protectors. The terminal strips attached to the end of the cable are mounted in a convenient position. The line terminal strips are then mounted about 14 inches to the right of the cable terminal strips. The line wires are connected to the line terminal strips and jumpered across with short wires to the cable terminal strips.

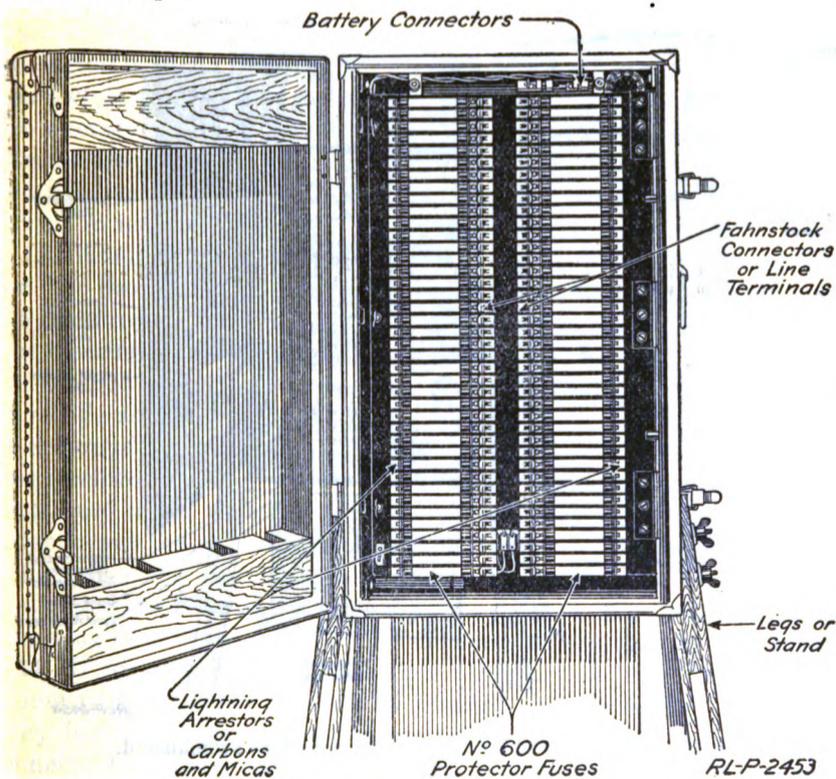


Fig. 41.—The protector panel of the camp-type switchboard.

7. To prepare the operator's set for service, the latch on the transmitter arm is released and the arm is pulled out; the transmitter is removed from the compartment in the front of the case, attached to the transmitter arm by means of the cords provided, and adjusted to the proper height. Next the plug on the end of the transmitter cord is inserted into its jack in the upper right-hand corner of the face of the switchboard. Likewise the plug on the end of the receiver cord is inserted into its jack in the lower left-hand corner of the face of the

switchboard. The handle is then placed on the generator. The operator's set should be tested by pushing a listening key forward, shorting one plug of the cord corresponding to the key pushed, and blowing in the transmitter.

8. If at any time it becomes necessary to make repairs to drops, jacks, or cords, access may be had to the interior of the switchboard by removing the three thumb nuts on the protector panel and swinging it open. (See Fig. 42.)

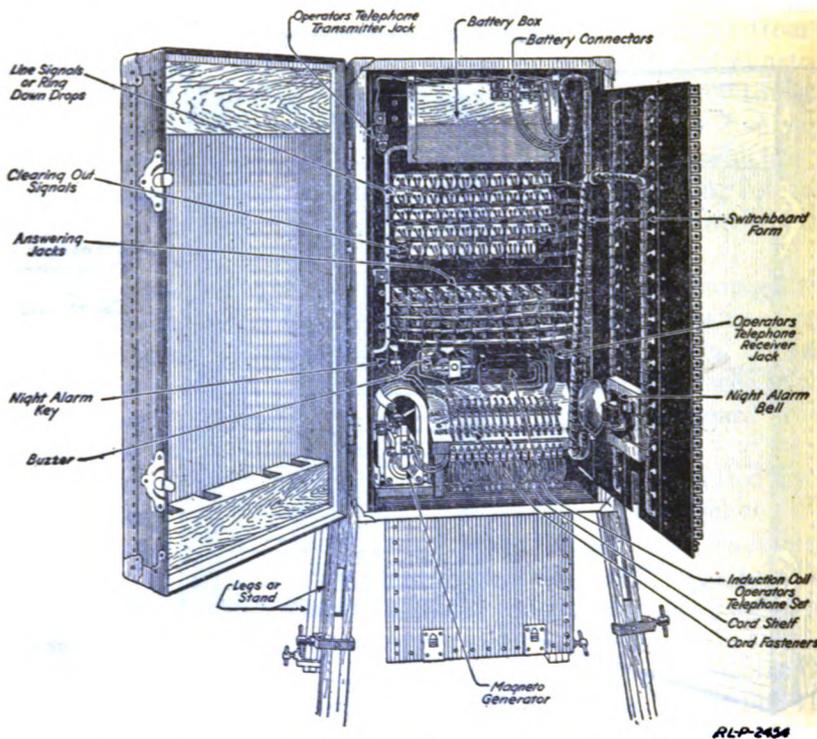


Fig. 42.—A rear view of the interior of a camp-type switchboard.

OPERATION OF THE CAMP SWITCHBOARD.

9. When a subscriber (the calling party) wishes to place a call, he turns the crank of his telephone. This energizes the drop magnet corresponding to the line terminals to which his station is connected, releases the shutter, which falls, attracting the attention of the operator.

10. To answer this call, the operator plugs into the jack corresponding to the drop which has fallen, using the rear plug of any pair of cords and at the same time restores the drop. He then operates

the listening key (front key is pushed away from him) corresponding to the cord used, which connects the operator's set to the cord and to the calling party. He ascertains the number desired from the calling party.

11. Having ascertained the number desired (the called party), the operator places the front plug of the same cord, which was used in answering, into the jack connected to the line of the called party, and throws the listening key into the ringing position (key is pulled toward him) and turns the generator crank. This rings the called party, at the same time disconnecting the calling party in order to prevent ringing back in his ear. If the call is more than one ring, the signal is made by operating the key the desired number of times, meanwhile turning the generator crank. The key when released by the operator springs back to its normal center position and the two parties are connected. The operator can then supervise the connection by merely pushing the listening key pertaining to the cord circuit in use, which bridges his set across that cord circuit.

12. When the plugs are placed in the line jacks of the two parties, the line-drop magnets are automatically cut out of the circuit, and the line drops will not fall even though one or both parties ring again. The clearing-out magnets, of which there is one for each pair of cords, are bridged across the cords. They are energized when either party rings off, allowing the clearing-out drop to fall, thus attracting the attention of the operator. The operator should, however, always challenge before breaking a connection, for the falling of the clearing-out drop may mean that one of the parties has rung his telephone in order to get the operator back on the line for some reason.

13. After the clearing-out drop has fallen and the operator has challenged twice without response, he breaks the connection by removing both plugs and allowing the cords to slip back in their holes.

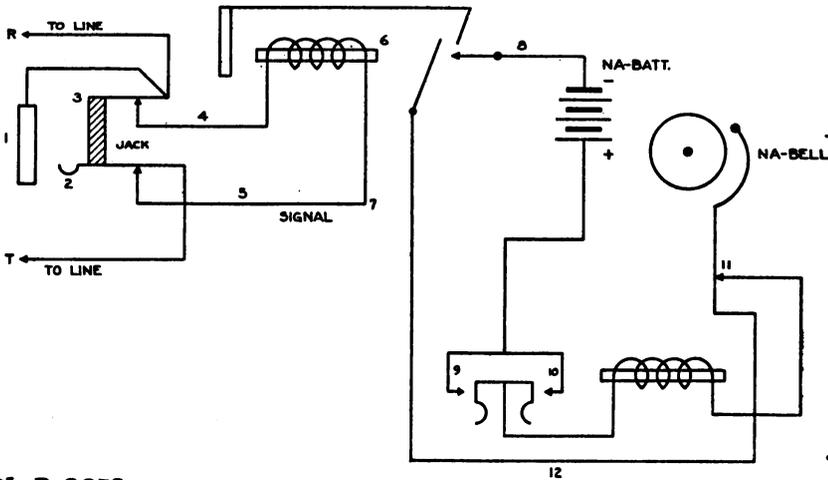
14. If for any reason it becomes necessary to ring back on the calling party, this can be done by pushing the ringing key (rear key) away from the operator and turning the generator crank. This disconnects the called party during the ringing and rings the calling party. This should only be done after the operator has ascertained that the calling party has left his telephone.

15. A night alarm is provided in this switchboard for use at night and during slack periods when it is not necessary for the operator to be constantly on duty in order to answer calls. It is connected in for use by means of the key lever located on the face of the board in the lower right-hand corner; when this is done any drop in falling makes the necessary connection and operates the alarm.

TELEPHONE SWITCHBOARD OPERATOR.

LINE AND NIGHT-ALARM CIRCUITS.

16. Fig. 43 shows the line circuit and the auxiliary night-alarm circuit. The line circuit is as follows: From the tip (T) side of the line, through jack springs 2 and 5, through terminal 7 of drop magnet, thence through winding of drop, through jack springs 4 and 3 to ring side of line (R). When the generator of the calling party is operated, the alternating current follows the path just described, causing the drop armature to rapidly move forward and backward and allows the drop to fall, thus attracting attention to this particular signal. The inner face of the signal displays a number corresponding to the associated jack. The drop in falling closes the night-alarm circuit at 8.



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Fig. 43.—The line and night-alarm circuits of a camp-type switchboard.

When the night-alarm key 9 is in the operated position, the local battery flows from the positive terminal, through the key springs 9, through magnet of bell 10, through contact 11, through the drop to the negative terminal of the battery, thus causing the bell to ring. Restoring the drop opens the circuit and silences the bell.

CIRCUIT WITH OPERATOR ANSWERING, KEY IN LISTENING POSITION.

17. Fig. 44 shows the circuit, when the operator is answering a call with the key in the listening position. The circuit is as follows: From tip T side of line, through jack springs 2, through tip of cord, through key spring A, through inside spring B, through spring C, through spring D, through contact spring E, to operator's receiver, through receiver to one side of secondary of induction coil, through coil to contact spring F, through spring G, through spring H, through spring

I, through spring L, to sleeve of jack 1, to ring side of line R. It will be noticed that the clearing-out signal is bridged across the answering cord at the springs B and I.

18. The operator's transmitter circuit (full detail is not shown) is from local battery to transmitter, to primary of coil, through primary winding, through spring J, through spring K, to battery. The springs J and K are operated by the rubber contact piece between springs E and J when the key is in the listening position, in order to prevent a waste of current from the local battery when the operator's set is not in use.

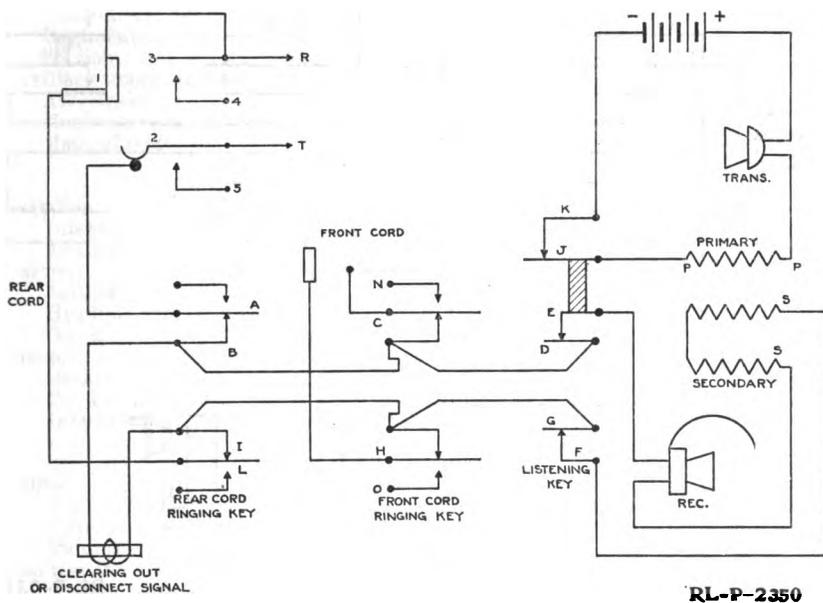


Fig. 44.—A circuit diagram showing the operator answering a call, with the front key in listening position, on a camp-type switchboard.

CIRCUIT WITH THE OPERATOR'S CALLING KEY IN THE RINGING POSITION.

19. Fig. 45 shows the calling end of the operator's cord circuit with the ringing key in position for ringing the called party, the operator's calling plug being in the desired jack. Turning the crank of the generator closes the contact on the automatic shunt circuit, placing the generator armature across the cord circuit. One side has a buzzer in series with the generator to notify the operator when the circuit is closed. When the listening key is pulled forward into the ringing position and the generator crank turned, the circuit may be traced as follows: From tip side of line T of front cord, through

contact springs C and N, to contact spring A, through series buzzer, through generator to contact spring L, through contact O, to ring side of line R. It may be seen that during the ringing the calling party (rear cord) is disconnected. Releasing the key opens the generator circuit and places the clearing-out drop across the cord circuit. The completed circuit for a conversation is as follows: From subscriber, through line jack, through answering cord, through calling cord, through line jack to subscriber.

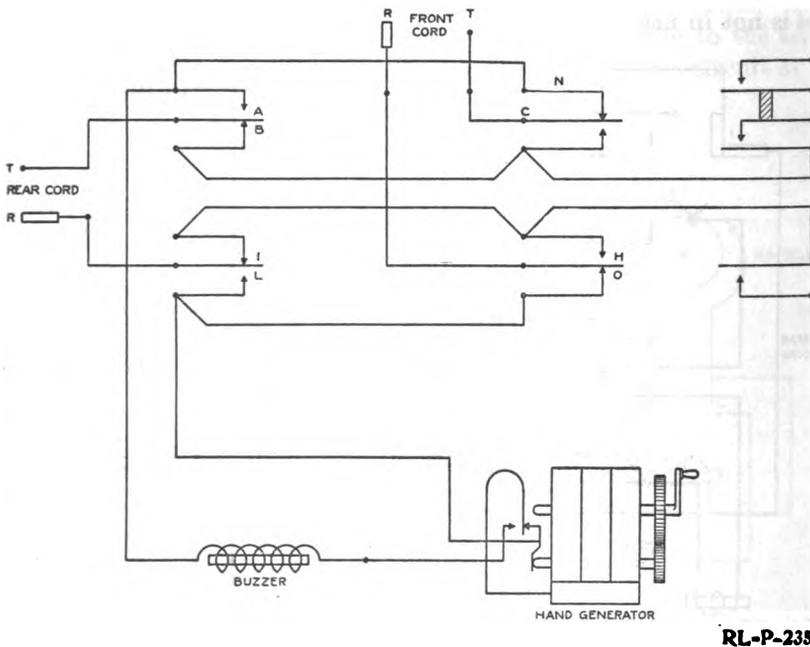


Fig. 45.—A circuit diagram showing the operator calling a subscriber, with the front key in the ringing position, on a camp-type switchboard.

Questions :

- (1) Under what circumstances is it necessary to use a camp switchboard? (Par. 1.)
- (2) How is the camp switchboard prepared for storage or transportation? (Pars. 3 and 4.)
- (3) How is the camp switchboard set up and prepared for service? (Pars. 5, 6, and 7.)
- (4) How does the operation of this type of switchboard differ from that of the monocord type? (Pars. 9, 10, 11, 12, 13, 14, and 15.)

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Adapted from...

UNITED STATES ARMY

TRAINING MANUAL No. 23



TELEPHONE SWITCHBOARD OPERATOR

INSTRUCTORS GUIDE
FOR ALL ARMS

PREPARED UNDER THE DIRECTION OF THE
CHIEF SIGNAL OFFICER

1923



WASHINGTON
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1923

CERTIFICATE: By direction of the Secretary of War, the matter contained herein is published as administrative information and is required for the proper transaction of the public business.

(11)

WAR DEPARTMENT,
WASHINGTON, June 28, 1923.

Manuals for training in the Army are to be prepared and revised from time to time by the branches of the service concerned, and when approved, published by The Adjutant General of the Army in pamphlet form in a series of training manuals.

In accordance with this plan there has been prepared by the Signal Corps a series of pamphlets relating to signal communication specialists.

The pamphlets in this series are titled as follows:

Training Manual No. 20—Basic Signal Communication, Students Manual.

Training Manual No. 21—Basic Signal Communication, Instructors Guide.

Training Manual No. 22—Telephone Switchboard Operator Students Manual.

Training Manual No. 23—Telephone Switchboard Operator Instructors Guide.

This pamphlet is published for the information and guidance of all concerned.

BY ORDER OF THE SECRETARY OF WAR:

JOHN J. PERSHING,
*General of the Armies,
Chief of Staff.*

OFFICIAL:

ROBERT C. DAVIS,
The Adjutant General.

(III)

PREFACE.

The Telephone Switchboard Operator Instructors Guide includes the following:

1. The text of the various Unit Operations just as they appear in the Students Manual, but printed on blue paper.

2. The Information Topics, printed on yellow paper, just as they appear in the Students Manual.

3. Material prepared for the assistance of the instructor who is teaching a class in this particular subject, which is printed on white paper. The list of illustrations for the instructors section is separate from the students section and appears on page VII.

This Guide contains an analysis of the methods of giving instruction to telephone switchboard operators on equipment used by the combat units of a division up to the point where such operators participate with linemen, message center personnel, and others in combined section field training. The work has been laid out for the student to do step by step, together with such questions as will lead the student to think and to experiment, and the instructor to lead his students in this process.

This Guide leaves the officer commanding a signal communication unit free to direct and improve the character of instruction, rather than to spend his time preparing a schedule, texts, etc.

The requirements which this Guide must fulfill are:

a. It must analyze the steps in training telephone switchboard operators in the combat units of a division up to the point where the joint training of the several sections of a signal communication platoon takes place, so that officers, in time of war, can quickly train such men for duty with combat units in the field.

b. It must provide directions for the students to follow these steps, and such directions for the instructor as will permit him to train efficient operators in a minimum time.

c. It must provide tests so that instructors can determine the progress of their students, and when the course is completed to determine their proficiency, so that the term "telephone switchboard operator" shall come to mean, just as "expert rifleman" means, a soldier who can do certain things in a certain time with a given degree of accuracy.

d. The instruction so outlined must be of such a nature that it can be given under conditions as they exist in the service.

e. It must provide a method of instruction for our peace-time Army—Regular, National Guard, and Reserve, and also for the R. O. T. C. and C. M. T. C., which requires no change of any kind for the training of these specialists in the larger Army which a national emergency may demand.

Notification of errors and suggestions for improvement of this manual should be addressed to the Chief Signal Officer of the Army.

TELEPHONE SWITCHBOARD OPERATOR INSTRUCTORS GUIDE FOR ALL ARMS.

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TELEPHONE SWITCHBOARD OPERATOR INSTRUCTORS GUIDE.

INTRODUCTION.

1. **Instructor's Guide.**—*a.* The instruction in this Guide is based upon the principle that the student learns by *doing* certain things. The student is accordingly brought into direct contact with tools and equipment at the very start. Thus his interest is aroused from the beginning, and he is consequently enabled by actual experiment as well as by thoughtful attention to get a clear understanding of the task and the principle involved.

b. A student must not only be able to *do* things; he must also *know* the essential facts and information necessary for an intelligent understanding of his work.

c. To determine just how much a student can do as well as to find out just what he knows certain definite types of questions and tests have been devised for the use of the instructor and are included in the Instructors Guide.

2. **Types of questions for Instructors Guide.**—The questions appearing in the Instructors Guide may be of two types:

a. Questions to be asked by the instructor at the first assembly of the class for each Unit Operation.—These questions should determine whether the students understand the directions, demonstrations, or explanations. At this time no question should be asked that will carry the men far afield, or which will divert their attention from the immediate and specific operation in hand.

Samples.

- (1) *How should the battery in the telephone, type EE-4, be tested?*
- (2) *How should the fuses in the BD-9 be tested?*
- (3) *Why should the circuits of the operator's set and the switchboard be tested as they are installed?*

b. Informal questions such as would be asked by the instructor as he makes his rounds.—These should be such as are designed to help a man who is experiencing difficulty in the doing of the operation assigned, or who may need a clearer understanding of some phase of the operation upon which he is engaged. Questions of this type will be of immediate value in the completing of the operation. They will differ from those described in Par. 2 *a* above, in that the knowledge which has been secured in the first part of the operation is necessary in order to answer the questions.

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Samples.

- (1) *Why not tilt the switchboard backward at the top?*
- (2) *Why are locks provided for the line drop shutters?*
- (3) *If, after installing a switchboard, type BD-9, it was found that one unit was bad, what should the operator do?*
- (4) *When it is necessary to obtain a new unit should the operator leave unanswered the calls that come in on the other three units while he is obtaining the new unit?*

3. Types of tests for Instructors Guide.—*a.* The tests which appear in this Guide are designed for three different purposes which are indicated by the names applied to them. These three kinds of tests are designated as:

- (1) Instruction Tests.
- (2) Progress Tests.
- (3) Proficiency Tests.

Each of these is described in greater detail below in paragraphs 4 to 10, inclusive.

b. The questions and problems of each of the above three types of tests naturally divide themselves into two classes, which for simplicity are called:

- (1) Performance Tests.
- (2) Information Tests.

Throughout this Guide all Performance Tests are labeled A and all Information Tests are labeled B. Each of these is described in greater detail below.

4. Instruction Tests.—A brief and informal test is given at the end of each teaching period or upon the completion of each Unit Operation. This is known as an Instruction Test. As the name implies, it is a device to aid instruction and may be used for the following purposes:

a. To determine if the student has correctly followed directions for the unit operation.

b. To determine if he understands the application of the principles taught to actual conditions as they may arise in the field.

c. To call special attention to those facts or processes which it is most important for him to know.

d. To arouse the interest and curiosity of the student.

e. To build up the spirit of competition. Students should be encouraged to look upon an Instruction Test as a game rather than an examination.

(f) To improve the quality of instruction. Any attempt to measure improvement in teaching requires a frequent and regular measurement of the student's understanding of what he is being taught.

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(g) To adapt instruction to individual needs. Without the aid of some such device as the Instruction Test it is not easy to locate the deficiencies or difficulties of each individual student.

(h) To bring immediate aid to the student who needs it. On the other hand an Instruction Test will also indicate the point beyond which further teaching or additional practice is unnecessary.

Samples.

See the Instruction Tests which have been prepared for the various Unit Operations.

5. *a.* If Instruction Tests are properly handled the instructor may find that some of the students have not profited as much as they should from the laboratory work and instruction. Under such circumstances the instructor can change his methods to fit individual cases. These tests bear the same relation to signal communications men that close order drill, sub-caliber practice, and range firing bear to another type of military training. Instruction Tests also require frequent repetition if a standard of proficiency, equivalent to that obtained in other types of military training, is to be established. An Instruction Test, particularly the performance part, thus becomes a valuable device for purposes of drill and should be frequently used with this end in view.

b. In many instances the instructor in charge of the class may not wish to include an examination on both the *know* and the *do* parts of a Unit Operation in the same Instruction Test. In such cases it is allowable to divide the Instruction Test, examining for performance at one period and for information at another.

6. The Instruction Tests, as given in this Guide are samples only. The instructor should devise others similar to the samples given. Questions which admit of one or more answers, and which tend to produce a discussion, even if they have previously been made use of, should be collected and included in the Instruction Test.

7. Instruction Tests may be scored by the instructor, or, better, by the students themselves. In the latter case, have the students first exchange papers, and then require them to score the test from correct answers given out by the instructor. The tests should then be collected and carefully studied by the instructor for the purpose of determining in just what particulars each individual student is lacking.

8. **Progress Tests.**—*a.* Progress Tests differ from Instruction Tests (which are given on the completion of a single Unit Operation) in that they are given at the end of a group of related Unit Operations. A Progress Test marks the point at which there is a more or less distinctive change in the subject matter, or where further practice or instruction on the know or do things in that group will not be

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continued unless the progress test should indicate failure on the part of the student to meet the requirements specified. Successful completion of a Progress Test should indicate that the student is capable of using the principles covered in combination with new or different ones.

b. Progress Tests should be used by the instructor:

(1) As an aid in determining upon the completion of any group of related Unit Operations whether the students are making satisfactory progress. The instructor will thus not need to wait until Proficiency Tests are given to determine whether students are ready to take up a new group of related Unit Operations or whether they must have additional work on the group just covered.

(2) To find out how accurately and quickly the student can perform specified operations, and to discover in what particular things students are below proficiency. An opportunity is thus provided to bring students up to the required degree of expertness.

(3) To prepare the student for proficiency tests and for field work. The Progress Tests, as given in this Guide, show how such tests are conducted and scored.

c. Progress Tests are to be scored by the instructor and should be systematically recorded. The score made by each student will at once indicate whether he should be placed in a special class for additional coaching and instruction.

9. **Proficiency Tests.**—*a.* Proficiency Tests differ from Instruction Tests and Progress Tests in that any Proficiency Test must cover the *entire* range of instruction and operations given in this Manual which is applicable to any given combat unit. Proficiency Tests are prepared in the same manner in which Progress Tests are prepared.

b. Proficiency Tests are given at the completion of a course in this Manual by instructors or unit commanders:

(1) To determine the character of the instruction given and the proficiency of their men in this subject.

(2) To determine the *relative* proficiency of their men in this subject.

(3) To rate their men in this subject, if notation of the fact that they have successfully completed this subject is desired on their service records.

c. Proficiency Tests may be used by higher unit commanders at any time:

(1) For determining the relative proficiency of men in different units.

(2) For determining which men must take instruction, in what units they are located, and in what they are deficient.

(3) For selecting men for various assignments which demand the knowledge and skill which the instruction in this Manual provides.

10. **The details of a test.**—*a.* Instruction, Progress, and Proficiency tests should include both performance and information questions. The first part (labeled A) should be made up of Performance Tests only, and the second part (labeled B) should include as many of the different types of the other five forms of questions as it is possible to devise. These five forms of questions are described in detail, beginning with Par. 12.

b. Tests should be given as frequently as possible, since they prepare the student for those varying conditions and situations that arise in the field and which the students must learn to meet by their own unaided efforts. The directions for preparing both parts of a test which will fulfill these requirements are given below.

11. **The performance part of any test.**—*a.* In preparing the performance part of any test arrange a list of those operations which students are required to do, either for an entire class to perform at one time or for each student to perform individually. The necessary directions for carrying out the test should be included, together with such other information regarding the conditions of the test as may be needed.

b. The character and form of the Performance Test are most easily understood by referring directly to the various tests which are distributed through this Guide. Suggestions for conducting each Performance Test are given just preceding such tests and include a method for scoring each of them. The points assigned to the different parts of any particular Performance Test for the purpose of scoring are based on the relative values of the different portions of the test with respect to each other as determined by the best available opinions of trained instructors. The total scores of the various Performance Tests have been so arranged that the more important receive the highest score and the less important smaller scores. These scores have been determined from the experience of all available trained instructors who have assisted in the preparation of this text.

c. **Scoring system for all Performance Tests.**

(1) The *total* score for a complete or perfect performance will always appear under "Scoring," Par. No. (1).

(2) The *partial* score will always appear under "Scoring," Par. (2). If no partial score is allowed there will appear the statement "No partial score allowed."

(3) The *zero* score will always appear under "Scoring," Par. (3).

12. **The information part of any test.**—*a.* In preparing the information part of any test:

(1) Make a brief, clear, and explicit statement of just what information is required by the examiner on "know" questions.

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(2) In order that there may be an equally clear, brief, and explicit answer from the student provide a *definite place* on the examination paper itself for such answers.

(3) Prepare questions covering the information which the students are presumed to know and ask as many of these questions as the best student in the class may reasonably be expected to answer during the examination period.

b. Tests composed of questions of the kinds described in Pars. 13, 14, 15, and 16 are most satisfactorily administered and scored by having the entire test typewritten, or mimeographed, and one copy placed in the hands of each person to be examined. Or the test can be placed on the blackboard or on large sheets of paper. In the latter case, the sheets of paper can be used over again with the same or successive classes, or different combinations of them can be made up and used in proficiency tests. The time thus required to prepare the test is more than compensated for by the ease and economy of time in grading and scoring. Since the answer for each question will have a definite place assigned for it on the examination paper, either at the end of a line or on a particular dotted line, the grading or scoring of papers may be done almost automatically by means of an approved answer sheet.

c. For clearness and convenience, the various types of questions to be included in the information part of any test will be arbitrarily designated as:

- (1) Completion questions.
- (2) Recognition questions.
- (3) True-False questions.
- (4) Single-word questions.
- (5) Observation questions.

d. In order to make clear just what is meant by the above, a very simple problem, covering an important point in Unit Operation No. 1, will be put into question form and asked in five different ways. The appropriate directions to the student will accompany each type of question, as well as instructions for devising and scoring such questions. These directions for devising information questions apply in all cases and for this reason are not repeated for each test throughout the Guide.

13. Completion questions.

a. SAMPLE: Directions to student.—Below is a sentence from which a word has been omitted. This word which has been omitted is indicated by a short dotted line, enclosed in parentheses, thus (.....). Fill in this blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as *one* word.

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The (.....) is the best stitch to use in lacing the cable connecting the terminal strip to the monocord switchboard. Answer: Lock-stitch (lock).

b. (1) In devising completion questions every omitted word should be indicated by a short dotted line enclosed in parentheses thus (.....).

(2) "A," "an," and "the" are to be counted the same as any other words. If two or more words in succession are omitted, each omitted word is to be represented by a dotted line enclosed in parentheses.

(3) Do not omit too many words nor unimportant words, as the question then becomes a mere puzzle and not a real test.

(4) Do not make the sentences too long.

c. In scoring, one point will be allowed for each numbered paragraph of one or more sentences. One point will also be allowed for each subparagraph (of one or more sentences) to which a letter is assigned as *a*, *b*, *c*, etc. A satisfactory solution in each case will consist in filling in all the blank spaces so that each sentence will make sense and at the same time be technically correct.

14. Recognition questions.

a. SAMPLE: *Directions to the student.*—Below is a sentence which is unfinished. Following it are five answers. Select the one of these which best fits the sentence or which makes the best sense and draw a line under it.

The best stitch with which to lace the cable connecting the terminal strip to the monocord switchboard is the—

granny lock thief loop Western Union

Answer: The word *lock* should be underscored.

b. In devising recognition questions:

(1) Give a choice of four or five possible answers, only one of which is correct.

(2) Vary the relative position of the correct answers from line to line, being careful to avoid any regular position or system for placing the true answer among the other three or four.

(3) In order to test the student's ability to discriminate, include among the wrong answers some which are partly right or which look like the correct answer.

c. In scoring, one point will be allowed for each correct answer—that is, for each word properly underscored.

15. True-False questions.

a. SAMPLE: *Directions to the student.*—Below is a sentence and just after it the words "True" and "False." Read the sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

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The best stitch to use in lacing the cable connecting the terminal strip with the monocord switchboard is either the Western Union or the loop stitch. True. False.

Answer: The word *False* should be underscored.

b. (1) In devising true-false questions, have approximately the same number of true statements as false.

(2) Vary as much as possible the order in which true and false sentences are presented. Do not put first all true statements and then all false, but mix them up, avoiding any regular system.

(3) Test the student's power of discrimination by purposely wording false statements so that they will appear to be true.

(4) In devising a true-false test ask as many questions as conveniently possible. The purpose of this is to overcome any tendency that a student will make points through mere chance by a number of lucky guesses.

c. The total score will be the number of questions correctly answered. Other ways of scoring might be used for this particular test, but this method is the simplest.

16. **Single-word questions.**—*a.* The question is carefully worded so that the answer will consist of a single word, phrase, number, or symbol. It is sometimes allowable to permit the use of more than one word, but this should be avoided if possible.

SAMPLE: *Directions to the student.*—The following questions can be answered by a single word or phrase. Write the answer on the short dotted line.

What do you call the stitch which is used in lacing the cable connecting the terminal strip to the monocord switchboard?

Answer: Lock (lock-stitch).

b. In devising single-word questions, be careful to call for answers which can be stated as far as possible, by a single word, phrase, number, or symbol.

c. In scoring, one point will be allowed for each question correctly answered, or for each statement properly completed.

17. **Observation questions.**—*a.* (1) For this type of question a drawing of the equipment is placed on the blackboard, or on a large sheet of paper. If more convenient, the equipment itself, instead of a drawing, may be placed on a table with the parts labeled or numbered. In either case simple and direct questions like the following are asked: "What is the name of this part?" "What does it do?" "What is it for?" If the actual equipment is used it should be plainly labeled with the number of the question, as, for example, "Question No. 7."

(2) Thus a section of cable properly laced or a drawing of it could be displayed with a tag or an arrow or cross marked on it to indicate

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clearly what is meant. Beside the cable would be a label, "Question No. 7." On the test paper would appear, "What do you call the kind of stitch on the cable labeled 'Question No. 7'?" "With what do you make it?" "How far apart should they be?" "When is it used?" etc.

(3) A very important and useful variation of this test is to show the equipment from which an essential part has been deliberately left out or in which it has been improperly connected. The student is asked to indicate on his test paper the names of parts designated and to state whether there are any missing parts or wrong connections.

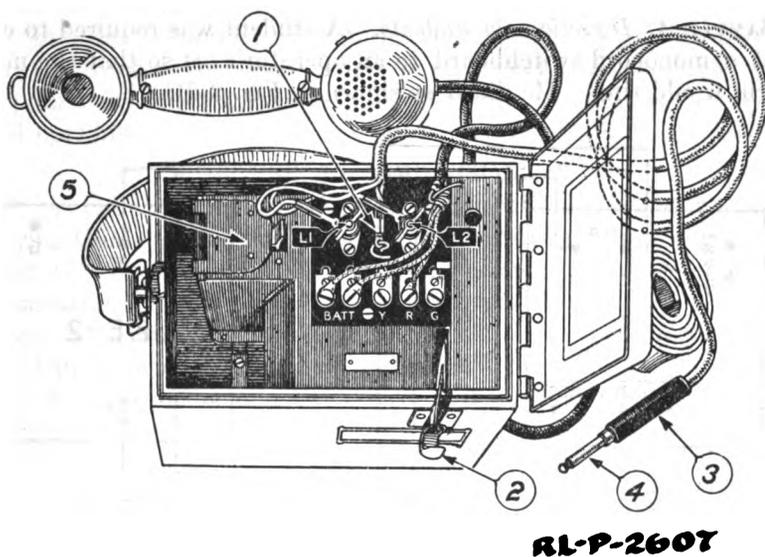


Fig. 1-IG.

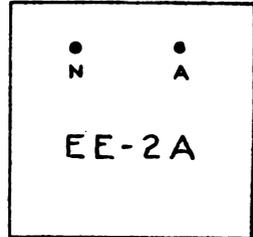
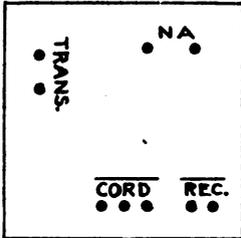
SAMPLE 1: Directions to students.—In the corresponding spaces provided below insert the names of the parts to which the numbered arrows in Fig. 1-IG refer:

- 1..... 2..... 3.....
4..... 5.....

SAMPLE 2: Directions to students.—If there are any wrong or missing connections in this figure, state what they are and how to correct them.

SAMPLE 3: Directions to students.—Fig. 2-IG shows the binding posts of a monocord switchboard type EE -2-A units and an operator's set. Complete the connections in Fig. 2-IG so that if a drop falls on the monocord switchboard the night alarm of the operator's set will ring.

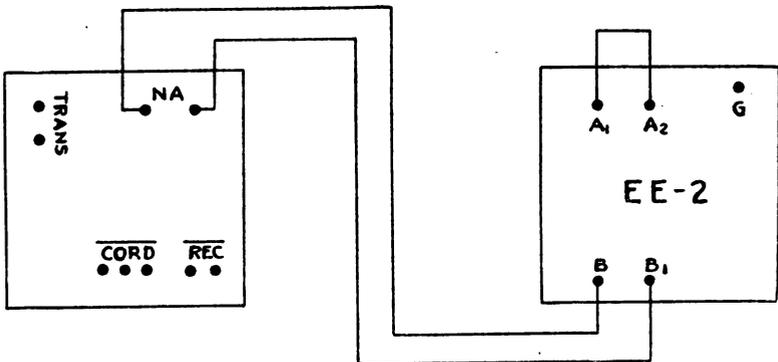
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RL-P-2602

Fig. 2-IG.

SAMPLE 4: *Directions to students.*—A student was required to connect a monocord switchboard to an operator's set so that the night alarm would ring. He did it as shown in Fig. 3-IG.



RL-P-2603

Fig. 3-IG.

(a) If the student performed the operation correctly, write *Yes* here

(b) If the student performed it incorrectly, write *No* here and show how it should have been done by drawing the proper connections in Fig. 3-IG.

b. (1) In devising observation questions remember that pictures, drawings, or diagrams must be large enough to be easily seen.

(2) All labels or numbers on either pictures or the equipment itself must be so placed that there will be no doubt as to exactly what they refer.

c. In scoring, one point may be allowed for each *item* correctly given, or a certain number of points may be arbitrarily assigned for a complete answer to the whole question.

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18. **Passing scores.**—*a.* In determining a student's standing in any test whether Instruction, Progress, or Proficiency, it will be necessary to take into account his score both for performance and information.

b. For each performance, or "A," part of any test the score necessary for a passing grade is stated definitely in the directions for conducting each test.

c. For each information, or "B," part of any test the score necessary for a passing grade has been arbitrarily fixed at 75 per cent of the total number of possible points. For example, if the total number of points which can be scored for the B part of a test is 28 points, the passing score will be 21 points.

d. In order to simplify the determination of this 75 per cent passing score the Information Tests have been purposely devised so that when the points are added up they will be exactly divisible by 4; that is, the total possible score will be some such number as 16, 24, 40, 52, etc.

INSTRUCTION IN ARMY ORGANIZATION.

19. As indicated in the preface, the Students Manual and its accompanying Guide are designed to fit instruction in any arm. It has been found that all signal communication personnel need to know the organization not only of their own units, but also that of other arms closely associated with their own. This necessary information is stated in Information Topic No. 2, Army Organization, of the Students Manual. The organization described therein is that of war strength units. War strength units alone are dealt with, not only because of the many variations existing in peace strength units but also for the reason that this Manual be available for war training.

20. Regular instruction covering Information Topic No. 2 may be given in either one of two ways at the option of the instructor:

a. The topic may be broken up into a number of short sections of convenient length and this material may then be systematically taught a little at a time, day by day, during a portion of the period assigned to a regular Unit Operation.

b. A second method is first to select all the material in Information Topic No. 2 which is needed by any particular arm. This larger block of information is then taught by devoting all the time of as many successive instruction periods as may be necessary for a satisfactory mastering of the subject matter.

21. To preserve the continuity of this Manual, there are given at the end of this Guide some samples of tests designed for examination in Army Organization, if this topic is taught as a separate subject as suggested in *b* above. If the topic, Army Organization, is divided into a number of short sections and taught with each unit operation, as in *a* above, then the appropriate questions should be included in the instruction tests given at the close of each unit operation.

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HINTS FOR THE INSTRUCTOR.

22. This Manual is the result of two years of experiment and research by a number of instructors who have had experience in teaching both officers and enlisted students in telephone switchboard operating.

23. As a necessary preliminary to the preparation of this Manual it was first necessary to decide upon just what things were essential for a telephone switchboard operator in a combat unit to know and to be able to do. Accordingly, these essentials were selected and agreed to *by all the arms of the service*. This text seeks to arrange the "know" and "do" things that have thus been agreed upon into teaching units and also to arrange them in logical order.

24. Since the selection and arrangement of the different unit operations have been carefully worked out, an instructor should not try to present more material than is contained in a given unit operation without first ascertaining whether the additional material which he proposes to insert is not already given in some other unit operation together with other instruction matter more closely related to it.

25. Efficient telephone switchboard operators can be obtained only through frequent and systematic practice, corresponding to the methods used for making a unit proficient in close order drill. This Manual seeks to do for the telephone switchboard operator what regulations do for close order drill. But it also attempts to go further than regulations by not merely specifying *what* should be done, but also *how*. Accordingly no effort has been spared to assist the instructor in the task of obtaining a high standard of proficiency from the men who are being trained as operators.

26. In peace training it is desirable that the telephone switchboard operator progress as far as possible. For this reason the capable student who desires to study circuits and the other technical details of field telephone equipment should be encouraged to take up succeeding Manuals after completing this one.

27. For training in time of war there will naturally be limitations both with respect to the personnel and to the time of training. To meet these conditions this Manual is so arranged that it can be adjusted to the needs of the personnel to be trained as well as to the time available for training.

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UNIT OPERATIONS.

PREPARING CABLE FOR MONOCORD SWITCHBOARD.

Equipment.

- 1 four-line monocord switchboard, type BD - 9.
- 1 terminal strip, type TM - 84.
- 1 pair pliers.
- 1 knife.
- 1 small screw driver.
- 50 feet field wire, twisted pair, type W - 40.
- 20 feet stout cord.

Information.

The object of this Unit Operation is to illustrate the methods used in the preparation of a monocord switchboard, so that it will be ready for installation in the field. While learning how to prepare such switchboards for installation, the student should also learn the technical names of those parts of the switchboard most frequently used.

Monocord switchboards are primarily designed for the use of such combat units as require a small amount of telephone communication, and where the apparatus for making connections between various subscribers must be carried by hand by soldiers to positions where temporary or permanent shelter can be obtained from enemy shells and enemy observations.

The smallest switchboard used by American troops is a four-line monocord switchboard. For ease in making requisitions this switchboard is given a shorter name, BD - 9. It is called a monocord switchboard because only one cord is used in connecting one subscriber to another. Commercial switchboards and large army switchboards ordinarily use two cords to connect two subscribers.

The switchboard type BD - 9, illustrated in Fig. 2, has arranged along the top two terminals for each of its four units, to which the

line wires or cable pairs are fastened. These terminals are known as line binding posts. Just below these binding posts are fuses, drops, jacks, and switchboard cords in the order named.

The operator's cord is red in color to distinguish it from the switchboard cords, which are usually green in color. At the end of each of the five cords is a plug.

For ease in locating trouble and for general neatness and convenience the four pairs of line binding posts are connected by wires about 10 feet long to a terminal strip, Type TM - 84. These wires are laced together into a cable.

Directions.

1. Mount the switchboard and the terminal strip in convenient locations about 8 feet apart. Measure off four lengths of twisted-pair field wire each 10 feet long. See Information Topic No. 3.

2. Connect one pair of wires to the upper left-hand contacts on the terminal strip; connect the same pair to the left-hand terminals of the switchboard as you face the switchboard, exercising care that the terminals are not shorted by loose strands. Connect the other

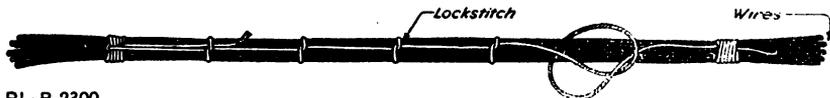


Fig. 1.—The lock stitch.

three circuits in order from left to right on switchboard and from top to bottom on the terminal strip, in the same manner as the first pair, so that the cable is formed to the left of the switchboard.

Questions.

(1) *What other method could be used to identify the pairs of wires in the cable besides attaching them to binding posts on the terminal strips?*

(2) *What is likely to happen if the terminals are shorted by loose strands?*

(3) *Why form the cable to the left rather than to the right of the switchboard?*

(4) *Why should the wires go from No. 1 drop on the switchboard to No. 1 terminals on the terminal strip?*

3. Take a piece of stout twine and lace the cable together neatly and securely with a lock stitch as shown in Fig. 1. This leaves a cable about 10 feet long with the switchboard on one end and a terminal strip on the other. When lacing the cable start at the switchboard and work toward the terminal strip, spacing the stitches $1\frac{1}{2}$ inches

apart and working the slack in the wires ahead of the lacing, so as to leave a neat compact cable under the portion which is laced up. After the cable is entirely laced up the ends of the wires at the terminal strip will probably show different amounts of slack due to the difference in the length of the wires. The long wires or the wires showing slack should be disconnected from the terminal strip and cut off, so that when formed out and reconnected they will appear as in Fig. 2.

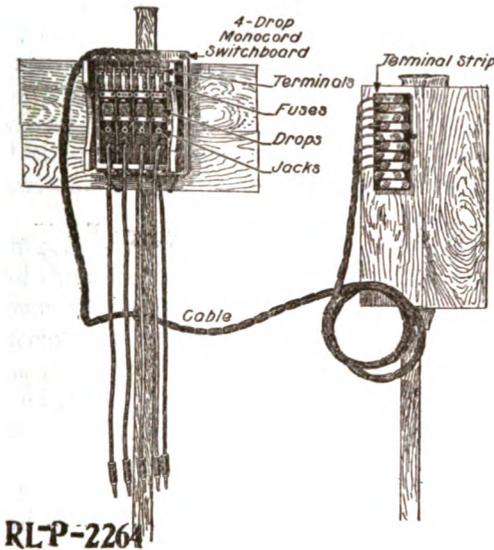


Fig. 2.—Cabling monocord switchboard to a terminal strip.

Questions.

- (5) *Why is the cable laced together?*
- (6) *Why not twist together the wires of the cable instead of lacing them?*
- (7) *Why make the cable 10 feet long rather than 4 or 15 feet long?*
- (8) *Is there a better way of lacing the cable than with the lock stitch?*
- (9) *If there is no cord with which to lace the cable, what could be done?*

4. To prepare a cable for a 12-line monocord switchboard, the same process is followed except that the cable consists of 12 pairs of wires instead of 4 pairs. The reason for this is that whenever a cable is formed there must be 1 pair of wires for each drop on the switchboard.

SUGGESTIONS FOR THE INSTRUCTOR.

1. The class should not be larger than 15 students for one instructor. Divide the class and provide equipment for each group as listed in Unit Operation No. 1 of the Students Manual.

2. At the first assembly of the class, explain why the switchboard is connected to the terminal strip by cable (Information Topic No. 3). Explain and demonstrate the necessity for a lock stitch being used in making a cable; show the difference between a loop stitch and a lock stitch. Have each member of the class make lock stitches around a pencil or wire; inspect the work and be sure each man is proficient.

3. Illustrate the method of making up a cable and its connection to the switchboard and to the terminal strip. The left-hand binding posts of the switchboard are connected to upper left-hand terminals of the terminal strip, etc. The cable should extend down the left-hand side of switchboard so as to be readily attached to a tree or post.

4. Have each group prepare a cable 10 feet long connecting the switchboard and the terminal strip. Inspect the work of each group, noting the following points:

a. Are the terminals on the switchboard and the terminal strip connected in the proper order?

b. Have the wires been properly placed under the binding posts?

c. Is the cable neatly laced up and no slack left in any of the wires?

d. Are the wires cut to the right lengths and neatly formed at both the terminal and the switchboard?

e. Is the cable laced in accordance with Fig. 1 of Unit Operation No. 1?

f. Is the cable formed on the correct side of the switchboard?

5. Select some of the worst installations and have the students criticize the work, especially emphasizing the points mentioned in paragraph 4 above.

6. After all groups have completed their work assemble the class. Go over the questions in the Unit Operation of the Students Manual. These questions can be answered by experiment or directly as a result of the work the student has done.

7. The following are comments on the questions in the Unit Operation of the Students Manual:

a. Question 1. There are at least two other methods of identifying the pairs of wires.

b. Question 2. The instructor should have the students actually short the conductors of different pairs at the terminals. Have the students test both circuits to see the results. Also have both conductors of one pair shorted at the terminal by a strand of wire and ascertain

by test what things would happen if shorted and what things will fail to happen. Use this method to get students to think of the things which are most apt to cause such failures.

c. Question 8. Other ways of lacing a cable may be devised. The student should be told, however, that the method given in this Manual is the one which will be used in all fieldwork.

8. Ask additional questions such as:

- (1) *Why not attach the line wires direct to the switchboard?*
- (2) *Why connect the binding posts of the switchboard with the terminals of the terminal strip, in regular order?*
- (3) *What might be the effect of a loose strand on the terminal strip or on the switchboard?*
- (4) *What might be the effect of corroded or loose terminals on either the terminal strip or the switchboard?*
- (5) *What would be the effect of using twisted pair with defective insulation in the cable? What would be the effect if a strand was broken inside of the insulation?*
- (6) *What would be the effect on the cable if a loop stitch is used instead of the lock-stitch?*

9. Emphasize and illustrate the results from improper and loose connections at both the switchboard and terminal strip. (An old corroded terminal strip, if available, should be used to illustrate the possibility of trouble caused by poor connections.)

10. Go over the questions in Information Topic No. 3 and ascertain whether the students have obtained correct answers to these questions for themselves. In those questions dealing with the choice of a location for the switchboard and how it is to be installed, the instructor by additional questions should lead the student to visualize the varying conditions in the field under which switchboards are set up.

11. a. After this Unit Operation has been completed and all the questions in the text have been answered by each student, give the following Instruction Test, or devise another one similar to it. If necessary the performance part of the test can be given to individual students while the others of the class are taking the information part of the test. The information part of the test can either be mimeographed, placed on the blackboard, or typewritten.

b. The sample test here given is designed for instructional purposes, and the instructor should accordingly use it with that end in view. As a result of the classroom work the student should have learned (1) how to lace the cable, (2) how to connect it to the switchboard and terminal strip, and (3) how to name the important parts of the equipment. This test should also demonstrate to the students themselves just who have learned to do this work quickly and in the most workmanlike manner, and also whether they correctly remember

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the names of the various parts of the equipment. The instructor should point out in just what particulars each student has failed, and if the results are unsatisfactory, repeat the test after an interval of a day or two.

c. If the instructor finds it necessary to repeat the information part of the test, or if for any other reason he desires to vary its form it can be arranged very easily in the form of observation questions. (See par. 17, p. XVIII.) To do this simply provide a supply of tags numbered plainly from 1 to 14. Tie tag No. 1 to the operator's plug and write on it: "No. 1. What is the name of this part?" In a similar manner fasten a tag to each of the other parts of the equipment. Supply each student with a slip of paper upon which he is to write plainly his name, the date, and the numbers 1 to 14. Then require each man, in turn, to inspect the equipment and to write down his answers opposite the corresponding numbers.

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 1-A. (PERFORMANCE).

Equipment.

Prepare in advance for each student:

- 1 switchboard, type BD - 9, in working order.
- 1 terminal strip, type TM - 84.
- 4 10-foot lengths of twisted pair wire, type W - 40 or W - 44.
- 20 feet of cord.

Procedure.

1. Prepare typewritten or mimeographed directions to the students.
2. Number the positions where the equipment is laid out plainly, and place corresponding numbers on the sheets containing directions to the student.
3. Assemble the students either at their seats or at some point away from the equipment.
4. Issue the directions sheet to the students and instruct them to read it.
5. Ask if there are any questions and if so answer them.
6. Direct the students to go to their assigned positions and to face the instructor.
7. Direct: "About face. Begin."
8. Note and record the time to the nearest second that the command "Begin" is given; and note and record the time each individual student finishes. These records will provide the instructor with information which will indicate those students who fall below the general average of the class and who will consequently require further practice.

Scoring.

1. The maximum possible score on this test is 28 points.
2. The score required to pass this test is 22 points.
3. Inspect and test the results of the students' work as described in Par. 4.

4. DIRECTIONS FOR SCORING.

- | | |
|--|----------------|
| <i>a. Lacing the cable:</i> | Points. |
| (1) If the cable is properly laced, that is, if it is as illustrated in Fig 2, with the details as shown in Fig. 1, even though it is not properly formed out at both ends..... | 6 |
| (2) No partial score allowed. | |
| (3) The following constitute defects: | |
| (a) Correct stitch not used. | |
| (b) Stitches more than 3 inches apart. | |
| (c) End ties incorrectly made. | |
| (d) Stitches not pulled tight. | |
| (e) Slack left in any wire at any place. | |
| (f) If wire is used which casual inspection shows is defective. | |
| If any one of the above defects exists..... | 0 |
| <i>b. Proper electrical connection of switchboard and terminal strip:</i> | |
| (1) If all four circuits are in working order, even if they are improperly arranged..... | 12 |
| (2) No partial scores allowed. | |
| (3) When tested with an operators' set and a telephone, if any one of the four circuits, from the EE - 2 units, through the terminals on the terminal strip, fail to work because of the following, the circuits are not in working order: | |
| (a) Split pairs on the EE - 2 units. | |
| (b) Split pairs on the terminals of the terminal strip. | |
| (c) Short circuits or open circuits at the terminals of the EE - 2 units. | |
| (d) Short circuits or open circuits at the terminals of the terminal strip. | |
| If any one of the above defects exists..... | 0 |
| <i>c. Circuits properly arranged:</i> | |
| (1) When tested with an operators' set and a telephone the pair of wires from the left-hand switchboard unit must go to the top pair of terminals on the terminal strip; and the others connected in the same order..... | 6 |
| (2) No partial scores allowed. | |
| (3) The following constitute defects: | |
| (a) If the pair of wires from any EE - 2 units, beginning from the left of the switchboard, does not go to the corresponding pair of terminals beginning at the top of the terminal strip. | |
| (b) If the terminal strip is connected upside down. | |
| (c) If the cable leaves the switchboard from the right-hand side. | |
| (d) If the bottom pair of binding posts on the terminal strip is used, unless one of the upper pair of terminals is defective. | |
| If any one of the above defects exists the circuits are not properly arranged..... | 0 |

| <i>d. Cable ends properly formed out:</i> | Points. |
|--|---------|
| (1) If the cable is formed at the switchboard and terminal strip ends and connected equally as well as illustrated in Fig. 2, even if there are split pairs, shorts, or opens. | 4 |
| (2) No partial scores allowed. | |
| (3) The following constitute defects: | |
| (a) If the ends of the cable are not formed out at the switchboard, to conform to the standard as illustrated in Fig. 2. | |
| (b) If the ends of the cable are not formed out at the terminal strip, to conform to the standard as illustrated in Fig. 2. | |
| (c) If there is not at least one stitch between every two wires where they are formed out as is shown in Fig. 2. | |
| If any one of the the above defects exists the cable ends are not properly formed out. | 0 |

INSTRUCTION TEST NO. 1-A (PERFORMANCE).

PROBLEM.

Directions to the student.—*a.* The following equipment is provided and laid out at your position:

- 1 switchboard, type BD - 9.
- 1 terminal strip, type TM - 84.
- 4 10-foot lengths of wire, type W - 44.
- 20 feet of cord.
- 1 electrician's knife and 1 pair of pliers (if students are not equipped with them).

b. When the instructor says, "Begin," start the work promptly.

c. Lace up the switchboard cable, attaching one end to the BD-9 and one end to the terminal strip, in the manner taught in Unit Operation No. 1.

d. Do the work quickly and neatly.

e. Notify the instructor at once when the work under *b* and *c* has been completed by facing about and calling your name.

f. The instructor will then record the time it has taken to do the work. He will also inspect it.

INSTRUCTION TEST NO. 1-B (INFORMATION).

NOTE.—The time allowed for this portion of the test is five minutes.

Directions to the student: Below are a number of questions and unfinished sentences. Following each one are several words, numbers, or statements. Select the one of these which best fits or which makes the best sense, and draw a line under it.

Only one of the answers given in each case is right.

1. The wire used in making cables for monocord switchboards is
insulated bare wrought iron of high resistance
2. The fixtures on the monocord switchboard to which the wires
of the cable are attached are called
binding posts fuses drops jacks strands

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3. A cable for monocord switchboards is laced with
bare wire cord fuses
4. How many pairs of wires are in the cable attached to a four-line monocord switchboard?
2 3 4 5 6
5. The end of the cable opposite a monocord switchboard is attached to
a terminal strip a plug the operator's telephone the armature
6. How many pairs of wires of the cable are attached to each unit of the monocord switchboard?
1 2 3 4 5 6
7. The operator's cord on the monocord switchboard is colored
red white blue green
8. The little shutter which falls when some one signals the operator is called
a drop a plug a sleeve a fuse
9. There is a socket in each unit of a monocord switchboard in which an object at the end of the operator's cord can be inserted. This socket is called
a fuse a drop a plug a jack
10. The object at the free end of an operator's cord or a switchboard cord is called
a jack a plug a line terminal a terminal strip
11. How many line cords and plugs are there on a 4-line monocord switchboard?
2 3 4 5 6
12. If the cable terminal strip was located very close to the switchboard—
Lineman testing circuits would interfere with the operator.
The operator could test circuits and operate his switchboard at the same time.
It would not take so long for the operator to answer calls.
Linemen testing circuits would not interfere with the operator.
13. The type number of a 4-line monocord switchboard is
TM - 17 BD - 84 SB - 7 BD - 9
14. The type number of a 5-pair terminal strip is
TM - 37 BD - 8 TM - 84 EE - 4
15. The length of the cable which connects a monocord switchboard to its terminal strip is
10 feet 20 feet 6 feet 8 feet 4 feet
16. The number of terminal strips required to accommodate a 12-line monocord switchboard is
8 3 2 5 7

INSTALLATION OF MONOCORD SWITCHBOARD WITH CAMP TELEPHONE FOR OPERATOR'S SET.

Equipment.

- 1 four-line switchboard with 10-foot cable and terminal strip attached.
- 1 terminal strip.
- 1 knife.
- 1 screw driver, if knife does not have screw-driver blade.
- 1 pair side cutting pliers.
- 1 telephone, EE - 4, or type with which unit is equipped.
- 40 feet twisted pair field wire.
- 4 tags.

Information.

It has been found necessary in the field to locate the terminal strip, attached to the cable and known as the cable terminal strip, as far from the switchboard as possible. This is done in order that the linemen who are testing circuits will not interfere with the operator and thus prevent him from handling his calls promptly. If, on the other hand, the cable were made too long, say 50 or 100 feet, the operator when carrying a switchboard and telephone forward in battle, from one position to another, would have too much weight to carry. To avoid these difficulties, the cable as usually constructed is made about 10 feet long.

In order that operators can quickly install their switchboards in battle, the switchboard, cable, and terminal strip after having been once connected together are not afterwards separated.

When the switchboard is installed for use at a headquarters or command post, if the location is out in the open, the cable is securely fastened at the switchboard end to a tree or post, and the terminal strip end is also securely fastened to some similar object. If this precaution is not taken, operators, linemen, or other soldiers may stumble against the cable, especially at night, and tear one end or the other loose. This will interrupt traffic by delaying subscribers who wish to use the telephone system. In order to prevent such interruptions to the service it is sometimes possible to lay the cable on the ground, or even to bury it. (See Information Topic No. 3.)

Whenever linemen install trunk circuits between two points where switchboards are to be installed they terminate both ends of their circuits in a terminal strip known as the "line terminal strip." An operator installing a switchboard places his "cable terminal strip" alongside the line terminal strip, if it has already been installed, and

connects the circuits on the two terminal strips by means of pieces of wire called "jumpers." Such circuits are said to be "jumped."

As soon as an operator installs a switchboard he tests the operator's telephone, the operator's cord, the talking circuit of each unit of his switchboard, and the signaling circuit of each unit.

Directions.

1. Make sure that the battery in the camp telephone is good, and examine the fuses if an old type switchboard is used, to see if they are in good condition. (See Information Topic No. 4.)

Questions.

(1) *How should the battery in the camp telephone be tested? (See directions 9 and 10, Unit Operation No. 7, Basic Signal Communication Manual.)*

(2) *What should be done if the battery is not good?*

(3) *How should the fuses be tested? (See Information Topic No. 4.)*

(4) *What should be done if a fuse is bad and there are no new fuses available?*

2. Pass a strong cord or piece of wire through the holes in the upper corners of the switchboard, allowing enough slack so as to hang the switchboard at a convenient height on a fence, wall, tree, or pole. In order that the drops will readily fall, the switchboard should be perpendicular or tilted slightly to the front. Fasten the switchboard by either nailing or tying the four corners down firmly.

Question.

(5) *Suppose it was necessary to set up and operate a switchboard in combat in a country without fences, poles, or trees. How would it be done?*

3. Fasten the terminal strip vertically to some object such as a tree, fence, or board, using nails or screws. It should be as distant from the switchboard as the length of the cable will permit without throwing a strain on the cable.

4. Similarly hook or tie another terminal strip for the line wires parallel to and about a foot from and to the right of the cable terminal strip.

5. Take four dummy line circuits each about 10 feet long, leaving sufficient slack so that they may be fastened to a post or tree, and bring the terminals to the right-hand binding posts of the terminal strip installed as in Par. 4 above. Place tags with the designation of the circuit on each line circuit. The line wires should be connected from top to bottom on the line terminal strip in the same order as on the switchboard terminal strip, in order that connections may be properly made between terminals.

6. After the line wires have been connected to the terminal strip securely fasten them to a post or tree, or other strong object, leaving a little slack in order that they will not be pulled loose from the terminal strip in the event of any strain being placed on the circuits.

Question.

(6) *Just how should the line wires be fastened to a post or tree so that they would be secure and not pull loose easily from the terminal strip?*

7. Cut four pieces of twisted-pair wire each about 14 inches long and connect the right binding posts of the switchboard terminal strip, installed as in Par. 3, to the left-hand binding posts of the line terminal strip installed as in Par. 4. This connects the drops on the switchboard to the different line circuits.

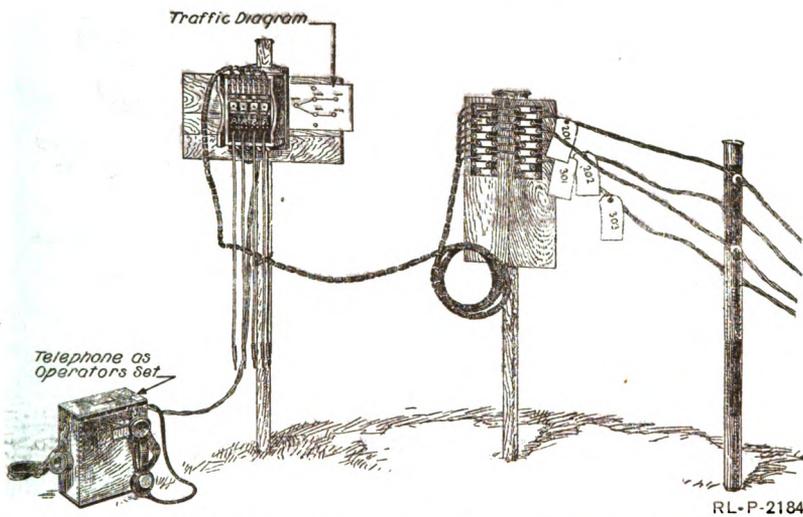


Fig. 3.—Installation of monocord switchboard with a camp telephone for operator's set.

8. If an old type of switchboard of type EE - 2 units is installed, connect the binding post L_1 of the camp telephone to the clip binding post L_1 on the bottom of the switchboard; similarly connect L_2 of the telephone to L_2 of the switchboard.

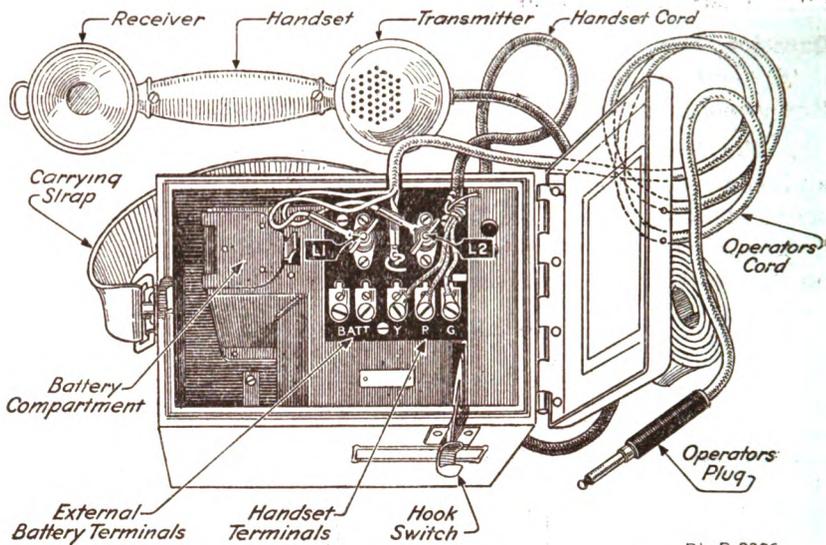
9. See that all plugs and cords are hanging free, and move the droplocks to a horizontal position, so that the drops will fall when a call comes in. (See Fig. 3.)

10. See that the switchboard is vertical.

11. If the new type of switchboard, of type EE - 2-A units, is installed, a two-conductor cord with plug must be provided for an operator's answering cord. The two terminals of the wires in the cord should be connected to L_1 and L_2 binding posts of the camp telephone. (See Fig. 4.)

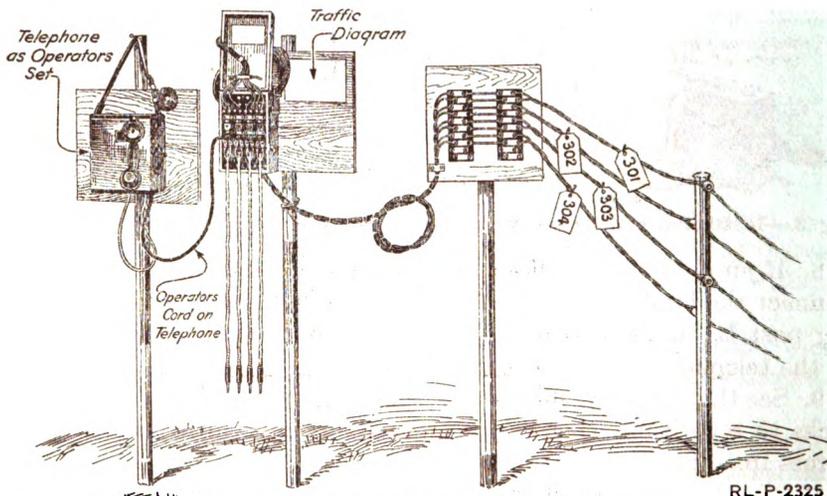
12. The complete installation is shown in Fig. 5.

13. To install a night-alarm circuit to the type EE - 2 unit switchboard, connections are made as in Fig. 6. Two dry cells are con-



RL-P-2326

Fig 4.—Camp telephone, type EE - 4, with operator's cord attached.



RL-P-2325

Fig. 5.—A telephone central with monocord switchboard of type EE - 2-A units, with camp telephone as operator's set.

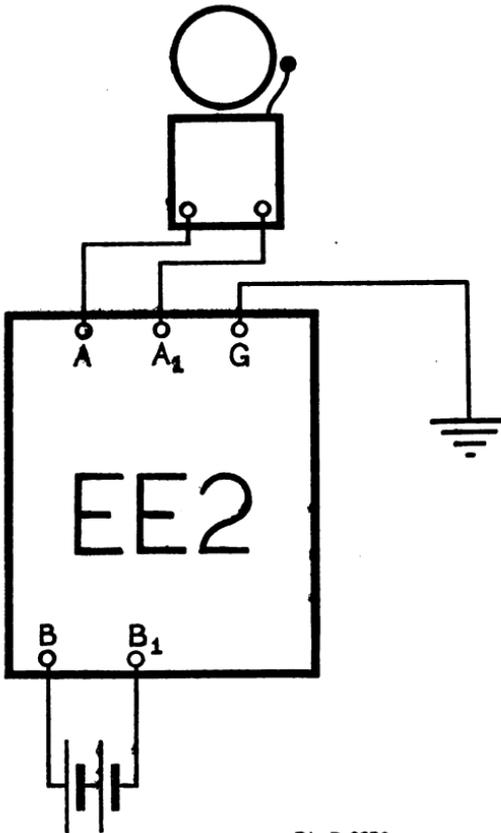
nected in series to the binding posts B and B₁, at the bottom of the switchboard, and the terminals of the bell or buzzer are connected to A and A₁, at the top of the switchboard. (See Fig. 6.)

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14. If the type EE - 2-A unit monocord switchboard is installed, connections should be made for the night alarm as shown in Fig. 7. Two dry cells and the bell or buzzer are connected in series to the switchboard terminals marked NA.

Questions.

(7) In making connections for a night alarm with the monocord switchboard of type EE - 2-A units, why are the cells connected in series?



RL-P-2290

Fig. 6.—Circuit diagram of night alarm with switchboard of type EE - 2 units.

(8) What advantage is there in using two cells?

(9) Why connect the battery and the night-alarm bell in series when using the new type switchboard?

15. Test the operator's cord by holding the tip and sleeve of the plug between the fingers; then turn the generator crank of the operator's telephone slowly, and if the current is felt in the fingers the cord is in good condition.

16. Test the talking circuit of each unit in the switchboard by placing the operator's plug in the jack and short circuiting the terminals with a wire or pliers; then remove the operator's telephone hand set from the hook and blow in the transmitter. If the sound is heard plainly in the receiver, the unit is in good condition for talking.

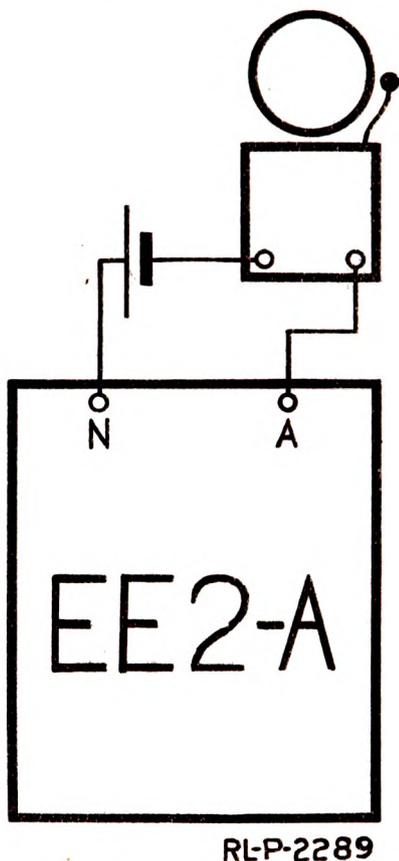


Fig. 7.—Night-alarm circuit with monocord switchboard of type EE - 2-A units.

17. Test the signaling circuit of each unit by placing the operator's plug across the terminals. Place the tip of the plug on one binding post and the sleeve on the other binding post; turn the generator crank of the operator's telephone, and if the drop falls the signaling circuit of that unit is in good condition.

SUGGESTIONS FOR THE INSTRUCTOR.

1. Divide the class into groups of three students each, and provide equipment as shown in the Students Manual. (Cables prepared previously by the students in Unit Operation No. 1 will be used for their own switchboards.)

2. At the first assembly of the class, exhibit, describe, and explain the use of the monocord switchboard (Information Topic No. 4). Install a model station with four dummy circuits and an operator's telephone, naming the various pieces of equipment installed and their use. Explain each step in the installation, showing how the switchboards should be installed and disconnected (leaving the line terminal strip in place) and the reasons that circuits are numbered and tagged.

3. After the demonstration have each group of three students install a switchboard with a camp telephone as operator's set; and inspect and criticize the work of each group until all installations are made in a workmanlike manner. Review the method of testing a camp telephone as given in Unit Operation No. 7 of the Basic Signal Communication Manual.

4. After the groups have completed their installations assemble the class and go over the questions in the Unit Operation of the Students Manual.

5. Ask questions concerning the work accomplished, such as

a. Why is it desirable to use a cable and a terminal strip with a switchboard?

b. Why is it necessary to hang the switchboard so that the drops are vertical?

c. Should the operator's telephone be placed on the ground or hung up?

d. Why does a switchboard have to be installed above the ground?

e. Why are circuits identified by number?

f. Why are circuits tagged at the terminal strip?

6. Go over the questions in Information Topic No. 3. Discuss the different battle and terrain conditions under which switchboards must be operated; and by questioning bring out and develop the students' suggestions for meeting these conditions.

7. Select several of the installations and require the students to criticize them. If the errors of these installations are not detected and criticized by the class, call attention to these irregularities by asking questions, such as

a. Is the switchboard hung in the most convenient position for operation?

b. Is the switchboard vertical so that the drops will fall?

- c. Are all the circuits properly connected to the switchboard ?
- d. Are the circuits properly tagged ?
- e. Is the operator's telephone placed in the most convenient position ?
- f. Are proper cross connections made between the terminal strips ?

8. Have each group install a night-alarm circuit connected as in Figs. 6 and 7 in Unit Operation No. 2 of the Students Manual.

9. Explain and illustrate fully the use of the night-alarm circuits under the various special conditions, such as during the operator's absence making repairs, making changes on the terminal strip, or other routine work about the station. Also explain that in some situations where traffic is light, especially at night, the night alarm may be used to permit the operator to obtain rest.

10. Determine by questions if the students are thoroughly familiar with the different methods used in connecting the night alarm on both the old and new type monocord switchboards if both are available.

11. After the installations have been completed, have the students remove the switchboard, the cable, and the cable terminal strip, and prepare them for transportation. The circuits which entered the switchboard should be patched together at the line terminal strip. Explain the reasons for this to the class. Inspect the work for the following points:

- a. On disconnection, are the circuits properly cut through ?
- b. Is the switchboard properly prepared to be moved ?

12. Simulate night conditions without light by blindfolding the students, and then require them to make the necessary installations. Practice in this way until students are proficient in setting up both the switchboard and its cable.

13. Prepare an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 2-A (PERFORMANCE).

Equipment.

PROBLEM NO. 1.

1. Prepare in advance for each student:
 - 1 hammer and nails (or 1 screwdriver and screws).
 - 1 electrician's knife and 1 pair of pliers (if students are not equipped with them).
 - 1 switchboard, type BD - 9.
 - 2 terminal strips, type TM - 84.
 - 4 10-foot lengths of twisted pair wire, type W - 44.
 - 1 5-foot length of twisted pair wire, type W - 44.

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2. For this test, as well as succeeding tests in which the same equipment under similar conditions is used, comply with the following standard test conditions:

- a. The switchboard shall be tested and prepared for transportation.
- b. All wires shall have the insulation extend to their ends.
- c. Equipment is to be neatly arranged at each student's assigned position.

PROBLEM NO. 2.

3. Prepare in advance for each student:

- 1 telephone, type EE - 4.
- 2 cells, type BA - 10.
- 1 5-foot length of twisted pair wire, type W - 44.
- 1 bell.

4. a. The telephone should be tested and prepared for transportation.

b. The cells and the bell should be tested.

Procedure.

1. The procedure in giving Problems 1 and 2 of this test is identical with that of Instruction Test No. 1 - A (Performance). Note that Problem No. 1 is in part a repetition of the first test, but with a time requirement added.

2. Problem No. 3 requires that an instructor be present to observe each student while he is being tested. If necessary this problem can be given during the instruction period and before the other questions are given.

Scoring.

1. The maximum possible score on Problem No. 1 is 54 points; on Problem No. 2, 8 points; on Problem No. 3, 18 points.

2. The score required to pass Problem No. 1 is 40 points; Problem No. 2, 6 points; Problem No. 3, 15 points.

3. Inspect and test the results of each student's work as described in Par. 4.

4. DIRECTIONS FOR SCORING.

PROBLEM NO. 1.

a. Lacing the cable:

Points.

- (1) If the cable is properly laced, that is if it is as illustrated in Fig. 2, with the details as shown in Fig. 1, even though it is not properly formed out at both ends..... 6
- (2) No partial scores allowed.
- (3) The following constitute defects:
 - (a) Correct stitch not used.
 - (b) Stitches more than 3 inches apart.

a. Lacing the cable—Continued.

(3) The following constitute defects—Continued.

- (c) End ties incorrectly made.
- (d) Stitches not pulled tight.
- (e) Slack left in any wire at any place.
- (f) If wire is used which casual inspection shows is defective. Points.

If any one of the above defects exists, the cable is not properly laced... 0

b. Proper electrical connection of switchboard and terminal strip:

- (1) If all four circuits are in working order even though they are im-
properly arranged..... 12
- (2) No partial scores allowed.
- (3) When tested with an operator's set and a telephone, if any one of the
four circuits, from the EE - 2 units, through the terminals on the
terminal strip, does not work because of the following, the cir-
cuits are not property connected:
 - (a) Split pairs on the EE - 2 units.
 - (b) Split pairs on the terminals of the terminal strip.
 - (c) Short circuits or open circuits at the terminals of the EE - 2
units.
 - (d) Short circuits or open circuits at the terminals of the terminal
strip.

If any one of the above defects exists..... 0

c. Circuits properly arranged:

- (1) When tested with an operator's set and a telephone the pair of wires
from the left-hand switchboard unit must go to the top pair of
terminals on the terminal strip (unless it is defective); and the
others connected in the same order..... 6
- (2) No partial score allowed.
- (3) If any one of the following defects occurs, the circuits are not properly
arranged:
 - (a) If the pair of wires from any EE - 2 unit, beginning from the
left of the switchboard, does not go to the corresponding pair
of terminals beginning at the top of the terminal strip.
 - (b) If the cable enters the terminal strip from the top instead of
from the bottom. (See Fig. 10.)
 - (c) If the cable leaves the switchboard from the right-hand side,
instead of from the left-hand side. (See Fig. 10.)
 - (d) If the bottom pair of binding posts on the terminal strip is
used, unless one of the upper pair of terminals is defective.

If any one of the above defects exists..... 0

d. Cable ends properly formed out:

- (1) If the cable is formed out at the switchboard and terminal strip end
and connected equally as well as illustrated in Fig. 2, even
though there are split pairs, shorts, or opens..... 4
- (2) No partial scores allowed.
- (3) If any one of the following defects occurs, the cable is not properly
formed out:
 - (a) If the ends of the cable are not formed out at the switchboard
to conform to the standard as illustrated in Fig. 2.
 - (b) If the ends of the cable are not formed out at the terminal strip
to conform to the standard as illustrated in Fig. 2.
 - (c) If there is not at least one stitch between every two wires where
they are formed out as shown in Fig. 2.

If any one of the above defects exists..... 0

| | Points. |
|--|---------|
| <i>e. Switchboard, terminal strips, and jumpers properly installed:</i> | |
| (1) (a) If the switchboard and cable terminal are installed under the existing conditions of the test equally as well as in Fig. 2, | 12 |
| (b) If the line terminal strip is installed equally as well as shown in Fig. 10. | 2 |
| (c) If the jumpers are connected as shown in Fig. 10. | 2 |
| (2) (a) If any one of the following defects occurs: Switchboard not firmly fastened to a support; switchboard not at proper height for operation; switchboard not vertical so that drops do not work properly; cords not hanging free; cable interferes with the cords; cable not securely fastened to switchboard and the terminal strip supports, when the installation is such that a passageway is provided between the switchboard and the terminal strip, deduct 2 points for each defect. | |
| (3) (a) If all of the defects listed under (2) (a) occur, the switchboard is not properly installed. | 0 |
| (b) If any one of the following defects occurs, the line terminal strip is not properly installed: | |
| 1. Line terminal strip not securely fastened. | |
| 2. Line terminal strip not arranged as shown in Fig. 10. | |
| If any one of the above defects exist. | 0 |
| (c) If any one of the following defects occurs, the jumpers are not properly connected: | |
| 1. Top pairs of the terminals of both the cable and the line terminals are not connected and those below in consecutive order. | |
| 2. Jumpers are not taut as shown in Fig. 10. | |
| If any one of the above defects exists. | 0 |
| <i>f. Time:</i> | |
| (1) If the time taken for this problem does not exceed 55 minutes. | 10 |
| (2) If the time taken exceeds 55 minutes but is less than 65 minutes. | 5 |
| (3) If the time taken exceeds 65 minutes. | 0 |

PROBLEM NO. 2.

| | |
|---|---|
| <i>g. Proper electrical connections for telephone and night alarm:</i> | |
| (1) If the telephone and night alarm are connected equally as well as shown in Fig. 10 and Fig. 6; or as shown in Fig. 10 and Fig. 7, if EE - 2 - A units are used. | 4 |
| (2) (a) If the night alarm bell is not mounted, deduct 1 point. | |
| (b) If twisted pair wire is not used for operator's set and night alarm, deduct 1 point. | |
| (3) If the electrical connections for the telephone and night alarm are improperly made so that either will not work. | |
| The telephone and night alarm are not properly installed. | 0 |
| <i>h. Central prepared for operation:</i> | |
| (1) If the central is prepared for operation. | 4 |
| (2) No partial scores allowed. | |
| (3) If any one of the following defects occurs, the central has not been prepared for operation: | |
| (a) Hand set not on the hook. | |
| (b) Drops not unlocked. | |
| If any of the above defects exist. | 0 |

PROBLEM NO. 3.

| | Points. |
|---|---------|
| <i>i. Operator's set and switchboard correctly tested.</i> | |
| (1) If operator's set and switchboard is correctly tested, as outlined under (2)..... | 12 |
| (2) (a) If the operator's cord is correctly tested..... | 2 |
| (b) If the telephone is correctly tested..... | 2 |
| (c) If the talking and signaling circuit of each unit of the switchboards are correctly tested..... | 6 |
| (d) If each unit is correctly tested for night alarm..... | 2 |
| (3) If anyone of the parts as listed in (2) are omitted or incorrectly performed, the score on that part will be..... | 0 |
| <i>j. Time.</i> | |
| (1) If the time required for this problem is 3 minutes or less..... | 6 |
| (2) If the time required is over 3 minutes but is not greater than 4 minutes..... | 3 |
| (3) If the time required exceeds 4 minutes..... | 0 |

INSTRUCTION TEST NO. 2-A (PERFORMANCE).

PROBLEM No. 1.

Directions to the student.—*a.* The following equipment has been provided and laid out at your station:

- 1 hammer and nails (or 1 screwdriver and screws).
- 1 switchboard, type BD - 9.
- 2 terminal strips, type TM - 84.
- 4 10-foot lengths of twisted pair wire, type W - 44.
- 1 5-foot length of twisted pair wire, type W - 44 (for jumper wire).
- 1 electrician's knife and 1 pair of pliers.
- 20 feet of cord.

b. When the instructor says, "Begin," start the work promptly.

c. Lace up the cable. Connect the cable to the switchboard and cable terminal strip.

d. Install the switchboard and terminal strip.

e. Install the line terminal strip and connect it by jumpers to the cable terminal strip.

f. Do the work quickly and neatly.

g. Notify the instructor at once when the work under *c*, *d*, and *e* has been completed by facing about and calling your name.

h. The instructor will then record the time it has taken to do the work. He will also inspect it.

i. The time consumed for this work should not exceed 55 minutes.

PROBLEM No. 2.

Directions to the student.—*a.* Obtain from the instructor a telephone, type EE - 4; two cells, type BA - 10; one 5-foot length of twisted pair wire, type W - 44; one bell or buzzer.

- b. When the instructor says, "Begin," start the work promptly.
- c. Connect the telephone as an operator's set to the switchboard.
- d. Connect the night alarm circuit.
- e. Prepare the central for operation.
- f. Do the work quickly and neatly.
- g. Notify the instructor at once when the work under *c*, *d*, and *e* has been completed by facing about and calling your name.
- h. The instructor will then record the time it has taken to do the work. He will also inspect it.

PROBLEM NO. 3.

Directions to the student.—*a*. When notified by the instructor to begin, do the following things in the order named without further instructions:

- (1) Open one side of the night alarm circuit.
- (2) Test the operator's cord.
- (3) Test the talking circuits of the telephone.
- (4) Test the talking and signaling circuits of each unit of the switchboard.
- (5) Reconnect the night alarm circuit.
- (6) Test all units for night alarm.
- b. Do the work quickly and accurately.
- c. The instructor will record the time taken to do the work, and whether or not each test was made correctly and in the order given.
- d. The time taken for this test should not exceed 3 minutes.

INSTRUCTION TEST NO. 2-B (INFORMATION).

NOTE.—The time allowed for this portion of the test is 12 minutes.

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted has been indicated by a short dotted line enclosed in parenthesis marks thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. (A word spelled with a hyphen, like to-day, counts as *one* word.)

1. The drop shutters on a monocord switchboard are kept shut so that they can not be broken in pulling the board out of the carrying case by means of (.....), (.....), or (.....) (.....).

2. The operator's telephone is connected to a monocord switchboard by running a piece of twisted pair from the telephone to the (.....) and (.....) terminals of the switchboard.

3. If a night bell is used with a monocord switchboard of type EE - 2 units, a battery is connected to the (.....) and (.....) terminals on the switchboard.

4. A fuse on an EE - 2 unit is tested by inserting the operator's (.....) into the (.....) of the unit being tested, shorting the line terminals, and turning the (.....) (.....). If the fuse is burned out, the (.....) will turn (.....).

5. The name of the lock which is raised when the switchboard operator is signaled is called the (.....) (.....).

6. The cords on a monocord switchboard of type EE - 2 units are known as (.....) conductor cords.

7. A battery is required to supply night alarm current to all units of a monocord switchboard thru a bar known as the (.....) (.....).

8. The circuits on the line terminal strip are (.....) to the circuits on the cable terminal strip.

9. An operator tests the operator's cord on a monocord switchboard by turning the generator crank of his telephone while holding the (.....) and (.....) of the plug in his fingers.

10. To test the talking circuit of a unit of a monocord switchboard place the (.....) plug in the jack of a unit and short circuit the (.....) with a pair of pliers. Remove the operator's (.....) (.....) from the hook and blow in the (.....). This (.....) should be heard in the (.....).

11. In testing the signaling circuit of a unit of a monocord switchboard the tip and ring of the operator's (.....) is placed across the terminals. The drop should fall when the (.....) of the operator's (.....) is turned.

12. The line drop shutters on a monocord switchboard are said to be of the (.....) type.

INSTALLATION OF MONOCORD SWITCHBOARD USING AN OPERATOR'S SET, TYPE EE-64.

Equipment.

- 1 four-line monocord switchboard with cable, terminal strip, tools, wire, and tape, as in Unit Operation No. 2.
- 1 monocord operator's set, type EE-64.

Information.

When a monocord switchboard operator uses a telephone as an operator's set he is handicapped in answering calls by the fact that he has to hold down the hook of his telephone and at the same time hold the hand set with one hand while ringing the called party with the other hand. He is further handicapped in plugging and ringing because he has a hand set instead of a head set. These facts require that he make a half dozen extra movements with both hands which it is possible to obviate.

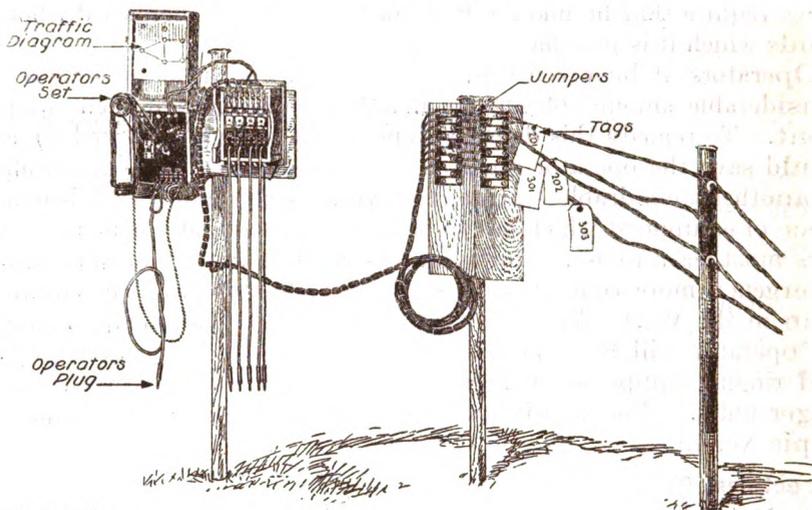
Operators at busy centrals, at regiments, and at brigades lose a considerable amount of time in handling calls through such equipment. To remedy this defect an operator's set was designed which would save the operator much time in handling calls. This results in another undesirable feature, however, since it adds an additional piece of equipment which has to be carried around, and which operators must learn to use. However, it is safe to assume that in another emergency more communication between all units will be required than in the World War, and that some improved method, whereby an operator will have both hands free to handle plugs, linedrops, and ringing equipment, will be necessary, especially at brigades and larger units. (For description of the operator's set see Information Topic No. 4.)

Directions.

1. Make switchboard, cable, and terminal strip installation as in Unit Operation No. 2. (See Information Topic No. 3.)
2. Before installing an operator's set the following tests should be made to determine its serviceability:
 - a. Test the battery in the set by holding the receiver to the ear with a piece of wire or metal across the plug terminals. Blow in the transmitter and note if the sound is reproduced in the receiver.
 - b. Test the night alarm by placing a wire or piece of metal across the terminals marked NA, and see whether the buzzer operates when the ringing and listening key under the transmitter arm is thrown to the upper position. The battery switch must be on position 1 or 2.
 - c. To test the generator and the operator's cord, place tip and ring of the operator's plug across the two line terminals of a switchboard unit. Turn the generator crank on the operator's set and the drop should fall if the operator's cord and generator are in good condition.

d. To test the operator's cord in case the drop does not fall when the test is made as in (c) above, hold the end of the operator's plug between the fingers and turn the generator crank. If a current is felt, it indicates that the cord and generator are in good condition and that the trouble is in the switchboard. If a current is not felt, the trouble may be either in the cord or the generator. In this case remove the T terminal of the cord, put the fingers across all three terminals, and again turn the generator crank; if current is felt, it indicates that the generator is all right and that the trouble is in the cord; if a current is not felt at the terminals, the trouble is in the generator.

e. If the trouble is within the switchboard unit, the cord, or the operator's set, the particular piece of apparatus should be replaced



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Fig. 8.—Telephone central with monocord switchboard, of type EE - 2 units, using operator's set.

with a new one. If the trouble is due to defective connections, it should be cleared by the operator.

3. Mount the operator's set immediately to the left of the switchboard by means of the carrying strap. (See Fig. 8.) See Information Topic No. 4 for method of preparing the operator's set for use with switchboard of type EE - 2 units.

4. Connect the night-alarm circuit by means of a short length of twisted-pair wire, from NA on the operator's set to A and A₁ on the monocord switchboard of type EE - 2 units. A piece of wire should be connected from B to B₁ at the bottom of this switchboard. When using the monocord switchboard of type EE - 2-A units, the only connection necessary is to connect NA on the switchboard to NA on the operator's set.

SUGGESTIONS FOR THE INSTRUCTOR.

1. Equipment should be ready for each group of three students, as noted in the Students Manual.

2. At the preliminary meeting of the class, exhibit and describe the operator's set (see Information Topic No. 4). Demonstrate how the operator's set is installed and used in answering calls. Compare the use of the operator's set with that of the camp telephone when used as an operator's set.

3. Ask questions, such as

a. Why place the operator's set on the left of the switchboard?

b. Should the operator's set be placed on the ground or hung up by the side of the switchboard? Why?

c. Can any difference be noted between the use of this set used as an operator's set and the camp telephone which was previously installed?

4. Have each group install the operator's set.

5. After the job is completed, assemble the students and ask questions concerning the work accomplished, such as

a. Which is preferable, the operator's set or the camp telephone as an operator's set? Why?

b. Why should the operator's set be mounted instead of being put on the ground?

c. Is it possible to operate this switchboard when it is placed flat on the ground?

d. Would an operator at a front line battalion command post in combat desire to operate the board standing up or lying down? Why?

e. What differences were noted between the night-alarm connections required on this set and those when the camp telephone was used as an operator's set?

f. Describe the different tests which should be made to determine if an operator's set is in a serviceable condition:

(1) In testing the generator and operator's cord, how could it be decided whether the trouble was in the cord or in the generator?

(2) What should be done if the trouble is in the cord?

(3) What should be done if the trouble is in the generator?

(4) If tests *a*, *b*, and *c* of direction 2, of the Students Manual all failed to locate the trouble and the operator's set still failed to work, what should be done?

g. What tests should be made to determine if the night alarm is working?

h. What is the purpose of the key immediately below the transmitter?

i. In what position should the key be placed when the set is not in use, or when packed for transportation? Why?

j. What is the purpose or use of the battery switch? What happens when the battery switch is on positions "1," "2," and "off"?

6. The instructor should carefully explain to the class the meaning of the terminals T, R, and S on the operator's set and illustrate the manner of connecting either a two or a three way cord to these terminals. He should also give a brief explanation of the purpose and use of such cords.

7. While the class is assembled and the instruction described in paragraphs 5 and 6 above is being given, have an assistant go over the student installations and

a. Place defective batteries in some sets.

b. Place a short across the generator terminals in some sets.

c. Replace operator's cords with defective ones.

d. Disconnect one terminal of receivers and cords on some sets.

e. Short the transmitter, receiver, or cord terminals on some sets.

8. Require the students to return to their installations and to perform the tests required in paragraph 2, Unit Operation No. 3 of the Students Manual.

9. Require the students to prepare a table showing every trouble described up to this point in each piece of equipment and the methods of testing for it. After the students have made up this list, a large, carefully prepared chart giving the same information can be posted in a conspicuous place. Operators are required to know how to detect troubles and how to determine in which piece of apparatus they are located. They must be able to make all repairs that can be made with a screw driver, knife, pliers, wire, and tape. They must be taught to rely on themselves and their own initiative to keep this equipment working in combat without the facilities or assistance obtainable in garrison.

10. Have the students disconnect their installations and prepare the apparatus for shipment. See that cords, receiver, and apparatus are placed in their proper places in the case.

11. Prepare an Instruction Test on this Unit Operation in advance. A sample of such a test is shown below. Require the students to prepare the equipment for the performance part of the test. In order that the students will have ample time for a review of their tests notify them that at some time following this test they will be given a Progress Test covering all the Unit Operations which they have completed to date.

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 3-A (PERFORMANCE).

Equipment.

Provide a monocord switchboard with its cable and terminal strip attached, and have the equipment installed in advance. Also provide an operator's set, type EE - 64, packed as for transportation, and wire for installation.

Procedure.

When the student has read his directions and is ready to be tested, direct him to "Begin." Note whether he performs the following operations correctly:

- a. Tests the operator's set.
- b. Connects the operator's set to the switchboard correctly.
- c. Tests the signaling and talking circuits of the switchboard correctly.
- d. Note and record the time to the nearest second that the command "Begin" is given; and note and record the time each individual student finishes.

Scoring.

1. The maximum possible score on this test is 18 points.
2. The score required to pass this test is 16 points.

3. DIRECTIONS FOR SCORING.

| | Points. |
|---|---------|
| <i>a. Operator's set properly tested:</i> | |
| (1) If the battery in the set, the night alarm, the generator, and the operator's cord are properly tested..... | 8 |
| (2) For any test in (1) improperly performed deduct 2 points from the total of 8 points. | |
| (3) If all tests are improperly performed or if the operator's set is not tested..... | 0 |
| <i>b. Operator's set correctly installed:</i> | |
| (1) If the operator's set is installed equally as well as the one shown in Fig. 8..... | 4 |
| (2) No partial scores allowed. | |
| (3) If any one of the following defects occurs, the operator's set is not correctly installed: | |
| (a) Operator's set so installed that turning the generator handle to call a party throws drops on the switchboard. | |
| (b) When a switchboard of EE - 2 units is used, if B and B ₁ of the switchboard are not connected, and NA of the operator's set is not connected to A and A ₁ of the switchboard. | |
| (c) When a switchboard of EE - 2-A units is used if "NA" of the switchboard is not connected to "NA" of the operator's set. | |
| If any of the above defects exist..... | 0 |
| <i>c. Signaling and talking circuits of the switchboard correctly tested:</i> | |
| (1) If the signaling and talking circuits are correctly tested..... | 6 |
| (2) No partial scores allowed. | |
| (3) If the circuits are not properly tested..... | 0 |

INSTRUCTION TEST NO. 3-A (PERFORMANCE).

Directions to the student.—*a.* A monocord switchboard together with its cable and terminal strip has been provided and installed at your assigned position.

b. An operator's set, type EE - 64, prepared for transportation, together with some wire, has also been placed with this equipment.

c. When the instructor says, "Begin," start the work promptly.

d. Test the operator's set (the battery in the set, the night alarm, the generator, and operator's cord).

e. Install the monocord operator's set and connect it to the switchboard. Connect the night alarm circuit of the operator's set.

f. Test the signaling and talking circuits of the switchboard.

g. Do the work quickly and neatly.

h. Notify the instructor when the work under *d*, *e*, and *f* has been completed by facing about and calling your name.

i. The instructor will then record the time it has taken to do the work. He will also inspect it.

INSTRUCTION TEST NO. 3-B (INFORMATION).

Directions to the student.—Below are several sentences and just after each one are the words "True" and "False." Read each sentence carefully and, if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

1. The operator's cord on the operator's set, type EE - 64, is a two-conductor cord. True. False.

2. The operator's set, type EE - 64, has an operator's headset. True. False.

3. When the transmitter of the operator's set, type EE - 64, is pushed down in position for transportation the battery furnishing talking current is disconnected. True. False.

4. There are three binding posts at the bottom of the operator's set, type EE - 64, for the operator's cord. True. False.

5. There are three binding posts at the bottom of the operator's set, type EE - 64, for the receiver. True. False.

6. The batteries for the night alarm circuit of the operator's set, type EE - 64, must be type BA - 10 batteries. True. False.

7. The batteries in the night alarm circuit of the operator's set, type EE - 64, are connected in series. True. False.

8. One difference between the operator's set (type EE - 64) and the telephone, type EE - 4, used as an operator's set, is that the handset in the telephone, type EE - 4, is replaced in the operator's set, type EE - 64, by a receiver which the operator can put on his head. True. False.

SUGGESTIONS FOR CONDUCTING PROGRESS TEST.

No. 1-A (PERFORMANCE).

Equipment.

PROBLEM NO. 1.

3 batteries, type BA - 1, serviceable; and 3 others which are un-serviceable.

1 monocord switchboard, type EE - 2.

1 operator's set, type EE - 64, without batteries.

PROBLEM NO. 2.

1 operator's cord equipped with plug.

1 telephone, type EE - 4.

Procedure.

PROBLEM NO. 1.

1. Have the central equipment listed in Problem No. 1 installed and then place the following troubles on the equipment in advance:

a. Short the tip and ring terminals of the operator's cord on the type EE - 64 operator's set with a fine wire.

b. Transpose one terminal of the receiver and the tip terminal of the operator's cord on the type EE - 64 operator's set.

c. Insert un-serviceable batteries in the type EE - 64 operator's set. Place the other serviceable and un-serviceable batteries together beside the equipment.

d. Remove a fuse from one unit of the monocord switchboard.

e. Open the line circuit of another unit by placing a very small piece of emery cloth or other very tough insulating material between one end of the fuse and its socket in such a manner that it will not be noticed.

f. Short circuit the A₁ and G terminals; also the B₁ and L₁ terminals.

g. Rearrange neatly the circuits to the cable terminal strip so that two pairs are split between the two sets of binding posts.

2. In placing these troubles, do not damage the equipment in any way. The troubles are placed on the equipment in order to ascertain whether the student is familiar not only with the various tests which he must make, but also whether he can locate the trouble and adjust it quickly.

3. A list of the names of the students on a card as shown below can be prepared.

| Student's name. | Time started. | Time finished. | Time elapsed. | Score. | | | | | | | Total score. |
|-----------------|---------------|----------------|---------------|--------|-------|-------|-------|-------|-------|-------|--------------|
| | | | | a | b | c | d | e | f | g | |
| Jones..... | | | | 4 | 0 | 4 | 4 | 4 | 0 | 4 | 20 |
| Smith..... | | | | | | | | | | | |

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- 4. Issue the directions for Problem No. 1.
- 5. After the students have read their directions and have indicated that they are ready, give the command "Begin" and note the time under "Time started" on the record card. Record the troubles corrected by the student as shown on the score card.

PROBLEM NO. 2.

- 6. *a.* After Problem No. 1 has been completed and scored issue the equipment and directions for Problem No. 2.
- b.* Arrange to have the work of each student observed while the set is being changed.
- c.* When the students have read the directions give the command "Begin" and note the time. Record the time each student finishes.

Scoring.

- 1. The maximum possible score for this test is 28 points for Problem No. 1 and 8 points for Problem No. 2.
- 2. The score required to pass this test is 24 points for Problem No. 1 and 6 points for Problem No. 2.

3. DIRECTIONS FOR SCORING.

| | |
|---|---------|
| <i>a. Locating troubles:</i> | Points. |
| (1) If all troubles listed under procedure from <i>a</i> to <i>g</i> are located by the student..... | 28 |
| (2) Deduct 4 points for each trouble the student fails to locate. | |
| <i>b. Replacing EE - 64 operator's set with EE - 4 telephone:</i> | |
| (1) If the operator's set is replaced correctly within 3 minutes without interrupting communications..... | 8 |
| (2) Deduct 1 point for each 10 seconds excess time required. | |

PROGRESS TEST NO. 1-A (PERFORMANCE).

PROBLEM NO. 1.

- Directions to the student.—*a.* There is installed at your position a monocord switchboard with a type EE - 64 as operator's set. This central equipment has its cable and terminal strip attached.
- b.* When the instructor says "Begin," start work promptly.
 - c.* Test the equipment. Locate and repair any defects.
 - d.* When the work in *c* has been completed and the equipment is in working order, face about immediately and notify the instructor by calling out your name.

PROBLEM NO. 2.

- Directions to the student.—*a.* Read this paragraph carefully. Then do what you are told to do in *c*.
- b.* At the telephone central of a command post of a combat unit in the field, equipment similar to that in question No. 1 was installed and working. The communications officer approached the operator

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at the switchboard and said: "That operator's set will be needed at the command post. Take it out and prepare it for transportation. Install a type EE - 4 telephone as an operator's set."

c. Comply with the above order, being careful not to interrupt your ability to handle calls on the switchboard.

d. When the work as assigned in c above has been completed and the equipment is in working order, face about immediately and notify the instructor by calling out your name.

e. The time allowed for this problem is 3 minutes.

PROGRESS TEST NO. 1-B (INFORMATION).

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line enclosed in a parenthesis. Fill in each blank space with a word which will make good sense and at the same time be technically correct. (A word spelled with a hyphen, like to-day, counts as one word.)

1. The wires of a cable are (.....) together.

2. Test the battery in a monocord operator's set by holding the (.....) to the ear and placing a piece of metal across the (.....) (.....). Rap on the (.....) and note if a sound is produced in the (.....).

3. When it is desired to use the night-alarm circuit the (.....) of the operator's set is thrown to the (.....) position.

4. To test the generator and the operator's cord of a monocord operator's set, the operator places his plug across the two (.....) terminals of a (.....) (.....). He turns the generator crank and the (.....) (.....) if both are in good condition.

5. If a night alarm is used with a monocord switchboard of type (.....) units a battery is connected to the (.....) and (.....) terminals on the switchboard.

Directions to the student.—Below are several paragraphs and just after each one are the words "True" and "False." Read each paragraph carefully and, if what it says is true, draw a line under "True." If what it says is not true, draw a line under the word "False."

6. A fuse on a switchboard of type EE - 2 units is used to protect the line from lightning. True. False.

7. When installing a monocord operator's set, type EE - 64 with a monocord switchboard of type EE - 2 units, the ring and sleeve terminals, R and S, must be electrically connected. True. False.

8. Monocord switchboards can not be operated on the ground. True. False.

9. Broken fuses on monocord switchboards can be replaced by a rubber band or by a paper clip. True. False.

10. If a night alarm is desired with a monocord switchboard using a telephone as an operator's set a separate bell or buzzer must be provided. True. False.

11. The cable between the switchboard and the terminal strip when installed in the open is tied near the switchboard and also near the terminal strip. True. False.

12. A defective type EE - 2 unit if removed prevents the operation of the other units. True. False.

13. Pairs of wires in the cable between a monocord switchboard and the terminal strip are identified by tagging or knotting them, by using different colored wires, or by arranging them from left to right on the switchboard and from top to bottom on the terminal strip. True. False.

14. In connecting the night-alarm circuit of the type EE - 64 monocord operator's set to a switchboard of type EE - 2 units, B and B₁ of the switchboard are not connected together. True. False.

15. Complete the diagram in Fig. 4-IG showing the necessary connections so that the bell will ring when a drop of the monocord switchboard of type EE - 2 units falls.

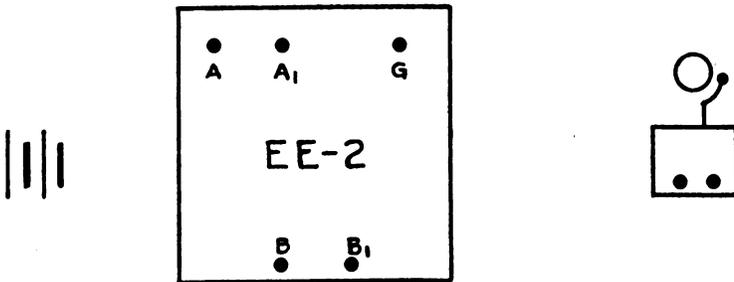
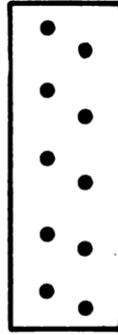
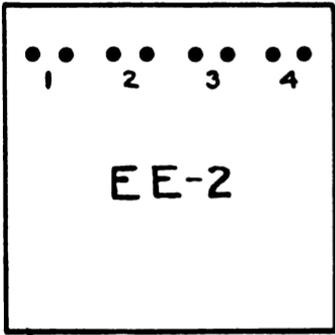


Fig. 4-1. G.

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16. Complete the diagram in Fig. 5-IG showing:

- (a) The direction taken by the circuits leaving the switchboard.
- (b) The direction taken by the circuits leaving the terminal strip.
- (c) The order in which circuits are connected on the terminal strip and switchboard.



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Fig. 5—I. G.

Note to instructor.

For a correct solution for question 15 or 16 credit 3 points for each question.

INSTALLATION OF TWO FOUR-LINE MONOCORD SWITCHBOARDS AS A SINGLE UNIT USING CAMP TELEPHONE AS OPERATOR'S SET.

Equipment.

- 2 four-line monocord switchboards with cable and terminal strips attached.
- 1 camp telephone, type EE - 4.

Information.

Monocord switchboards are manufactured and issued to troops in 4-line, 8-line, and 12-line sizes, known as BD - 9, BD - 10, and BD - 11 switchboards, respectively.

All headquarters frequently move by bounds. When a command post moves by bounds, communication has to be installed and put in operation at the new location of the command post before the old command post closes. This requires that centrals be equipped with at least two switchboards. When a command post of a small unit, such as a battalion, remains at one location for a considerable length of time it may be necessary to use both switchboards at the one location in order to take care of the increased number of local subscribers. In this case it becomes necessary to connect the boards so that they can be operated as a single unit by one man.

The usual operations involved in the movement of a telephone central by bounds for the command post of a small unit are:

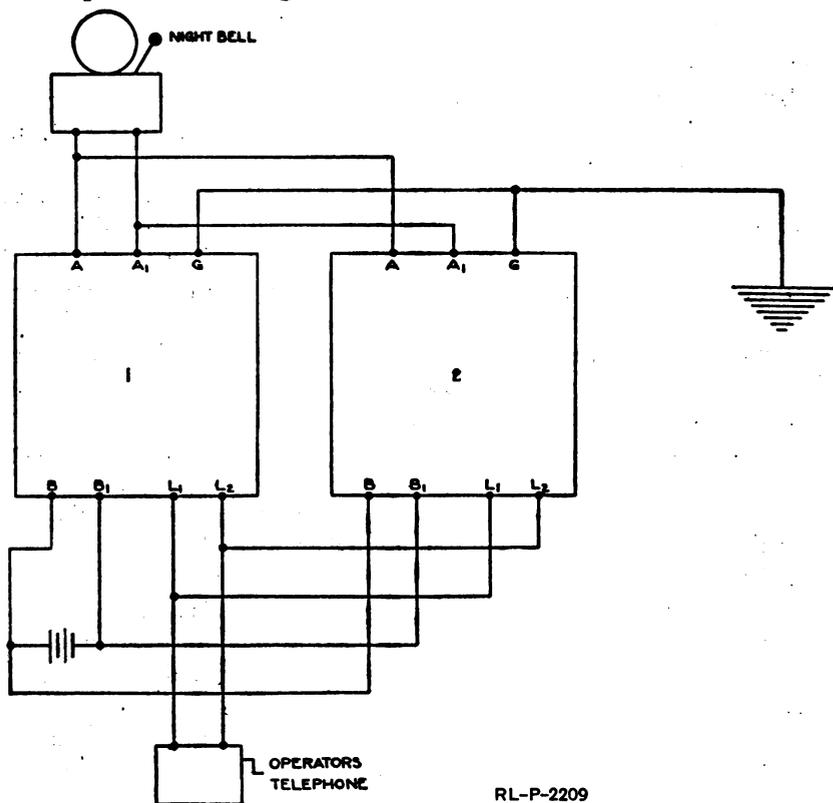
- a. The installation of one BD - 9 switchboard at the new location of the C. P., together with a telephone or operator's set.
- b. The installation of a second BD - 9 switchboard, without disturbing communication, on the first BD - 9 switchboard in order that one operator can operate both switchboards.
- c. The removal of one BD - 9 switchboard and of part of the local telephones preparatory to a forward movement of the command post.

Directions.

1. Mount the two switchboards side by side, close together, and the two terminal strips on the cables one immediately above the other at a convenient location about 8 feet to the right of the switchboard. The terminal strip which is connected to the left-hand switchboard should be above the terminal strip attached to the right-hand switchboard. (See Information Topic No. 3.)
2. Connect the terminals designated A at the top of switchboard No. 1 to A of switchboard No. 2, and A₁ of switchboard No. 1 to A₁ of switchboard No. 2.

3. Similarly connect the terminal B of switchboard No. 1 to B of switchboard No. 2, and B₁ of switchboard No. 1 to B₁ of switchboard No. 2.

4. Connect the L₁ of switchboard No. 1 to L₁ of switchboard No. 2, and L₂ of switchboard No. 1 to L₂ of switchboard No. 2, and run a piece of wire from L₁ of one switchboard to L₁ of the camp telephone, and another piece of wire from L₂ of the same switchboard to L₂ of the telephone. (See Fig. 9.)



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Fig. 9.—A diagram of the connections between two monocord switchboards of type EE - 2 units installed as a single unit.

Questions.

- (1) What is the purpose of making the connections specified above? What is this type of connection called?
- (2) What should be done in order to provide central switchboard accommodations for 12 lines when only four-line monocord boards are available?
- (3) How could 16 lines be provided for under similar conditions?
- (4) What is the limit to the number of four-line boards that can be installed and operated as one unit?

(5) *In Fig. 9 some wires are shown intersecting each other without a dot, and some with a dot. What does each mean?*

(6) *What are the principal differences between the installation with the operator's set and the installation with the field telephone?*

5. To install two switchboards of type EE - 2-A units as one unit, the switchboards are mounted as above. The only connection necessary between the boards is to connect NA of one switchboard to NA of the other switchboard. Connect NA of the left-hand switchboard to NA of the operator's set.

SUGGESTIONS FOR THE INSTRUCTOR.

1. The equipment in this Unit Operation in the Students Manual should be ready for each group of three students.
2. At the first assembly of the class describe fully the necessity for an installation requiring two switchboards to be combined into a single unit.
3. Illustrate and explain fully the method of mounting the switchboards and the terminal strips, forming and connecting the cable, and the night-alarm connections.
4. Have each group prepare a cable 10 feet long connecting the switchboard and the terminal strips, as in Unit Operation No. 1, and mount the operator's set.
5. After all groups have completed their work, assemble the class, and go over the questions in the Unit Operation of the Students Manual. Ask questions such as
 - a. Under what conditions are such installations required?
 - b. Can more than two monocord switchboards be connected and operated as a single unit?
 - c. Why is it necessary to connect the terminals on the top and bottom of one switchboard to the corresponding terminals on the other switchboard?
6. Dismount the operators' sets and have various groups replace these sets with field telephones to be used as operators' sets.
7. Determine whether the members of the class fully understand the difference between the installation with the operator's set and the one with the field telephone, and that they can make all wiring connections for either installation. Proceed as follows: Give one student the equipment and require the members of the class, in turn, to tell the student selected for demonstrating the installation what he is to do.
8. As a test for the class have an installation prepared with the following defects:
 - a. Cable made up with loop-stitch instead of lock-stitch.
 - b. Wires not correctly connected to binding posts at terminals and switchboards.
 - c. Slack left in wires of the cable.
 - d. Night-alarm connections improperly made.
 - e. Operator's set so located that all jacks can not be reached.
 - f. Cable lying on the ground.
 - g. Cable not fastened to switchboard post and terminal-strip post.
 - h. Line circuits not properly fastened to a strong object.
 - i. Jumper wires connected to wrong binding posts on terminal strips so as to split pairs.

- j. No tags on circuits.
 - k. Switchboard not mounted perpendicularly.
 - l. Fuse missing on the EE-2.
 - m. One drop locked up.
9. Require the students, without conferring among themselves, to inspect the installation and to write out and hand in a list of all the defects they observe.

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 4-A (PERFORMANCE).

Equipment.

- 2 switchboards, type BD - 9 each with cable and terminal strip properly attached.
- 1 telephone, type EE - 4
- 1 bell or buzzer.
- 2 dry cells, type BA - 10.
- 1 hammer and nails (or screw driver and screws).
- 1 ground rod.
- 20 feet wire, type W - 40 or W - 44.

Procedure.

1. The procedure for Problem No. 1 of this test is identical with that of Instruction Test No. 1-A. The procedure in Problems No. 2 and No. 3 is the identical procedure required in Instruction Test No. 2-A, Problem No. 3, except that an instructor during the operation will test the circuits of the switchboard, which is not removed, to see that drops will fall and that calls can be answered.

Scoring.

- 1. The maximum possible score in this test is 48 points.
- 2. The score required to pass this test is 36 points.
- 3. Inspect and test the result of the students' work as described in Par. 4.
- 4. DIRECTIONS FOR SCORING.

PROBLEM NO. 1.

| | |
|---|---------------|
| <i>a. Switchboards properly installed.</i> | Points |
| (1) If the switchboards are installed under the existing conditions of the test so that they can be operated equally as well as the switchboards as shown in Fig. 10..... | 6 |
| (2) No partial scores allowed. | |

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a. *Switchboards properly installed—Continued.*

- (3) If any one of the following defects occurs, the switchboard is not properly installed:
- (a) Switchboards not firmly fastened to supports,
 - (b) Switchboards not at convenient height for operation,
 - (c) Switchboards not vertical, cords not hanging free, plugs not accessible for use, and cables not out of the way of cords and plugs,
 - (d) Switchboards so far apart that a switchboard cord of external unit of one switchboard can not be used to plug into the jack of the external unit of the other switchboard,
 - (e) Night alarm not mounted.

Points.

If any one of the above defects exists..... 0

b. *Proper electrical connection of central equipment.*

- (1) (a) If the switchboards of EE - 2 units are connected so that they will work equally as well as when connected as shown in Fig. 9..... 12
- (b) If the switchboards are of EE - 2 - A units and the "NA" of one switchboard is connected to the "NA" of the other switchboard and the "NA" of the left-hand switchboard is connected to the "NA" of the operator's set..... 12
- (2) No partial scores allowed.
- (3) If the switchboards are not connected as described in (1) (a) or (1) (b) above, the central equipment is not properly connected.. 0

c. *Central ready for operation.*

- (1) If the central is ready for operation..... 6
- (2) No partial scores allowed.
- (3) If any one of the following defects occurs, the central is not ready for operation:
 - (a) Hand set not hanging on the switch hook.
 - (b) Telephone so far away from the switchboard that the operator can not ring and handle plugs with the same hand.
 - (c) If the lock drops are not unlocked.
 If any one of the above defects exists..... 0

PROBLEM NO. 2.

d. *Operator's set and switchboard circuit correctly tested.*

- (1) If operator's set and switchboard circuit is correctly tested, as outlined under (2)..... 12
- (2) (a) If the operator's cord is correctly tested..... 2
- (b) If the telephone is correctly tested..... 2
- (c) If the talking and signaling circuit of each unit of the switchboards is correctly tested..... 6
- (d) If each unit is correctly tested for night alarm..... 2
- (3) If any one of the tests listed as in (2) is omitted or incorrectly performed, the score on that partial test will be..... 0

PROBLEM NO. 3.

e. *One BD - 9 properly removed.*

- (1) If the switchboard is properly removed..... 10
- (2) No partial scores allowed.

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e. One BD - 9 properly removed—Continued.

(3) If any one of the following defects occurs, the switchboard has not been properly removed:

- (a) If during the removal of the switchboard it is possible to ring on any circuit of the switchboard which is not being removed and the corresponding drop does not fall,
- (b) (Case I. Operator's telephone connected to switchboard which remains.) If during the removal of the switchboard the operator is not able to answer a drop that does fall,
- (c) (Case II. Operator's telephone connected to switchboard which is removed.) If the operator after removing leads from the telephone to the switchboard does anything else before replacing the leads from the telephone to the switchboard which remains,

If any one of the above defects exists..... Points. 0

f. Switchboard properly prepared for transportation.

- (1) If the switchboard is properly prepared for transportation..... 2
 - (2) No partial scores allowed.
 - (3) If any one of the following defects occurs, the switchboard has not been properly prepared for transportation:
 - (a) If the drops are not locked,
 - (b) If the cable and terminal strip are not removed with the switchboard and kept attached to it,
 - (c) If the switchboard is of EE - 2 unit and is not placed in its carrying case with the cable and terminal strip neatly wrapped around the case and secured,
- If any one of the above defects exists..... 0

INSTRUCTION TEST NO. 4-A (PERFORMANCE).

PROBLEM NO. 1.

Directions to the student.—*a.* At the location of Magic central there are two switchboards, type BD - 9, each with cables and terminal strips attached; a hammer and nails (or screw driver and screws); a telephone, type EE - 4; a bell; two dry cells; ground rod and necessary wire.

b. When the instructor says "Begin," start work promptly and perform the following operations in order:

c. Install the two switchboards as a single unit, using the type EE - 4 telephone as an operator's set, and arrange the equipment ready for operation as a telephone central.

d. Connect the night-alarm circuit and ground.

e. When the work as assigned in *c* and *d* has been completed and the equipment is in working order, face about immediately and notify the instructor by calling out your name.

f. The instructor will then record the time it has taken to do the work. He will also inspect it.

PROBLEM NO. 2.

- Directions to the student.**—*a.* When notified by the instructor to do so, perform the following tests:
- b.* Test the operator's set.
 - c.* Test the switchboard circuits.
 - d.* Test all units for night alarm.
 - e.* Do the work quickly and accurately.

PROBLEM NO. 3.

Directions to the student.—*a.* Read the following paragraph carefully. Then do what you are told to do in section *c* below.

b. At the telephone central of a command post of a combat unit in the field, equipment similar to that in Question No. 1 was installed and working. The communication officer approached the operator at the switchboard and said:

- (1) "The wire section will prepare to establish a forward echelon of this command post 2 miles nearer the front."
- (2) "The local telephones on that switchboard (the right-hand switchboard) are being disconnected."
- (3) "Remove that switchboard."
- (4) "Prepare it for transportation."
- (5) "Be careful in removing it not to interrupt your ability to handle calls on the remaining switchboard."

c. When the instructor says "Begin," comply with that portion of the above order contained in subparagraphs (3), (4), and (5).

d. Do the work quickly and neatly.

e. Notify the instructor at once when the work has been completed by facing about and calling your name.

f. The instructor will then record the time it has taken to do the work. He will also inspect it.

INSTRUCTION TEST NO. 4-B (INFORMATION.)

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line enclosed in parentheses, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as *one* word.

1. When two four-line monocord (.....) are connected, to be used as a (.....) unit, they must be mounted close together in order that the (.....) of any unit will reach the unit (.....) (.....) from it.

2. Accommodation could be provided for 12 lines when only (.....) line monocord switchboards were available by using (.....) such switchboards and (.....) them for operation as a (.....) unit.

3. To connect as a single unit two monocord switchboards of type EE - 2 units, proceed as follows:

a. Connect the terminals on the top of each switchboard marked (.....) together, and also those marked (.....) together.

b. Then connect the terminals on the bottom of each switchboard marked (.....) together, and also those marked (.....).

c. Next connect the terminals on the bottom of each switchboard marked (.....) together, and connect those marked (.....) together.

d. Finally connect the terminals on the top of each switchboard marked (.....) together.

4. To install the switchboard for operation after the connections have been made as described in question No. 3 proceed as follows:

a. Connect (.....) to ground.

b. Connect an alarm bell between (.....) and (.....).

c. Connect an external battery between (.....) and (.....).

d. Connect a camp telephone as an operator's set between (.....) and (.....).

5. When two switchboards are installed to be operated as a single unit, the terminal strip which is connected to the left-hand switchboard should be mounted (.....) the (.....) (.....) which is connected to the right-hand switchboard.

6. When connecting, as a single unit, two monocord switchboards of type EE - 2 - A units, the only (.....) necessary between the boards is that connecting the (.....) marked (.....) on one switchboard to those marked (.....) on the other switchboard.

OPERATION OF MONOCORD SWITCHBOARD.

Equipment.

A four-line monocord switchboard installed complete with operator's set or camp telephone, with four lines and telephones.

Information.

The previous Unit Operations have been concerned with the installation of monocord switchboards, together with the simple tests made by operators to determine whether the circuits of their equipment are in working order.

Beginning with this Unit Operation the operation of monocord switchboards will be taken up.

After an operator has installed his switchboard and cable terminal strip and a line terminal strip (if one is not already in place), he connects the line terminal strip to the cable terminal strip. The Message Center and commanding officer's telephone are usually the first local circuits that are installed by the other members of the wire section. These two local circuits are usually followed by the trunk circuits to the next superior and next subordinate units.

The code names of these circuits are written on the strips above the drops as soon as a circuit is connected. For convenience the commanding officer's telephone is ordinarily placed on the left-hand unit of the switchboard and the Message Center telephone on the extreme right-hand unit. Although this scheme of installation is not strictly necessary, its use will be found a great convenience.

In handling calls there are a number of movements to be made by an operator. To increase speed and accuracy of these movements approved methods of manual operation in handling calls are given below.

Directions.

1. The instructor will assign names to the various local telephones connected to the switchboard. These names will be written on the celluloid strips above the drops. (See Information Topic No. 6.)

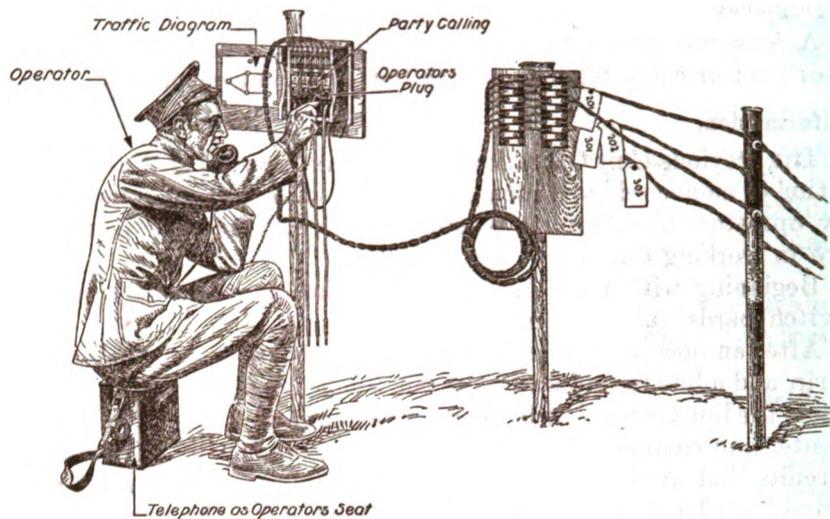
Question.

(1) *With what should the names be written on the celluloid strips above the drops?*

2. It is to be borne in mind that, except in certain special cases, which will be discussed in detail later, the operator's duty is to connect one party with another. In this capacity he does not originate calls; therefore after his switchboard is installed and in working order

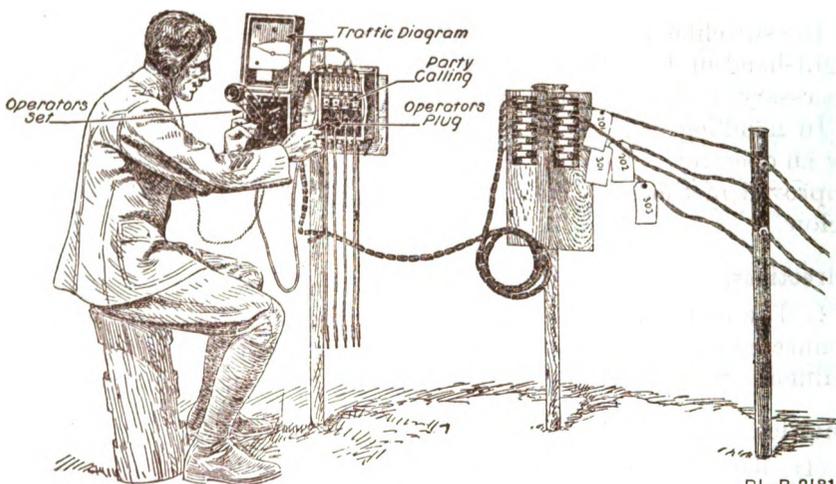
TELEPHONE SWITCHBOARD OPERATOR.

he waits for drops to fall, with the answering cord in his hand (see Fig. 15) in order that he can make connections with the least delay.



RL-P-2185

Fig. 10.—Operator answering a call on the monocord switchboard.



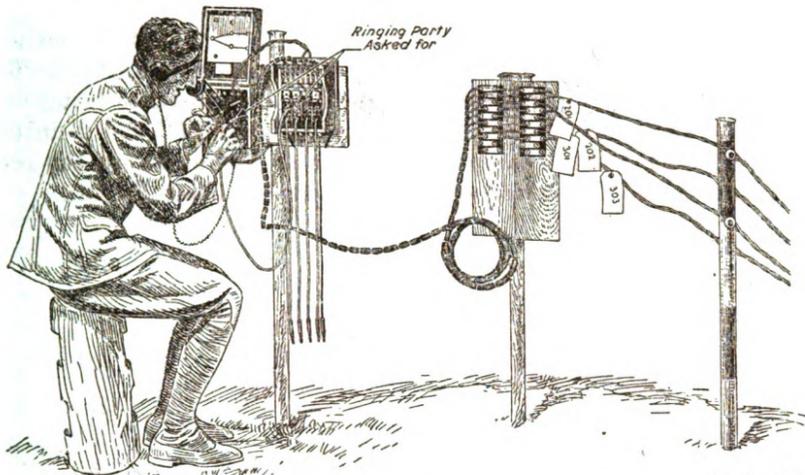
RL-P-2181

Fig. 11.—Operator preparing to call the called party on a monocord switchboard.

Question.

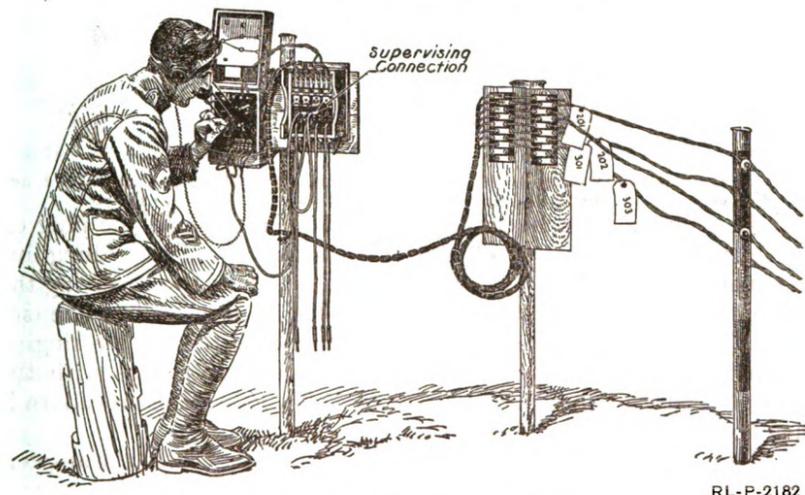
(2) Suppose that some one came to a switchboard operator and asked him to transmit an important message. What should the operator do?

3. Suppose that the number 3 drop falls. The operator inserts the operator's plug into the number 3 jack (see Fig. 10) and answers, giving the code name of his central followed by the word "operator," as "MUTTON operator."



RL-P-2192

Fig. 12.—Operator ringing a called party.



RL-P-2182

Fig. 13.—Operator supervising a call.

Suppose the call is for "MUTTON-1" (battalion commander) and that MUTTON-1 is on the No. 2 jack of the board. The reply is "MUTTON-1 ?" Then the operator removes the operator's plug from No. 3 jack (see Fig. 11) and inserts it into the No. 2 jack, giving

the generator handle three or four vigorous turns (see Fig. 12). Then he takes the cord of No. 2 unit and inserts the plug into the jack of the No. 3 unit and restores the drop. He does not remove the operator's plug from No. 2 jack until conversation is started and the connection appears to be satisfactory. (See Fig. 13.)

4. The operation of the switchboard of EE-2-A units using either a camp telephone as operator's set or the regular operator's set EE-64 is the same as above, the operator's cord in each instance being attached to the operator's set. In the switchboard of EE-2 units, however, when using a camp telephone as an operator's set the red cord attached to the switchboard is used as the operator's cord.

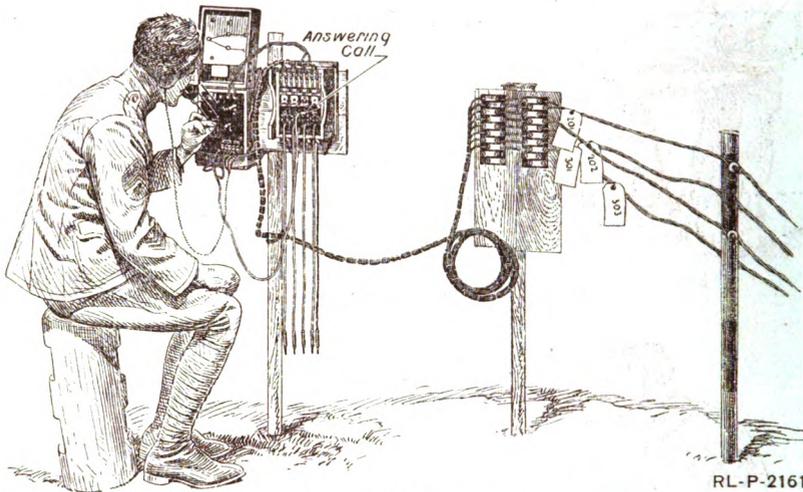
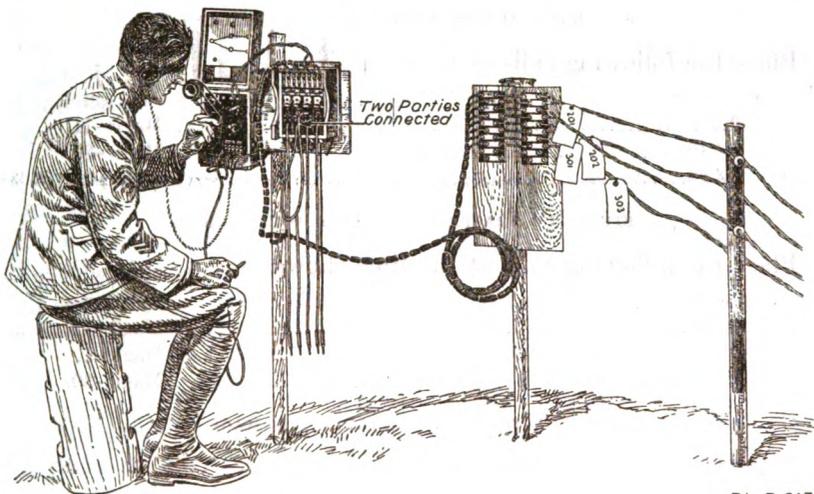


Fig. 14.—Operator answering a call with the monocord switchboard operator's set.

5. In establishing connections with the operator's set the plug on the cord on the operator's set is inserted in the jack of the calling line and answered as in Par. 3 above. (See Fig. 14.) After receiving the number desired the operator removes his plug from the calling line (see Fig. 11), inserts it in the jack of the called line, throws the ringing and listening key to lower nonlocking position, and rings with the hand generator of the operator's set (see Fig. 12). The procedure is then the same as in Par. 3 (see Fig. 13).

6. Unless it is necessary to answer other incoming calls, the answering plug should be left in the jack until the calling and called parties are talking to each other. (See Fig. 13.) The answering plug is not necessary for conversation between the parties, and it impairs transmission, so that it should be removed as soon as the operator has satisfied himself that the connection is satisfactory. (See Fig. 15, where operator is waiting for another call.) If it is necessary to use the answering plug to answer another incoming call before the called

party has answered, it is permissible to remove it and proceed with the other call. The drop is left unreturned as a reminder to the operator that the call is uncompleted. When the second call is complete, however, the operator must insert the answering plug into the free jack of the first connection to find out if the called party has answered. If the called party has not answered, the operator removes the called party's plug from the calling party's jack, and rings as before, immediately replacing the called party's plug in the calling party's jack. *The operator must never ring on a line that is connected through to a calling subscriber.* When the two persons on a connection or line have finished their conversation, they will hang up, and ring off by giving the generator handle a turn, or, similarly,



RL-P-2179

Fig. 15.—Operator waiting for calls.

if either of these two persons desires to attract the attention of the operator, he will hang up and ring. In either case this ringing will cause the drop above the free jacks to fall. In such cases the operator will insert his answering plug into the free jack of the two and challenge with "WAITING?" spoken with a rising inflection, as if asking a question. If no response is received when this challenge has been repeated, he is safe in assuming that the two persons have completed their conversation. He therefore clears the switchboard of the connection and restores the drop. (Procedure in case there is an answer to the challenge "Waiting?" will be taken up later.)

Questions.

(3) Suppose that two drops fall at the same time. What should be done?

(4) How can an operator tell whether both parties ring off or not?

7. When the operator's set is used with the switchboard of type EE - 2 - A units, the following procedure is necessary: The operator answers the call by inserting the plug on the operator's cord in the jack of the calling party and answers as in Par. 3 above. He then places the calling party's plug in the called party's jack and with the key of the operator's set in its center or normal position turns the generator crank vigorously. He listens in to see that the conversation is started and then removes the operator's plug. In case it becomes necessary to ring the calling party, the operator, with his plug in the calling party's jack, throws the key of the operator's set to its lower position and rings.

8. Each student subscriber will make calls as follows:

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-1.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0..... | Magic-11. |
| 0+10..... | Magic-3. |
| 0+20..... | Magic-30. |

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-3.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0+3..... | Magic-11. |
| 0+12..... | Magic-1. |
| 0+22..... | Magic-30. |

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-11.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0+5..... | Magic-3. |
| 0+15..... | Magic-30. |
| 0+25..... | Magic-1. |

STUDENT'S TRAFFIC-LOAD TABLE FOR MAGIC-30.

Place the following calls at the time shown—

| Time of call. | Party called. |
|---------------|---------------|
| 0+8..... | Magic-1. |
| 0+18..... | Magic-11. |
| 0+27..... | Magic-3. |

Students will place the calls as shown on their traffic-load tables. When the party called answers "MAGIC-30, telephone orderly speaking," the calling party replies "MAGIC-1, telephone orderly speaking; ring off." Then both orderlies ring off.

SUGGESTIONS FOR THE INSTRUCTOR.

1. Provide for each group of five students the equipment shown in the Unit Operation of the Students Manual.

2. At the preliminary meeting of the class have one group make a complete installation, including four short lines with camp telephones connected on each line, for demonstration purposes. Direct the other men to observe the installation. This is a review of Unit Operations Nos. 2 and 3 and should clear up all points not covered in those Unit Operations.

3. Designate the central and the various lines on the switchboard in order as follows, and tag accordingly:

| | |
|------------------------------------|----------|
| Line No. 1—Commanding officer..... | Magic-1 |
| Line No. 2—Chief of staff..... | Magic-3 |
| Line No. 3—Message center..... | Magic-11 |
| Line No. 4—Radio station..... | Magic-30 |

4. Explain fully to the class the complete operation of the switchboard and demonstrate how a call is made and a connection established through the board. In connection with the above, a full explanation should be given the class that the telephones are merely used to illustrate how connections are established through the board, and that in actual practice some of the lines would terminate at other switchboards, and some at telephones in the vicinity of the switchboard.

5. The difference between local lines and trunk lines should be thoroughly explained and illustrated, also that all local lines to a switchboard are designated by the name of the central and a number.

6. To test the demonstration and explanation given above ask various questions, such as

a. How would you answer an incoming call as indicated by a falling drop?

b. How would you ring the called party or line?

c. How would you establish the talking connections between the calling and called party?

d. How would you determine if conversation over the connection was satisfactory?

e. How would you determine when conversation over the connection is finished?

f. How should disconnection be made?

7. Have each group install their equipment as stated above. Do not connect the switchboards together. Designate "Magic" as the code name of each of the centrals. Assign students as operators and subscribers. Issue the same traffic loads to all Magic-1's, to all

Magic-3's, etc. (See Par. 8 of Unit Operation No. 5 of the Students Manual.) Space the calls sufficiently so that the operator has time to think and make connections properly. Group the switchboards so that their operation can be watched, placing the local circuits farthest away so that the replies of the switchboard operators can be heard by the instructor (see Fig. 6-IG). Have subscribers place calls according to their traffic load tables over the telephone to each other. Have the students rotate so as to give each student practice as an operator.

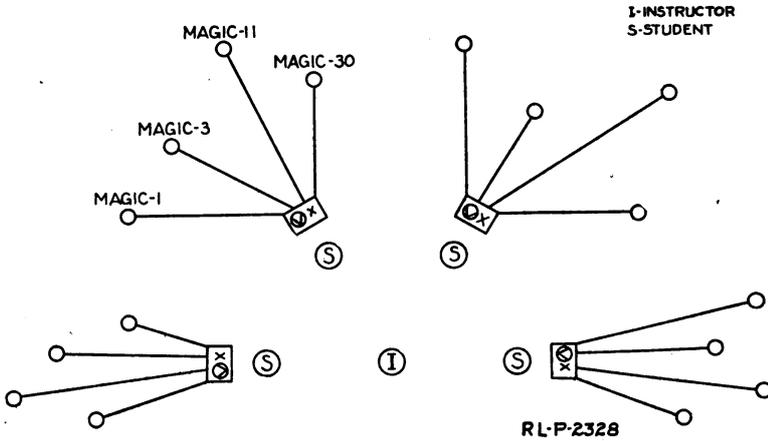


Fig. 6-IG.—Instructor supervising operators.

8. Observe how the telephone orderlies are functioning on the outer circle or better, if possible, have an assistant do it; ask informal questions and correct mistakes.

9. At the end of the period call attention to errors made, and ask questions, such as

a. Why should care always be taken to challenge with "Waiting?" before removing a connection?

b. Why should care be taken to remove the calling party from the line before ringing the called party?

c. Should the operator remain on the line after the connection is established? Why?

d. Can more than two parties be placed on one connection? How?

e. Why should the connection be taken down immediately after the disconnect signal is observed and the proper challenge has been made?

10. Have one group operate a system before the entire class and invite criticisms from the class as to any irregularities noted. The instructor will call attention to any and all errors or omissions not noted by the class.

11. The instructor will test the operating speed and accuracy of his students as follows: Using a demonstration installation installed as in paragraph 2 above, place the four telephones close together so that an assistant can ring them. Select an operator. Have the assistant ring two of the telephones in succession, and call the free telephones. Count time from the falling of the first drop until the operator has rung the called line. Both calls should be completed in 30 seconds.

12. Go over the questions in this Unit Operation in the Students Manual and in Information Topic No. 6. Ask additional questions, such as

a. When a connection has been made between two parties, if the answering plug is not removed by the operator it will impair transmission. Just what is it that impairs transmission?

b. Is it necessary when ringing to remove the operator's plug from the calling party's jack and place it in the called party's jack while using the monocord operator's set?

c. What is gained by officers and signal communications men using a telephone code?

d. What three facts must each code group indicate?

e. A regiment is acting alone and has not been issued a code. Make up one for it. (If the students are Artillery men use the First Field Artillery. If they are Infantry men use the First Infantry. This will bring in a knowledge of organization as well as that of the code.)

f. How does this military telephone code differ from the telephone directory used in civilian life?

g. Is the military telephone code secret? Why?

13. After this unit operation has been completed it is suggested that an Instruction Test similar to the one on the following pages be given to the students.

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST

No. 5-A (PERFORMANCE).

Equipment.

Install a monocord switchboard of EE - 2 units with operator's set, type EE - 64, and equipped with two local and two trunk circuits. Place four telephones connected to the two local and two trunk circuits far enough away so as not to interrupt the operator. At the switchboard label the local circuits MAGIC-1 and MAGIC-11, and the trunk circuits Mobile and Motive. Tag the telephones connected to these circuits with the corresponding names.

Procedure.

1. At the command "Begin," have an assistant place a call from MAGIC-11 for MOBILE-11, At the same time have another assistant

place a call from Motive for MAGIC-1. Answer on Mobile-11, but do not answer on MAGIC-1 until the operator has rung a second time.

2. Note whether the connections were correctly made, and whether the student acting as operator rang MAGIC-1 the second time correctly.

3. Note and record the time to the nearest second that the command "Begin" is given; and note and record the time each individual student finishes.

Scoring.

1. The maximum possible score in this test is 16 points.
2. The score required to pass this test is 12 points.
3. Observe and score this test as described in Par. 4.
4. DIRECTIONS FOR SCORING.

| | |
|--|---------|
| <i>a. Establishing first connection.</i> | Points. |
| (1) If the proper connections are made for ringing MOBILE-11..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any one of the following, the first connection is not properly established: | |
| (a) Plug in with the operator's cord. | |
| (b) Ring the called party. | |
| (c) Place the called party's plug in the calling party's jack. | |
| (d) Remove the operator's plug and leave the drop unrestored in order to answer the second call. | |
| If a student fails in any one of the above..... | 0 |
| <i>b. Establishing the second connection.</i> | |
| (1) If the second connection is properly established..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any of the following, the second connection is not properly established: | |
| (a) Plug in with the operator's cord. | |
| (b) Ring the called party. | |
| (c) Place the called party's plug in the calling party's jack. | |
| If a student fails in any one of the above..... | 0 |
| <i>c. Supervising the connections.</i> | |
| (1) If both connections are properly supervised..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any of the following, the connections have not been properly supervised. | |
| (a) If after ringing the second party the operator fails to ascertain whether the called party on the first connection answered. | |
| (b) If after supervising the first connection the operator fails to supervise the second connection and ring a second time. | |
| If a student fails in any one of the above..... | 0 |
| <i>d. Time for completing two connections.</i> | |
| (1) If the student completes the connections for the two calls in 30 seconds (not including supervising)..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to complete the connections for both calls in 30 seconds or less..... | 0 |

INSTRUCTION TEST.**No. 5-A (PERFORMANCE).****PROBLEM.**

Directions to the student.—*a.* There has been installed a monocord switchboard, together with operator's set, type EE-64, equipped with two local and two trunk circuits.

b. When the instructor says "Begin," go to switchboard assigned to you and act as operator on that switchboard.

c. Observe that two local circuits and two trunk circuits enter the switchboard.

d. The code name of the central is MAGIC. The two local circuits are MAGIC-1 and MAGIC-11. The two trunk circuits are MOBILE and MOTIVE.

e. Two calls will be placed on this switchboard. Make the proper connections for completing the calls.

f. If the called party does not answer the first time, ring him again.

g. When prepared to handle calls notify the instructor by saying, "No. 1 SWITCHBOARD, READY."

h. The instructor will then record the time it has taken to do the work. He will also inspect it.

No. 5-B (INFORMATION).

Directions to the student.—Below are a number of sentences and just after each one are the words "True" and "False." Read each sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

1. The telephone code is a nonsecret code. True. False.
2. The telephone code is used to increase the speed, accuracy, and simplicity with which telephonic connections can be made. True. False.
3. When a drop falls it is an indication that a party is either calling or ringing off. True. False.
4. A connection between two parties is made with the calling party's cord. True. False.
5. When answering a call at "MAGIC" the operator should plug into the jack of the called party and say, "MAGIC OPERATOR." True. False.
6. Before disconnecting after a "ring off" an operator always plugs in and challenges by saying "WAITING?" True. False.

7. An operator never originates a call. True. False.
8. Local lines are lines which are run from one switchboard to another switchboard. True. False.
9. An operator should never remain on the line until the called party has answered. True. False.
10. If a connection between two parties has been properly made, when either party rings off the called party's drop will fall. True. False.
11. A pencil should be used when writing the names or numbers of the circuits on the celluloid strips on the switchboard. True. False.
12. A connection on a monocord switchboard is broken as soon as the drop on the calling party's line falls. True. False.

USE OF THE VOICE.

Equipment.

Two telephones and two lists of numbers, two lists of telephone code names and numbers, and two messages in code for each pair of students.

Directions.

1. Two students, each with a telephone and a list of numbers, will connect their instruments to opposite ends of a line. One will then call the other in the usual way and repeat to him 20 numbers from the list furnished by the instructor. The other will copy the numbers on a sheet of paper, repeating them back at the same time. When 20 numbers have been sent, the operator who was copying will call 20 numbers to the other, who will copy them in a similar manner.

2. The following will give the correct pronunciation of the numbers:

- 0 to be pronounced as "ZERO"..... With long O.
- 1 to be pronounced as "WUN"..... With a strong N.
- 2 to be pronounced as "TOO"..... With a strong T and OO.
- 3 to be pronounced as "TH-R-R-EE".... With a slightly rolling R and long E.
- 4 to be pronounced as "FOUR"..... As one syllable with a long O.
- 5 to be pronounced as "FIVE"..... With a long I and strong V.
- 6 to be pronounced as "SIX"..... With a strong X.
- 7 to be pronounced as "SEV-EN"..... As two syllables.
- 8 to be pronounced as "ATE"..... With a long A and a strong T.
- 9 to be pronounced as "NIEN"..... As one syllable with a strong N on the end.

3. When words are misunderstood they should be spelled out, using the following phonetic alphabet:

| | | |
|---------------------|---------------------|---------------------|
| A pronounced Ack. | J pronounced Jig. | S pronounced Esses. |
| B pronounced Bough. | K pronounced K. | T pronounced Toc. |
| C pronounced Caw. | L pronounced L. | U pronounced U. |
| D pronounced Don. | M pronounced Emma. | V pronounced Vic. |
| E pronounced E. | N pronounced N. | W pronounced W. |
| F pronounced F. | O pronounced O. | X pronounced X. |
| G pronounced Gogo. | P pronounced Pip. | Y pronounced Yoke. |
| H pronounced H. | Q pronounced Quash. | Z pronounced Zed. |
| I pronounced I. | R pronounced R. | |

For example, take the word "Table," which is not understood by the distant operator. Phonetically it is spelled "TOC-ACK-BOUGH-L-E."

Learn this alphabet. The student should begin by learning to spell his full name in the phonetic alphabet.

4. In calling a number, speak the name of the central deliberately and distinctly, making a pause between the name and the first digit. Speak each digit separately, giving a slight pause between each digit.

The following examples will illustrate:

| | | |
|-----------|--------------------------------|------------------------|
| TABLE | 44; repeat "TA-BLE....." | FOUR-FOUR." |
| TURKEY | 8ø; repeat "TUR-KEY....." | EIGHT-ZERO." |
| TOWN | 136; repeat "TOWN....." | ONE-THREE-SIX." |
| TABLE-X | 1478; repeat "TABLE-X....." | ONE-FOUR-SEVEN-EIGHT." |
| TARTAR | 2222; repeat "TAR-TAR....." | TWO-TWO-TWO-TWO." |
| TARRYTON | 2øø; repeat "TARRY-TON....." | TWO-HUNDRED." |
| TURNSTILE | 5øøø; repeat "TURN-STILE....." | FIVE-THOUSAND." |
| TRACK | 61øø; repeat "TRACK....." | SIX-ONE-HUNDRED." |

Each series of dashes represents a pause of about one second. The single short dash indicates a slight pause. Remember, "The voice with a smile wins." Use the rising inflection, as though asking a question, when answering calls, supervising, or repeating numbers.

5. The instructor will furnish each member of the two-men groups with a list of telephone code names and numbers to transmit.

6. The instructor will furnish each student group with two code messages. Transmit the messages without using the phonetic alphabet; the instructor will check these messages for errors. Each student will then be furnished with another code message to be transmitted using the phonetic code; the instructor will check these for errors and compare the two methods for accuracy. The student receiving a message in code should repeat each group back as he receives it to avoid errors.

SUGGESTIONS FOR THE INSTRUCTOR.

1. The equipment as listed in the Students Manual should be ready for issue to each group of two students.

2. At the preliminary meeting of the class explain why care should be taken in pronouncing numbers. Demonstrate how different numbers and designations of centrals would be correctly pronounced. Explain that 0 is a number with a distinctive name like the numerals one, two, etc., and is called "Zero." The reason for this is that in coding messages, in call letters for radio and other transmitting systems, O and 0 are not alike and there must be some way for all operators to distinguish between them.

3. Give to each member of the class the name of a central office with a number which the student will repeat aloud to the class, using the pronunciation outlined in Unit Operation No. 6 of the Students Manual. Correct any errors made by students in pronunciation.

4. Give the members of the class various words to be spelled, using the phonetic alphabet. First make them spell their own names. Outline and explain the necessity for the use of the phonetic alphabet. Select words from Information Topic No. 6 and have the entire class spell them phonetically.

5. Have each pair of students connect their telephones to the ends of a wire, one of each pair in a circle around you, where you can watch and listen to them, with their partners at the other end spread out fanwise some 20 or more feet away. Give to each group of two students (see direction 1 of Unit Operation No. 6, Students Manual) a list of numbers. See that they pronounce them correctly.

6. Give each group a list of telephone code names and numbers to transmit and make necessary corrections.

7. In order to give the student practice in the phonetic alphabet, and to induce competition in speed and accuracy, give each of the groups of two students a 20-word coded message using a 5-letter code such as:

ABVEU LXZYB TMFVE, etc.

Have the students transmit these without using the phonetic alphabet. Take the average time of transmission. Check the errors made in received copies. Have them transmit similar messages using the phonetic alphabet. Check the time of transmission and errors. Compare the two methods for time and accuracy.

8. Relocate the telephone in a noisy location where transmission will be more difficult and repeat the above. This will bring out more clearly to the student the necessity for the use of the phonetic alphabet.

9. Assemble the class, call attention to errors, and ask questions regarding the use of the voice, such as

a. How would you give the call, Mamaroneck 1382? Tarrytown 7300ø? Sedgwick 93ø?

b. Use the phonetic alphabet for spelling out Kansas City, Boynton, Loyal, Mississippi.

c. What do you understand by a "long O," a "long A," a "long E"?

d. What do you understand by a "rolling R"?

e. In the phonetic alphabet why do you think G is pronounced gogo and not just G?

f. Why is there no word used to represent the letter E?

g. Could you think of a reason why J is represented by jig rather than by jack?

h. Have you found any defects or had any trouble in using the phonetic alphabet specified in this Unit Operation?

i. Have you found out for yourself any short-cut methods in learning the phonetic alphabet?

j. What error do you make the oftenest in receiving the alphabet?

10. To test the operators in phonetic spelling, repeat the test in Par. 7. Take the time for each group to complete their transmission. Check the errors. Notify the class of the team making the best speed with fewest errors and the team taking the most time and making the most errors.

11. When the students have completed the unit operation give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 6-A (PERFORMANCE).

PROBLEM NO. 1.

Equipment.

Prepare a 20 code group message similar to the following:

| | | | | |
|-------|-------|-------|-------|-------|
| SOVER | XJUMP | OWNFO | ICKBR | THEQU |
| PVMLF | LDAGY | HZEAT | MSVER | BPJUX |
| GZMGA | BXHNY | VCIWO | UJTDP | KSERQ |
| OFQIU | HKCCD | NWTRD | ZYDOG | THELA |

Procedure.

When the class is ready, read the message, using the phonetic alphabet, and require each student to write it down in printed capital letters. Gauge the reading so as to complete the message in two minutes.

Scoring.

1. The maximum possible score for this problem is 10 points.
2. The score required to pass this problem is 7 points.
3. DIRECTIONS FOR SCORING.

| <i>a. Writing a coded message from dictation.</i> | Points. |
|--|---------|
| (1) If the message is correctly written in printed capital letters as read by the instructor..... | 10 |
| (2) Deduct 1 point for each error in the message. | |
| (3) (a) If there is a total of 10 or more errors to be deducted the message has not been properly written..... | 0 |
| (b) If printed capital letters have not been used the message has not been properly written..... | 0 |

PROBLEM NO. 2.

Equipment.

1. Divide the students into groups of two men each.
2. Issue two telephones and 20 or 30 feet of twisted pair wire to each group.
3. Have each group connect their two telephones.
4. Prepare for one-half of the class copies of a 20-group code message similar to the following, where each letter of the alphabet appears at least three times:

| | | | | |
|-------|-------|-------|-------|-------|
| FLMVP | YGADL | TAEZH | REVSM | XUJPB |
| UIQFO | BCCKH | DRTWN | GODYZ | ALEHT |
| REVOS | PMUJX | OFNWO | RBKCI | UQEHT |
| AGMZG | YNHXB | OWICV | PDTJU | QRESK |

5. Prepare copies of a similar message for the other half of the class.

Procedure.

1. When ready for the students to proceed, hand one man of each group the first message.
2. Take time from the moment the command "Begin" is given.
3. As the students finish, note the time after the names of those who received the message.
4. Issue the second message to those students who received the first message. Direct them to transmit it when the command "Begin" is given. Note the time each student completes reception of this message.
5. The following form has been found convenient for use in these tests.

NOTE.—This is the record of an actual test.

TEST RECORD.
INSTRUCTION TEST NO. 6-A (PERFORMANCE).

| (Class.) | | (Instructor.) | | (Date given.) | | | Team score. |
|-----------------------|--------------------|---------------------|---------|---------------------|----|--------|-------------|
| Student transmitting. | Student receiving. | Elapsed time. | Errors. | Score (see par. 4). | | | |
| | | | | a. | b. | Total. | |
| Cain..... | Cutler..... | 4' 30" | 1 | 7 | 9 | 16 | 33 |
| O'Donohue..... | Farris..... | 6' 30" | 0 | *0 | 10 | 10 | 25 |
| Rebola..... | Spring..... | 5' 30" | 3 | 0 | 7 | 7 | 21 |
| Cutler..... | Cain..... | 4' 00" | 1 | 8 | 9 | 17 | |
| Farris..... | O'Donohue..... | 4' 30" | 2 | 7 | 8 | 15 | |
| Spring..... | Rebola..... | 5' 00" | 2 | 6 | 8 | 14 | |

*This student did not copy the message in capital letters.

Scoring.

1. The maximum score a team can make on this problem is 40 points.
2. The score required for a team to pass this problem is 30 points.
3. *a.* Collect the received messages and by comparison with the original obtain the number of errors made by each student in receiving the message. *b.* Credit the student who receives, for instance, "Cutler" in the above table, with the points determined from Par. 4 *a* and *b*. *c.* Credit the other member of the team, "Cain," when he receives with a score determined in the same manner. *d.* To obtain the team score add the two scores made by each member of the team.

4. DIRECTIONS FOR SCORING.

- | | |
|---|---------|
| <i>a. Message received and properly written in required time.</i> | Points. |
| (1) If the message was received in three minutes, even if errors are made. | 10 |
| (2) (a) If the time required to receive the message exceeded three minutes, deduct 1 point for each half minute over three, up to five minutes. | |
| (3) (a) If the time exceeded five minutes..... | 0 |
| (b) Even if the message was received correctly in three minutes, but is not written in capital letters..... | 0 |
| <i>b. Message correctly received.</i> | |
| (1) If the message was correctly received, even if the time exceeds five minutes..... | 10 |
| (2) If the message was incorrectly received, deduct from the 10 points one point for each erroneous code group. | |
| (3) If the number of erroneous code groups is ten or more, the message was incorrectly received..... | 0 |

INSTRUCTION TEST NO. 6-A (PERFORMANCE).

PROBLEM NO. 1.

Directions to the student.—When the instructor directs "Begin," write down in printed capital letters the 20 code groups which he will read. He will use the phonetic alphabet. No requests for repeats will be made. The time allowed for this test is three minutes.

PROBLEM NO. 2.

Directions to the student.—*a.* The instructor will divide the class into groups of two men each, and issue each group two telephones and 20 feet of wire. Connect the two telephones together.

b. When directed to do so, transmit the coded message to the other member of your group over the telephone using the phonetic alphabet.

c. When directed to do so, copy the coded message as transmitted over the telephone by the other member of your group.

d. Do the work quickly.

e. Notify the instructor at once when the work under *b* has been completed by rising and calling your name. Notify the instructor in the same manner when the work under *c* has been completed.

f. The instructor will then record the time it has taken to do the work. He will also correct it.

INSTRUCTION TEST NO. 6-B (INFORMATION).

Directions to the student.—Below are a number of questions and unfinished statements. Following each one are several words or phrases. Select the one of these which best fits or which makes the best sense, and draw a line under it. Only one of the answers given in each case is right.

1. The phonetic alphabet is used for the transmission of what kind of messages? Secret—Code—Clear—Routine—Priority.

2. The telephone code is—secret—nonsecret—confidential—ordinary.

3. The telephone code is used for what purpose? To confuse the enemy.—To facilitate encoding and decoding of messages.—To limit telephone conversations.—To simplify the handling of connections and to increase their accuracy.

4. In the telephone code names are used for—centrals—headquarters—officers—local telephones—trunk lines.

5. In the telephone code numbers are used for—headquarters—test stations—officers—centrals—switching points.

6. The phonetic alphabet is used—for purposes of secrecy—for the purpose of preventing the confusion of those letters having similar sounds—for economy of time—in place of the division field code—for technical messages pertaining to the telephone system.

7. The numeral 0 is pronounced—ought—nought—oh (like the letter *o* on the word *code*)—cipher—zero.

8. The number 6100 is pronounced—six-one-hundred—sixty-one-hundred—six-thousand-one-hundred—six-one-zero-zero—six-one-double-zero.

PHRASES USED IN ROUTINE SWITCHBOARD OPERATING.

Equipment. For each group of five students.

- 1 monocord switchboard, type BD - 9 (four line).
- 5 field telephones.
- Twisted pair field or outpost wire.

Information.

Supervising calls consists essentially in using every available effort to connect the calling party with the called party; in seeing that uninterrupted connection is maintained during conversation; and in clearing the lines promptly when the conversation is completed. It is a combination of watchfulness and courtesy.

When a drop falls on the BD - 9, BD - 10, or BD - 11 switchboard, indicating to the operator that a subscriber is calling, the operator answers by plugging into the jack of the calling subscriber, using the operator's cord and plug, and saying, for example, "MAGIC OPERATOR." When the calling party has given the number he desires, the operator acknowledges by repeating the number. The operator then removes the operator's plug and places it in the jack of the called party and rings, thus ringing the called party's telephone.

Connections made on the Type BD - 9, BD - 10, and BD - 11 switchboard must be supervised by the telephone operator to insure that the calling party gets into communication with the called party or that the calling party is notified that the called party does not answer. If the traffic through the switchboard is light enough, it will be possible for the operator to remain cut in on the connection to ascertain whether the called party does answer.

Should the called party fail to answer in about thirty seconds the operator will inform the calling party, "I'LL RING THEM AGAIN," and proceed to do so. In the event that the called party fails to answer the second ring the operator will repeat the operation again. If after the third ring the called party fails to answer, the operator will inform the calling party that the called party does not answer. After the calling party "hangs up" the operator may cut out of the circuit. The calling party may, however, order the operator to ring the called party again, in which case the operator will do so. He will repeat the operation as many times as ordered by the calling party.

If the operator should receive another signal from another calling party before communication over the first connection is established, it will be necessary for him to cut out of the first connection in order to answer the second call. In this case he should *leave the drop unrestored* to remind him that the connection requires supervision. At the first opportunity the operator should again cut in on the connection and listen. If he hears conversation he will know that the

called party has answered and that communication is established. If he does not hear conversation it may be that the called party has answered and one of the parties is temporarily away from his telephone and that the other party understands about it, or it may be that conversation has been completed. The operator should therefore say, "DID YOUR PARTY ANSWER?" If communication has not yet been established the calling party will so inform the operator, in which case he will proceed as described in third paragraph.

If either of the connected parties should "ring off," the drop of the unit whose jack remains unplugged will fall. The parties may, however, have concluded their conversation and either the calling or called party may desire connection with another subscriber. Therefore before taking down a connection after what may appear to be a "ring off" the operator will always cut in on the connection and challenge by saying "WAITING." If he receives no reply, he will take down the connection. If a new number is ordered, he will repeat it and ask "WHAT NUMBER IS CALLING?" and then proceed to make the desired connection. It may be that parties concluding a conversation will neglect to "ring off," therefore the operator will supervise all connections at intervals of about three minutes in order to clear the switchboard of unused connections.

The following is a summary of the phrases the use of which are discussed above:

a. "MAGIC OPERATOR."—Used by an operator in answering a calling subscriber or other central.

b. "MAGIC-11?"—Used by the operator when repeating back a number to a calling party as an acknowledgment of having understood.

c. "WAITING?"—Used by the operator when challenging on a connection.

d. "WHAT NUMBER IS CALLING?"—Used by an operator when he has challenged on a connection and has been given a new number to call, by one of the two connected parties, and he desires to know which of them is calling for the new number.

Directions.

1. Each group of five students will install a switchboard with four local telephones Nos. 1, 2, 11, and 30. The name of the central will be designated by the instructor.

2. The students in each group will be assigned as switchboard operators or at a local telephone and will be changed from one duty to another from time to time by the instructor.

3. Students at local telephones will be issued Students' Traffic-Load Tables and will place calls according to these tables, commencing when directed to do so by the instructor.

Questions.

- (1) *What precautions should an operator take in order to avoid breaking a connection over which conversation is going on?*
- (2) *What should an operator do in order to make certain that the switchboard is promptly cleared of connections when the conversation over them is completed?*
- (3) *Under what circumstances should an operator leave a connection before the called party has answered?*
- (4) *What should an operator do when the called party does not answer the first ring?*
- (5) *When it is necessary to leave a connection before the called party has answered, what does the operator say when he listens in again on that connection and hears no conversation?*
- (6) *If a drop falls on one of two connected units, what is it an indication of?*
- (7) *If a drop falls on one of two connected units, and the operator challenges on the connection and gets the reply, "I want MAGIC-3," what must he do?*
- (8) *How does an operator answer a call coming in over a trunk line? How does he answer one on a local line?*

SUGGESTIONS FOR THE INSTRUCTOR.

1. Have the students install in advance as many telephone switchboards with four local telephones at each station as will accommodate the class where five students are in each group. Give each central a code name such as TABLE and each local telephone numbers such as 1, 2, 11, and 30.

2. At the first meeting of the class explain the use of the telephone code and traffic rules. Ask questions to bring out a clear understanding of the procedure used, such as—

a. Which would be more convenient to ask for, Commanding Officer, 1st Brigade, or simply ask for TABLE-1?

b. If TABLE-1 is the Commanding Officer, 1st Brigade, what is the 1st Infantry Commanding Officer's code number if the 1st Infantry is TOY?

3. Demonstrate how an ordinary call through one switchboard is handled by the operator and explain if necessary the phrases used.

4. Assign one student in each group to a local telephone and one as switchboard operator. Issue to each student at local telephones a Students' Traffic-Load Table as shown below and make certain that he understands how to use it. Announce the zero hour at which the traffic load is to commence, and require the students to place calls in accordance with their traffic load tables.

INSTRUCTOR'S TRAFFIC LOAD TABLE.

X indicates the calling party and O indicates the called party. For example, in the table below at zero time TABLE-1 calls TABLE-30.

| Time. | TABLE-1. | TABLE-2. | TABLE-11. | TABLE-30. |
|---------|----------|----------|-----------|-----------|
| 0..... | X | | | O |
| 0..... | | X | O | |
| 5..... | | O | X | |
| 5..... | O | | | X |
| 10..... | X | | O | |
| 10..... | | X | | O |
| 15..... | O | | X | |
| 15..... | | O | | X |
| 20..... | X | O | | |
| 20..... | | | X | O |
| 25..... | O | X | | |
| 25..... | | | O | X |

Repeat as often as necessary.

STUDENTS' TRAFFIC LOAD TABLES.

| | | |
|--------------------------|-----------|-----------------------------|
| At the time shown below. | TABLE-1. | Call the party shown below. |
| 0..... | | TABLE-30 |
| 10..... | | TABLE-11 |
| 20..... | | TABLE-2 |
| At the time shown below. | TABLE-2. | Call the party shown below. |
| 0..... | | TABLE-11 |
| 10..... | | TABLE-30 |
| 25..... | | TABLE-1 |
| At the time shown below. | TABLE-11. | Call the party shown below. |
| 5..... | | TABLE-2 |
| 15..... | | TABLE-1 |
| 20..... | | TABLE-30 |
| At the time shown below. | TABLE-30. | Call the party shown below. |
| 5..... | | TABLE-1 |
| 15..... | | TABLE-2 |
| 25..... | | TABLE-11 |

5. If possible place a large clock where all students can see it and have individual's watches set by this clock. It may simplify matters to have 12 o'clock for the zero hour. If there is no clock available and not sufficient watches the time may be indicated by ringing a bell or calling time at definite prearranged intervals.
6. Observe the operating at the various switchboards and correct any errors in procedure. Have the men in each group rotate so as to give each student a chance at the switchboard.
7. At the conclusion of the schedule on the Traffic Load Table, assemble the class and ask questions to determine that all students understand the work which has been done, such as the following:
 - a. How would an operator at a switchboard whose code name is TAR, answer an incoming call from TAR-1?
 - b. If TAR-1 asked for TAR-11 what would the operator then say?
 - c. How would the operator go about clearing a connection which had been established for a long time?
 - d. How does an operator supervise a connection which he had to leave before he heard the called party answer?
8. When it appears that all students thoroughly understand all the points covered in the unit operation give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.
No. 7-A (PERFORMANCE).

Equipment.

Prepare a switchboard (MYRTLE) with four local telephones connected as follows:

| | |
|-------------------------|-----------|
| Commanding officer..... | MYRTLE-1 |
| Executive officer..... | MYRTLE-3 |
| Supply officer..... | MYRTLE-7 |
| Message center..... | MYRTLE-11 |

INSTRUCTORS GUIDE FOR ALL ARMS.

Procedure.

1. When the student who is to be tested and who is to act as operator has read his directions and has indicated that he is ready, place a call from MYRTLE-1 for MYRTLE-11. The student acting as operator should answer by saying "MYRTLE OPERATOR." The student should repeat the number the instructor has asked for thus: "MYRTLE-11?" and give him the connection. Have an assistant answer at MYRTLE-11.

2. After the operator has left the connection, the instructor should ring. The operator should listen in and challenge by saying, "WAITING?"

3. When the operator challenges, give him a new number MYRTLE-3 and see that he repeats the number back and makes the connection.

Scoring.

1. The maximum possible score for this test is 8 points.

2. The score required to pass this test is 6 points.

3. DIRECTIONS FOR SCORING:

| <i>a. Establishing the first connection.</i> | Points. |
|--|---------|
| (1) If the student establishes the first connection properly..... | 3 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any one of the following, the first connection is not properly established: | |
| (a) Answer, "MYRTLE OPERATOR." | |
| (b) Repeat, "MYRTLE-11?." | |
| (c) Establish correct connection. | |
| (d) Ring MYRTLE-11. | |
| (e) Restore the drop after MYRTLE-11 answers and remove operator's plug. | |
| If a student fails in any one of the above..... | 0 |
| <i>b. Challenging when drop falls on an established connection.</i> | |
| (1) If student plugs in and challenges promptly by saying "WAITING?..." | 2 |
| (2) No partial scores allowed. | |
| (3) If student does not challenge within 10 seconds after instructor rings.. | 0 |
| <i>c. Establishing the connection for one of two connected parties desiring a new number.</i> | |
| (1) If student follows correct procedure in establishing new connection.. | 3 |
| (2) No partial scores allowed. | |
| (3) If student fails to do any one of the following, the connection is not properly established: | |
| (a) Determine by proper phrase which of the two connected parties desires the new number. | |
| (b) Repeat "MYRTLE-3?..." | |
| (c) Establish correct connection. | |
| (d) Ring MYRTLE-3. | |
| (e) Restore the drop when MYRTLE-3 answers and remove operator's plug. | |
| If a student fails in any one of the above..... | 0 |

INSTRUCTION TEST NO. 7-A (PERFORMANCE).

PROBLEM.

Directions to the student.—*a.* The instructor will designate a switchboard to which you will be assigned as operator. This central will be called MYRTLE and will have the following local stations connected to it:

MYRTLE-1, MYRTLE-3, MYRTLE-7, MYRTLE-11.

b. When the instructor says "Begin," be prepared to start work promptly.

c. Act as operator for this central and answer any calls that come in.

d. Do the work quickly using the approved procedure.

e. Remain at the switchboard until relieved by the instructor.

INSTRUCTION TEST NO. 7-B (INFORMATION).

Directions to the student. Below are a number of sentences and just after each are the words "True" and "False." Read each sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

1. When a drop falls on a monocord switchboard, indicating to the operator what a subscriber is calling, the operator answers by plugging into the jack of the calling subscriber and saying "NUMBER, PLEASE." True. False.

2. After the calling party has given the number he desires the operator acknowledges by repeating the number, thus "MAGIC-11?" True. False.

3. If after ringing a party and no answer is received within about 30 seconds, the operator informs the calling party, "MAGIC-30 DOES NOT ANSWER." True. False.

4. After a connection has once been completed the operator need not supervise it further unless a drop on one of the connected units falls. True. False.

5. When a drop falls on a unit which is connected through to another unit the operator immediately breaks the connection. True. False.

6. Code names should always be used when placing calls in a field telephone net. True. False.

7. In order that he will not forget to return to supervise a call which is uncompleted and which he must leave before the called party answers, the operator should leave a drop unrestored as a reminder. True. False.

8. A local line is a line run from a switchboard to a subscriber. True. False.

ROUTING CALLS AND USE OF THE TRAFFIC DIAGRAM.

Equipment.

- 1 net installed for each group of 15 students. (See Fig. 16.)
- 6 monocord switchboards, type BD - 9 (four line), with terminal strips attached. (Two switchboards are for CANFIELD.)
- 10 field telephones.
- Twisted pair, field or outpost wire.

Information.

In order that operators can handle calls promptly in a telephone net which furnishes service to combat units in the field, they are provided with a traffic diagram and a telephone code. The traffic diagram shows the operator at any central the circuits over which any other central in the net can be reached. The telephone code provides abbreviated names for units, officers, and offices, and is used in order to increase the simplicity, accuracy, and speed of handling calls.

To train operators to handle calls rapidly and accurately a telephone net composed of several centrals is established. For training purposes these centrals are close together in order that the instructor can supervise the operations. In the field, however, these same centrals may be a mile or more apart. The centrals set up for practice are assumed to represent centrals at the headquarters of the student's own branch of the service, and will include the headquarters of this particular unit, together with subordinate and superior units.

When it is necessary that a call be routed through one or more other switchboards in order to establish communication with the called party, the operator refers to the circuit diagram and routes the call by the most direct working circuit to the first intermediate central. He calls the next central, and upon being answered repeats the order he has received to this next central and then connects this next central through to the calling party. This concludes his responsibility with the exception of supervision. When the operator receives a call over a trunk line for a number that is one of his local lines, the procedure and supervision responsibility is the same as in local to local connections.

Suppose the student operator is at TABLE (see Fig. 16). A call comes for "LARBOARD-11." A glance at the traffic diagram shows that the call would normally go through "CANFIELD." He calls "CANFIELD," and when that operator answers he asks for "LARBOARD-11," and when the "CANFIELD" operator has repeated this

order, then places the plug of the called party into the jack of the calling party. He does not remove the operator's plug from the connection until conversation is started.

In the case of a busy switchboard, it may not be possible for the operator to wait until "LARBOARD-11" has answered. In that case, after having given the order "LARBOARD-11" to the "CANFIELD" operator he will remove the operator's plug, but will leave the calling party's drop unreturned to remind him that the connection requires supervision, and he will proceed to answer other calls, returning, however, at the first opportunity to see that "LARBOARD-11" has answered.

Using the same situation as before, suppose a call comes in for "LARBOARD-11." All trunks to "CANFIELD" are busy. A glance at the traffic diagram shows the secondary routing to be through "CANTEEN." The operator at "TABLE" calls "CANTEEN" and when that operator has answered, asks for "LARBOARD-11." The procedure is as before from this point.

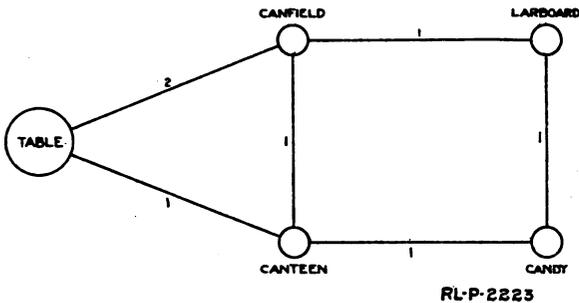


Fig. 16.—Traffic diagram.

Directions.

1. The traffic diagram (Fig. 16) shows an Infantry brigade with its two regiments on the front line. Each regiment has one battalion in the front line. The other battalions of each regiment are in support or reserve and are not in this problem. Each group of three students will be assigned to a station and directed to install that station and certain trunk lines by the instructor. See Information Topics Nos. 4, 5, and 6.

2. The students in each group will be assigned to duty as switchboard operators or at a local telephone and will change from one duty to another as directed by the instructor.

3. The instructor will issue Students' Traffic-Load Tables to the students, at local telephones, who will place calls in accordance therewith, starting when directed to do so by the instructor.

Questions.

- (1) *In what manner is a traffic diagram of assistance to an operator?*
- (2) *Do subscribers have any use for a traffic diagram? Why?*
- (3) *In what manner does the telephone code assist operators and subscribers?*
- (4) *Of what does a telephone net consist?*
- (5) *How much of the routing of a call is an operator responsible for?*
- (6) *When should an operator use a secondary routing for a call?*
- (7) *When it is necessary for an operator to leave a connection before the called party has answered, what precautions should he take to insure that he does not forget to return and again supervise the connection?*

SUGGESTIONS FOR THE INSTRUCTOR.

1. Have the students install the telephone net illustrated in Unit Operation No. 8 of the Students' Manual with a switchboard and a telephone at each station. Provide a traffic diagram and a telephone code for each station. A sufficient number of nets should be provided so that the assignment of three men to a station will take care of the class.

2. At the first meeting of the class explain and illustrate by Fig. 7-IG what a telephone net is. This diagram can be drawn on the blackboard or a large piece of paper. Explain that the Infantry

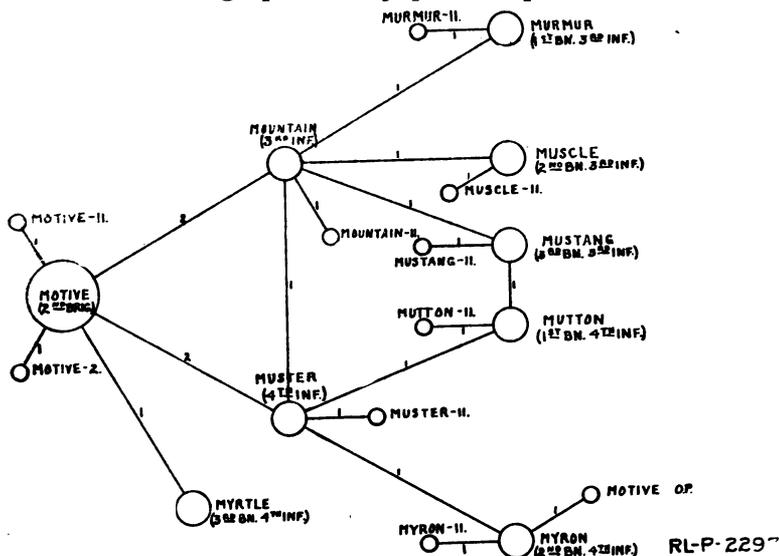


Fig. 7-IG.

brigade shown in this figure has two regiments on the front line, "MOUNTAIN" and "MUSTER." Each of these regiments has three battalions. Explain that this traffic diagram does not show how these units are laid out on the battle field, for "MUSCLE" may be a mile in front of or behind "MURMER," but the diagram does show how any regiment can call its battalions and the battalions call each other. If operators did not have traffic diagrams they would be unable to handle calls promptly, for the circuits change frequently in combat. Call attention to the fact that "MYRTLE" gets its regiment through the brigade. Bring out the peculiar feature of "MOTIVE OP" in this diagram.

3. In a like manner explain and demonstrate the use of traffic rules and telephone codes (see Information Topic No. 6); explain the use of a traffic diagram. (See Information Topic No. 7.)

4. Ask questions such as—

- (1) What is the purpose of a switchboard?

(2) Why do you use a telephone code?

(3) In case you have a call for the 1st Brigade message center, what is the code name used?

(a) For 2d Brigade communications officer?

(b) For 1st Brigade intelligence officer?

(c) For 3d Infantry message center?

(d) For 2d Battalion, 4th Infantry, message center?

5. When the instructor has cleared up the questions on what a net is, and what its use is, issue the traffic diagrams and telephone codes for the simple net of Par. 1 and assign three men to each station of this simple net already installed. Assign one man and an assistant as switchboard operator and the third to the local telephone, giving the latter a number of calls to make at stated times to each local telephone at the other stations. (Give the local telephone the message center number—11'.) Have the men rotate on different duties. Arrange for a clock or bells as described in Unit Operation No. 7 for indicating the time.

6. Have easy calls made until the operators become proficient. Increase the number of switchboards through which calls are passed to be completed. As operators become proficient, change the operators on the various switchboards.

7. In providing in advance the calls which are to be made, the instructor will prepare a table for himself and each message center, as follows:

INSTRUCTOR'S TABLE FOR TRAFFIC LOAD.

X, calling party; O, called party.

Example: At O time in the table below TABLE-11 calls CANFIELD-11.

| TIME. | TABLE-11. | CANFIELD-11. | CANTEEN-11. | LARBOARD-11. | CANDY-11. |
|-----------|-----------|--------------|-------------|--------------|-----------|
| 0..... | X | O | | | |
| 0..... | | | | X | O |
| 0+5..... | O | | X | | |
| 0+5..... | | X | | O | |
| 0+10..... | X | | O | | |
| 0+10..... | | O | | X | |
| 0+15..... | | X | O | | |
| 0+15..... | | | | O | X |
| 0+20..... | O | X | | | |
| 0+20..... | | | O | | X |
| 0+25..... | X | | | O | |
| 0+25..... | | | X | | O |
| 0+30..... | X | | | | O |
| 0+30..... | | O | X | | |
| 0+35..... | O | | | X | |
| 0+35..... | | X | | | O |
| 0+40..... | O | | | | X |
| 0+40..... | | | X | O | |
| 0+45..... | | O | | | X |
| 0+45..... | | | O | X | |

STUDENTS' TRAFFIC LOAD TABLES.

| | | |
|--------------------------|----------------|------------------------------|
| At the time shown below. | TABLE - 11. | Call the number shown below. |
| 0 | | CANFIELD - 11 |
| 0+10 | | CANTEEN - 11 |
| 0+25 | | LARBOARD - 11 |
| 0+30 | | CANDY - 11 |
| At the time shown below. | CANFIELD - 11. | Call the number shown below. |
| 0+5 | | LARBOARD - 11 |
| 0+15 | | CANTEEN - 11 |
| 0+20 | | TABLE - 11 |
| 0+35 | | CANDY - 11 |
| At the time shown below. | CANTEEN - 11 | Call the number shown below. |
| 0+5 | | TABLE - 11 |
| 0+25 | | CANDY - 11 |
| 0+30 | | CANFIELD - 11 |
| 0+40 | | LARBOARD - 11 |
| At the time shown below. | LARBOARD - 11. | Call the number shown below. |
| 0 | | CANDY - 11 |
| 0+10 | | CANFIELD - 11 |
| 0+35 | | TABLE - 11 |
| 0+45 | | CANTEEN - 11 |
| At the time shown below. | CANDY - 11. | Call the number shown below. |
| 0+15 | | LARBOARD - 11 |
| 0+20 | | CANTEEN - 11 |
| 0+40 | | TABLE - 11 |
| 0+45 | | CANFIELD - 11 |

8. The table above shows a very simple traffic load covering one call from each message center for every other message center. The time as shown in the above table can be varied at will. Shorten the time between calls as the student becomes more proficient in handling them. Make this traffic load just as heavy as the operators can correctly handle it, but as this particular operation is for the purpose of teaching the use of traffic diagrams and obtaining correct methods in routing and handling calls do not try for too much speed. The items in the table from 0+25 to 0+45 include the calls which pass through three centrals. These items should be repeated until the students are proficient in handling calls.

9. Assemble the class when they have completed the schedule of calls. Place the diagram shown in Fig. 7-IG on the blackboard or on a large sheet of paper where all can see it, and ask the students the following questions regarding the placing of calls such as the following:

a. You are the operator at "MOTIVE." How would you use the traffic diagram to place a call to "MUSTANG - 11"? To "MURMUR - 11"? To "MOTIVE OP"?

b. You are the operator at "MUTTON." How would you place a call to "MYRON - 11"? To "MYRTLE"? To "MOUNTAIN - 11"? To "MURMUR - 11"? To "MOTIVE - 11"?

10. Give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 8-A (PERFORMANCE).

Equipment.

Lay out a telephone net with three centrals: **Boy**, **Box**, and **Book**. Connect each central to each of the other two by a trunk line—three trunks in all. Connect two local subscribers, No. 1 and No. 11, to each switchboard. Connect **BOY - 11** through to **Box - 11**. Provide an operator for **BOOK** switchboard and an assistant to operate local telephones. Provide a traffic diagram for **Boy**.

Procedure.

1. Ascertain that the student is at his central, **Boy**, and that he understands his directions as given in the test and the layout of the net.

2. When the student is ready, have an assistant place a call from **Boy - 1** for **Box - 1**. The line to **Box** is busy, as **Box - 11** is connected to **Boy - 11**. The student should accordingly route the call through **Book**.

3. After the call has been correctly completed have an assistant ring off on **Box - 11**. Then see that the student correctly clears his board of this connection.

Scoring.

1. The maximum possible score for this test is 12 points.
2. The score required to pass this test is 12 points.

Directions for Scoring.

| | |
|--|---------|
| <i>a. Establishing connection.</i> | Points. |
| (1) If the student follows correct procedure in establishing connection.. | 8 |
| (2) No partial scores allowed. | |
| (3) If student fails to do any one of the following; the connection is not properly established: | |
| (a) Answer, "Boy Operator." | |
| (b) Repeat, "Box - 1?" | |
| (c) Ring "Book Operator." | |
| (d) Ask for "Box - 1." | |
| If a student fails in any one of the above..... | 0 |
| <i>b. Disconnecting.</i> | |
| (1) If correct procedure is followed..... | 4 |
| (2) No partial scores allowed. | |
| (3) If student fails to do any one of the following, the disconnection is not properly made: | |
| (a) Say, "Waiting." | |
| (b) Disconnect. | |
| If a student fails in any one of the above..... | 0 |

INSTRUCTION TEST NO. 8-A (PERFORMANCE).

PROBLEM.

Directors to the student.—*a.* There is a monocord switchboard installed with the code name Boy, which has a number of local telephones and other switchboards connected to it.

b. Examine the traffic diagram posted beside the switchboard, and note that the markings on the panels of the switchboard have been so arranged as to correspond to this diagram.

c. Notify the instructor when the above has been completed and whenever the command "Begin" is given stand by to operate the switchboard. Do not disturb any connections already made when you take charge of the switchboard unless directions are given to do so.

d. Do the work quickly.

e. Remain at the board until relieved by the instructor.

INSTRUCTION TEST NO. 8-B (INFORMATION).

Directions to the student.—Each of the following questions can be answered by a single word or phrase. Write the answer on the short dotted line.

1. What is the diagram called which shows the operator how to route a call by the most direct route?
2. What does the diagram referred to in question No. 1 show in regard to the circuits between every two switchboards?
3. What is the system called in which several centrals are connected together by circuits, each central being connected with a number of local telephones?
4. Whose telephone is usually installed first at a command post?
5. What is a circuit called which connects two centrals?
6. What is a circuit called which connects a telephone to a switchboard?
7. When the most direct route for a call is not available, what routing is used?
8. What name is applied to individuals who have local telephones?
9. What code is used when placing a telephone call?
10. What is the person called who rings a central and asks for a number?
11. What must an operator always do until he knows that the called party has answered?
12. How many connections can be established at one time between subscribers on a four-line monocord switchboard?

SUGGESTIONS FOR CONDUCTING PROGRESS TEST.

No. 2-A (PERFORMANCE).

PROBLEM NO. 1.

Equipment.

- 1 bell, night alarm.
- 2 cells, type BA - 10.
- 1 hammer.
- 1 inspector's pocket kit.
- 6 nails, No. 10d.
- 6 screws, 1-inch, size No. 10.
- 2 switchboards, monocord type BD - 9, with cable and terminal strips attached.
- 1 telephone, type EE - 4, equipped with cord and plug. Wire, type W - 40 or W - 44 sufficient for installation.

PROBLEM NO. 2.

- 3 bells, night alarm.
- 6 cells, type BA - 10.
- 3 switchboards, monocord, type BD - 9, with cable and terminal strips attached.
- 7 telephones, type EE - 4, three of which should be equipped with cords and plugs. Wire, type W - 40 or W - 44, sufficient for installation.

PROBLEM NO. 1.

Procedure.

- 1. Give the student the equipment listed under Problem No. 1.
- 2. Direct the student to mount this equipment and connect it for operation as a single unit.

PROBLEM NO. 2.

- 3. Install in advance a telephone net with three centrals as shown below, the centrals being connected to each other by one trunk. Prepare a traffic diagram for the net and post it by MAN central. Place one operator at MARS and one at MIKE to operate switchboards.

| Centrals. | Local subscribers. |
|------------|-------------------------|
| MAN | MAN - 1 and MAN - 11. |
| MARS | None. |
| MIKE | MIKE - 1 and MIKE - 11. |

- 4. Set up a connection from MAN - 1 through MAN and MIKE switchboards to MIKE - 1. Place an assistant at MIKE - 1 to hold the connection in case the operator challenges on it. Have this assistant also answer calls on MIKE - 11.
- 5. Assign the student as operator at MAN switchboard.

6. Place a call from MAN - 11 for MAN - 1. The student should report this circuit busy. Then place a call from MAN - 11 for MIKE - 11. The direct trunk to MIKE is busy; therefore the call should be routed by the secondary routing through MARS.

Scoring.

1. The maximum possible score for this test is 12 points for Problem No. 1 and 8 points for Problem No. 2.

2. The score required to pass this test is 12 points for Problem No. 1 and 8 points for Problem No. 2.

3. DIRECTIONS FOR SCORING.

a. *Installing central.*

- | | Points. |
|---|---------|
| (1) If all equipment is installed correctly..... | 12 |
| (2) No partial scores allowed. | |
| (3) If any one of the following defects occur, the equipment is not properly installed: | |
| (a) Switchboards not firmly fastened to support. | |
| (b) Switchboards not at convenient height for operation. | |
| (c) Switchboards not close enough together to be operated as one unit. | |
| (d) Terminal strips not securely fastened. | |
| (e) Night alarm bell not firmly fastened to support. | |
| (f) Wiring not properly connected for operation as a single unit. | |

If any one of the above defects exists..... 0

b. *Operating switchboard.*

- | | |
|---|---|
| (1) If the connections were properly established..... | 8 |
| (2) No partial scores allowed. | |
| (3) If the student failed to do any one of the following, the connections are not properly established: | |
| (a) Answer, "MAN OPERATOR." | |
| (b) Repeat, "MAN - 1?" | |
| (c) Say, "MAN - 1 is busy." | |
| (d) Repeat, "MIKE - 11?" | |
| (e) Ring MARS. | |
| (f) Ask for MIKE - 11. | |

If a student fails in any one of the above..... 0

PROGRESS TEST NO. 2-A (PERFORMANCE).

PROBLEM NO. 1.

Directions to the student.—a. At the location, which will be designated by the instructor, there are two switchboards, type BD - 9, each with cables and terminal strips attached. There is also a telephone, type EE - 4; a night alarm bell; two dry cells, type BA - 10; and tools.

b. When the instructor says "Begin," start work promptly.

c. Connect the two switchboards, including the night alarm, so that they are ready for operation as a single unit.

d. Notify the instructor when the work is completed by facing about and calling your name.

PROBLEM NO. 2.

Directions to the student.—*a.* There is a telephone net installed in which one of the centrals is named MAN.

b. When the instructor directs go to the central at MAN and note the markings on the line panels and examine the traffic diagram posted by the switchboard.

c. Do not disturb any connections set up on the switchboard, but note what they are.

d. Notify the instructor when you are ready to operate the switchboard.

e. When the command, "Begin," is given take charge of the switchboard.

f. Remain at the board until relieved by the instructor.

PROGRESS TEST NO. 2-B (INFORMATION).

Directions to the student.—Below are several sentences and just after each one are the words "True" and "False." Read each sentence carefully; and if what it says is true, draw a line under "True." If what it says is not true, draw a line under the word "False."

1. Zero should never be called by using the letter O. True. False.
2. An operator should let the subscriber route his own call. True. False.
3. The operator on an intermediate switchboard always lets the originating operator tell the operator at the next switchboard the number desired. True. False.
4. The operator at the originating switchboard is responsible that the call goes through. True. False.
5. A traffic diagram shows each circuit with its numerical designation. True. False.
6. An operator should never allow anyone else to use his set to talk over. True. False.
7. An operator should remove the connection between the two parties who are connected when it is necessary to ring back on the calling party's telephone. True. False.
8. An operator in answering a call should say, "Magic operator. Whom do you want?" True. False.
9. If the called party does not answer when rung the first time the operator should remove the connection and go on with other business. True. False.

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line inclosed in a parenthesis,

INSTRUCTORS GUIDE FOR ALL ARMS.

thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct.

10. When operating the monocord switchboard of EE-2 units, using a camp telephone as operator's set, the following procedure is used:

(a) When a drop falls plug into that jack with the (.....) (.....), remove the hand set from the hook on the (.....) and ascertain the party desired.

(b) Then remove the (.....) (.....), place it in the (.....) of the party desired and holding down the (.....) on the telephone, ring.

(c) Now take the (.....) (.....) cord and plug into the (.....) (.....) jack and listen in to see that the conversation starts, then remove the (.....) (.....) and proceed to other business.

11. The following connections are necessary to connect the operator's telephone to the switchboard of type EE-2 units: L_1 on the telephone must be connected to (.....) on the switchboard, L_2 on the telephone to (.....) on the switchboard.

12. In order to use a night alarm with the switchboard of type EE - 2 units the following connections must be made:

a. Connect the terminals of a small bell or buzzer to the terminals on the switchboard marked (.....) and (.....).

b. Connect two dry cells in (.....) between the terminals marked (.....) and (.....) on the switchboard.

13. In order to protect the switchboard from lightning the terminal marked (.....) on the switchboard should be connected to (.....).

14. a. When operating a switchboard of type EE - 2 units using the operator's set the following method may be used in connecting the two: Replace the (.....) on the operator's set with the (.....) (.....) taken from the switchboard, connect the two wires in this (.....) to the terminals on the operator's set marked (.....) and (.....); now connect together the terminals marked (.....) and (.....) on the operator's set.

b. When operating a switchboard of type EE - 2 units using the operator's set the following method may be used in connecting the two: Connect the (.....) terminal on the operator's set to (.....) on the switchboard; connect "R" and (.....) together on the operator's set and then connect the (.....) terminal to (.....) on the switchboard. When these changes have been made the (.....) (.....) on the switchboard is used to answer calls.

15. In order to use the night-alarm buzzer in the type EE - 64 operator's set the following connections must be made in either of the above cases: Connect the terminals (.....) and (.....) on the switchboard to the terminals marked (.....) on the operator's set. Connect (.....) and (.....) on the switchboard together.

16. The operation of the switchboard after either of the above changes has been made is the (.....) (.....) when operating the switchboard using a camp telephone as operator's set. The operator when ringing throws the (.....) and (.....) key to its (.....) position.

17. a. When using the monocord operator's set type EE - 64, with the monocord switchboard of type EE - 2-A units, in order to answer a call the operator plugs into the jack of the calling line and with the ringing and listening key in the (.....) (.....) ascertains the party desired.

b. The operator then places the plug of the (.....) party's line into the jack of the (.....) party's line and with the key on the operator's set in the (.....) position turns the generator crank. This rings the (.....) party's telephone.

c. When the (.....) party answers, the operator removes the operator's plug from the (.....) party's jack and proceeds to other business.

18. a. If for some reason the calling party leaves his telephone and it becomes necessary to recall him, the operator with the plug in (.....) party's jack and the connection completed as above (.....) his (.....) and (.....) key to its (.....) position.

b. This rings back on the calling party but does (.....) ring the (.....) party. This is accomplished by certain circuits in the operator's set and is made possible by the three-way cord and plug used with the operator's set.

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19. When using the type EE - 64 operator's set with the monocord switchboard of type EE - 2A units, the only connection necessary between the (.....) (.....) and the (.....) is a pair of wires connecting the terminals marked (.....) on the switchboard to the terminals marked (.....) on the operator's set. The cord and plug on the (.....) is used in answering calls.

20. a. When using a camp telephone as an operator's set for the monocord switchboard of type EE - 2-A units separate night-bell and battery must be connected in (.....) between the (.....) terminals on the switchboard and an extra cord and plug provided and attached to the (.....) terminals of the telephone.

b. The operation is then the same as when using the operator's set except that there can be (.....) connection between the (.....) and (.....) parties when ringing on either line. Therefore the use of cords and plugs is the same as when operating a monocord switchboard of type EE - 2 units.

21. An operator should supervise all calls through his switchboard to see that conversations are started and disconnections are made when the call is finished. He should (.....) (.....) a connection until he has challenged twice with (.....).

22. The phonetic alphabet consists of arbitrary words which are substituted for certain letters. The purpose in using this alphabet is to provide a method of repeating letters so that those (.....) will not be (.....) with other letters.

23. The traffic diagram is used by the operator in order to route calls by the (.....) and most (.....) route. It shows the number of (.....) between each switchboard in the telephone net.

24. a. An operator in placing a call from a local subscriber to a party connected to some other switchboard, should always tell the other switchboard operator the correct number desired and not leave this for the (.....) to do.

b. The operator at the originating switchboard is responsible only for the (.....) of a call so far as the (.....) switchboard. However, he is (.....) that the call finally does get through if possible, and it is up to him to supervise the call.

25. a. When answering a call using the monocord switchboard of type EE - 2 units the operator at a central whose code name is

"MAGIC" should proceed in the following manner: Place the (.....) plug in the (.....) (.....) jack and say (.....) (.....).

b. Upon ascertaining the party desired he removes the (.....) plug and places it in the (.....) of the line desired and (.....).

c. He then places the (.....) of the (.....) party's unit into the (.....) of the (.....) party's unit and listens in to see that the called party answered.

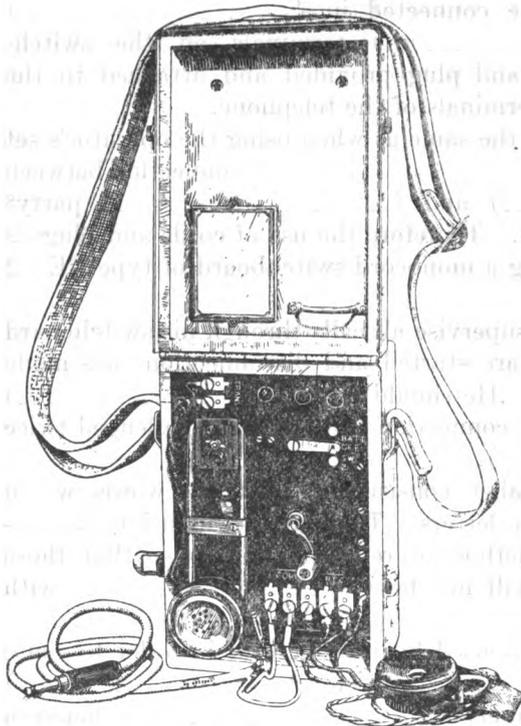


Fig. 8-IG.

switchboard which is marked (.....).

d. Connect the (.....) terminals marked (.....) to the terminals on the switchboard which are marked (.....) and (.....).

27. Directions to the student.—Indicate by filling in the blank spaces below what connections must be made on the operator's set shown in Fig. 8 - IG above, to connect it for use with a monocord switchboard of type EE - 2 - A units.

Connect the (.....) terminals marked (.....) to the terminals on the switchboard which are marked (.....).

26. Directions to the student.—Indicate by filling in the blank spaces below what connections must be made on the operator's set shown in Fig. 8 - IG below, to connect it for use with a monocord switchboard of type EE-2 units.

a. Connect the terminal marked (.....) to the terminal marked (.....).

b. Connect the terminal marked (.....) to the terminal on the switchboard which is marked (.....).

c. Connect the terminal marked (.....) to the terminal on the

PHRASES USED IN SPECIAL CASES IN SWITCHBOARD OPERATING.

Equipment.—For each group of five students.

1 monocord switchboard, type BD - 10 (8 line) with terminal strip attached.

5 field telephones.

Twisted pair field or outpost wire.

Information.

It is the duty of switchboard operators to be courteous and accommodating but at the same time to be as brief as possible in their dealings with subscribers. When calls are put through and connection established between the called party and the calling party without any difficulty, there is little that the operator is required to say. There will be many occasions, however, when the called party can not be reached, or else can be reached only by special handling of the call. It is also impossible to avoid a certain amount of errors, such as the breaking of a connection before the conversation over it is complete, giving a subscriber the wrong number, etc. These cases may require a certain amount of conversation between the calling subscriber and the operator. To prevent as far as possible confusion or misunderstanding, operators are required in these special cases to be polite, avoid argument, and accommodate the subscriber in every way possible and use the prescribed phrases where there are any.

The following phrases are prescribed for use by switchboard operators when answering and supervising calls and must be strictly adhered to:

a. "MAGIC OPERATOR."—Used by the operator in answering a calling subscriber.

b. "MAGIC-1."—Used by the operator when repeating a number to a calling party as acknowledgment of having understood.

c. "HERE'S YOUR PARTY."—Used by the operator whenever it is necessary for him to start the conversation over a connection. For example, if the called party should answer before the operator had connected him through to the calling party the operator, after completing the connection, would start conversation by using this phrase.

d. "MAGIC-11 IS BUSY."—Used by the operator when reporting to the calling party that the called party's line is busy.

e. "MAGIC-11 DOES NOT ANSWER."—Used by the operator when reporting to the calling party that the called party does not answer.

f. "MAGIC-11 HAS NO TELEPHONE."—Used by the operator when reporting to the calling party that the party called has no telephone.

g. "MAGIC-30 HAS NO TELEPHONE, BUT I WILL GIVE YOU MAGIC-11. I THINK YOU CAN GET HIM THERE."—Used by the operator when the

called party has no telephone but can be reached through another telephone.

h. "DID YOUR PARTY ANSWER?"—Used by the operator when he listens in on a connection to determine whether or not the called party has answered and he hears no conversation.

i. "I'LL RING THEM AGAIN."—Used by the operator when he has cut in on an uncompleted connection and has been told that the called party did not answer.

j. "WAITING?"—Used by an operator when he cuts in on a connection after a drop has fallen on one of the two connected units.

k. "JUST A MOMENT, PLEASE. WHAT NUMBER WERE YOU CALLING?"—Used by the operator when a party calls and reports that he has just been given a wrong number. In case a connection between two subscribers is broken before they are finished and either party rings the operator and tells him that they were cut off from the party they were talking to the same phrase is used. If the operator knows what party the complaining subscriber was talking to, he need not ask "What number were you calling?"

l. "WHAT NUMBER IS CALLING?"—Used by an operator after he has challenged on a connection on which a drop has fallen and as a result he has been given a new number by one of the two parties, and he does not know which of the two connected parties is calling.

m. "HELLO MAGIC" or "HELLO MAGIC-3."—Used by the operator when there is confusion or interruption on a connection through two or more switchboards and he is trying to get a distant operator or called party back on the line.

n. "WHO IS CALLING, SIR?"—Used by the operator when a calling party who can not get the number he desires on account of a busy line asks the operator to call him back to the phone when the party desired can be reached. Also used in any other case when the operator desires to know who the calling party is.

o. "I CAN GIVE YOU THE MESSAGE CENTER."—Used by the operator when, after reporting that the called party's telephone is out of order, or that the called party has no telephone. If the called party has no telephone but answers over another number, this phrase does not apply.

p. "CAPTAIN SMITH'S CODE NUMBER IS MAGIC-4. I WILL CONNECT YOU."—Used by the operator when a call comes in for a subscriber by name or some designation other than his telephone code number.

Directions.

1. Each group of five students will be required to install and operate a central with a number of local lines as follows:

TABLE-1.

TABLE-2.

TABLE-3. (Dummy. No telephone connected.)

TABLE-4. (Dummy. No telephone connected.)

TABLE-11.

TABLE-30.

TABLE-3 and TABLE-4, it will be noted, have no telephone connected. They will be marked with their proper designation on the celluloid strip on the switchboard, but will be considered as "out of order." The switchboard units will be so marked with a slip of paper.

2. Students will be assigned to duty as switchboard operator or at a local telephone and will rotate from one duty to another as the instructor directs.

3. This is primarily an exercise in answering and supervising, and the prescribed phrases will be used in every case for which there is a phrase given.

4. The instructor will issue Students Traffic Load Tables to students at local telephones who will place calls in accordance therewith, starting when directed to do so by the instructor.

Questions.

(1) *Why is it necessary that operators be required to use certain definite phrases in particular situations?*

(2) *When does an operator use the phrase "MAGIC OPERATOR"?*

(3) *How does the operator answer on a trunk line? On a local line?*

(4) *Are there any occasions when an operator might be required to give a subscriber a number other than the one asked for?*

(5) *What is the difference in the procedure used by an operator when listening in on a connection to find out if the called party has answered and when listening in after a drop has fallen on one of two connected lines?*

(6) *In what cases, if any, should an operator use the word "HELLO"?*

(7) *How should calls for subscribers who have no telephones be handled?*

(8) *When a call is made for a subscriber by name, what should an operator do to try and prevent the calling subscriber from again calling for the same person by name?*

(9) *If a subscriber accuses an operator of giving the wrong number, when the operator is certain he gave the number asked for, what should the operator do and what phrases should he use?*

SUGGESTIONS FOR THE INSTRUCTOR.

1. This unit operation is a continuation of Unit Operation No. 7 and the same equipment is used. This equipment consists of a central (TABLE) with four local lines, TABLE-1, TABLE-2, TABLE-11, and TABLE-30. In this Unit Operation an 8 or 12 line board, or two 4-line boards should be used with one unit marked "TABLE-3" and one marked "TABLE-4." These two need not have any telephones, but should be marked "Out of order" by tagging the unit with a slip of paper.

2. Issue a special order to the centrals covering all the special information that they require, as follows:

SPECIAL ORDERS FOR SWITCHBOARD OPERATORS.

a. TABLE-3 and TABLE-4 are out of order.

b. TABLE-5, TABLE-6, and TABLE-7 have no telephone and can not be reached over any other telephone.

c. TABLE-8, TABLE-9, and TABLE-10 receive calls at TABLE-11.

d. (1) TABLE-1 is Brig. Gen. A. B. Smith.

(2) TABLE-2 is Capt. R. B. Black.

(3) TABLE-4 is Lieut. S. M. Brown.

(4) TABLE-5 is Lieut. W. O. Jones.

3. At the first meeting of the class take up each phrase used in switchboard operating and demonstrate when and how it is used. Ask questions of individual students and have other members of the class indicate whether the answers are correct or not. When satisfied that all members of the class understand the use of the various phrases, assign each student in each group to a duty and issue and explain the Students Traffic Load Tables to the group. Arrange for a clock or a bell as described in Unit Operation No. 7 for indicating the time. All students should understand how the operation is to be carried out before starting on the schedule of calls.

4. The Students' Traffic Load Tables, and the Instructor's Traffic Load Table from which they are extracted are shown below. These are similar to those used in Unit Operation No. 7 but they have a number of special cases included which will require the use of most all of the phrases given in the Students' Manual.

INSTRUCTORS TRAFFIC LOAD TABLE.

NOTE 1.—TABLE-3 and TABLE-4 are out of order.

TABLE-5, TABLE-6, and TABLE-7 have no telephone.

TABLE-8, TABLE-9, and TABLE-10 answer on TABLE-11.

Captain Black is TABLE-2.

Lieutenant Brown is TABLE-4.

NOTE 2.—X, calling party; O, called party.

UNIT OPERATION No. 9.

Page No. 5.

TELEPHONE SWITCHBOARD OPERATOR.

| Time. | TABLE-1. | TABLE-2. | TABLE-11. | TABLE-30. | Other numbers. |
|-------|--|--|--------------------------------------|-----------------|---|
| 0 | X | O {Two of the calling parties get busy report.} | | | |
| 0 | | | X | | |
| 0 | | | | | X |
| 0+5 | | X | | | TABLE-3 (out of order). TABLE-5 (no telephone). |
| 0+5 | | | X If can't get TABLE-5 then TABLE-1. | | |
| 0+10 | | O Does not answer. | | X | |
| 0+10 | X | | | | Captain Black (TABLE-2). |
| 0+15 | | O {One gets busy report.} | X | | |
| 0+15 | X | | | | |
| 0+20 | | X | | | TABLE-10 (answers on TABLE-11). |
| 0+20 | X | | O Does not answer. | | |
| 0+20 | | | | X | TABLE-4 (out of order). |
| 0+25 | | | X | | TABLE-7 (no telephone). Lieutenant Brown (TABLE-4, which is out of order). |
| 0+25 | | | | X | |
| 0+25 | | X Asks for TABLE-1 by mistake; tells operator he got wrong number; wants TABLE-30. | | | |
| 0+30 | O {One gets busy report.} | | X | | |
| 0+30 | | | | X | |
| 0+30 | | X | | | |
| 0+35 | X Tells operator he was talking to TABLE-11 and was cut off. | | | | |
| 0+35 | | | X | | TABLE-3 (out of order). |
| 0+35 | | X | | O Don't answer. | |

STUDENTS TRAFFIC LOAD TABLES.

TABLE-1.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|--|----------------------------|
| 0 | TABLE-2..... | |
| 0+10 | Captain Black..... | |
| 0+15 | TABLE-2..... | |
| 0+20 | TABLE-11..... | |
| 0+35 | Call operator and tell him that you were talking to TABLE-11 and were cut off. | |

TABLE-2.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|---|----------------------------|
| 0+5 | TABLE-3..... | |
| 0+10 | Do not answer any calls that come in at this time..... | |
| 0+20 | TABLE-10..... | |
| 0+25 | TABLE-1. Then ring and tell operator you got wrong number. Tell operator you want TABLE-30. | |
| 0+30 | TABLE-8..... | |
| 0+35 | TABLE-30..... | |

TABLE-11.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|--|----------------------------|
| 0 | TABLE-2..... | |
| 0+5 | TABLE-5. If you can't get them, then ask for TABLE-1.. | |
| 0+15 | TABLE-2..... | |
| 0+20 | Don't answer any calls that come in at this time..... | |
| 0+25 | TABLE-7..... | |
| 0+30 | TABLE-1..... | |
| 0+35 | TABLE-3..... | |

-TABLE-30.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|---|----------------------------|
| 0 | TABLE-2..... | |
| 0+10 | TABLE-2..... | |
| 0+20 | TABLE-4..... | |
| 0+25 | Lieutenant Brown..... | |
| 0+30 | TABLE-1..... | |
| 0+35 | Don't answer any calls that come in at this time..... | |

5. Require each student to enter under remarks on his Students' Traffic-Load Table the result of the call, such as "Line busy, connection not obtained," or "Line busy, connection obtained later."

6. Direct all students that when they place a call for a party and receive a report that the line is busy that they are to ask to be called back later when the line is free. Direct operators to comply with such requests.

7. After the operation has been completed assemble the class and ask questions such as the following:

a. Why is it necessary to restore the drop to the normal position after completing a connection through a switchboard?

b. Why is it necessary to clear a connection immediately after a ring-off signal is observed?

c. How would you report to the calling party that the called party did not answer?

d. How would you report to the calling party the fact that the station called does not exist?

e. What phrases should be used in making reports on busy and out-of-order lines?

8. If the time indicated is too short to obtain correct procedure, lengthen the time between calls. The first essential thing is to obtain switchboard operators who can handle these calls correctly. To obtain more speed in switchboard operation repeat this Unit Operation two or three times shortening the time if advisable and change switchboard operators so that they get the cases that some other student handled the time before.

9. Before taking up the next Unit Operation give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 9-A (PERFORMANCE).

Equipment.

1. Prepare a switchboard (MAGIC) with local subscribers as follows:

| | |
|-------------------------|-----------|
| Commanding officer..... | MAGIC-1. |
| Executive officer..... | MAGIC-3. |
| Supply officer..... | MAGIC-7. |
| Message center..... | MAGIC-11. |

2. Set up a connection from MAGIC-1 to MAGIC-11.

Procedure.

1. When the student who is to be tested and who is to act as operator has read his directions and has indicated that he is ready, place a call from MAGIC-3 for MAGIC-1. The student acting as operator should give a report, "MAGIC-1 is busy." An assistant should be placed on MAGIC-1 or MAGIC-11 to answer in case the student challenges on either of these connected telephones.

2. Next, place a call from MAGIC-3 for MAGIC-30. The student acting as operator should report, "MAGIC-30 has no telephone."

3. Finally, place a call from MAGIC-3 for MAGIC-7. Do not have anyone answer MAGIC-7. The student acting as operator should listen on the line for about 30 seconds and then say, "I'll ring them again." He should repeat the operation again and then say, "MAGIC-7 does not answer."

Scoring.

1. The maximum possible score for this test is 12 points.
2. The score required to pass this test is 8 points.
3. Observe and score this test as described in Par. 4.
4. **DIRECTIONS FOR SCORING.**

| | Points. |
|--|---------|
| <i>a. Use of proper phrases in the first call:</i> | |
| (1) If the correct phrases are used..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any one of the following, the correct phrases have not been used: | |
| (a) Answer, "MAGIC OPERATOR." | |
| (b) Repeat, "MAGIC-1?" | |
| (c) Challenge properly and report, "MAGIC-1 is busy." | |
| If a student fails in any one of the above..... | 0 |
| <i>b. Use of proper phrases in second call.</i> | |
| (1) If correct phrases are used..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any one of the following, the correct phrases have not been used: | |
| (a) Answer, "MAGIC OPERATOR." | |
| (b) Repeat, "MAGIC-30?" | |
| (c) Reply, "MAGIC-30 has no telephone." | |
| If a student fails in any one of the above..... | 0 |
| <i>c. Use of proper phrases in third call:</i> | |
| (1) If the correct procedure is followed..... | 4 |
| (2) No partial scores allowed. | |
| (3) If the student fails to do any one of the following, the proper phrases have not been used: | |
| (a) Answer, "MAGIC OPERATOR." | |
| (b) Repeat, "MAGIC-7?" | |
| (c) Supervise connection and after about 30 seconds have elapsed say, "I'll ring them again." | |
| (d) After ringing twice and waiting about 30 seconds, say, "MAGIC-7 does not answer." | |
| If a student fails in any one of the above..... | 0 |

INSTRUCTION TEST NO. 9-A (PERFORMANCE).

PROBLEM.

Directions to the student.—1. The instructor will designate a switchboard to which you will be assigned as operator. This central will be called "MAGIC" and will have the following local stations connected to it:

MAGIC-1. MAGIC-3. MAGIC-7. MAGIC-11.

2. a. When the instructor says, "Begin," act as operator for this central and answer any calls that come in.

b. Do the work quickly and use the prescribed phrases taught in this unit operation.

c. Do not disturb any connections that are already set up without using correct phrases.

d. Remain at the switchboard until relieved by the instructor.

INSTRUCTION TEST NO. 9-B (INFORMATION).

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted has been indicated by a short dotted line enclosed in a parenthesis, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as *one* word.

1. In a field telephone system, each central has a code (.....) and each local (.....) has a (.....) (.....).

2. When a call comes into a central whose code name is "TABLE" the operator (.....) by saying (.....) (.....).

3. Supervising calls consist essentially in using every available effort to (.....) the (.....) with the (.....) party; in taking care that uninterrupted (.....) is maintained during (.....) and in clearing the lines (.....) when the (.....) completed.

4. When a call is made the operator (.....) (.....) on the line for about (.....) seconds after the connection has been established. Then if no (.....) is heard, he should (.....) (.....).

5. After a connection has been established it is the duty of the operator to (.....) the (.....) as far as he is able as (.....) as it is (.....).

6. Before (.....) a connection an operator should always listen in and challenge by saying, (".....").

7. Whenever possible, telephone calls should be made by the (.....) name and (.....) and not by (.....) name or title and (.....).

8. If an operator wanted to report that MAGIC-11 was busy he would say, (".....") (.....) (.....).

ANSWERING, SUPERVISING, AND ROUTING CALLS.

Equipment.

| Central. | Number of students. | Monocord switchboards. | Field telephone. | Wire. |
|-------------|---------------------|---------------------------|------------------|---------------------------------------|
| TABLE..... | 4 | Type BD-11 (12-line)..... | 4 | Twisted pair, field or out-post wire. |
| TOY..... | 3 | Type BD-11 (12-line)..... | 3 | Twisted pair, field or out-post wire. |
| TAR..... | 4 | Type BD-11 (12-line)..... | 4 | Twisted pair, field or out-post wire. |
| TARRY..... | 3 | Type BD-10 (8-line)..... | 3 | Twisted pair, field or out-post wire. |
| TRAVEL..... | 4 | Type BD-10 (8-line)..... | 4 | Twisted pair, field or out-post wire. |

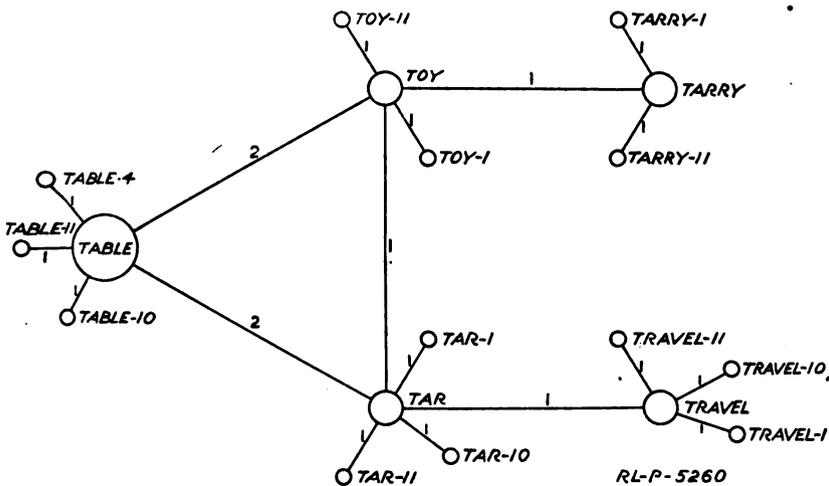


Fig. 17.—Traffic diagram showing subscribers.

Information.

This Unit Operation is a review of Unit Operations Nos. 7, 8, and 9. The students should carefully review the information given in those Unit Operations and the Information Topics referred to. This exercise covers all the cases commonly met with by an operator of a monocord switchboard in a wire net, and it requires the use of the rules for routing and the phrases given in the previous three Unit Operations.

Directions.

1. The class will be divided into groups and assigned to centrals as indicated above under the heading EQUIPMENT. They will be

required to install the net shown in Fig. 17. This figure represents a telephone net pertaining to the 1st Brigade (TABLE). The 1st Brigade (TABLE) has both regiments in the assault echelon, i. e., 1st Infantry (TOY) and 2d Infantry (TAR). Each regiment has one battalion in the assault echelon, i. e., 3d Battalion, 1st Infantry (TARRY). and 2d Battalion, 2d Infantry (TRAVEL). The other battalions are in reserve and are not shown as connected by telephone.

2. Each student will be assigned to duty as switchboard operator or at a local telephone and will rotate from one duty to another, as directed by the instructor.

3. Students at local telephones will be issued Student's Traffic-Load Tables and will place calls according to these tables, commencing when directed to do so by the instructor.

Questions.

(1) *In Fig. 17 what centrals would a call have to go through if it were given the direct route from TABLE-4 to TARRY-11?*

(2) *Describe a possible secondary routing for the call mentioned in question (1).*

(3) *Suppose the connection was completed for a call from TABLE-4 for TRAVEL-1 by the secondary routing. Could TABLE-11 call and get TARRY-1? (See Fig. 17.)*

(4) *Why is it necessary for operators to know the organization of their own, superior, and subordinate units?*

(5) *How and from what information is a traffic diagram made?*

(6) *What is a telephone code and what is its purpose?*

SUGGESTIONS FOR THE INSTRUCTOR.

1. This unit operation is a continuation of Unit Operations 7, 8, and 9 and is a general review of the matter contained in those Unit Operations. It is an exercise in routing calls in a telephone net and in the use of the traffic diagram. It affords training in the use of the various phrases given and explained, for use in operating and supervising, and the instructor should insist that operators use these prescribed phrases. At the completion of this Unit Operation the class should be proficient in the operation of monocord switchboards under all conditions.

2. Divide the class into groups so as to allow one student operator at each switchboard and one student at each local telephone and install the net shown in Fig. 17. Have the students correct Fig. 17 in the Students Manual to agree with Fig 17 as shown in this Guide.

| Central. | Size of switchboard required. | Local telephones. | Number of students in group. |
|-------------|-------------------------------|-------------------------|------------------------------|
| TABLE..... | 12-line..... | Nos. 4, 10, and 11..... | 4 |
| TOY..... | 12-line..... | Nos. 1 and 11..... | 3 |
| TAR..... | 12-line..... | Nos. 1, 10, and 11..... | 4 |
| TARRY..... | 8-line..... | Nos. 1 and 11..... | 3 |
| TRAVEL..... | 8-line..... | Nos. 1, 10, and 11..... | 4 |

3. Require each central to post a traffic diagram and to write the numbers of local telephones and the names of trunks on the celluloid strips on the switchboard units including dummy local Nos. 2, 3, 12, and 13. Nos. 2 and 3 represent local telephones which are out of order and these circuits should be so marked on the switchboard. Numbers 12 and 13 represent local parties which do not answer. They require no special tagging, but whenever the operator has occasion to ring them he will have to give a "DOES NOT ANSWER" report to the calling party.

4. Issue a copy of the following order to each central and require it to be posted by the switchboard.

SPECIAL ORDER FOR SWITCHBOARD OPERATORS.

- a. No.-2 and No.-3 are out of order.
- b. No.-5, No.-6, and No.-7 have no telephone, and can not be reached over any other telephone.
- c. Nos.-8 and 9, receive calls at No.-11.
- d. (1) No.-1 is Brig. Gen. A. B. Smith.
- (2) No.-2 is Capt. R. B. Black.
- (3) No.-10 is Capt. S. M. Brown.
- (4) No.-5 is Lieut. W. O. Jones.

5. When the net is installed complete, with all local telephones, issue to each student at a local telephone a Student's Traffic-Load Table. These Student's Traffic-Load Tables and the Instructor's Traffic-Load Table, from which they are extracted are shown below. These tables are similar to those used in previous Unit Operations and the students should have no difficulty with them. They cover a schedule of calls which include for each central the various cases which must be handled by the operator.

INSTRUCTOR'S TRAFFIC LOAD TABLE.

| TIME. | TABLE. | | | TOY. | | TAB. | | | TARRY. | | TRAVEL. | | |
|-------|-------------|----------|----|--------------|----|------------------|-------------|----|-----------|--------------|--------------|----|------------|
| | 4 | 10 | 11 | 1 | 11 | 1 | 10 | 11 | 1 | 11 | 1 | 10 | 11 |
| 0 | X | | | O | | X | | | X | | CAPT. BROWN. | | |
| 0+5 | | O | | TOY-5. | | | X | X | | | X | | O |
| 0+10 | X | | | X | | TAB-13 TAB-8. | | | | O | | X | |
| 0+15 | O | | | X | | TAB-9. | | | O | | | | X |
| 0+20 | | TABLE-2. | | O | | X | X | | | | X | | TRAVEL-8. |
| 0+25 | X | | | X | O | CAPT. BROWN. | | | TARRY-12. | | X | | |
| 0+30 | | TABLE-6 | | X | | O | | | TARRY-3. | | | | X |
| 0+35 | | | X | O | X | | O TAB-7. | | | X | | | TRAVEL-2. |
| 0+40 | X | | | TOY-3. | | | | O | | O | X | | |
| 0+45 | X | X | | | X | | O O O | | X | | | O | X |
| 0+50 | | | X | CAPT. BROWN. | | X | TAB-2. | | O | X | | | |
| 0+55 | | | | | | | X | | X | CAPT. BROWN. | | | TRAVEL-13. |
| 0+60 | O O O | | X | | X | | X | | X | | | X | O X |
| | | | | TOY-13. | | | | | | | | | |

INSTRUCTOR'S TRAFFIC LOAD TABLE—Continued.

| TIME. | TABLE. | | | TOY. | | TAR. | | | TARRY. | | TRAVEL. | | |
|-------|--------|----------|----|------------------|----|------|----|----|--------|---------------|---------|----|----|
| | 4 | 10 | 11 | 1 | 11 | 1 | 10 | 11 | 1 | 11 | 1 | 10 | 11 |
| 0+65 | X | | | Toy-6. Toy-2. | | X | | | | X | | | O |
| 0+70 | | | | | | | | X | | X TARRY-7. | | O | |
| 0+75 | | X | | | X | | O | | | TARRY-8. | | | X |
| | | TABLE-9. | | X | | | | O | | | | | |

NOTE—Nos. 2 and 3 at each central are out of order. Nos. 5, 6, and 7 at each central have no telephone. Nos. 8 and 9, at each central answer on No. 11. Nos. 12 and 13 at each central don't answer. The number of the officer called for by name is No. 10 at each central.

STUDENTS' TRAFFIC LOAD TABLES.

TABLE-1.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0 | TOY-1..... | |
| 0+25 | TOY-11..... | |
| 0+40 | TOY-3..... | |
| 0+65 | TOY-6..... | |

TABLE-10.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+10 | TAR-13..... | |
| 0+15 | TARRY-1..... | |
| 0+30 | TARRY-3..... | |
| 0+45 | TAR-10..... | |
| 0+75 | TAR-10..... | |

TABLE-11.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+5 | TRAVEL-11..... | |
| 0+20 | TRAVEL-8..... | |
| 0+35 | TOY-1..... | |
| 0+45 | TAR-10..... | |
| 0+50 | CAPT. BROWN AT TOY..... | |
| 0+60 | TABLE-4..... | |

STUDENTS' TRAFFIC LOAD TABLES—Continued.

TOY-1.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+10 | TABLE-11..... | |
| 0+15 | TAR-9..... | |
| 0+25 | CAPT. BROWN AT TAR..... | |
| 0+30 | TAR-1..... | |
| 0+40 | TAR-11..... | |
| 0+75 | TABLE-9..... | |

TOY-11.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+10 | TARRY-11..... | |
| 0+35 | TAR-7..... | |
| 0+45 | TRAVEL-10..... | |
| 0+50 | TAR-11..... | |
| 0+60 | TRAVEL-6..... | |
| 0+75 | TARRY-8..... | |

TAR-1.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0 | CAPT. BROWN AT TRAVEL..... | |
| 0+35 | TRAVEL-2..... | |
| 0+50 | TRAVEL-1..... | |
| 0+65 | TRAVEL-10..... | |

TAR-10.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+5 | TABLE-10..... | |
| 0+20 | TABLE-2..... | |
| 0+60 | TABLE-4..... | |

TAR-11.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+5 | TOY-5..... | |
| 0+20 | TOY-1..... | |
| 0+55 | CAPT. BROWN AT TARRY..... | |
| 0+70 | TARRY-7..... | |

STUDENTS' TRAFFIC LOAD TABLES—Continued.

TARRY-1.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0 | TOY-11..... | |
| 0+45 | TAR-10..... | |
| 0+60 | TABLE-4..... | |
| 0+65 | TOY-2..... | |

TARRY-11.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+5 | CAPT. BROWN AT TABLE..... | |
| 0+20 | TABLE-4..... | |
| 0+35 | TAR-10..... | |
| 0+50 | TAR-2..... | |
| 0+55 | TRAVEL-13..... | |
| 0+70 | TRAVEL-1..... | |

TRAVEL-1.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+25 | TARRY-12..... | |
| 0+40 | TARRY-11..... | |
| 0+60 | TRAVEL-10..... | |

TRAVEL-10.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+10 | TAR-8..... | |
| 0+75 | TAR-11..... | |

TRAVEL-11.

| At the time shown below. | Call the party shown below. | Remarks on result of call. |
|--------------------------|-----------------------------|----------------------------|
| 0+15 | TABLE-4..... | |
| 0+30 | TABLE-6..... | |
| 0+45 | TOY-11..... | |
| 0+60 | TOY-13..... | |

6. Direct the students to keep a record on their Traffic-Load Tables under remarks of the result of their calls, such as—

- a. Did not answer.
- b. Wrong number.
- c. Line busy. Completed later.
- d. No telephone. Completed through No. -11.
- e. Captain Jones number TABLE - 15.

7. If they know that Nos. 12 and 13 have no telephone on them, caution operators, that they will ring these numbers the prescribed number of times when they are called for and will report in the prescribed manner that they do not answer.

8. Have the class perform the operations according to the Traffic-Load Table arranging for a clock or bells as described in Unit Operation No. 7. If the time schedule is too slow, cut it down to three or two minute intervals.

9. At the completion of the operation assemble the class and explain any difficulties that have been observed during the operation. Give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 10-A (PERFORMANCE).

Equipment.

1. Prepare a switchboard connected as follows to represent a wire net:

- a. Name of central CAP.
- b. One trunk circuit to CAB.
- c. One trunk circuit to CANARY.
- d. One trunk circuit to CAPER with a short circuit on it.
- e. One local circuit to CAP - 11.
- f. One trunk circuit from CAPER to CANARY.

2. Connect a telephone representing a switchboard on both CAB and CANARY trunks. Nothing need be connected on CAPER trunk or CAP - 11 local. Place an assistant at CAB and CANARY.

Procedure.

1. When the student who is to be tested and who is to act as operator has read his directions and has indicated that he is ready, say "Begin," and have an assistant place a call from CAB for CAPER - 11. The student operator at CAP will receive no reply when he rings CAPER for there is a short on this circuit. He should therefore route the call through CANARY, connecting CAB to CANARY as soon as

the assistant at CANARY has answered as CANARY operator and has repeated back the number given him. This assistant should be instructed finally to answer as CAPER - 11; immediately after which the student acting as operator at CAP should remove his plug from the connection.

2. When the student acting as operator has completed the connection and has removed his plug, have the assistant at CAB call again and say, when the operator answers, "YOU GAVE ME THE WRONG NUMBER." The student acting as operator should reply, "JUST A MOMENT, PLEASE"; and if necessary, "WHAT NUMBER WERE YOU CALLING?" Have your assistant give the number CAPER - 1 if asked. See that the operator puts the call through correctly.

Scoring.

1. The maximum possible score for this test is 8 points.
2. The score required to pass this test is 8 points.
3. Observe and score the test as directed in Par. 4.
4. DIRECTIONS FOR SCORING.

| | Points. |
|--|---------|
| a. Correct routing, supervising, and use of proper phrases for the first call. | |
| (1) If correct routing, supervising, and proper phrases were used..... | 4 |
| (2) No partial score allowed. | |
| (3) A failure to do any one of the following makes the procedure incorrect and the first call is not properly handled: | |
| (a) Answer, "CAB OPERATOR." | |
| (b) Repeat, "CAPER - 11?" | |
| (c) Ring CAPER central. | |
| (d) Ring CANARY, when it is found that CAPER operator does not answer and the circuit rings short. | |
| (e) Ask for "CAPER - 11" when CANARY operator answers. | |
| (f) Remove his plug when "CAPER - 11" has answered. | |
| If a student fails in any one of the above..... | 0 |
| b. Correct routing, supervising, and use of proper phrases for the second call. | |
| (1) If correct procedure is followed..... | 4 |
| (2) No partial scores allowed. | |
| (3) A failure to do any one of the following makes the procedure incorrect and the second call is not properly handled: | |
| (a) Challenge by saying, "Waiting?" when the drop falls on the connected unit. | |
| (b) Reply, "Just a moment please. What number were you calling?" when the subscriber complains that he was given the wrong number. | |
| (c) Repeat procedure of a, b, c, d, e, and f above in paragraph a. | |
| If a student fails in any one of the above..... | 0 |

4. When a call comes in to MAGIC for Captain Jones, whose code number is MAGIC - 5, the operator should say “(.....)
(.....) (.....) (.....)
(.....) (.....) (.....)
(.....) (.....) (.....)”

5. When a call comes into MAGIC for MAGIC - 7, who has no telephone, and MAGIC - 7 receives calls at MAGIC - 11, the operator should say “(.....) (.....)
(.....) (.....) (.....)
(.....) (.....) (.....)
(.....) (.....) (.....)
(.....) (.....) (.....)
(.....) (.....)”

6. The proper routing of a call is the duty of the (.....).

7. The (.....) (.....) is used to determine the best routing for a call.

8. In order to (.....) a switchboard promptly of (.....) connections an operator should (.....) (.....) periodically on all (.....)

HANDLING TRAFFIC.

Equipment.

A telephone net installed with a switchboard and several local telephones at each central; a traffic diagram; and a telephone code

Information.

Up to this Unit Operation, the student operator has handled only calls. When conversations or messages are to be handled it easily becomes possible to pull the wrong plug and thus to cut off a conversation. Besides this, calls will come in for circuits that are busy. In order to familiarize operators with such conditions, a traffic load providing a situation in which actual messages are to be transmitted will be applied to the telephone net.

Directions.

1. A student will be assigned as telephone orderly at each local telephone. This station will bear the code designation of his central and office, as, for example, "Daylo-5" or "Table-5." Daylo or Table is the code designation of the central, and 5 is the code designation of the officer, viz., intelligence officer. Each local telephone will be given messages by the instructor to transmit to other stations, and the time each message is to be transmitted.

2. The switchboard operator will handle this traffic in accordance with the rules and routine procedure covered in the preceding Unit Operation, supervising all calls.

UNIT OPERATION No. 11.

Page No. 2.

TELEPHONE SWITCHBOARD OPERATOR.

3. Students assigned as telephone orderlies will have a message issued to them similar to the following:

MESSAGE

No. 8 DATE 1 Jan 22

TO CO 3d Inf AT _____

Your regiment will be relieved tomorrow.

Details later

| | | |
|---|------------------------------|-----------|
| CO 2d Brig | 8:05 | AM |
| <small>SIG. TRANSMITTED -- TITLE AND ORGANIZATION</small> | <small>HOURLY SIGNED</small> | |

| | |
|--------------------------------------|-----------|
| C.C. Brown Brig Gen | AT |
| <small>SIG. -- NAME AND RANK</small> | |

SPACES BELOW FOR SIGNAL COMMUNICATIONS PERSONNEL ONLY

| <small>OD</small> | <small>TP</small> | <small>SPECIAL INSTRUCTIONS</small> | | |
|-------------------------------|-------------------------|-------------------------------------|----------------------------|-----------------------|
| <small>CLASS</small> | <small>HOW SENT</small> | | | |
| 2d Brigade | 5 | 1 Jan 22 | 8:10 A | M |
| <small>MESSAGE CENTER</small> | <small>NO.</small> | <small>DATE</small> | <small>HOURLY</small> | |
| 8:45 AM | | | | M |
| <small>TIME FILED</small> | <small>CHECK</small> | <small>SENT BY</small> | <small>RECEIVED BY</small> | <small>HOURLY</small> |

TSO -1

4. The instructor will insert in the space marked "Time filed," the time at which the student is required to make the call and transmit the message.

5. The student who is acting as telephone orderly at a local telephone will proceed as follows:

a. Look up in his telephone code the code name and number corresponding to the CO 3d Infantry. (NOTE.—This message would normally be sent to the message center, but for practice in training switchboard operators in handling calls for different numbers the student at each number acts as a telephone orderly would act at a message center.)

- b. Enter 8 in the space "Check." This is the number of words in the body of the message.
- c. Enter name in the space "Sent by."
6. Establish connection with the 3d Infantry as follows:
 - a. Ring the switchboard operator and ask for "MOUNTAIN - 11."
 - b. The telephone orderly at the 3d Infantry message center should answer "MOUNTAIN - 11, SMITH SPEAKING."
 - c. Enter the name Smith in space "Received by."
 - d. Then say "MOTIVE - 11, JONES SPEAKING, TAKE THIS MESSAGE."
 - e. Mountain telephone orderly should say "GO AHEAD."
7. Transmit as follows, reading from the message blank:
 - a. "Number—Eight."
 - b. "Date—One, January, two, two."
 - c. "To—CO, 3d Infantry."
 - d. "Your regiment will be relieved to-morrow. Details later."
 - e. "Signature transmitted—CO 2d Brigade."
 - f. "Hour signed—Eight, zero, five, A. M."
 - g. "Class—OD."
 - h. "Message center—2d Brigade."
 - i. "Number—Five."
 - j. "Date—One, January, two, two."
 - k. "Hour—Eight, one, zero, A. M."
 - l. "Check eight words."
 - m. "End of message, repeat back."
8. The receiving telephone orderly should then repeat the message back, correcting any errors he has made.
9. When the receiving operator has repeated the message back correctly, say: "Correct, I have nothing further."
10. Ring off.
11. Enter the time that transmission was completed in the space marked "Hour."

Questions.

- (1) Why are the number of words in the body of the message entered under "CHECK" on the field-message blank?
- (2) After having obtained connection with the called party, what would the operator say if he had more than one message to transmit?
- (3) When transmitting a message, why is the name of the person receiving the message entered on the message blank?
- (4) What is meant by the body of the message?
- (5) Is the actual signature and rank of the writer usually transmitted?
- (6) Does a switchboard operator on duty ever transmit messages?

fall, and can ascertain by a brief question to the operator such events as he can not hear or see. He can be given a copy of the instructor's traffic load table, which will assist him in making his entries and in noting errors and omissions. In selecting recorders take the best operators first. They are the instructor's assistants. Then rotate them on the other assignments in order to give all the men practice as switchboard operators, message center operators, and recorders.

3. Consolidate the traffic records in the following form and post it where students can see it.

Consolidated traffic record.

.....
(Date).

| Operator. | Number of calls handled. | Average time to complete a call. |
|-------------|--------------------------|---|
| Jones..... | | (Obtained by dividing the total time by the total number of calls taken from the traffic record.) |
| Smith..... | | |
| Rankin..... | | |

Note that where calls have to be made through two or more centrals, more time is required than through just one central, but if the instructor will adjust his traffic load table properly so that each operator has the same number of two and three central calls to make, and will keep these records for several days, the fast and accurate operators can be told by the average time taken to complete calls as determined from these records. This will serve to introduce competition among the students.

4. Prepare the instructor's traffic-load table as before, providing a message on a field-message blank for each case where the call is to be completed. The students at local telephones will be given a student's traffic-load table as in the previous case. They are also given the messages which are to be sent for completed calls. Insert trouble calls and calls by name as in previous Unit Operations.

5. Go over the field-message blank and explain to the students how they indicate on their blanks the time when the message was started and when completed, together with the initials of the receiving and the transmitting telephone orderlies. This is required in order that the instructor can determine how long it took the students acting as orderlies to transmit their messages. These messages should bring in the use of phonetic spelling. Check the transmitted message with the received message for errors. Ascertain which students make the most errors, for they are also probably poor operators.

7. The handling of messages is not ordinarily a duty of the switchboard operator, but it is required in this operation to train switchboard operators while acting as such;

a. To operate their boards where actual messages are being handled:

- (1) Not to ring on lines that are working.
- (2) Not to pull plugs on lines that are working.
- (3) In giving proper answers for uncompleted or trouble calls.
- (4) In promptness in disconnecting lines.

b. To train switchboard operators while acting as message-center personnel:

(1) In accurate handling of words, phrases, and numbers over the telephone as well as the use of phonetic spelling.

(2) So that they know what it means to have an operator interfere by ringing or pulling a plug while they are transmitting or receiving a message.

8. Since messages must be handled to give switchboard operators the required training, do not waste the time of men acting as telephone orderlies but train them as indicated. All communication personnel must know how to use the field-message blank.

9. Students should be cautioned that their progress in speed and accuracy depends in some measure on how they handle the Unit Operation given them. If they play the game they can help train each other. Require that when not otherwise indicated on their traffic tables orderlies shall answer calls instantly and be prepared to copy messages. Impress on them the fact that a big telephone net in combat is a busy affair, and that switchboard operators must be so expert in handling calls that in the usual and very urgent cases they can handle routine calls automatically and still think and act quickly on the difficult ones.

10. Go over the questions in the Students Manual. Ask additional questions such as:

a. What is indicated by the difference in the entries under "Time filed," "Time" (sent by), on the field-message blank?

b. What is S. T.?

c. Why not have an officer write out his name on the line marked S. T.?

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 11-A (PERFORMANCE).

Equipment.

Prepare two switchboards (MOBILE and MODERN) with a local telephone at each switchboard for the message center (MOBILE - 11 and MODERN - 11). Run a trunk line between the two switchboards. Place the switchboards so that they will be out of ordinary hearing distance of each other.

Procedure.

1. Assign the student who is to be tested to MOBILE - 11 as telephone orderly at that message center and give him the following message to transmit. Insert the proper dates and hours on the message blank before it is given to the student.

MESSAGE

No. 1 DATE _____

TO CO 1st Inf AT _____

Have one battalion report to me as
brigade reserve. This battalion will be
returned to your command as soon as
practicable.

| | |
|--|-------------|
| CO 1st Brig | M |
| SIG. TRANSMITTED -- TITLE AND ORGANIZATION | HOUR SIGNED |

| | |
|-----------------------|----|
| C.C. Brown Brig Gen | AT |
| SIG. -- NAME AND RANK | |

SPACES BELOW FOR SIGNAL COMMUNICATIONS PERSONNEL ONLY

| | | |
|-------|----------|----------------------|
| OD | TP | |
| CLASS | HOW SENT | SPECIAL INSTRUCTIONS |

| | | | | |
|----------------|-----|------|------|---|
| 1st Brigade | 1 | | | M |
| MESSAGE CENTER | NO. | DATE | HOUR | |

| | | | | | | |
|------------|-------|---------|-------------|------|--|---|
| M | | | | | | M |
| TIME FILED | CHECK | SENT BY | RECEIVED BY | HOUR | | |

TELEPHONE SWITCHBOARD OPERATOR.

2. Make an exact copy of the above message and go to MODERN - 11. Act as telephone orderly at MODERN - 11; receive the message which the student transmits, checking the transmission against your copy.

3. When the student has completed the transmission and has hung up, call MOBILE - 11 and transmit the following message. Insert the proper dates and hours before commencing.

MESSAGE

NO. 1 DATE _____

TO CO 1st Brig AT _____

Second battalion has been ordered to report to you at once in compliance with your message number one this date.

CO 1st Inf M
SIG. TRANSMITTER -- TITLE AND ORGANIZATION HOUR SIGNED

C.K. Jones Maj Inf AT
SIG. -- NAME AND RANK

SPACES BELOW FOR SIGNAL COMMUNICATIONS PERSONNEL ONLY

OD TP
CLASS HOW SENT SPECIAL INSTRUCTIONS

1st Infantry 1 M
MESSAGE CENTER NO. DATE HOUR

M M
TIME FILED CHECK SENT BY RECEIVED BY HOUR

TSO-3

4. Finally have the student turn in the message he has written down and check it against the original.

Scoring.

1. The maximum possible score for this test is 20 points.
2. The score required to pass this test is 15 points.
3. DIRECTIONS FOR SCORING.

INSTRUCTORS GUIDE FOR ALL ARMS.

| | |
|---|---------|
| <i>a. Transmitting a message.</i> | Points. |
| (1) If the message is transmitted correctly in 2 minutes..... | 10 |
| (2) (a) Deduct one point for each error made in transmission. | |
| (b) Deduct one point for each 30 seconds in excess of allowed time. | |
| (3) If there is a total of ten or more points to be deducted..... | 0 |
| <i>b. Receiving a message.</i> | |
| (1) If the message is received correctly..... | 10 |
| (2) Deduct one point for each error in the message. | |
| (3) If there is a total of ten or more points to be deducted..... | 0 |

INSTRUCTION TEST NO. 11-A (PERFORMANCE).**PROBLEM.**

Directions to the student.—*a.* The instructor will designate a local telephone to which you will be assigned as message center telephone orderly. There are two centrals, MOBILE and MODERN (1st Brigade and 1st Infantry), each having a telephone for the message center (MOBILE - 11 and MODERN - 11).

b. When the instructor says, "Begin," be prepared to act as telephone orderly for the message center to which you are assigned and transmit and receive such messages as may come in, using the proper procedure.

c. Do the work quickly and neatly.

d. Remain at the telephone until relieved by the instructor.

e. The instructor will record the time it has taken to handle the messages.

INSTRUCTION TEST NO. 11-B (INFORMATION).

Directions to the student.—Below are a number of sentences and just after each are the words "True" and "False." Read each sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

1. When transmitting a message by telephone to another headquarters the message center telephone orderly always calls for the person to whom the message is addressed and not the message center.

True. False.

2. The "Time filed" is not transmitted.

True. False.

3. The check is the number of words in the message including address and signature.

True. False.

4. The time under "Sent by" is the time at which the operator finished sending a message and had received the proper acknowledgment.

True. False.

5. The class of a message is never sent when sending a message by telephone.

True. False.

6. The name of the person signing the message is always sent when transmitting a message by telephone. True. False.
7. The phonetic alphabet should always be used when transmitting a coded message by telephone. True. False.
8. The telephone orderly when receiving a message by telephone should write it in duplicate on a field message blank. True. False.
9. Never repeat a message back to the person sending it by telephone. True. False.
10. When sending a coded message by telephone never give the name of the organization from which it is sent. True. False.
11. The telephone switchboard operator transmits messages. True. False.
12. A message for the chief of the wire section would be received by the switchboard operator. True. False.

TESTS AND TROUBLES.

Equipment.

A telephone net installed with a switchboard and several local telephones and a chief operator's telephone at each central; a telephone code; a test and trouble record; a station log. (See Information Topic No. 8.)

Directions.

1. *Tests.*—All circuits to the switchboard, both trunks and locals, should be tested at periodic intervals unless circuits are in continuous use; in such cases the fact that they are in use will show that there is no trouble on the circuits. The operator at the specified time should test all circuits and make suitable entries on the operator's test and trouble record. Entry should not be made on the test and trouble record unless a circuit is found defective. A test consists of plugging into and ringing on a line. When the party at the other end answers, the operator says, "Test, thank you," and clears the line. Each operator will also keep a station log under the supervision of the chief operator. (See Information Topic No. 8.)

Question.

(1) *Why is it necessary to test all circuits periodically?*

2. *Trouble.*—When a circuit is reported out of order, or when it shows up as out of order under test or traffic, it is entered on the test and trouble record. The chief lineman is notified and the jack of that line is marked "Out of order." The operator is notified when the trouble has been found and the repairs made; he then tests the line and completes the entry on the test and trouble record.

Question.

(2) *Should a connection between two parties be broken in order to test the circuit?*

3. The students acting as switchboard operators will handle calls and make tests at such times as may be specified by the instructor. Students acting as telephone orderlies will transmit messages in accordance with the student's traffic load as issued by the instructor.

Question.

(3) *What is the purpose of the chief operator's telephone? (Refer to Information Topic No. 5.)*

SUGGESTIONS FOR THE INSTRUCTOR.

1. A telephone net should be installed with switchboard and several local telephones at each central, including an additional telephone at each central for the chief operator, which will be used for trouble, complaint, or service work. A test and trouble record, a traffic diagram, a station log, and a telephone code will be issued to each central.

2. This operation should be carried on in conjunction with the chief operator's class and lineman's class. If this is not possible, one man should be assigned as chief operator at each central and at least one man as lineman, making a total of six men at each central.

3. Explain the station log and how tests and troubles are handled. (See Information Topic No. 8.)

4. Ask questions such as:

(a) What should be done if circuit No. 202 was reported out of order?

(b) What entry should be made on the test and trouble record?

(c) If the trouble was cleared by Lineman Jones 10 minutes after being reported, and was found to be a broken wire, what entries would be made on the test and trouble record?

(d) Why is the chief operator's telephone not located right at the switchboard?

(e) If some one calls up and complains about the service, what does the operator do?

5. Prepare an instructor's traffic load table, and prepare student's traffic-load tables for the telephone orderlies. Insert on these latter tables some cases of trouble, making your list up from those covered in previous Unit Operations. Issue these and proceed as in previous Unit Operations. Require each operator to keep a test and trouble record and a station log. Require tests to be made every 10 minutes. Have the student acting as chief operator use the telephone assigned to him for directing the student acting as lineman in the clearing of trouble.

6. Require each student to make out a station log from the following or similar data:

Station name—Logan.

Station opened—Three minutes after 9 a. m., December 15, 1922, with circuits Nos. 301, 303, and 304 connected.

Station closed—Quarter of 4 p. m., December 15. Circuit 302 connected to switchboard at noon.

Circuit 301 removed at half past 1.

Circuit 303 in trouble at 10 a. m. Cleared at 15 m.
Names of operators to be those of any students in the class.

Log to be signed by the student as chief operator.

7. Repeat this procedure until all thoroughly understand the method of keeping a station log.

8. Require the members of the class to make out test and trouble records from the following or similar data: Station Mohawk on December 15, 1922, had the following trouble: Circuit 401 was tested by J. S. H. at 10.02 a. m. and found open. It was cleared by lineman A. B. B. at 10.16 a. m. The trouble was caused by a broken wire. Circuit 403 was tested at 10.05 a. m. by J. S. H. and found noisy. It was cleared by lineman A. R. B. at 10.15. The trouble was caused by ground on a wire fence. Circuit 404 was tested by J. S. H. 11.30 a. m. and found crossed with circuit 402. It was cleared by lineman A. R. B. at 11.50. The trouble was caused by a loose wire end on the terminal strip.

9. Repeat the procedure until all students thorough the use of and the method of making entries on the test records. Then give an Instruction Test similar to the following.

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 12-A (PERFORMANCE).

Equipment.

Provide a supply of test and trouble records and issue one to each student.

Procedure.

Instruct the students to read their directions and to proceed as soon as the command "Begin" is given.

Scoring.

1. The maximum possible score for this test is 12 points.
2. The score required to pass this test is 9 points.
3. DIRECTIONS FOR SCORING.

| | |
|---|---------|
| a. Correct test and trouble record. | Points. |
| (1) If all the entries are made correctly | 12 |
| (2) Deduct 1 point for each error, up to 12 points. | |
| (3) If there is a total of 12 or more points to be deducted | 0 |

SUGGESTIONS FOR THE INSTRUCTOR.

1. A telephone net should be installed with switchboard and several local telephones at each central, including an additional telephone at each central for the chief operator, which will be used for trouble, complaint, or service work. A test and trouble record, a traffic diagram, a station log, and a telephone code will be issued to each central.

2. This operation should be carried on in conjunction with the chief operator's class and lineman's class. If this is not possible, one man should be assigned as chief operator at each central and at least one man as lineman, making a total of six men at each central.

3. Explain the station log and how tests and troubles are handled. (See Information Topic No. 8.)

4. Ask questions such as:

(a) What should be done if circuit No. 202 was reported out of order?

(b) What entry should be made on the test and trouble record?

(c) If the trouble was cleared by Lineman Jones 10 minutes after being reported, and was found to be a broken wire, what entries would be made on the test and trouble record?

(d) Why is the chief operator's telephone not located right at the switchboard?

(e) If some one calls up and complains about the service, what does the operator do?

5. Prepare an instructor's traffic load table, and prepare student's traffic-load tables for the telephone orderlies. Insert on these latter tables some cases of trouble, making your list up from those covered in previous Unit Operations. Issue these and proceed as in previous Unit Operations. Require each operator to keep a test and trouble record and a station log. Require tests to be made every 10 minutes. Have the student acting as chief operator use the telephone assigned to him for directing the student acting as lineman in the clearing of trouble.

6. Require each student to make out a station log from the following or similar data:

Station name—Logan.

Station opened—Three minutes after 9 a. m., December 15, 1922, with circuits Nos. 301, 303, and 304 connected.

Station closed—Quarter of 4 p. m., December 15. Circuit 302 connected to switchboard at noon.

Circuit 301 removed at half past 1.

5. A connection between two parties should not be broken in order to make a test. True. False.
6. The test and trouble record shows the time the central opened and closed. True. False.
7. The station log shows the time of connection or removal of any circuits. True. False.
8. The station log shows the schedule of operators at a station. True. False.
9. From the test and trouble record the communications officer can tell whether the circuits are being tested at the prescribed time. True. False.
10. The chief operator signs the station log. True. False.
11. The switchboard operator refers complaints to the chief operator. True. False.
12. In case of trouble on a circuit the operator notifies the communications officer. True. False.

PROCEDURE DURING TROUBLE.

Equipment.

A telephone net installed with a switchboard and several local telephones, including a chief operator's telephone at each central; a traffic diagram; a telephone code; a station log; and a test and trouble record.

Information.

Up to this Unit Operation, student operators have handled traffic without being purposely impeded by having trouble intentionally placed in the net.

In the field, however, troubles always occur. These are caused by circuits being cut by vehicular traffic or enemy fire, by mistakes or errors of wire construction, by incompetent or careless personnel, or by defective equipment.

In order to give students experience with the sort of troubles that are likely to occur in the field, a "trouble load" will be applied to a telephone net in addition to the traffic load.

Directions.

1. *Telephone or line out of order.*—As soon as a line or telephone has been found to be out of order, it is reported to the operator. He records it on the test and trouble record and notifies the chief lineman or, in his absence, one of the trouble men assigned to that station. The operator then places a slip of paper with the words "Out of order" printed on it in the jack of the faulty line and reports the line "out of order" to anyone calling that party. As soon as the trouble is repaired the trouble man or chief lineman will report the fact to the operator, who then tests the line. The test consists of plugging into and ringing that line. When the party at the other end answers, the operator says "Test, thank you," clears the line, and removes the "Out of order" designation from over the line or jack.

Questions.

(1) *What would be indicated if the operator rang on one line and got a party on another line?*

(2) *If two parties, who are connected through the switchboard and conversing, are disconnected, whose fault is it?*

2. *Complaints and inquiries.*—Complaints or inquiries about the telephone service should be referred to the chief operator. If it becomes necessary for the chief operator to leave the office, he will leave a competent operator to act in his place.

3. Students will carry out the instructions they receive for the training required under this Unit Operation.

SUGGESTIONS FOR THE INSTRUCTOR.

1. A telephone net is installed with a switchboard and several local telephones, including a chief operator's telephone, at each central. A traffic diagram, a telephone code, a station log, and a test and trouble record, is furnished each central.

2. Assemble the class and explain that this Unit Operation is a continuation of the previous one. Review the various kinds of trouble and the method of reporting and handling it. Explain thoroughly the trouble which may develop on party lines by the wrong party answering the telephone.

3. Give the various stations, calls and messages to handle at specified times, by means of traffic-load tables.

4. Place various kinds of trouble on the different telephones, lines, and switchboards. Have the telephone orderlies place trouble on some lines. Give the switchboard operators instructions to place trouble on some of their circuits at the switchboard, which will require the lineman from another central to come up and clear it. Issue an order in the manner shown you in a previous Unit Operation to take care of the special instructions you want all to follow. Continue the operation of the net until all the students are proficient in the handling and reporting of trouble.

5. It takes time to train operators to handle calls and trouble promptly and accurately. It is much easier to give this training where the students are located close to you. When they are out on field exercises, with centrals a mile or more apart, it is more difficult to instruct them, and much time is wasted in getting from one central to another. If message-center teams are also being trained at the same post or station and their training has progressed far enough to permit it, arrange to have them send their own messages for their training over your circuits. Do not fail to have message-center teams train with your operators before you go in the field with them.

6. Assemble the class and ask questions such as:

(a) How should an out-of-order line be designated on the switchboard?

(b) What record is made under the above procedure?

(c) In case of trouble who should be notified? Why?

(d) When ringing on a party line what would be the operator's reply to a party who has answered by mistake?

(e) What is the procedure for reestablishing a connection after conversation has been interrupted?

(f) Why should a complaint or inquiry be referred to the chief operator?

(g) What are some of the things which would indicate that a line is out of order?

7. Give an Instruction Test similar to the following when the Unit Operation has been completed:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 13-A (PERFORMANCE).

Equipment.

Prepare in advance a monocord switchboard with an operator's set and three local circuits. Number these circuits and place trouble on them as follows:

- a. Line No. 1..... Short circuit.
- b. Line No. 2..... Open circuit.
- c. Line No. 3..... Ground.

Be sure that the switchboard has its ground connection properly made.

(NOTE.—No ground is provided for switchboards of EE-2-A units.)

Procedure.

- a. When the student who is to be tested has read his directions and has indicated that he is ready, direct, "Begin."
- b. Note and record the time to the nearest second that the command "Begin" is given, and note the time that the student finishes.
- c. Note whether the student makes the proper tests of circuits as required and whether he determines what particular trouble is on the several circuits.

Scoring.

- 1. The maximum possible score for this test is 12 points.
- 2. The score required to pass this test is 8 points.
- 3. DIRECTIONS FOR SCORING.

a. Testing circuits.

| | Points. |
|---|---------|
| (1) If the student properly tests and determines the nature of the trouble on all three circuits..... | 12 |
| (2) If the student fails to determine the nature of the trouble on any one circuit, deduct 4 points. | |
| (3) If the student fails to determine the nature of the trouble on all three circuits | 0 |

INSTRUCTION TEST NO. 13-A (PERFORMANCE).

PROBLEM.

Directions to the student.—a. A switchboard with three lines, Nos. 1, 2, and 3, connected to it will be assigned by the instructor.

There is trouble on each one of these lines. Make the necessary tests and determine what the nature of the trouble is on each line and record it in the blank spaces below.

- Line No. 1.....
- Line No. 2.....
- Line No. 3.....

- b. Report to the instructor as soon as the work is completed.
- c. The instructor will note the time taken to do the work.

INSTRUCTION TEST NO. 13-B (INFORMATION).

Directions to the student.—Each of the following sentences can be answered by a single word or phrase. Write your answer on the short dotted line.

1. What does an operator do to test a line? (.....)
2. In a large central, to whom should complaints or inquiries be referred? (.....)
3. On what record is an "out of order" line recorded? (.....)
4. What should an operator do as soon as a line is reported as repaired? (.....)
5. What would be the trouble indicated if the conversation over one line could be heard on another line? (.....)
6. If, when ringing on a line with a camp telephone, the operator's generator crank turned very hard, his bell did not ring, and the called party did not answer, what would be the trouble indicated? (.....)
7. If, when ringing on a line with a camp telephone, the crank turned very easily, the bell rang, but the called party did not answer, what would be the trouble indicated? (.....)
8. If the operator were notified that on a certain subscriber's telephone he could be plainly heard, but that the subscriber could not make himself heard, where would the trouble most likely be found? (.....)

SUGGESTIONS FOR CONDUCTING PROGRESS TEST.

No. 3-A (PERFORMANCE).

Equipment.

- 1 Operator's set, EE - 64.
- 1 Switchboard, monocord 8-line.
- 5 Telephones, EE - 4.

Procedure.

1. Install in advance a telephone net with three centrals and with three subscribers' stations at TABLE CENTRAL as shown below. Provide blank forms for Test and Trouble Records for the student acting as operator. Prepare a Traffic Diagram and post it by TABLE CENTRAL, together with a set of Instructions for Operators which should be as follows:

- a. TABLE-9 answers on TABLE-1.
- b. Test all circuits every 5 minutes.
- c. Keep a record of tests and troubles on the test and trouble record.

| Drop No. | Party. |
|----------|------------|
| 1..... | OPAL |
| 2..... | DAYLO |
| 3..... | TABLE-1 |
| 4..... | TABLE-2 |
| 5..... | TABLE-11 |
| 6..... | (Not used) |
| 7..... | (Not used) |
| 8..... | (Not used) |

2. When the student who is to be tested has read his directions and is ready to begin, direct him to go to TABLE CENTRAL and act as operator, and also keep a Test and Trouble Record.

3. Place a call from TABLE-11 for OPAL-1. Have an assistant answer on OPAL trunk, first as OPAL operator and then as OPAL-1, and hold the circuit in case the operator should challenge.

4. Then place a call from TABLE-1 for OPAL-1. The instructor should get a busy report from the operator.

5. Put TABLE-2 out of order by opening the circuit.

6. Have your assistant ring off on OPAL trunk. The operator should challenge and clear the connection.

7. Place a call from DAYLO for TABLE-9. The operator should connect you with TABLE-1.

8. After TABLE-2 has been out of order during at least two tests by the operator, repair the trouble and wait until the operator makes another test of circuits.

9. Then have your assistant place a call from OPAL for TABLE-2.

Scoring.

1. The maximum possible score for this test is 24 points.
2. The score required to pass this test is 20 points.
3. DIRECTIONS FOR SCORING:

a. Keeping test and trouble record.

- | | Points. |
|---|---------|
| (1) If the Test and Trouble Record is correctly kept..... | 4 |
| (2) No partial scores allowed. | |
| (3) If any errors occur in Test and Trouble Record..... | 0 |

b. Establishing first connection.

- | | |
|--|---|
| (1) If the first connection was properly established..... | 4 |
| (2) No partial scores allowed. | |
| (3) A failure to do any one of the following makes the <i>procedure incorrect</i> and the <i>first connection</i> is not properly established: | |
| (a) Answer, "TABLE OPERATOR." | |
| (b) Repeat, "OPAL-1." | |
| (c) Ring OPAL CENTRAL. | |
| (d) Ask for OPAL-1. | |

If a student fails in any one of the above..... 0

c. Giving a busy report.

- | | |
|--|---|
| (1) If correct procedure is used in giving busy report..... | 4 |
| (2) No partial scores allowed. | |
| (3) A failure to do any one of the following makes the <i>procedure incorrect</i> and the busy report is not properly given: | |
| (a) Answer, "TABLE OPERATOR." | |
| (b) Repeat, "OPAL-1?" | |
| (c) Say, "OPAL-1 is busy." | |

If a student fails in any one of the above 0

d. Disconnecting.

- | | |
|---|---|
| (1) If correct procedure is used in disconnecting..... | 4 |
| (2) No partial scores allowed. | |
| (3) A failure to do any one of the following makes the <i>procedure incorrect</i> and the disconnection is not properly made: | |
| (a) Challenge by saying, "WAITING." | |
| (b) Disconnect. | |

If a student fails in any one of the above 0

e. Establishing second connection.

- | | |
|--|---|
| (1) If correct procedure is used in establishing connection..... | 4 |
| (2) No partial scores allowed. | |
| (3) A failure to do any one of the following makes the <i>procedure incorrect</i> and the second connection is not properly established: | |
| (a) Answer, "TABLE OPERATOR." | |
| (b) Repeat, "TABLE-1?" | |
| (c) Ring TABLE-1. | |

If a student fails in any one of the above 0

f. Establishing third connection.

- | | |
|---|---|
| (1) If correct procedure is used in establishing connection..... | 4 |
| (2) No partial scores allowed. | |
| (3) A failure to do any one of the following makes the <i>procedure incorrect</i> and the third connection is not properly established: | |
| (a) Answer, "TABLE OPERATOR." | |
| (b) Repeat, "TABLE-2?" | |
| (c) Ring TABLE-2. | |

If a student fails in any one of the above 0

PROGRESS TEST NO. 3-A (PERFORMANCE).

PROBLEM.

Directions to the student.—*a.* At the location which will be designated by the instructor there is a telephone central with a number of local lines and trunk lines connected to it.

b. When the instructor directs, go to this switchboard and examine the Traffic Diagram and Instructions for Operators, posted by the switchboard.

c. Examine the markings on the units and when ready notify the instructor and stand by to handle traffic.

d. Test all circuits entering the switchboard every five minutes and keep a record on the Test and Trouble Record which will be furnished by the instructor.

e. When a party fails to answer, determine the nature of the trouble if possible and record it.

PROGRESS TEST NO. 3-B (INFORMATION).

Directions to the student. Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line enclosed in a parenthesis, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like "armor-plated" or "back-fire," counts as *one* word.

1. A call comes in for MAGIC-20. However, MAGIC-20 has no telephone; neither can he be reached by telephone. Therefore the operator tells the calling party (.....) (.....) (.....).

2. When an operator tests a line he rings on that line, and when the party answers, he says "(.....) (.....)" and clears the connection. In case there is trouble on the line the operator enters it on (.....) (.....) and (.....) (.....) and notifies the chief lineman and (.....) that (.....) "out of order."

3. A test and trouble record is kept, so that a record is available to show at what time any circuit was out of order, what time it was cleared, and the reasons therefor. This information shows the circuits on which the (.....) (.....) (.....).

4. The proper routing of a call is the (.....) of the (.....).

Directions to the student.—Below are several paragraphs and just after each one are the words "True" and "False." Read each paragraph carefully and if what it says is true, draw a line under "True." If what it says is not true, draw a line under the word "False."

5. No record is made of a test unless there is something wrong with the line. True. False.

6. An operator never completes a call for a party who has no telephone even though he may be reached at a near-by telephone. True. False.

7. An operator will never let a party know when he can get through a call which he previously could not complete. True. False.

8. An operator should never complete a call unless the calling party gives the called party's code designation. True. False.

9. An operator uses only the most direct routing for a call. True. False.

10. The circuit diagram is the means by which an operator determines how to route a call. True. False.

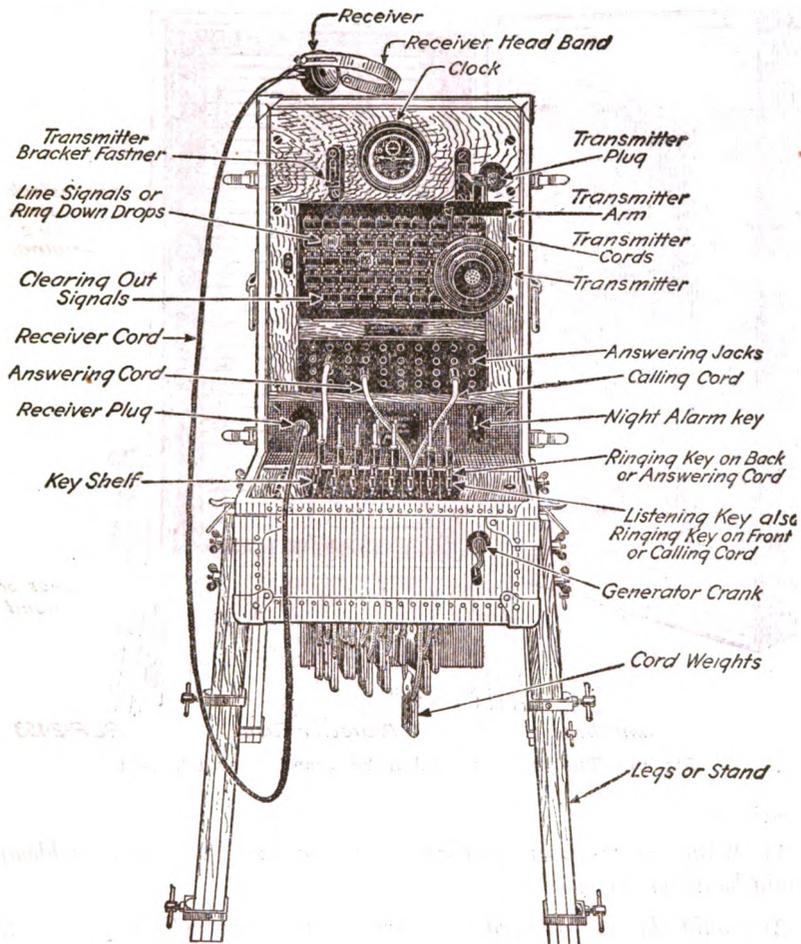
11. All connections on a switchboard should be supervised periodically to determine whether or not they are in use. True. False.

12. The operator may say, "Hello" when trying to attract the attention of a distant operator. True. False.

INSTALLATION OF THE CAMP SWITCHBOARD.

Equipment.

- 1 camp switchboard.
- 8 terminal strips, type TM - 84.
- 400 feet field wire, twisted/-/pair.
- 40 feet lacing twine or cord.
- 10 feet switchboard cable.



R-P-2487

Fig. 18.—Front view of the camp-type switchboard.

Information.

Unit Operations No. 14 and No. 15 are furnished in this text for such units as are equipped with the camp switchboard type BD - 14 - 5 and type BD - 14 - 6.

Directions. (See Information Topic No. 9.)

1. Open the rear of the switchboard case and take out the four telescopic legs. Fasten the legs to the switchboard case by means of the wing nuts on the legs and the corresponding slots on the case of the switchboard. Adjust the distance above the ground or floor by loosening the wing nuts which control the telescopic action of the legs. (See Fig. 18.)

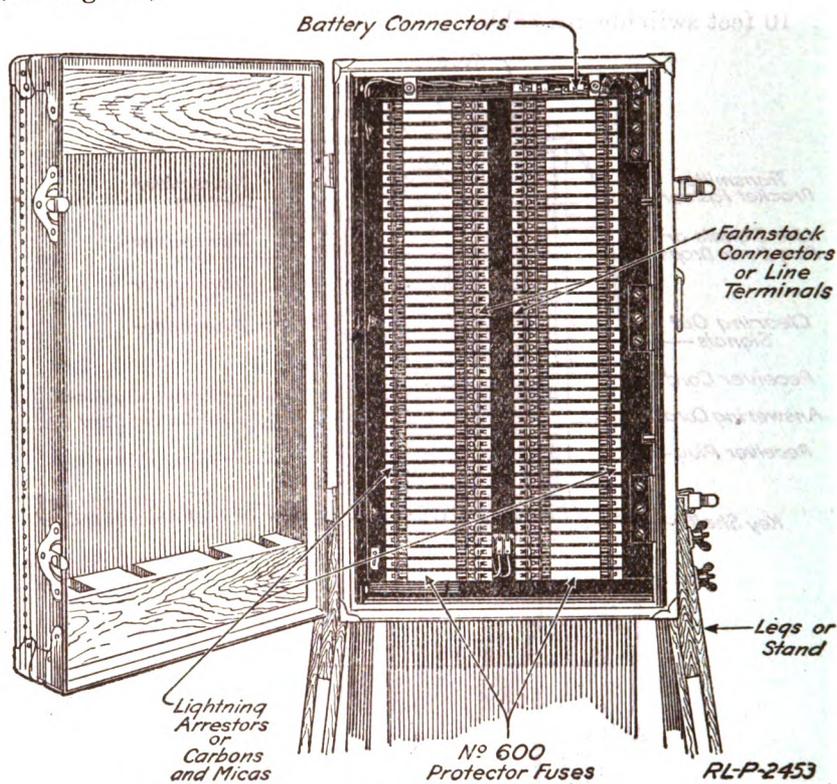


Fig. 19.—The protector panel of the camp-type switchboard.

Questions.

- (1) What are the points which determine how high the switchboard should be above the ground?
- (2) Could the switchboard be operated if it were placed flat on the ground?
- (3) What are the points which should be observed when putting the legs on the switchboard?

2. Open the front of the switchboard case and loosen the cords, working them down through the holes in the key shelf until the plugs

seat on the rims of the holes. Loosen the swinging transmitter arm located at the top of the switchboard panel. The transmitter, head set, and generator crank are in the front of the switchboard case, which was removed when the case was opened. The transmitter cord is now suspended from the transmitter arm by separating the twisted pair cord, near the transmitter, and placing the two conductors of the cord in the holes on the crosspiece of the transmitter arm. The cord is suspended under the transmitter arm by the two

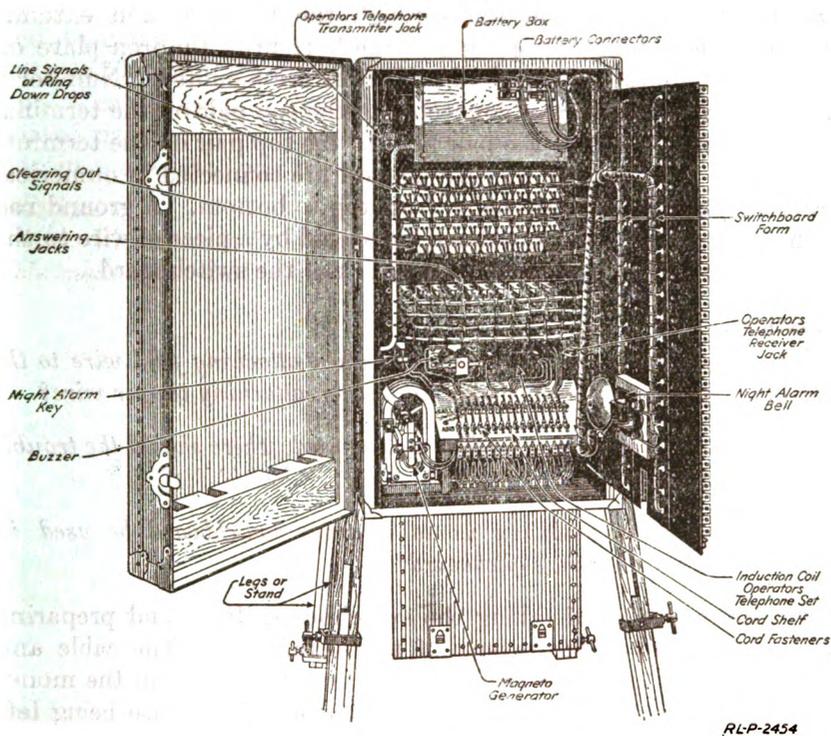


Fig. 20.—Rear view of the interior of the camp-type switchboard.

eyes on the underside of the arm and the plug on the end of the cord is connected to the switchboard by inserting it in the jack located to the right of the point where the transmitter arm is fastened to the face of the switchboard. The plug on the cord to the head set or receiver is inserted in the jack located in the lower left-hand corner of the face of the switchboard and the generator crank is screwed on the generator shaft through the hole in the lower right-hand corner of the case. Batteries for the operator's set and night alarm are placed in the battery box behind the face of the switchboard. (See Figs. 19 and 20.)

Questions.

(4) *How could the battery and operator's set in the camp switchboard be tested?*

(5) *How is the clock on the camp switchboard wound and set?*

3. Mount eight terminal strips on a board in a vertical row, about 8 feet from the switchboard, and connect the terminal strips and the Fahnestock clips at the back of the switchboard with a 40-pair cable prepared as in Unit Operation No. 1. The cable enters the switchboard case from the bottom, through the trapdoor and extends through the rectangular opening in the bottom of the iron plate on which the Fahnestock clips and protectors are mounted. Number 0 pair on the switchboard is connected to the top pair on the terminal strips, number 1 pair to the pair next to the top pair on the terminal strips, etc. The pairs on the switchboard are connected in numerical order to the terminal strip pairs, from top to bottom. A ground rod is then driven into the ground and connected by a piece of wire to the ground clip on the iron plate on the back of the switchboard.

Questions.

(6) *Why must greater care be taken when attaching field wire to the terminals of the camp switchboard than when attaching copper wire?*

(7) *If it was found that the line was shorted, where should the trouble be looked for first?*

(8) *Under what condition would a camp switchboard be used in preference to a monocord switchboard?*

4. The operation of taking the switchboard down and preparing it for movement is the reverse of the installation. The cable and terminal strips are left attached to the switchboard as in the monocord installation, the trapdoor in the bottom of the case being left open. The transmitter, receiver, and generator crank are disconnected and placed in their proper place in the cover of the switchboard. The cords are pulled up until the cord weights are well up in the switchboard case; then they are bunched and a piece of string is wrapped around the bunch of cords as close to the key shelf as possible and tied. This will prevent the weights falling through the hole in the bottom of the case. The legs are removed and placed in the space provided for them in the rear of the case. The rear door is fastened and the front of the case placed in position and fastened. When the switchboard is prepared for shipment or storage, the cable is detached from the rear of the switchboard. (See Par. 3, Information Topic, No. 9.)

Questions.

(9) *What might happen if the generator crank is not removed when moving the switchboard?*

(10) *Is there any method for mounting the terminal strips which would simplify matters when it is necessary to move the installations?*

5. The cable to connect the switchboard and terminal strip is often made up from twisted pair wire, cabled as in Unit Operation No. 1. On account of the number of drops on the switchboard and the difficulty in making up a cable, okonite cable, if available, should be used to make the installation. If the switchboard is located in a protected location, standard switchboard cable may be used. This type of cable becomes shorted from dampness and water. Okonite twisted pair wire can be used without any more trouble developing than in the twisted pair wire.

Question.

(11) *Which would be preferable for use with this type switchboard—cable made up of field wire or standard switchboard cable? Why?*

SUGGESTIONS FOR THE INSTRUCTOR.

1. Equipment as listed in the Students Manual will be provided for each group of three students.
2. At the preliminary assembly of the class, explain and demonstrate the features of the camp switchboard by taking up in detail the following points:
 - a. Preparation for service.
 - b. The mounting of the protectors on the iron plate and the manner of grounding the arresters.
 - c. The location and method of connecting the local battery.
 - d. Mounting the transmitter and connecting the receiver to the switchboard.
 - e. Numbering of the drops and jacks.
 - f. Arrangement of cords in pairs, location of answering cord, and location of calling cord.
 - g. Use of the "ringing and listening" key and location of keys with respect to the cords.
 - h. Use of the "ring-back" or rear key.
 - i. Location of clearing-out drops and relative location of drops to cords.
 - j. Manner of connecting night-alarm circuit by means of key.
3. Explain to the class that the switchboard has a cable, similar to that used with the monocord switchboard, connecting the Fahnestock clips of the protectors with the binding posts of the terminal strips. This cable and the terminal strips after being installed are to remain a part of the switchboard and not to be removed on moving the switchboard except when it is to be prepared for storage or shipment.
4. Have a group of three students set up a switchboard and prepare a cable connecting the switchboard to the terminal strips. Correct any errors made by the students and criticise the installation.
5. Have each group set up and install the switchboard until they can make a satisfactory installation.
6. Note and call attention to the following points in connection with each installation:
 - a. Are the switchboard terminals and the terminals on the terminal strips connected in the proper order?
 - b. Is the cable neatly and properly laced up?
 - c. Have the ends of the cable been well formed and run between protector mountings in the best manner?
 - d. Has the battery been properly connected?

7. Assemble the class and illustrate the method of forming the ends of the switchboard cable which is to be used instead of the cable made up of twisted pair wires. Explain that such a cable is most desirable, when all the drops of the switchboard are to be utilized, on account of permitting a neater and more compact installation.

8. Explain that the twisted-pair wire cable is more suitable for field conditions on account of trouble developing in the switchboard cable, due to dampness, and that switchboard cable should not be used unless the central is to be in a protected location. Explain that rubber-covered okonite cable is different from silk and cotton cable and that it can be used in all locations with no more trouble developing than in a cable made up of twisted-pair wires.

9. Have the various groups remove the twisted-pair cables and connect the switchboard and terminal strips with switchboard or okonite cable. Call attention to any errors made by the students.

10. Have the students disconnect the switchboards and prepare them for movement. Call attention to errors made by them, such as:

- a. Cords not properly fastened up.
- b. Transmitter and receiver not disconnected and not packed in proper space.
- c. Generator crank not removed.
- d. Local battery not disconnected.
- e. Cable disconnected from switchboard.
- f. Telescopic legs not placed in proper place in case.

11. When the unit operation has been completed, give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 14-A (PERFORMANCE).

Equipment.

Prepare in advance a serviceable camp-type switchboard in the condition in which it is placed in storage.

Procedure.

1. When the student who is to be tested has read his directions and has indicated that he is ready, direct, "Begin."
2. Note and record the time to the nearest second that the command, "Begin," is given; and note the time that the student finishes.
3. Note whether the student correctly performs the several operations listed in the directions for scoring.

Scoring.

1. The maximum possible score for this test is 14 points.
2. The score required to pass this test is 10 points.
3. DIRECTIONS FOR SCORING.

| <i>a. Setting up the camp-type switchboard and preparing it for operation.</i> | Points. |
|--|---------|
| (1) If the student sets up and prepares the switchboard for operation, making the necessary tests of the operator's set..... | 14 |
| (2) Deduct 2 points if the student fails to do any one of the following correctly: | |
| (a) Place legs on switchboard and adjust it to the proper height. | |
| (b) Prepare cords for service. | |
| (c) Prepare transmitter for service. | |
| (d) Prepare receiver for service. | |
| (e) Attach generator crank. | |
| (f) Place and connect batteries. | |
| (g) Test operator's set. | |
| (3) If the student fails to do all of the above things..... | 0 |

INSTRUCTION TEST NO. 14-A (PERFORMANCE).

PROBLEM.

Directions to the student.—*a.* The instructor will furnish a camp-type switchboard which is packed in condition for storage.

b. When the instructor says "Begin," set up the switchboard and prepare it for operation. Make the necessary tests to determine whether it is in working order.

c. Do the work quickly.

d. Notify the instructor when you are finished.

e. The instructor will then record the time it has taken to do the work. He will also inspect it.

INSTRUCTION TEST NO. 14-B (INFORMATION).

Directions to the student.—Below are a number of sentences which are unfinished. After each are several words or phrases. Select the one of these which best fits the sentence or which makes the best sense and draw a line under it.

1. The camp-type switchboard will accommodate—10 lines—20 lines—30 lines—40 lines—50 lines.

2. The camp-type switchboard has—no lightning protection—provision for multiple operation—eight pairs of cords—a power ringer—supervisory lamps.

3. The signaling on a camp-type switchboard is accomplished by means of—lamps—a hand generator—an automatic ringer—a dry battery—a storage battery.

4. On the camp switchboard lightning arrestors are—mounted on the face of the switchboard—mounted on the protector panel—of the horn-gap type—not provided.

5. The wires of the cable connecting the terminal strips to the camp switchboard are connected to the switchboard by means of—wing-nut binding posts—terminal screws—Fahnstock clips—soldered connections—clamps.

6. The transmitter on the camp switchboard—is in the operator's hand set—is of the breast type—is suspended from an arm by cords—not of adjustable height—can not be disconnected from the switchboard.

7. The camp-type switchboard must be placed on its legs up off of the ground in order that—the operator can have space for his feet underneath the switchboard—the cable can have room to pass out of the bottom of the switchboard—the cords will have space to hang—it will be nearer the terminal strips.

8. The camp-type switchboard is mounted on—an iron frame—telescopic wooden legs—telescopic aluminum legs—rigid iron stands—hollow steel legs.

9. To accommodate all the lines on a camp-type switchboard, the number of terminal strips, Type TM-84, required is—4—6—7—8—10.

10. The camp switchboard if possible, should be used rather than a monocord switchboard when there are—more than 4 lines—more than 8 lines—less than 50 lines—more than 12 lines—12 lines.

11. The number of connecting cords on the camp-type switchboard is—4—8—12—16—6.

12. On the camp-type switchboard there is a clearing-out drop for each—line—call—connecting cord—subscriber—operator.

OPERATION OF THE CAMP SWITCHBOARD.

Equipment.

A telephone net installed with a camp-type switchboard and several local telephones at each central; a traffic diagram; and a telephone code for each central.

Directions.

1. The operation of the camp switchboard differs from the mono-cord switchboard in that calls are completed by using two cords instead of one. (See Information Topic No. 9.)

2. The switchboard is equipped with eight pairs of cords. The cord next to the face of the switchboard is designated the "rear cord" or "answering cord" and is used to plug into the calling jack to answer calls. The cord nearest the operator is designated the "front cord" or "calling cord" and is used to complete the connection of the calling party to the called party. Any pair of the eight pairs of cords can be used to make a connection, but the rear cord of one pair can not be used to answer a call and the front cord of another pair used to complete the connection; in other words, they must be used in pairs.

3. On the key shelf are eight pairs of keys, one pair for each pair of cords. The rear key can be moved in only one direction, toward the operator; and when released the key returns to a vertical position. This key when pulled toward the operator connects the generator to the rear cord of the pair corresponding to the key. This permits ringing back on the calling party in case he hangs up.

4. The front key has two movements. The one toward the operator is the ringing position. When in this position it connects the generator to the front cord; when released the key returns to the vertical position. If the key is pushed away from the operator, it locks and remains in that position until the operator releases it by pulling it toward him. This rear position of the key is designated the "listening position," as it connects the operator's transmitter and receiver to the line for the purpose of answering calls and supervising connected lines. The key should not be kept in the listening position any longer than required to make or supervise a connection, for if left in this position while another listening key is operated, the two keys will connect the two pairs of cords together, and the four parties will be connected.

5. Each pair of cords is provided with a "clearing-out" drop, located on the face of the switchboard immediately below the line drops. When the parties connected are through talking, the operation of the generator in the telephone of either party will cause the

shutter of the clearing-out drop, corresponding to the pair of cords used, to fall. This calls the attention of the operator to the fact that the connection can be taken down.

6. The operator, after his switchboard is installed and in working condition, waits for a drop to fall, with the rear cord of any pair of cords in his right hand, the left hand being used to operate the keys and restore drop shutters.

7. Suppose that No. 10 drop falls. The operator inserts the plug of a rear cord into No. 10 jack, at the same time moving the front key, corresponding to the cord being used, to the rear or listening position and restores the drop shutter. He answers the call as in the procedure outlined in Unit Operation No. 5, giving the code name of his central followed by the word "operator," as "Magic operator." After ascertaining the number desired, for example "Magic-30" (radio station) which is on No. 22 jack of the switchboard, the operator's reply is "MAGIC-30?" The operator will then take the front cord of the pair of which the rear cord was used to answer, insert it in No. 22 jack, pull the listening key toward him as far as it will go to the ringing position, and give the generator handle several turns, to ring the called party. The listening key is then pushed to the rear, as far as it will go to the listening position, and the operator supervises the connection until conversation is started and the connection appears satisfactory, unless it is necessary to answer other incoming calls. In the latter case the operator restores the listening key to a vertical position and proceeds to answer other calls, returning, however, at the first opportunity to see whether the called party has answered. If the operator can not hear any conversation on the line he will challenge with "Did —————(giving code name and number) answer?" If the calling party says, "No," the operator replies "I will ring them again," and proceeds to ring again, using the front key. The call is supervised as in Unit Operation No. 8.

8. As soon as the clearing-out signal is observed, the operator will clear the lines after challenging, restoring the clearing-out drop.

9. The night alarm is connected by throwing the night-alarm key, on the lower right-hand side of the face of the switchboard, to the upper position. Any shutter on the switchboard that falls, with the night alarm on, will ring the bell and attract the attention of the operator.

10. Each subscriber of the various centrals will place calls in the net in accordance with instructions issued by the instructor.

SUGGESTIONS FOR THE INSTRUCTOR.

1. The class will be divided into groups of six men each. Have the students install a telephone net with as many camp switchboards as centrals as available. Each central to be provided with a traffic diagram and a telephone code. Several local telephones are to be installed at each central, and for centrals equipped with the camp switchboard install at least four local telephones designated:

| <i>Party.</i> | <i>Telephone No.</i> |
|-------------------------|----------------------|
| Commanding officer..... | No. 1 |
| Chief of staff..... | No. 2 |
| Message center..... | No. 11 |
| Chief operator..... | No. 33 |

2. Assemble the class and demonstrate and explain the method of handling calls, using the camp switchboard. Calls for this purpose should be originated at the local telephones by the students.

3. Demonstrate, by comparison with a monocord switchboard, the faster operation of the camp switchboard and show how calls are supervised.

4. Have two calls passing through the switchboard simultaneously and illustrate to the class how the four parties are connected together when both listening keys are thrown in.

5. Demonstrate to the class how the operation of the wrong ringing key will cause inconvenience to the party using the telephone.

6. Prepare an instructor's traffic-load table and a student's traffic-load table for each local telephone, as in the previous operations. Have the students operate the net, keeping a record of the time required by each operator to handle calls through his switchboard.

7. Tabulate the results and call the attention of the students to the difference in time taken by individual students to handle calls; also call attention to the difference in time required to handle calls with the monocord switchboard and the camp switchboard.

8. Ask questions such as the following:

a. What is the principal difference between the operation of the camp switchboard and the monocord switchboard?

b. What are the advantages of the camp switchboard as compared with the monocord switchboard?

c. Suppose that an operator using a camp switchboard wished to recall the calling party to the telephone. What should he do?

d. If the clearing-out drop has fallen, what may have happened other than one party ringing off?

e. How should a left-handed operator handle his cords, keys, and drops?

9. When the class has completed the Unit Operation, give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 15-A (PERFORMANCE).

Equipment.

Prepare a camp-type switchboard (MAGIC) for operation. Connect two local telephones, No. 2 and No. 7.

Procedure.

1. When the student is ready to operate the switchboard in accordance with his directions, have an assistant place a call from MAGIC-2 for MAGIC-7. Have an assistant answer MAGIC-7.

2. After conversation has been completed have both assistants hang up their receivers, and have the assistant at MAGIC-2 ring off.

Scoring.

- 1. The maximum possible score for this test is 6 points.
- 2. The score required to pass this test is 6 points.

3. DIRECTIONS FOR SCORING.

| | |
|---|----------------|
| <i>a. Establishing connections.</i> | Points. |
| (1) If the student established the connections properly..... | 4 |
| (2) No partial scores allowed: | |
| (3) The connections are not properly established if the student fails to do any one of the following: | |
| (a) Use rear or answering cord, answer "MAGIC OPERATOR." | |
| (b) Repeat "MAGIC-7?" | |
| (c) Ring MAGIC-7 with calling cord. | |
| (d) Restore drop on MAGIC-2. | |
| (e) Close listening key. | |
| If a student fails in any one of the above..... | 0 |
| <i>b. Disconnecting.</i> | |
| (1) If the student disconnects properly..... | 2 |
| (2) No partial scores allowed: | |
| (3) The disconnection is not properly made if the student fails to do any one of the following: | |
| (a) Close listening key. | |
| (b) Say "Waiting?" | |
| (c) Disconnect. | |
| If a student fails in any one of the above..... | 0 |

INSTRUCTION TEST NO. 15-A (PERFORMANCE).

PROBLEM.

Directions to the student.—1. *a.* Go to the camp-type switchboard which will be designated by the instructor and act as operator; make necessary connections for any calls that come in; and remain on duty until relieved by the instructor.

b. Note that there are two local subscribers, Nos. 2 and 7, connected to the switchboard.

c. When ready to operate notify the instructor.

INSTRUCTION TEST NO. 15-B (INFORMATION).

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line inclosed in a parenthesis, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct.

1. The rear cord of any pair of cords on the camp-type switchboard is called the (.....) cord.

2. The front cord is called the (.....) cord.

3. On the camp-type switchboard there are (.....) keys for each pair of cords.

4. The rear key can be moved in (.....) direction.

5. When the rear key is pulled toward the (.....) it connects the (.....) on the (.....) party's side of the circuit and disconnects the (.....) party.

6. The front key can be moved in (.....) directions.

7. When the front key is pulled toward the (.....) it connects the (.....) to the (.....) party's side of the circuit, at the same time (.....) the (.....) party.

8. When the front key is pushed away from the (.....) it connects the (.....) (.....) across the circuit.

9. To answer a call on the camp-type switchboard, the operator, when a line drop falls, inserts an (.....) plug into the (.....) jack, at the same time (.....) the (.....) key to its (.....) position.

10. Having ascertained the number desired by the calling party the operator inserts the (.....) plug of the (.....) pair of cords into the (.....) of the party desired and pulls the (.....) key to its (.....) position and turns the (.....) (.....).

11. The night alarm (.....) on the camp-type switchboard is located on the lower (.....) hand corner of the (.....) of the switchboard.

12. The night alarm on the camp-type switchboard is connected by (.....) the night-alarm (.....).

INSTALLATION AND OPERATION OF A CENTRAL IN A WIRE NET IN THE FIELD.

Equipment.

A 12-line monocord switchboard; operator's telephone or operator's set; short lengths of wire (for any necessary splicing); roll of friction tape; and a roll of rubber tape will be furnished to each group.

Directions.

1. Proceed to the location to which you have been assigned. Get from the instructor the necessary information, i. e., code name of central, traffic diagram, the distribution of local telephones, telephone code, etc.

2. Install the switchboard and the local telephones. Connect the trunks from the other centrals to your terminal strips. These trunks are laid by the construction section and should not be accepted by an operator until they are properly tagged and tested.

3. Test all local telephones and all trunks that go into the switchboard. Then report to the next higher unit, "Daylo (or whatever the code name of the central is) is in order," or report any trouble that can not be repaired 10 minutes after the installation, as "Circuit No. 104 out of order between Daylo and Daybreak."

4. Stand by to handle traffic. .

SUGGESTIONS FOR THE INSTRUCTOR.

1. Divide the class into groups of six men each and issue the equipment listed in the unit operation in the Students Manual.
2. This operation should be performed in conjunction with the chief operators' and linemen's classes. The linemen's class should lay the circuits and deliver them, tagged and tested, to the operator.
3. Have a circuit diagram prepared in accordance with Fig. 9-IG and show each group where their station is to be. Explain and ask various questions in connection with the diagram, making sure that each student is thoroughly familiar with the work to be performed.
4. Have each group install their station and put in at least two local telephones. Require each station to make up a traffic diagram.
5. Put traffic on the net as in previous unit operations. Require this operation to be repeated until work is satisfactorily done at each station and traffic correctly handled.
6. During the exercise the instructor should go around to the different centrals, inspect the work, and ask questions, such as:
 - (a) Why is it required that circuits be tagged and tested before being connected to switchboard?
 - (b) Why is the construction section required to tag and test the trunk circuits?
 - (c) Why should the operator report to the next higher unit when his station is in order?

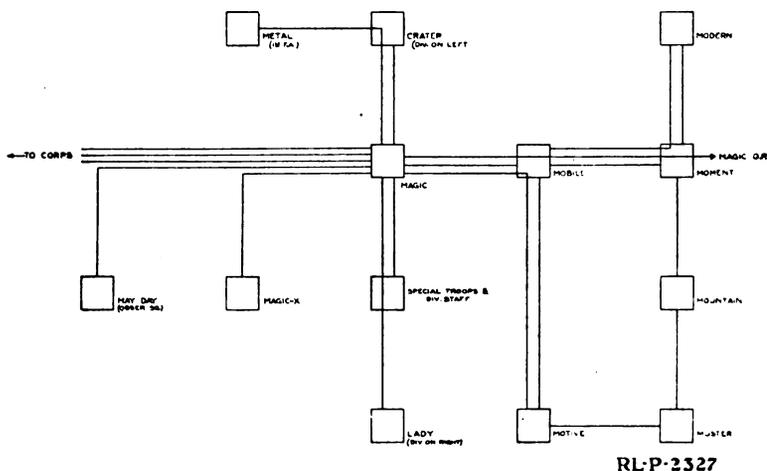


Fig. 9 - IG.—Circuit diagram division telephone net.

7. At the next assembly of the class after the completion of this Unit Operation give an Instruction Test similar to the following:

SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST.

No. 16-A (PERFORMANCE).

Equipment.

1. Prepare an 8- or 12-line monocord switchboard (DON) with the panels marked from left to right as follows:

- a. DAN.
- b. DELL.
- c. DIG.
- d. DOG.
- e. No. 1.
- f. No. 2.
- g. No. 11.
- h. No. 30.

2. Connect a telephone to the units marked "DELL," "DIG," and "No. 11." These telephones should be located at sufficient distance so as not to disturb the operator. The installation described above constitutes a skeleton net, the traffic diagram of which is to be prepared by the student.

Procedure.

PROBLEM NO. 1.

1. Have the student prepare a traffic diagram from information contained in directions to the student.

PROBLEM NO. 2.

2. When the student is ready to operate have an assistant place a call from DON-11 for DAN-11. Since there is no telephone on the circuit marked DAN the student will not get an answer. He should then route the call through DELL. When he rings, DELL answers the telephone on that line by saying, "DELL OPERATOR." After the student has asked for DAN-11, answer first as the DAN operator and later as DAN-11, and note whether the student has put the call through correctly.

3. After the above call has been completed, ring off. Have the assistant place a call from DON-11 for DOG-11. This circuit has no telephone and the student will not receive an answer. He should route the call through DIG. Answer the telephone on this circuit in the same manner as described above, first as DIG operator, then as DOG operator, and finally as DOG-11.

Scoring.

- 1. The maximum possible score for this test is 14 points.
- 2. The score required to pass this test is 12 points.
- 3. DIRECTIONS FOR SCORING.

| | |
|--|---------|
| a. Preparation of traffic diagram. | Points. |
| (1) If traffic diagram is prepared correctly..... | 4 |
| (2) No partial score allowed. | |
| (3) If traffic diagram contains one or more errors, the traffic diagram was not properly prepared..... | 0 |

| | | |
|---|--|----------------|
| <i>b. Establishing first connection.</i> | | Points. |
| (1) If the student established the first connection properly..... | | 4 |
| (2) No partial scores allowed. | | |
| (3) The first connection is not properly established if the student fails to do any one of the following: | | |
| (a) Answer "DON OPERATOR." | | |
| (b) Repeat "DAN-11?." | | |
| (c) Ring DAN OPERATOR in accordance with standard operating procedure. | | |
| (d) Disconnect from DAN. | | |
| (e) Ring DELL Operator. | | |
| (f) Ask for DAN-11. | | |
| If a student fails in any one of the above..... | | 0 |
| <i>c. Disconnecting.</i> | | |
| (1) If the student disconnects properly..... | | 2 |
| (2) No partial scores allowed. | | |
| (3) The disconnection is not properly made if the student fails to do any one of the following: | | |
| (a) Challenge on line by saying "Waiting"? | | |
| (b) Disconnect. | | |
| If a student fails in any one of the above..... | | 0 |
| <i>d. Establishing second connection.</i> | | |
| (1) If the student followed the correct procedure in establishing connection..... | | 4 |
| (2) No partial score allowed. | | |
| (3) The second connection is not properly made if the student fails to do any one of the following: | | |
| (a) Answer "DON OPERATOR." | | |
| (b) Repeat "DOG-11?" | | |
| (c) Ring DOG OPERATOR in accordance with standard operating procedure. | | |
| (d) Disconnect from DOG. | | |
| (e) Ring DIG OPERATOR. | | |
| (f) Ask for DOG-11. | | |
| If a student fails in any one of the above..... | | 0 |

INSTRUCTION TEST NO. 16-A (PERFORMANCE).

PROBLEM NO. 1.

Directions to the student.—1. The 1st Brigade switchboard (code name DON) was connected to a terminal strip which had four circuits that had been connected to it and tagged by the construction section. These circuits were numbered from top to bottom on the terminal strip as follows: 201, 205, 301, and 302. The 1st Brigade had no traffic diagram, but on testing the circuits they obtained information from the parties who answered as follows:

a. Circuit 201 ran to the 1st Division (code name DAN), who said that they had a direct circuit to the 2d Brigade (DELL).

b. Circuit 205 ran to the 2d Brigade, who said that they had direct connection with the 1st Division (DAN), the 3d Infantry (DOLL), and the 4th Infantry (DENT).

c. Circuit 301 ran to the 2d Infantry (DIG), who said that they had direct connection with their 1st Battalion (DIP), 2d Battalion (DRAY), and the 1st Infantry (DOG).

- d. Circuit 302 ran to the 1st Infantry (DOG), who said that they had circuits to their 1st, 2d, and 3d Battalions (DROP), (DUST), and (DONG), respectively.
- e. Make a traffic diagram from the information given above.
- f. Notify the instructor as soon as the work is completed.

PROBLEM NO. 2.

2. Go to the switchboard which will be designated by the instructor and, using the diagram which has been prepared, complete any calls that come in. Note that this central (DON) in addition to the trunks, 201, 205, 301, and 302, has the local circuits to DON-1, DON-2, DON-11, and DON-30. Remain at the switchboard until relieved by the instructor.

INSTRUCTION TEST NO. 16-B (INFORMATION).

Directions to the student.—Below are a number of sentences and just after each one are the words "True" and "False." Read each sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true draw a line under the word "False."

- 1. A wire net consists of a number of local telephones connected to each switchboard by means of wire lines. True. False.
- 2. The construction detail installs local telephones. True. False.
- 3. The operating detail installs the switchboard and trunk lines. True. False.
- 4. Trunk lines are turned over to the operator after being connected to the terminal strip, tagged, and tested. True. False.
- 5. All units must have additional switchboards, to be used when advancing, in order that the continuity of the telephone service may be maintained. True. False.
- 6. Switchboards are installed at important junctions of wire lines at each headquarters when two or more local telephones are installed. True. False.
- 7. An operator is responsible for routing a call to all the centrals through which it must go to reach its destination. True. False.
- 8. Before going into the field all apparatus should be tested to determine whether or not it is in working order. True. False.
- 9. An operator must be familiar with the organizations in the wire net and the circuit number of the circuits to each. False. True.
- 10. An operator in the field should always be provided with a traffic diagram. True. False.
- 11. A switchboard operator is stationed at Test Stations. True. False.
- 12. The construction detail installs switchboards. True. False.

SUGGESTIONS FOR CONDUCTING PROGRESS TEST.

No. 4-A (PERFORMANCE).

Equipment.

PROBLEM NO. 1.

- 2 cells BA - 10.
- 1 switchboard, camp-type in the condition in which it is placed in storage.
- 1 inspector's pocket kit.

PROBLEM NO. 2.

- 1 switchboard, camp-type.
- 4 telephones, type EE - 4.
- Wire, sufficient for installation.

Procedure.

PROBLEM NO. 1.

1. When the student is ready to be tested, issue him the directions for this problem. Do not require the student to attach the cable to the switchboard.

PROBLEM NO. 2.

2. *a.* Using the switchboard set up in Problem No. 1, install two local and two trunk circuits. Connect a telephone to each of these circuits to represent two local subscribers Fox-1 and Fox-11, and two other centrals Fin and Fan. Prepare a traffic diagram and post it at Fox Central. Issue the students the directions for this problem.
3. Place a call from Fox-11 for Fan-11. Have an assistant place a call from Fin for Fox-1. Have another assistant answer on Fan first as Fan operator and then as Fan-11. Do not answer Fox-1 until the operator has rung a second time. After answering Fox-1 ring off. Remain on the line until the operator challenges, then tell him to ring Fin-1 back.

Scoring.

1. The maximum possible score for this test is 28 points for Problem No. 1 and 8 points for Problem No. 2.
2. The score required to pass this test is 24 points for Problem No. 1 and 8 points for Problem No. 2.
3. DIRECTIONS FOR SCORING.

PROGRESS TEST No. 4.

Page No. 2.

TELEPHONE SWITCHBOARD OPERATOR.

PROBLEM NO. 1.

- a. Setting up and testing camp switchboard:** Points.
- (1) If the switchboard is properly set up and tested..... 28
 - (2) Deduct 2 points for each case in which the student fails to do one of the following:
 - (a) Open the rear of switchboard.
 - (b) Fasten legs to keyboard.
 - (c) Level keyboard by adjusting legs.
 - (d) Open the front of switchboard case and loosen cords.
 - (e) Seat plugs properly.
 - (f) Loosen transmitter arm.
 - (g) Suspend transmitter in proper position.
 - (h) Insert receiver plug in jack.
 - (i) Attach generator crank.
 - (j) Connect up battery.
 - (k) Wind and set clock.
 - (l) Test operator's circuits.
 - (m) Test all ringing circuits.
 - (n) Test night alarm circuit.
 - (3) If a student fails in all the above..... 0

PROBLEM NO. 2.

- b. Establishing connections:**
- (1) If correct procedure is followed in establishing connections..... 8
 - (2) No partial scores allowed.
 - (3) A failure to do any one of the following makes the *procedure incorrect*:
 - (a) Answer "Fox operator."
 - (b) Repeat "Fan-1?"
 - (c) Ring Fan central.
 - (d) Ask for Fan-11.
 - (e) Answer "Fox operator."
 - (f) Repeat "Fox-1?"
 - (g) Ring Fox-1.
 - (h) After about 30 seconds supervise on Fox-1 connection and say "I'll ring them again."
 - (i) Ring Fox-1.
 - (j) Supervise by saying "Waiting?"
 - (k) Repeat "Fin-1?"
 - (l) Ring Fin-1 with rear key.
 - If a student fails in any one of the above..... 0

PROGRESS TEST NO. 4-A (PERFORMANCE).

PROBLEM NO. 1.

- Directions to the student.**—1. *a.* The instructor will furnish a camp-type switchboard which is packed in condition for storage.
- b.* Set up this switchboard and prepare it for operation.
- c.* Make the necessary tests to determine whether it is in working order.

PROBLEM NO. 2.

Directions to the student.—2. *a.* Go to the switchboard which will be designated by the instructor. The name of the central is FOX, and the lines connected to the switchboard are as follows:

- Drop No. 1..... FAN (trunk).
- Drop No. 2..... FIN (trunk).
- Drop No. 3..... FOX-1 (local).
- Drop No. 4..... FOX-11 (local).

b. Act as operator on the switchboard and handle any calls that come in until relieved by the instructor.

PROGRESS TEST NO. 4-B (INFORMATION).

Directions to the student.—Each of the following questions can be answered by a word or by a phrase of not more than five words. Write your answer on the short dotted line.

1. When a central is installed, and the circuits entering it have been tested, to whom is this fact reported by telephone?
2. How many pairs of keys are there on the key shelf of the camp-type switchboard?
3. With what key of the camp-type switchboard can the operator ring back on the calling party?
4. Which way, toward him or away from him, does the operator move the key of the camp-type switchboard to ring back on the calling party?
5. Which key of the camp-type switchboard is used by the operator for "listening in" on a circuit?
6. In what position is the key which is mentioned in question No. 5 placed when the operator is listening?
7. Which key of the camp type switchboard is used for ringing the called party?
8. In what position is the key mentioned in question No. 7 placed when ringing the called party?
9. Where are clearing-out drops located on the camp-type switchboard?
10. How many clearing-out drops are there on a camp-type switchboard?
11. When does the operator restore the drop shutter of a calling party on the camp-type switchboard?
12. Does a camp-type switchboard need a ground?
13. If the camp-type switchboard needs a ground, where is the clip to which the ground rod is connected?
14. When it is desired to connect the night alarm of the camp-type switchboard, what is done?
15. Has the camp-type switchboard protection against lightning?
16. If the camp-type switchboard has protection against lightning, what is it?

SUGGESTIONS FOR CONDUCTING PROFICIENCY TEST.

No. 1-A (PERFORMANCE).

Equipment.

PROBLEM NO. 1.

Cord, lacing.
Wire, type W - 40.

PROBLEM NO. 2.

No equipment required.

PROBLEM NO. 3.

2 telephones, type EE - 4 or type EE - 5.
100 feet wire, type W - 40.

PROBLEM NO. 4.

1 switchboard, camp, type BD - 14.
4 telephones, type EE - 4 or type EE - 5.
Wire, type W - 40.

PROBLEM NO. 5.

1 switchboard, monocord, type BD - 9.
5 telephones, type EE - 4 or type EE - 5.

Procedure.

PROBLEM NO. 1.

1. a. Prepare in advance for each student four pieces of twisted pair outpost wire each 12 inches long and a piece of cord about 4 feet long. Tie each set of four twisted pair wires together at one end, using an end of the piece of cord. This will be used in testing students on the lock switch.

b. When the student who is to be tested has read his directions, give him the 1-foot piece of cable to lace. Allow 1 minute to complete the operation.

PROBLEM NO. 2.

2. Require the student to repeat the phonetic alphabet in 30 seconds.

PROBLEM NO. 3.

3. *a.* Prepare in advance two telephones connected by a twisted pair wire sufficiently long so that the telephones are not within hearing distance of each other. Designate these telephones, **MOBILE-11** and **MORIVE-11** (1st Brigade and 2d Brigade message centers). Provide messages in advance as follows:

(1) One copy of a 20-group code message addressed to the "CO 1st Brig" from the "CO 2d Brig."

(2) Two copies of a 20-group code message addressed to the "CO 2d Brig" from the "CO 1st Brig." Make appropriate message center entries on these messages.

b. Assign the student who is to be tested to the telephone **Mobile-11** to act as telephone orderly.

(1) Give him the message prepared in accordance with Par. 3 *a* (2) above, retaining the copy. Act as telephone orderly on the other telephone and receive the message, checking the transmission for errors against the copy.

(2) When the student has rung off, call him and transmit to him the message prepared in accordance with Par. 3*a* (1) above. Check the message which the student writes against the original for errors.

PROBLEM NO. 4.

4. *a.* Prepare a camp-type switchboard with four lines and telephones connected thereto. Write the following telephone directory on a card and place it on the key shelf of the switchboard.

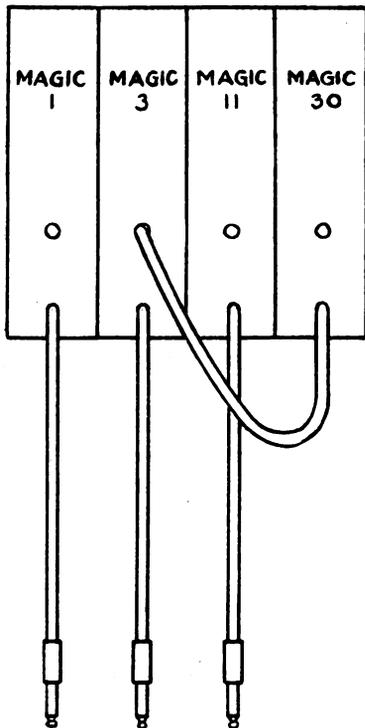
NANCY CENTRAL.

| | |
|-----------------|------------------------------|
| Drop No. 1..... | NEST (representing a trunk). |
| Drop No. 2..... | NILE (representing a trunk). |
| Drop No. 3..... | NANCY-1 (local). |
| Drop No. 4..... | NANCY-11 (local). |

b. Then assign the student to the camp-type switchboard which was prepared according to the directions in Par. 4. When he is ready to be tested, have an assistant place a call from **NANCY-1** for **NEST-11**. Have another assistant place a call from **NANCY-11** for **NILE-1**. Have still other assistants answer on the telephone on **NILE** and **NEST** trunks, first as operators, then as called subscribers. Note whether the calls are correctly handled at the switchboard.

PROBLEM NO. 5.

5. a. Prepare in advance a 4-line monocord switchboard with four local lines connected thereto. Mark the panels on the switchboard and set up a connection as shown in Fig. 10-IG below:



RL-P-2606

Fig. 10-IG.—Diagram of connections.

b. Assign the student to act as operator at the monocord switchboard prepared in accordance with the directions in Par. 5. When he is ready to be tested:

(1) Place a call from MAGIC-1 for MAGIC-30. The operator should report, "MAGIC-30 IS BUSY."

(2) Ring off on MAGIC-3. The operator should challenge by saying, "WAITING?" before disconnecting.

(3) Place a call from MAGIC-11 for MAGIC-7. The operator should report, "MAGIC-7 HAS NO TELEPHONE."

(4) Place a call from MAGIC-30 for MAGIC-3. Do not have anybody answer on MAGIC-3. The operator should report, "MAGIC-3 DOES NOT ANSWER."

(5) Place a call from MAGIC-11 for MAGIC-2. The operator should report, "MAGIC-2 HAS NO TELEPHONE, BUT I WILL GIVE YOU MAGIC-1. I THINK YOU CAN GET HIM THERE."

(6) Place on a slip of paper the notice "Out of order" on the MAGIC-30 switchboard unit. Then place a call from MAGIC-3 for MAGIC-30.

The operator should report, "MAGIC-30 IS OUT OF ORDER."

Scoring.

1. The maximum score on this test is 46 points.
2. The score required to pass this test is 38 points.
3. DIRECTIONS FOR SCORING.

PROBLEM NO. 1.

a. Lacing the cable:

| | Points. |
|--|---------|
| (1) If the cable is laced equally as well as that shown in Fig. 1 in 1 minute..... | 4 |
| (2) If the cable is laced correctly, but the time exceeds 1 minute..... | 2 |
| (3) If the cable is incorrectly laced..... | 0 |

PROFICIENCY TEST No. 1.
Page No. 4.

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PROBLEM NO. 2.

- | | |
|--|---------|
| b. Repeating the phonetic alphabet: | Points. |
| (1) If the phonetic alphabet is repeated correctly in 30 seconds..... | 4 |
| (2) If the phonetic alphabet is repeated correctly, but the time exceeds 30 seconds..... | 2 |
| (3) If the phonetic alphabet is incorrectly repeated..... | 0 |

PROBLEM NO. 3.

- | | |
|---|----|
| c. Receiving and transmitting a message: | |
| (1) If the message is received and transmitted correctly..... | 10 |
| (2) Deduct one point for each error. | |
| (3) If there are 10 or more errors..... | 0 |

PROBLEM NO. 4.

- | | |
|---|---|
| d. Operating the camp-type switchboard: | |
| (1) If the connections are correctly established for both calls..... | 8 |
| (2) No partial scores allowed. | |
| The calls are not properly handled if the student fails to do any one of the following: | |
| (a) Answer, "NANCY OPERATOR." | |
| (b) Repeat, "NEST-11?" | |
| (c) Ring NEST CENTRAL. | |
| (d) Ask for NEST-11. | |
| (e) Answer, "NANCY OPERATOR." | |
| (f) Repeat, "NILE-1?" | |
| (g) Ring NILE CENTRAL. | |
| (h) Ask for NILE-1. | |
| If a student fails in any one of the above..... | 0 |

PROBLEM NO. 5.

- | | |
|---|----|
| e. Operating the monocord switchboard: | |
| (1) If all four calls are handled correctly..... | 20 |
| (2) Deduct five points for any call not handled as described below. | |
| 1st call— | |
| Answer, "MAGIC OPERATOR." | |
| Repeat, "MAGIC-30." | |
| Report, "MAGIC-30 is busy." | |
| Challenge, "WAITING?" on the ring-off. | |
| 2d call— | |
| Answer, "MAGIC OPERATOR." | |
| Repeat, "MAGIC-7?" | |
| Report, "MAGIC-7 HAS NO TELEPHONE." | |
| 3d call— | |
| Answer, "MAGIC OPERATOR." | |
| Repeat, "MAGIC-2?" | |
| Report, "MAGIC-2 HAS NO TELEPHONE, BUT I WILL GIVE YOU MAGIC-1; I THINK YOU CAN GET HIM THERE." | |
| 4th call— | |
| Answer, "MAGIC OPERATOR." | |
| Repeat, "MAGIC-30?" | |
| Report, "MAGIC-30 IS OUT OF ORDER." | |
| (3) If a student fails to handle all four calls correctly..... | 0 |

PROFICIENCY TEST NO. 1-A (PERFORMANCE).

PROBLEM NO. 1.

Directions to the student.—1. *a.* The instructor will provide a 1-foot piece of monocord switchboard cable which is not laced.

- b.* Lace this cable, using the correct stitch.
- c.* Time allowed, one minute.

PROBLEM NO. 2.

Directions to the student.—2. *a.* When the instructor directs, repeat the phonetic alphabet.

- b.* Time allowed, 30 seconds.

PROBLEM NO. 3.

Directions to the student.—3. *a.* Go to the telephone which will be designated by the instructor and act as message center telephone orderly at that station, which represents the 1st Brigade.

- b.* The number of the telephone is MOBILE - 11.
- c.* Receive or transmit messages as directed.

PROBLEM NO. 4.

Directions to the student.—4. *a.* Go to the camp type switchboard which will be designated by the instructor.

- b.* Inspect the directory.
- c.* Act as operator and handle any calls that come in until relieved by the instructor.

PROBLEM NO. 5.

Directions to the student.—5. *a.* Go to the monocord switchboard which will be designated by the instructor.

- b.* Observe the code names of the circuits as marked on the switchboard.
- c.* Note that there is a connection already set up on the switchboard.
- d.* Do not disturb this connection, except in the prescribed manner.
- e.* Be sure to use the correct phrases in each case.
- f.* MAGIC - 2 answers on MAGIC - 1 on this switchboard.
- g.* Act as operator and handle any calls that come in until relieved by the instructor.
- h.* Notify the instructor when you are ready.

PROFICIENCY TEST NO. 1-B (INFORMATION).

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line inclosed in a parenthesis, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically

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correct. Blank spaces inclosed in quotation marks should be filled in with the exactly correct phrase. A word spelled with a hyphen, like armor-plated or back-fire, counts as *one* word.

1. To install a monocord switchboard of type EE - 2 units for operation:

- a. Connect the terminal marked (.....) to ground.
- b. Connect an alarm bell between the (.....) and (.....) terminals.
- c. Connect an external battery between the (.....) and (.....) terminals.
- d. Connect a camp telephone as an operator's set between the (.....) and (.....) terminals.

2. The proper routing of a call is the (.....) of the (.....).

3. On the camp type switchboard there are (.....) keys for each pair of cords.

4. The back key on the camp type switchboard can be moved in (.....) direction.

5. When pulled toward the (.....) the rear key on the camp type switchboard connects the (.....) on the (.....) party's side of the circuit, and disconnects the (.....) party.

6. When a call is made, the switchboard operator should (.....) (.....) on the line for about (.....) seconds after the connection has been established. Then if no (.....) is heard, he should (.....) (.....).

7. After a connection has been established it is the duty of the switchboard operator to (.....) the (.....) as far as he is able.

8. Before (.....) a connection a switchboard operator should always listen in and challenge by saying, "(.....)."

9. When a call comes in over a trunk to MAGIC for a local party, MAGIC - 7 who has no telephone, the switchboard operator should say, "(.....) (.....) (.....) (.....)."

10. When a call comes in to MAGIC for Captain Jones, whose code number is MAGIC - 5, the switchboard operator should say, "(.....) (.....) (.....) (.....) (.....) (.....) (.....)."

11. In testing the signaling circuit of a unit of a monocord switchboard of EE-2 units, the tip and ring of the operator's (.....) is placed across the line terminals. The drop should fall when the (.....) of the operator's (.....) is turned.

12. The line drop shutters on a monocord switchboard are said to be of the (.....) type.

13. Supervising calls consists essentially in using every available effort to (.....) the (.....) with the (.....) party; in taking care that uninterrupted (.....) is maintained during (.....); and in clearing the lines (.....) when the (.....) is completed.

Directions to the student.—Below are a number of questions and unfinished statements. Following each one are several words or phrases. Select the one of these which best fits or which makes the best sense, and draw a line under it. Only one of the answers given in each case is right.

14. The camp-type switchboard will accommodate—10 lines—20 lines—30 lines—40 lines—50 lines.

15. The camp-type switchboard has—no lightning protection—provision for multiple operation—eight pairs of cords—a power ringer—supervisory lamps.

16. The signaling on a camp-type switchboard is accomplished by means of—lamps—a hand generator—an automatic ringer—a dry battery—a storage battery.

17. The phonetic alphabet is used for the transmission of what kind of messages?—secret—code—clear—routine—priority.

18. The telephone code is—secret—nonsecret—confidential—ordinary.

19. The number 6100 is pronounced—six-one-hundred—sixty-one-hundred—six-thousand-one-hundred—six-one-zero-zero—six-one-double-zero.

20. The type number of a 4-line monocord switchboard is known as a—TM/-/17—BC/-/84—SB/-/7—BD/-/9.

21. The type number of a 5-pair terminal strip is known as a—TM/-/37—BD/-/8—TM/-/84—EE/-/4.

22. A cable for monocord switchboards is laced with—bare wire—cord—fuses.

23. The usual order for installing telephones at a command post is to install first the telephone for the—commanding officer—message center—operations office—ammunition dump—brigade headquarters.

Directions to the student.—Below are a number of sentences and just after each are the words "True" and "False." Read each sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

24. Before disconnecting, after a "ring off," an operator on a mono-cord switchboard always plugs in and challenges by saying "Waiting."
True. False.
25. Local lines are lines which are run from one switchboard to another switchboard.
True. False.
26. There are three binding posts at the bottom of the operator's set, type EE - 64, for the operator's cord.
True. False.
27. There are three binding posts at the bottom of the operator's set, type EE - 64, for the receiver.
True. False.
28. The batteries for the night alarm circuit of the operator's set, type EE - 64, must be BA - 10's.
True. False.
29. After ringing a party and failing to receive an answer within about 30 seconds, the operator informs the calling party, "MAGIC - 30 DOES NOT ANSWER."
True. False.
30. The telephone code is a nonsecret code.
True. False.
31. The telephone code is used to increase the speed, accuracy, and simplicity with which telephonic connections can be made.
True. False.
32. In order that he will not forget to return to supervise a call which is uncompleted and which he must leave before the called party answers, the operator should leave a drop unrestored as a reminder.
True. False.
33. A local line is a line run from a switchboard to a subscriber.
True. False.
34. When sending a coded message by telephone never give the name of the organization from which it is sent.
True. False.
35. The telephone-switchboard operator transmits messages.
True. False.
36. A message for the chief of the wire section would be received by the switchboard operator.
True. False.
37. The station log shows the time of connection or removal of any circuits.
True. False.
38. The station log shows the schedule of operators at a station.
True. False.
39. From the test and trouble record the communications officer can tell whether the circuits are being tested at the prescribed times.
True. False.
40. All units are required to have additional switchboards to be used when advancing, in order that the continuity of the telephone service may be maintained.
True. False.
41. Switchboards are installed at important junctions of wire lines and at each headquarters when two or more local telephones are installed.
True. False.
42. An operator is responsible for routing a call through all the centrals by which it must go to reach its destination.
True. False.

43. Before going into the field all apparatus should be tested to determine whether or not it is in working order. True. False.

Directions to the student.—Each of the following questions can be answered by a single word or phrase. Write the answer on the short dotted line.

44. What is a circuit called which connects a telephone to a switchboard?

45. When the most direct route for a call is not available, what routing is used?

46. What name is applied to individuals who have local telephones?

47. If, when ringing on a line with a camp telephone, the crank turned very easily, the bell rang, but the called party did not answer, what was the trouble indicated?

48. What is the person called who rings a central and asks for a number?

49. What does an operator do on a line when testing it?

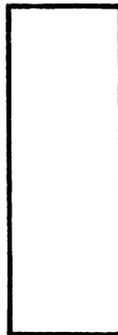
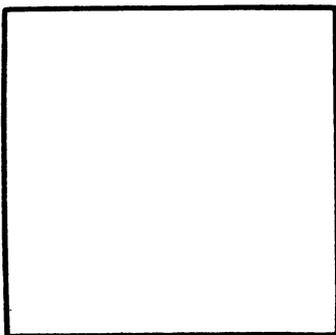
50. On what record is an "out of order" line recorded?

51. When is it best to attach line wires direct to the switchboard?

52. During what part of the 24 hours should a switchboard operator on duty transmit messages?

53. If two parties are talking over a circuit when the time comes to test the circuits, what should the operator not remove in order to make the test?

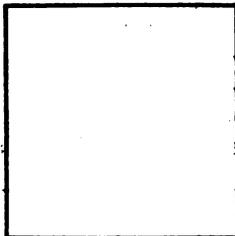
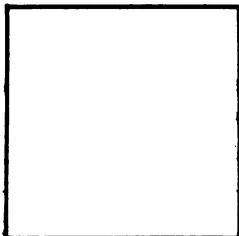
54. Complete the diagram in Fig. 11 - IG below showing in what order the wires of the cable are attached to the switchboard and terminal strip.



RL-P-2600

Fig. 11-IG.

55. Complete the diagram in Fig. 12 - IG below showing the connections necessary in order to use two monocord switchboards of type EE - 2 units as one unit, including night-alarm circuit.



RL-P-2601

Fig. 12-A-IG.

Note to instructor.

For a correct solution of questions 54 and 55 credit each with one point. For Pars. 3 and 4 of question 56 credit one point for each answer correctly underscored. Credit a correct solution of question 57 with 4 points and question 58 with 8 points.

56. Directions to the student.

1. a. Read Par. 2 carefully.

b. Answer the questions as directed in Pars. 3 and 4.

2. A soldier reported to the headquarters of a signal communication platoon at noon during combat and stated he was a trained telephone switchboard operator. He had no signal equipment. The signal communication officer issued him the following order to test the extent of his training:

a. "About one mile and a half down that road you will find two circuits crossing the road under a culvert. There are two circuits from this headquarters running along the road.

b. "Draw the necessary equipment from my supply sergeant there (pointing) and install a BD - 9 switchboard at the junction point and operate it.

c. "When the switchboard is connected notify the operator at these headquarters.

d. "You will be relieved at dusk. Report to me here when relieved for further orders.

e. "Any questions?"

3. Underscore any of the following things for which the soldier should ask the officer issuing the order in Par. 2 to furnish him in order to perform the mission assigned.

a. Division field code.

b. Telephone code.

- c. Traffic diagram.
- d. Radio service code.
- e. Name of the new central to be established.
- f. Circuit diagram.
- g. Line route map.
- h. Cipher device.

4. Underscore any of the following articles of equipment and insert the number of such articles which the soldier should draw in order to perform satisfactorily the mission assigned him.

| Article. | Number rolls or feet drawn. | Article. | Number rolls or feet drawn. |
|------------------------------|-----------------------------|----------------------------|-----------------------------|
| Radio message blanks..... | | Delivery list..... | ..... |
| 17 - 2..... | | W - 44..... | ..... |
| Reel cart, type RL - 16..... | | BA - 1..... | ..... |
| TM - 84..... | | Copper sleeves..... | ..... |
| Field message blanks..... | | BD - 9..... | ..... |
| BB - 14..... | | Hand axe..... | ..... |
| Tape, rubber..... | | Tape, friction..... | ..... |
| EE - 4..... | | Spare cords..... | ..... |
| Field buzzer..... | | Pencil..... | ..... |
| Insulators..... | | EE - 5..... | ..... |
| W - 40..... | | Screwdriver..... | ..... |
| Climbers..... | | Blow torch..... | ..... |
| Message center register..... | | BA - 2..... | ..... |
| Knife..... | | Pliers..... | ..... |
| EE - 3..... | | Camp type switchboard..... | ..... |
| Buzzerphone..... | | Breast reel..... | ..... |
| Spare fuses..... | | No. 19 T. P..... | ..... |
| VT - 1..... | | Station log..... | ..... |
| Test and trouble record..... | | | |

57. Directions to the student.

a. Fig. 12-B-IG shows a traffic diagram of a telephone net with certain of the subscribers at each central.

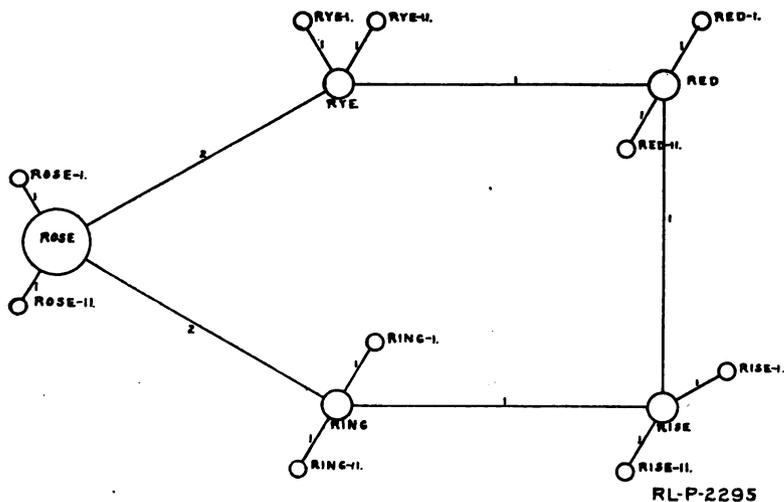


Fig. 12-B-IG.

a. Draw a circuit diagram of this telephone net.

58. Directions to the student.

a. Fig. 12-C-IG shows a diagram of a monocord switchboard of type EE-2 units connected to an operator's set, type EE-64.

b. If this equipment is connected so that if a drop falls on the monocord switchboard, the night alarm of the monocord operator's set will ring, write *yes* here

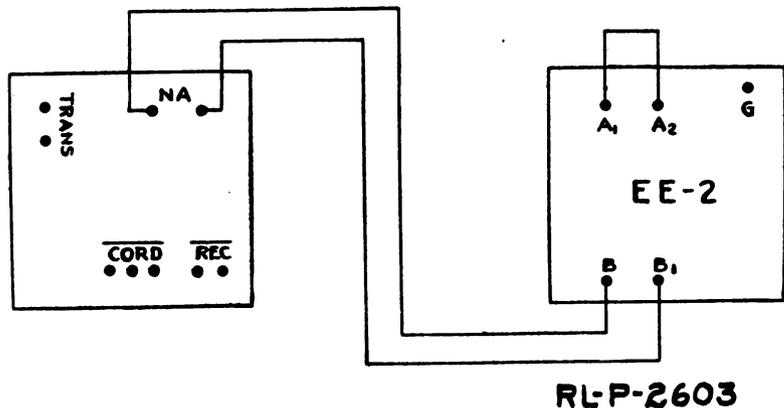


Fig. 12-C-IG.

c. If the equipment is not connected as described in b, write *no* here and correct the connections so that it will be so connected.

SUGGESTIONS FOR CONDUCTING PROFICIENCY TEST.

No. 2 - A (PERFORMANCE).

Equipment.

PROBLEMS NOS. 1 AND 2.

- 1 switchboard, monocord, type BD - 9.
- 5 telephones, type EE - 4 or EE - 5.
- Wire, type W - 40 or W - 44.

PROBLEM NO. 3.

- 1 switchboard, camp, type BD - 14.
- 4 telephones, type EE - 4 or EE - 5.

Procedure.

PROBLEM NO. 1.

1. *a.* Prepare a 20-group code message to be used in testing the students in the use of the phonetic alphabet. The following example contains each letter of the alphabet at least three times:

KSERQ NJTDB VCIWO BXHNY GZMGA
THEQU ICKBR OWNFO XJUMP SOVER
THELA ZYDOG NWTRD HKOCB OFQIU
VPJUX MSVER HZEAT LDAGY PVMLF

b. Read these code groups to the students, using the phonetic alphabet, in 2½ minutes. Allow no requests for repeats.

PROBLEM NO. 2.

2. *a.* Install in advance a monocord switchboard as MUSTER central with four local lines with the panels labeled as follows:

| Drop No. | Line No. |
|----------|-------------|
| 1..... | MUSTER - 1 |
| 2..... | MUSTER - 7 |
| 3..... | MUSTER - 11 |
| 4..... | MUSTER - 30 |

b. Assign a student to be tested as operator at MUSTER central and provide an assistant to operate each local telephone. Have an assistant place a call from MUSTER - 1 for MUSTER - 11 and at the same time have another assistant place a call from MUSTER - 30 for MUSTER - 7. Note whether the connections are correctly made on the switchboard. The time allowed for handling both calls is 30 seconds.

PROBLEM NO. 3.

3. *a.* Install in advance a camp switchboard with four local lines and place on the key shelf the following card:

MAGIC CENTRAL.

| Drop No. | Line No. |
|----------|--------------------------------|
| 1..... | MAGIC - 1, Commanding officer. |
| 2..... | MAGIC - 3, Executive officer. |
| 3..... | MAGIC - 11, Message center. |
| 4..... | MAGIC - 30, Radio station. |

b. Set up a connection between MAGIC - 30 and MAGIC - 3 and have an assistant on each telephone carrying on a conversation.

c. Assign a student to be tested to act as operator at MAGIC central. Provide an assistant for each of the other two local telephones.

d. Have the assistant at MAGIC - 1 place a call for MAGIC - 30. The operator should report MAGIC - 30 busy.

e. Have the assistant at MAGIC - 3 ring off. The operator should challenge before disconnecting. Signal the assistant at MAGIC - 3 to answer no further calls.

f. Have a call placed from MAGIC - 11 for MAGIC - 7. The student should report that MAGIC - 7 has no telephone.

g. Have a call placed from MAGIC - 30 for MAGIC - 3. The operator should report that MAGIC - 3 does not answer.

h. Have a call placed from MAGIC - 11 for "The Radio Station." The operator should say "The radio station's code number is MAGIC - 30. I will connect you." Arrange to have conversation on this circuit maintained.

i. Have a priority call placed from MAGIC - 1 for MAGIC - 30. The operator should say "I must interrupt—priority call," and connect MAGIC - 1 with MAGIC - 30.

Scoring.

1. The maximum possible score for this test is 48 points.
2. The score required to pass this test is 35 points.
3. DIRECTIONS FOR SCORING.

PROBLEM NO. 1.

| <i>a. Copying a coded message.</i> | Points. |
|---|---------|
| (1) If the message is copied correctly in 2½ minutes..... | 10 |
| (2) (a) Deduct one point for each erroneous code group. | |
| (b) If there are 10 or more errors..... | 0 |

PROBLEM NO. 2.

b. Operating the monocord switchboard.

- | | |
|--|---|
| (1) If both connections were established in 30 seconds..... | 8 |
| (2) If both calls were properly established but the time exceeded 30 seconds, deduct 2 points for each 5 seconds over the allowed time up to 50 seconds. | |

PROFICIENCY TEST No. 2.

Page No. 3.

TELEPHONE SWITCHBOARD OPERATOR.

b. Operating the monocord switchboard—Continued. Points.

- (3) (a) If the student failed on either call to do any one of the following: Answer, "Muster operator," repeat the number called, or ring the number called..... 0
- (b) If both were properly established, but the time exceeded 50 seconds..... 0

PROBLEM NO. 3.

c. Operating camp switchboard.

- (1) If the connections, disconnections, and phrases in all cases in this test are correct..... 30
- (2) If the student fails to handle any one of the operations as described below, deduct 5 points for any operation in which a defect occurs:

FIRST CALL.

- (a) Answer, "Magic operator"; repeat, "MAGIC - 30?"; test and report, "MAGIC - 30 is busy";

SIGNAL ON AN ESTABLISHED CONNECTION.

- (b) Challenge on MAGIC - 3, "Waiting?"; disconnect MAGIC - 3 and MAGIC - 30.

SECOND CALL.

- (c) Answer, "Magic operator"; repeat, "MAGIC - 7?"; report, "MAGIC - 7 has no telephone."

THIRD CALL.

- (d) Answer, "Magic operator"; repeat, "MAGIC - 3"; ring MAGIC - 3. After about 30 seconds supervise MAGIC - 30 and say, "Did your party answer?"—"I'll ring them again"; repeat supervision and ring MAGIC - 3 again; report, "MAGIC - 3 does not answer."

FOURTH CALL.

- (e) Answer, "Magic operator"; say, "The radio station's code number is MAGIC - 30, I will connect you"; ring MAGIC - 30.

FIFTH CALL.

- (f) Answer, "Magic operator"; repeat, "MAGIC - 30?"; test MAGIC - 30; report, "MAGIC - 30 is busy"; repeat, "MAGIC - 30 priority?"; interrupt MAGIC - 11 and MAGIC - 30 connection with "I must interrupt—priority call" and connect MAGIC - 1 with MAGIC - 30.
- (3) If a student fails in all six of the above..... 0

PROFICIENCY TEST NO. 2-A (PERFORMANCE).

PROBLEM NO. 1.

Directions to the student.—*a.* The instructor will read a 20-group code message using the phonetic alphabet in 2½ minutes.

b. Write this message down on the paper provided and sign your name.

c. Students will not be allowed to ask for repeats.

PROBLEM NO. 2.

Directions to the student.—*a.* The instructor will designate a monocord switchboard at which you are to act as operator.

b. Go to the switchboard and note the code names on the panel of each unit.

c. Notify the instructor when you are ready to handle calls.

PROBLEM NO. 3.

Directions to the student.—*a.* The instructor will designate a camp type switchboard at which you are to act as operator.

b. Go to the switchboard and note the directory.

c. Do not disturb any established connections without using the proper phrases.

d. Notify the instructor when you are ready to handle calls.

e. Do not leave the switchboard until notified by the instructor.

PROFICIENCY TEST NO. 2-B (INFORMATION).

Directions to the student.—Below are a number of sentences from which certain words or phrases have been omitted. Each word or phrase that has been omitted has been indicated by a short dotted line inclosed in parentheses, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. Blank spaces inclosed in parentheses should be filled in with the exactly correct phrase. A word spelled with a hyphen, like armor-plated or back-fire, counts as one word.

1. The rear cord of any pair of cords on the camp-type switchboard is called the (.....) cord.

2. The front cord of any pair of cords on the camp-type switchboard is called the (.....) cord.

3. To establish a connection through the camp-type switchboard, the operator, when a line drop falls, inserts the (.....) plug into the (.....), jack, at the same time (.....) the (.....) key to its (.....) position.

4. Having ascertained the number desired by the calling party the operator on a camp type switchboard inserts the (.....) plug of the (.....) pair of cords into the (.....) of the party desired and operates the (.....) key to its position and turns the (.....) (.....).

5. To connect as a single unit two monocord switchboards of type EE - 2 units, proceed as follows:

a. Connect the terminals on the top of each switchboard marked (.....) together, and also those marked (.....) together.

b. Then connect the terminals on the bottom of each switchboard marked (.....) together, and also those marked (.....).

c. Next connect the terminals on the bottom of each switchboard marked (.....) together, and connect those marked (.....) together.

d. Finally connect the terminals on the top of each switchboard marked (.....) together.

6. Whenever possible, telephone calls should be made by (.....) name and (.....) and not by (.....) name or title and (.....).

7. In order that the line-drop shutters on a monocord switchboard will not be broken in pulling the board out of the carrying case, they are kept shut when the switchboard is in its carrying case by means of (.....) (.....).

8. The operator's telephone is connected to a monocord switchboard by running a piece of twisted pair wire from the telephone to the (.....) and (.....) terminals of the switchboard.

9. The (.....) (.....) is used to determine the best routing for a call.

10. In order to (.....) a switchboard promptly of (.....) connections an operator should (.....) (.....) periodically on all (.....).

11. At each headquarters there is usually a (.....) with (.....) lines connecting to other (.....) and (.....) lines connecting various (.....) at that headquarters.

12. In a field telephone system, each central has a code (.....) and each local (.....) has a (.....) (.....).

13. When a call comes into a central whose code name is "TABLE" the operator (.....) by saying (.....) (.....).

Directions to the student.—Below are a number of sentences which are unfinished. Following each are several words or phrases. Select the one of these which best fits the sentence or which makes the best sense and draw a line under it.

14. To accommodate all the lines on a camp type switchboard, the number of terminal strips, type TM-84, required is four six seven eight ten.

15. The operator's cord on the monocord switchboard is colored red white blue green.

16. The little shutter which falls when someone tries to signal the operator is called a drop a plug a sleeve a fuse.

17. There is a socket in each unit of a monocord switchboard in which an object at the end of the operator's cord can be inserted. This socket is called a fuse a drop a plug a jack.

18. In the telephone code names are used for centrals headquarters officers local telephones trunk lines.

19. In the telephone code numbers are used for headquarters test stations officers centrals switching points.

20. The phonetic alphabet is used for purposes of secrecy for the purpose of preventing the confusion of those letters having similar sounds for economy of time in place of the division field code for technical messages pertaining to the telephone system.

21. The wires of the cable connecting the terminal strips to camp switchboards are connected to the switchboard by means of wing nuts binding posts terminal screws Fahnstock clips soldered connections clamps.

22. The transmitter on the camp switchboard is in the operator's hand set is of the breast type is suspended from an arm by cords not of adjustable height can not be disconnected from the switchboard.

23. The circuit diagram not only shows the number of circuits and the numerical designation of the circuits but also the actual connections grounds leads traffic terminal strip.

Directions to the student.—Below are several sentences and just after each one are the words "True" and "False." Read each sentence carefully and if what it says is true, draw a line under the word "True." If what it says is not true, draw a line under the word "False."

24. The check is the number of words in the message, including address and signature. True. False.

25. The telephone orderly when receiving a message by telephone should write it in duplicate on a field message blank. True. False.

26. A connection between two parties is made on a monocord switchboard with the calling party's cord. True. False.

27. A connection on a monocord switchboard is broken as soon as the drop on the calling party's line falls. True. False.

28. When a drop falls on a unit on a monocord switchboard which is connected thru to another unit the operator immediately breaks the connection. True. False.

29. The operator's cord on the type EE-64 operators set is a two-conductor cord. True. False.

30. The type EE-64 operator's set has an operator's handset. True. False.

31. When the transmitter of the type EE-64 operator's set is pushed down in position for transportation the battery furnishing talking current is disconnected. True. False.

32. In order to determine whether a conversation between two parties is finished or not the operator should proceed as follows: Insert the operator's plug in the free jack and challenge by saying "Hello." Then repeat this challenge. If there is no answer do not break the connection. True. False.

33. In order to ring the called party on a camp switchboard, the operator plugs into the called party's jack using the back cord, pushes the listening key from him, and turns the generator crank. True. False.

34. A wire net consists of a number of local telephones connected to each switchboard by means of wire lines. True. False.

35. The construction detail installs local telephones. True. False.

36. The operating detail installs the switchboard and trunk lines. True. False.

37. Trunk lines are turned over to the operator after being tagged, marked, and connected to the terminal strip. True. False.

38. Tests are made periodically but no record is made unless trouble is disclosed by the test. True. False.

39. A connection between two parties should not be broken in order to make a test. True. False.

40. The Test and Trouble Record shows the time the central opened and closed. True. False.

41. When a drop falls on a monocord switchboard, indicating to the operator that a subscriber is calling, the operator answers by plugging into the jack of the calling subscriber and saying, "NUMBER, PLEASE." True. False.

42. After the calling party has given the number he desires the operator acknowledges by repeating the number thus "MAGIC-11?" True. False.

43. When transmitting a message by telephone to another headquarters the message center telephone orderly always calls for the person to whom the message is addressed and not the message center. True. False.

INSTRUCTORS GUIDE FOR ALL ARMS.

Directions to the student.—Each of the following questions can be answered by a single word or phrase. Write the answer on the short dotted line.

44. What is the diagram called, which shows the operator how to route a call by the most direct route?

45. What does the diagram referred to in question No. 44 show in regard to the circuits between every two switchboards?

46. What is the system called in which several centrals are connected together by circuits, each central being connected with a number of local telephones?

47. Whose telephone is usually installed first at a command post?

48. What is a circuit called which connects two centrals?

49. If the operator were notified that on a certain subscriber's telephone he could be plainly heard, but that the subscriber could not make himself heard, where would the trouble most likely be found?

50. If both sides of a circuit were to become grounded what would be the effect?

51. What would be the trouble indicated if the conversation over one line could be heard on another line?

52. If, when ringing on a line with a camp telephone, the operator's generator crank turned very hard, his bell did not ring, and the called party did not answer, what would be the trouble indicated?

53. In what position is a monocord switchboard hung in order that the drops will fall promptly?

54. Complete the diagram in Fig. 13-IG below showing a monocord switchboard installation with two lines from the east and two lines from the west.

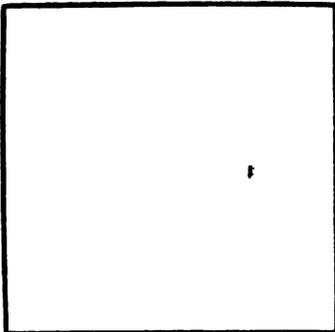


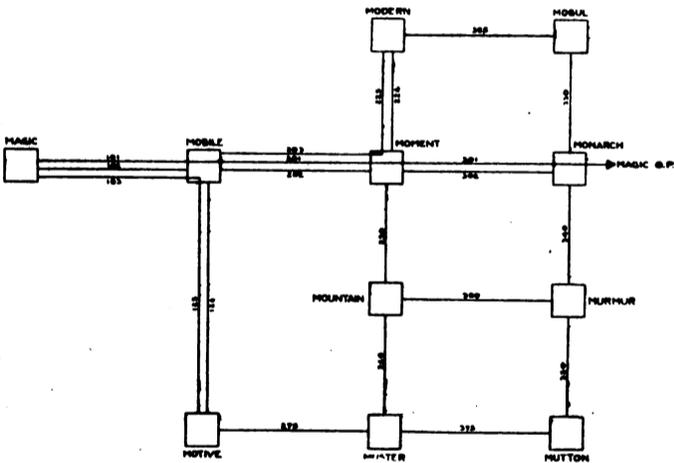
Fig. 13-IG.



RL-P-2600

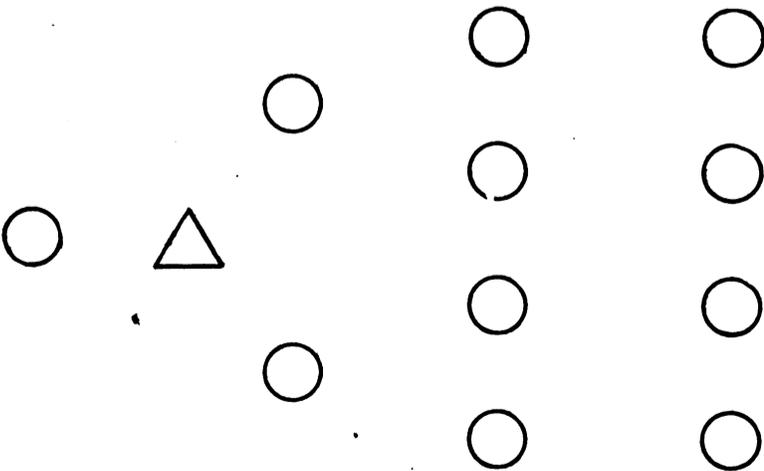
55. Draw a diagram on a separate piece of paper showing the foregoing installation after it has been converted into a test station.

56. Complete the diagram in Fig. 15-IG below making the traffic diagram for the circuit diagram which is shown in Fig. 14-IG below.



RL-P-2219

Fig. 14-IG.



RL-P-2605

Fig. 15-IG.

Note to instructor.—Credit a correct solution for questions 54 and 55 with 4 points each, and question 56 with 8 points.

ARMY ORGANIZATION.

TEST NO. 1 (INFORMATION).

Suggestions for scoring test No. 1 in Army organization.

| | Points. |
|---|---------|
| 1. The maximum possible score for this test is..... | 79 |
| 2. The score required to pass this test is..... | 60 |
| 3. Directions for scoring.—Credit one point for each blank space correctly filled in. | |

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line enclosed in a parenthesis, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct.

1. The eight combatant arms of the United States Army are the (1) (.....), (2) (.....), (3) (..... c.....), (4) (.....), (5) (.....), (6) (.....), (7) (.....), and (8) (.....).

2. Six of the departments and corps are the (1) (.....), (2) (.....), (3) (.....), (4) (.....), (5) (.....), and (6) (.....).

3. The (.....) is the basic arm.

4. The smallest infantry unit is a (.....) consisting of (.....) men commanded by a (.....).

5. (.....) squads of infantry make a (.....) which is commanded by a (.....) and (.....) sections make a platoon which is commanded by a (.....).

6. (.....) platoons of infantry make a (.....) which is commanded by a (.....).

7. The (.....) is the largest infantry unit which is capable of being personally directed in battle by one man.

8. (.....) rifle companies, (.....) machine gun company, and a (.....) (.....) make an infantry battalion which is commanded by a (.....) or a (.....).

9. A machine gun company of infantry consists of (.....) platoons, each platoon consisting of (.....) sections, each section consisting of (.....) squads.

10. There are (.....) machine guns in a machine gun company of infantry.

11. (.....) battalions of infantry plus a (.....) company, (.....) company and a (.....) company make a (.....) which is commanded by a (.....).

12. The (.....) company of an infantry regiment is the company which furnishes food, supplies and equipment.

13. The communication platoon in an infantry unit is in the (.....) company.

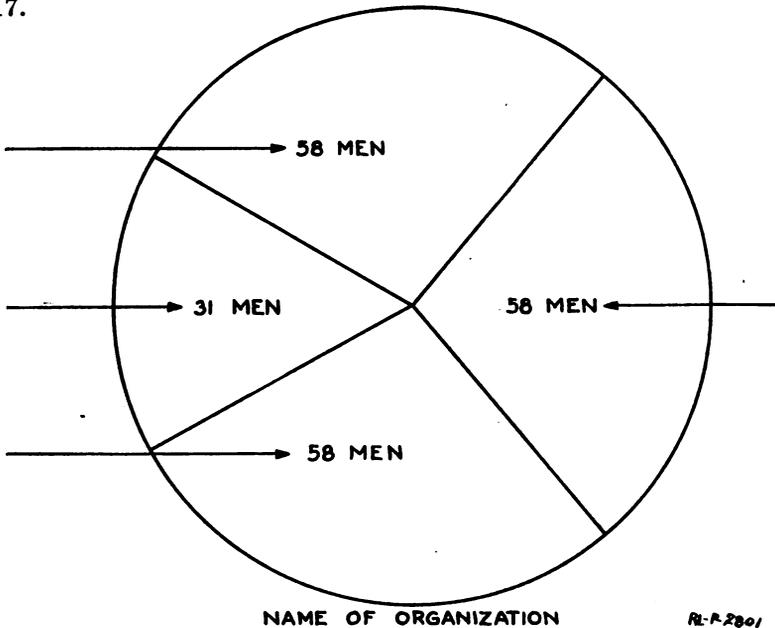
14. A brigadier general commands a (.....) which in the infantry consists of (.....) (.....) and a (.....) company.

15. There are (.....) brigades in an infantry (.....) one (.....) (.....) brigade and (.....) infantry brigades.

16. A division is commanded by a (.....) (.....).

Directions to the student.—Below are four diagrams from which the names of the organization and the units composing it have been omitted. Complete the diagram by filling in the correct names of the units on the arrows pointing to a number of men. On the line just below each figure fill in the name of the entire organization.

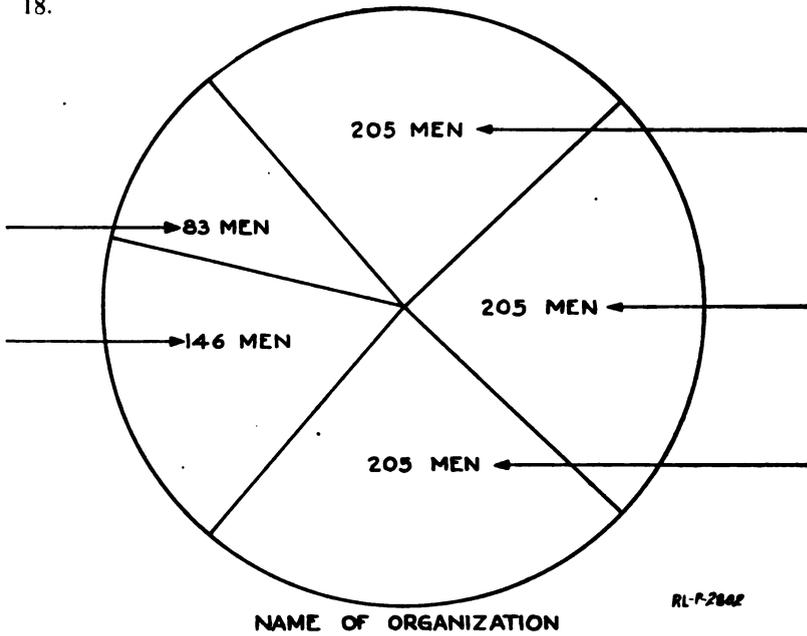
17.



Rt-P-2801

Fig. 16-IG.

18.

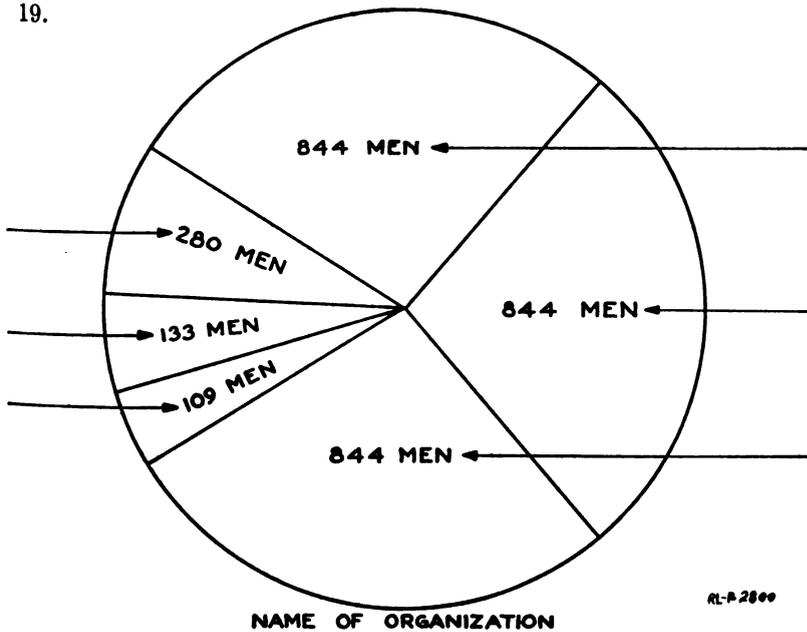


RL-P-2842

NAME OF ORGANIZATION

Fig. 17-IG.

19.

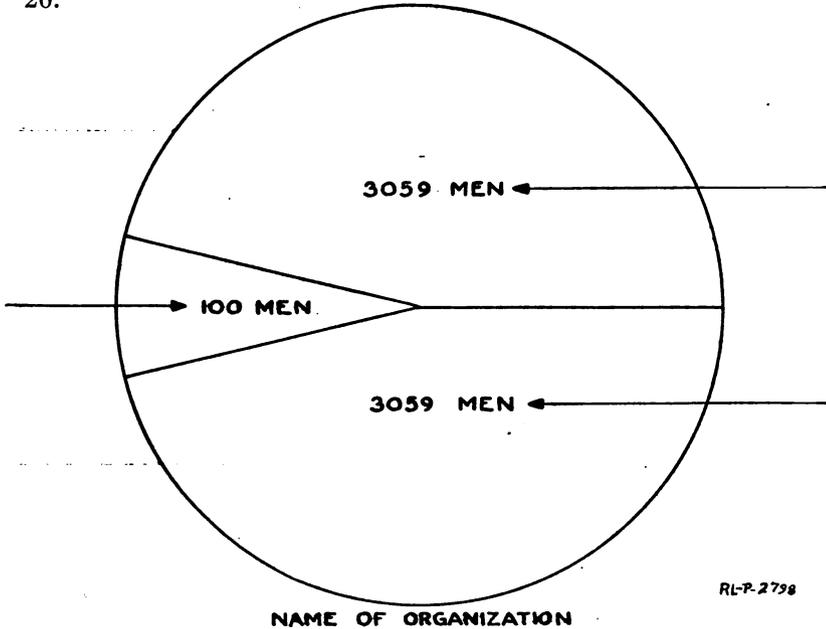


RL-P-2800

NAME OF ORGANIZATION

Fig. 18-IG.

20.



RL-P-2798

Fig. 19-IG.

ARMY ORGANIZATION.

TEST No. 2.

Suggestions for scoring test No. 2 in Army organization.

- | | Points. |
|---|---------|
| 1. The maximum possible score for this test is..... | 61 |
| 2. The score required to pass this test is..... | 46 |
| 3. Directions for scoring.—Credit one point for each blank space correctly filled in. | |

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line inclosed in parentheses, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct.

1. The smallest unit in the Cavalry is the rifle (.....) which consists of (.....) privates commanded by a (.....).

2. A (.....) in the Infantry is composed of 26 men, including the commander and one guide.

3. The unit in question 2 is composed of (.....) smaller units of (.....) men, which is called (.....).

4. A machine (.....) platoon of a Cavalry troop is divided into (.....) squads, each consisting of (.....) men. Each squad has (.....) machine rifles.

5. (.....) troops, a headquarters, and (.....) make a Cavalry (.....), which is commanded by a major.

6. There are (.....) squadrons, a (.....) troop and a (.....) troop in a Cavalry (.....), which is commanded by a colonel.

7. The signal communication personnel of a Cavalry regiment are in the (.....) (.....) of the (.....) troop.

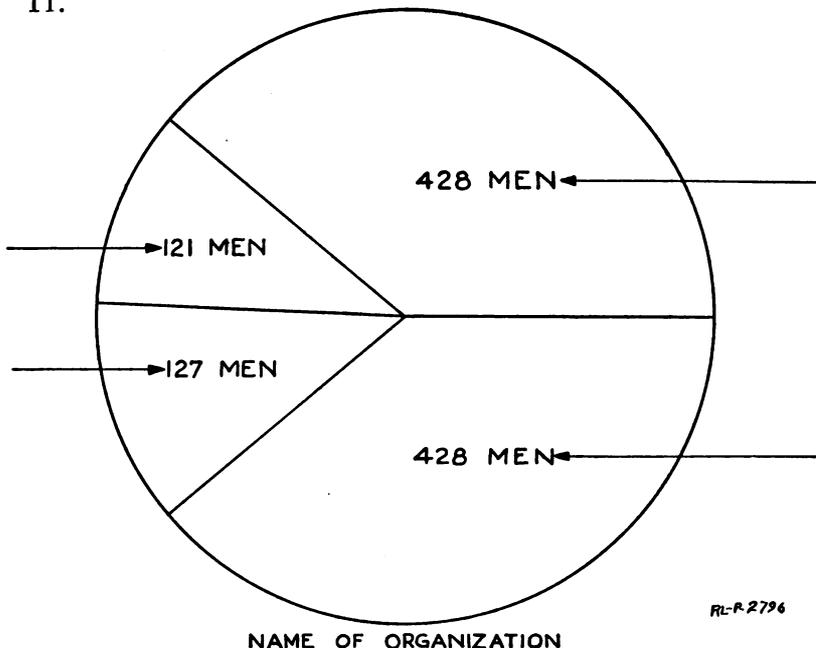
8. A brigadier (.....) commands a Cavalry (.....), which consists of (.....) regiments, (.....) machine gun (.....) and a (.....) troop.

9. A Cavalry machine gun (.....) is divided into (.....) troops. There are (.....) machine guns in the machine gun (.....).

10. A Cavalry division consists of the following units: Two Cavalry (.....), one (.....) of (.....) artillery, (.....), combat engineer (.....), division (.....) (.....), division (.....), ambulance (.....), and (.....) troops.

Directions to the student.—Below are three diagrams from which the names of the organization and the units composing it have been omitted. Complete the diagram by filling in the correct names of the units on the arrows pointing to a number of men. On the line just below each figure fill in the name of the entire organization.

11.



RL-P-2796

Fig. 20-IG.

12.

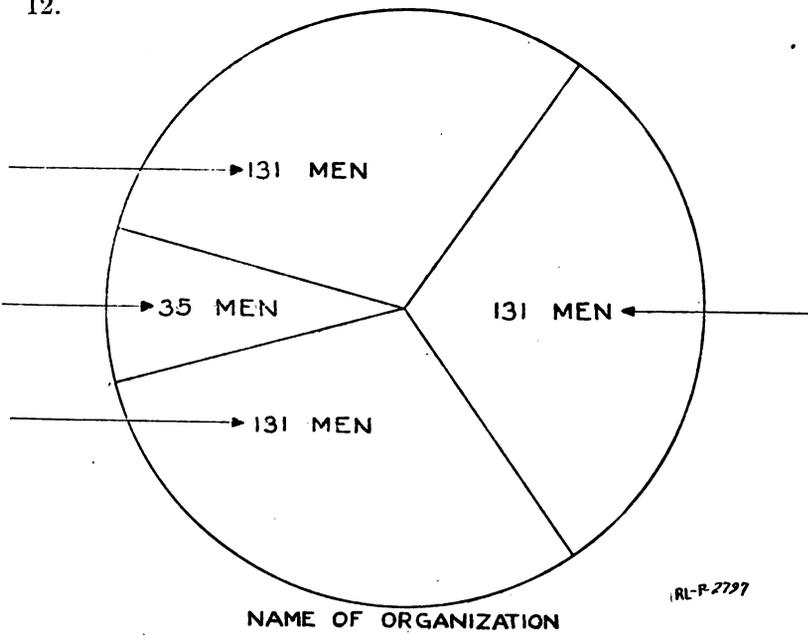


Fig. 21-IG.

13

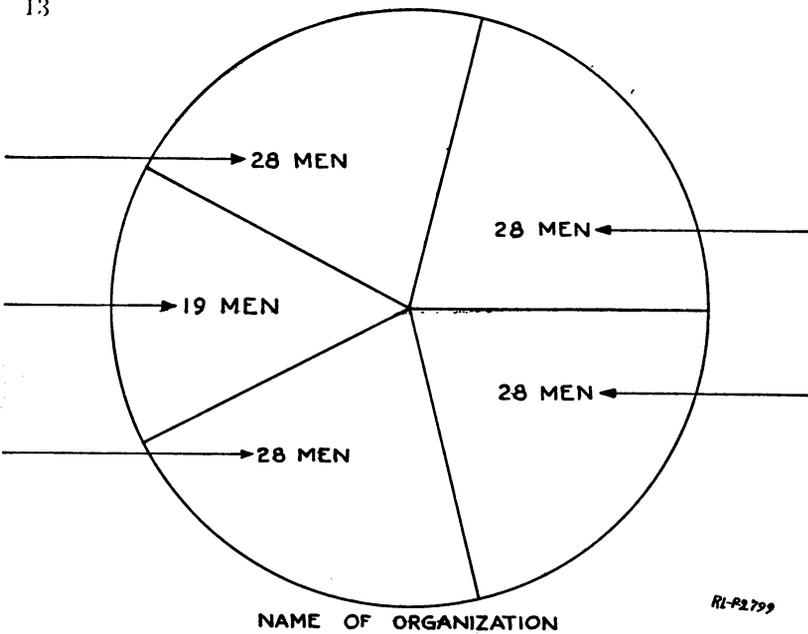
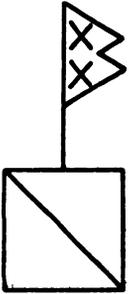
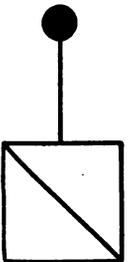
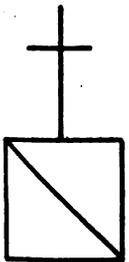


Fig. 22-IG.

14. Directions to the student.—Write in the spaces provided below the name of each organization for which the conventional sign is given:







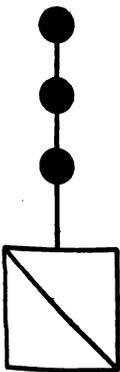


Fig. 23-IG.

ARMY ORGANIZATION.

TEST No. 3.

| Suggestions for scoring test No. 3 in Army organization. | Points. |
|---|---------|
| 1. The maximum possible score for this test is..... | 67 |
| 2. The score required to pass this test is..... | 50 |
| 3. <i>Directions for scoring.</i> —Credit one point for each blank space correctly filled in. | |

Directions to the students.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line enclosed in a parenthesis, thus (.....) Fill in each blank space with a word which will make good sense and at the same time be technically correct.

1. The smallest unit in the Field Artillery is the (.....), which comprises from 15 to 21 men.
2. (.....) sections of Field Artillery form a (.....); which is commanded by a (.....).
3. Three (.....) make a (.....) of Field Artillery, which is commanded by a (.....).
4. The Field Artillery battery corresponds to the Infantry (.....) (.....) and the Cavalry (.....).
5. A major commands a Field Artillery (.....), which consists of (.....) batteries, a (.....) battery, and a (.....) (.....).
6. A Field Artillery regiment consists of (.....) battalions, a (.....) battery, and a (.....) (.....). It is commanded by a (.....).
7. The communication personnel for the artillery regiment is in the (.....) (.....).
8. The (.....) is the largest Field Artillery unit. It consists of (.....) regiments and is commanded by a (.....) (.....).
9. The primary use of the Field Artillery is to support the (.....) in battle.
10. The Infantry division (.....) (.....) furnishes runners, messengers, and orderlies for division headquarters.

11. The Infantry division (.....) (.....) furnishes the signal communication for division headquarters and between the division and the (.....).

12. The (.....) (.....) company in an Infantry division is equipped with 25 light (.....), which are used to assist the Infantry's advance during attack.

13. The (.....) (.....) company in an Infantry division is used to regulate traffic and maintain discipline.

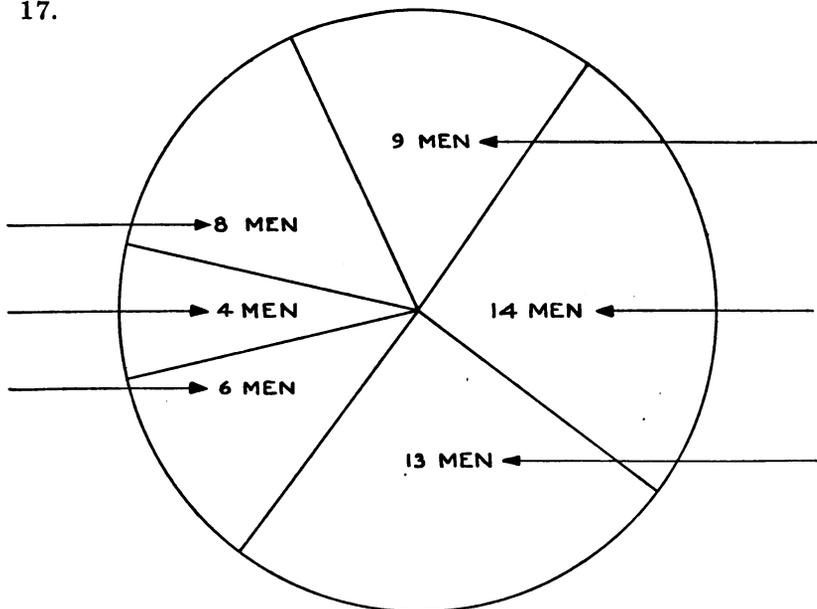
14. The (.....) (.....) repairs ordnance equipment within the Infantry division.

15. The (.....) (.....) is used for general quartermaster duty in an Infantry division.

16. The Infantry divisional unit which takes care of the sick and wounded is the (.....) (.....).

Directions to the student.—Below are three diagrams from which the names of the units have been omitted. The name of the organization is given below each figure. Complete the diagrams by filling in the correct names of the units on the arrows pointing to a number of men.

17.



INFANTRY, REGIMENTAL COMMUNICATION PLATOON.

RL-7-2795

Fig. 24-IG.

18.

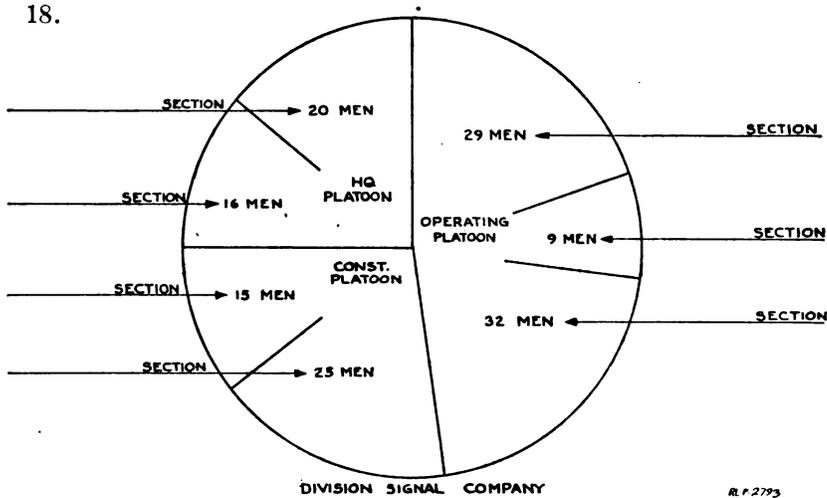


Fig. 25-IG.

19.

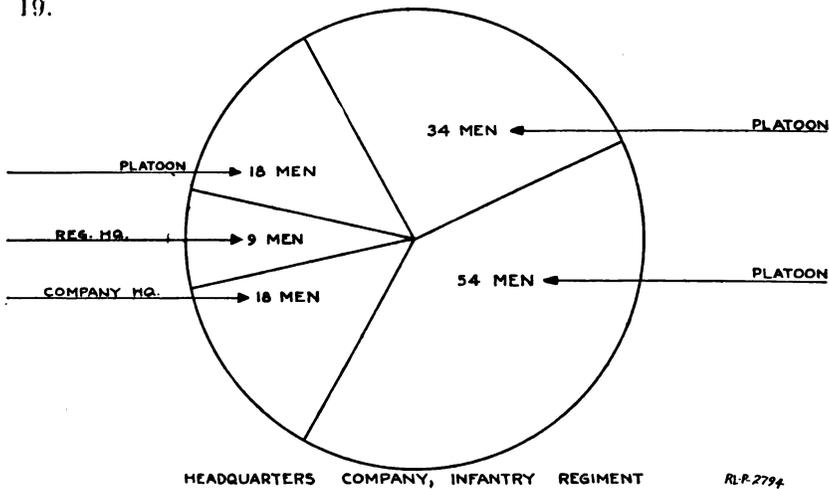


Fig. 26-IG.

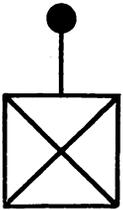
20a. Directions to the student.—Draw in the spaces provided below the conventional signs for each of the units indicated.

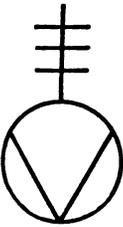
Infantry observation post.

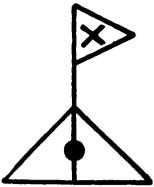
Cavalry troop command post.

Third medical regiment.

b. Directions to the student.—Write in the spaces provided below the name of each unit for which the conventional sign is given:







RL-P-279'

Fig. 27-IG.

INFORMATION TOPICS.

DEFINITIONS.

NOTE.—The definitions given below are the common meanings of words *as used in this manual.*

Bass wood.—Light soft wood used for furniture, carrying cases for equipment, etc.

Bridge.—To connect an apparatus from one side of a circuit across to the other side.

Buzzer, series.—A buzzer which is placed in series in one side of the circuit; not bridged across the circuit.

Cable, standard switchboard.—A cable composed of silk and cotton covered wires, usually coded to facilitate making connections.

Called party.—The person who is called by the operator when making a telephonic connection.

Call, completed.—One where the calling party obtains an answer from the called party's telephone

Call, uncompleted.—One where the switchboard operator is unable to get an answer from the called party's telephone.

Challenge.—An operator's inquiry by saying, "Waiting?" on a connection to determine whether or not the connection is in use.

Circuit diagram of a telephone net.—A diagram which shows graphically the various circuits in a telephone net, the actual connections, the code names of centrals, and the numerical designation of each circuit.

Circuit diagram.—A diagram showing graphically the course traversed by an electric current.

Circuit, signalling.—The path followed by the signaling current in a telephone circuit.

Circuit, talking.—The path followed by the talking currents in a telephone circuit.

Code, names.—An arbitrary series of names given to various headquarters for the purpose of obtaining speed and accuracy in the handling of telephone calls.

Cord.—An insulated cord containing one or more conductors.

Cord, answering.—The rear cord on a camp switchboard, type BD - 14, which is used for plugging into the line of a calling subscriber.

Cord, calling.—The front cord on a camp switchboard, type BD - 14, which is used for plugging into the line of a party to be called by the operator.

Cord, operator's.—The cord on a monocord switchboard or an operator's set used by the operator for answering and supervising. It is usually a different color than the switchboard cords.

Cords, switchboard.—Those cords on a switchboard which are used in connecting two parties together.

Cord, three-conductor.—The cord on the operator's set, type EE - 64.

Cord, two-conductor.—An insulated cord containing two conductors. For example, the operator's cord on a monocord switchboard.

Cord weights.—Weights attached to the cords on a switchboard to pull the cords automatically, so that when released from a jack a cord returns to its proper place on the key shelf.

Corrode.—To wear away by degrees, such as by rusting.

Drop.—*a.* The electromagnet with its armature and catch which permits a shutter to fall for the purpose of attracting the attention of an operator.

b. Sometimes used to mean the shutter.

Drop, clearing out.—The drop on any cord circuit of a magneto switchboard which falls when one of two connected subscribers rings off.

Drop lock.—A spring clip or latch for holding the drop up securely when a switchboard is being transported.

Drop magnet.—The electromagnet which actuates the drop armature, releasing the shutter.

Drop shutter.—The shutter which falls when the drop armature is lifted.

Exchange.—Switchboard; central.

Fahnstock clips.—Patented spring clips used for attaching wires.

Fuse.—A safety piece of fusible metal in an electrical circuit which melts when the current is too strong.

Ground rod.—A rod which is driven in the earth to obtain a ground connection.

"Handle traffic."—Term used to mean making the necessary connections to complete calls through a switchboard.

Induction coil.—An apparatus for transforming currents by electromagnetic induction, consisting usually of two concentric cylindrical coils of insulated wire inclosing an iron core.

Key shelf.—The part of a switchboard on which are mounted the operator's keys and cords.

Key switches.—Compact form of switches made to fit into a flat mounting plate which are operated by keys.

Line circuits, dummy.—Circuits which have no apparatus connected on one end.

Line signals, gravity type.—See Drop.

Line route map.—A map which shows the geographical location of the centrals in a telephone net, the number of circuits and the route of each.

Night alarm.—An alarm so connected to a switchboard that it will be automatically operated when any drop on the switchboard falls.

“Nonlocking position.”—A position to which a switchboard key on the camp-type switchboard may be operated and from which the key returns to a normal position when released.

Phonetic alphabet.—An alphabet for use in telephone conversation in which certain letters having similar sounds are given names which have different sounds.

Plug.—A special form of terminal for attachment to a flexible conductor (switchboard cord) in order to make an easy and quick connection to a jack.

Priority.—*a.* The order in which calls are answered by an operator.

b. The right to interrupt an established connection between two parties.

c. The order in which telephones are installed at a command post.

Protectors.—Two fuses and lightning arrester, used in combination to protect equipment from lightning and other foreign currents.

Protector panel.—The panel or board on which protection devices are mounted. (See Fig. 41.)

“Restore the drop.”—To place the shutter of a drop back in its normal or original position after the shutter has fallen.

Ring and listening key.—A key on a camp type switchboard which has two positions; one for ringing and one for listening.

Secondary routing.—A routing for a telephone connection other than the most direct routing.

Sleeve.—*a.* The cylindrical contact or barrel of a switchboard jack.

b. The contact of switchboard plug which makes connections with sleeve of jack.

Supervising.—Using every available effort to connect the calling party to the called party; seeing that uninterrupted connection is maintained during conversation; and in clearing the lines promptly when the conversation is completed.

Switch.—A device for making and breaking a circuit.

Switching central.—A switchboard located at the junction of two or more wire lines at a location which is not at any headquarters or command post.

Telephone, central.—A switchboard with lines, telephone, and related apparatus, for the purpose of enabling any subscriber to talk with any other subscriber.

Telephone, common battery.—A telephone used in a system in which the battery is located at the central or exchange.

Telephone, magneto or local battery.—A telephone used in a system in which the battery is located in the subscriber's instrument.

Telephone net.—A wire system in which a number of switchboards, to which are connected local telephones, are connected together by wire lines called trunks.

Test and trouble record.—A record kept at a switchboard of tests made and troubles occurring on any circuits connected to the switchboard.

Tip.—*a.* The forward contact of a telephone switchboard plug.

b. That terminal of a switchboard jack with which the tip of plug makes contact.

Traffic.—Telephone calls.

Traffic load table.—A schedule for placing calls in a telephone net for training purposes.

Trouble.—A fault on a circuit such as short circuit, open circuit, or ground.

Trunk.—A telephone circuit connecting two centrals.

Wing nuts.—Nuts provided with winglike extensions to facilitate turning by hand.

Wire line.—One or more circuits of the same type of construction along a given route forming an integral portion of a wire system.

Wire lines, junction of.—A point where two or more wire lines terminate.

Wire net.—A system in which a number of switchboards, to which are connected local telephones, are connected together by wire lines.

ARMY ORGANIZATION.

The United States Army is made up of different branches or arms of the service, such as Infantry, Cavalry, Field Artillery, and others that will be mentioned later.

In order to create a fighting team, these branches must be divided up into units of different sizes for purposes of training, feeding, clothing, and so on, that they may be efficiently directed on the battlefield.

The Infantry is the basic arm, and upon its success depends the success of the Army. All other branches are organized, equipped, and trained to assist the Infantry in its needs, functions, and methods in war.

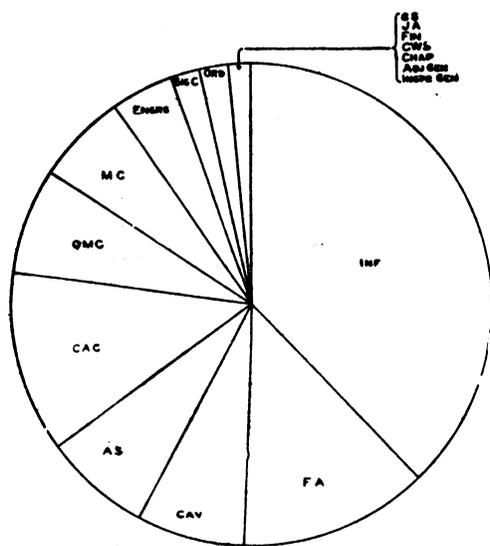


Fig. 1.—Branches of the United States Army.

Fig. 1 shows the various combat arms, departments, and corps of the Army. The big organization, the Army, is composed of 17 parts, and each part has its particular duties which help the other branches to function more efficiently.

INFANTRY.

Since the Infantry is so important, and since most of the combatant branches are divided up into parts that correspond nearly to the parts into which the Infantry is divided, a study of the Infantry

organization is important. All communication men in their everyday work, in maneuvers, in battle, or in training have to deal with units of the other arms, and they must therefore be familiar with the names and composition of the parts of organizations and know the rank and duties, in general, of the officers that command these parts. A study of the Infantry will teach this, so that a similar knowledge of the other branches can be quickly learned.

The smallest Infantry unit is a squad, consisting of 7 men commanded by a corporal. Three squads make a section of 26 men commanded by a sergeant and two sections make a rifle platoon

of about 60 men commanded by a lieutenant. The symbol

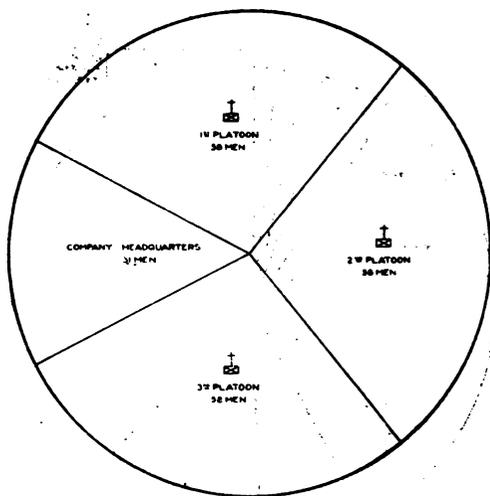


Fig. 2.—Rifle company, Infantry.



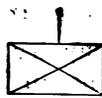
represents an Infantry rifle platoon. The next higher unit is the rifle company of about 200 men, divided into three rifle platoons and commanded by a captain. (See Fig. 2. The symbol



will be noted and will always mean an Infantry rifle company. The cross in the rectangle represents two crossed rifles and means Infantry troops. The three bars indicate that the company has three platoons.)

The rifle company is the smallest self-sustaining unit in the Infantry capable of replacing its losses in battle.

Three rifle companies plus one machine-gun company and headquarters company constitute a battalion of about 850 men commanded by a major or lieutenant colonel. (See Fig. 3. The symbol



will be noted in Fig. 3 and will always mean an infantry battalion.)

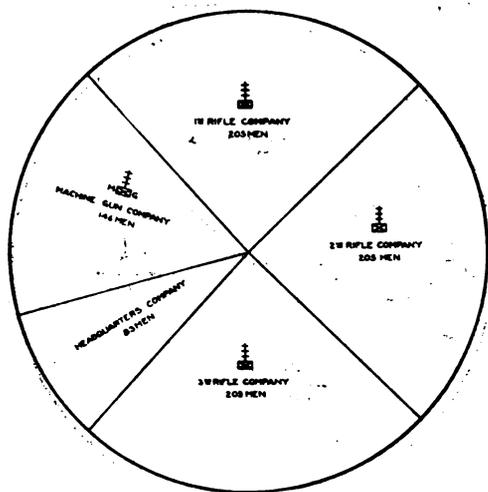


Fig. 3.—Infantry battalion.



Three battalions plus a headquarters company, howitzer company, and service company constitute a regiment of about 3,000 men com-

manded by a colonel. (See Fig. 4. The symbol



will be noted and will always mean an Infantry regiment.) The three dots in this symbol indicate that the regiment has three battalions.

The service company is the company that furnishes food, supplies, and equipment for the regiment.

The howitzer company is the company which contains certain auxiliary Infantry weapons and is under the direct command of the colonel, to be used as needed.

The headquarters company furnishes the communication, personnel for the regiment, and has other smaller platoons for particular duties

TELEPHONE SWITCHBOARD OPERATOR.

at regimental headquarters during combat. Fig. 19 shows the various platoons of this company. In addition to the communications platoon are the pioneer platoon, which constructs sufficient shelters, wire entanglements, etc., to insure the safe operation of regimental headquarters during combat; the intelligence platoon, which discovers, collects, and prepares for the use of the colonel all information that can be found out about the enemy; and company headquarters, which contains the personnel necessary for the administration of the company and sufficient personnel to perform the clerical work at regimental headquarters.

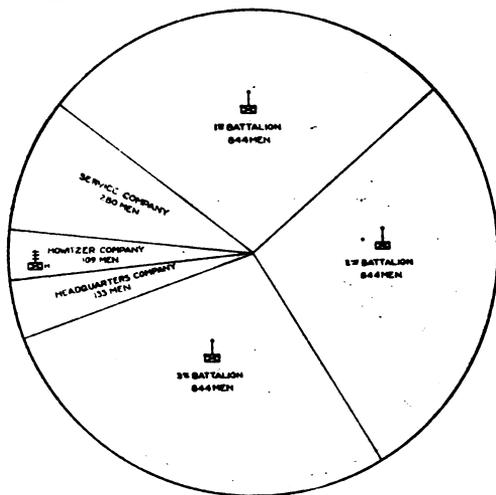


Fig. 4.—Infantry regiment.



Two Infantry regiments plus a brigade headquarters company constitute an Infantry brigade of about 6,000 men commanded by a

brigadier general. (See Fig. 5. The symbol  will be noted and will always mean an Infantry brigade.)

Two Infantry brigades plus the Artillery brigade and certain auxiliary organizations constitute one Infantry division of about 20,000 men commanded by a major general. (See Fig. 6. The

symbol  will be noted and will always mean an Infantry division. A flag with one star is the flag of a brigadier general. A flag with two stars is the flag of a major general.)

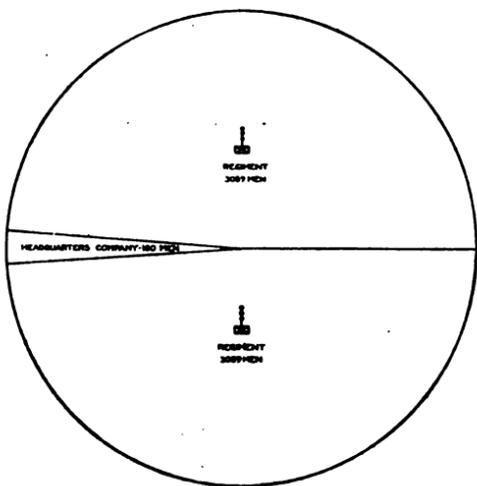


Fig. 5.—Infantry brigade. 

The auxiliary troops that, in addition to the Infantry and Artillery, make up the whole division of about 20,000 men are: Engineers, Air Service, Medical, special troops, and trains. These will be mentioned later.

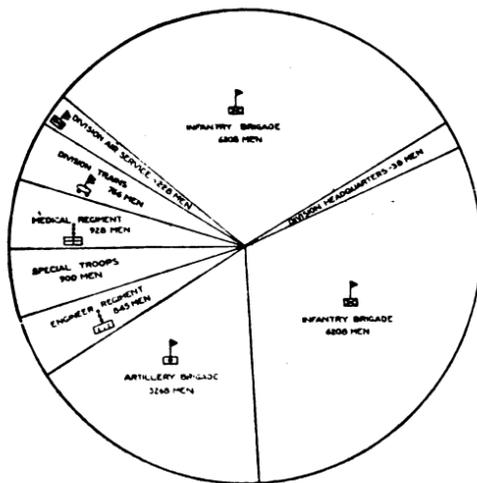


Fig. 6.—Infantry division. 

CAVALRY.

In the Cavalry the smallest unit is the rifle squad, consisting of seven troopers commanded by a corporal. Three squads make a rifle platoon of 28 men, commanded by a lieutenant. The symbol



denotes a Cavalry rifle platoon. Three rifle platoons and

one machine-rifle platoon constitute a troop of about 130 men commanded by a captain. (See Fig. 7. The symbol



will be noted and will always mean a troop of Cavalry. The difference

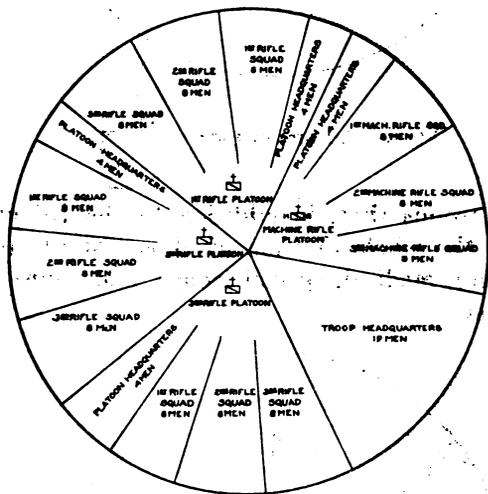


Fig. 7.—Cavalry troop.



between the symbol for Cavalry and the symbol for Infantry troops will be noted. The diagonal in the rectangle represents a saber.)

The machine-rifle platoon is divided into three squads, each consisting of eight men and two pack horses.

The Cavalry troop is a self-sustaining unit capable of replacing its losses in battle and corresponds to the Infantry rifle company.

The squadron of about 400 men is the next higher unit and consists of three troops plus a squadron headquarters and headquarters detachment commanded by a major. (See Fig. 8. The symbol



will be noted and will always mean a squadron of Cavalry.)

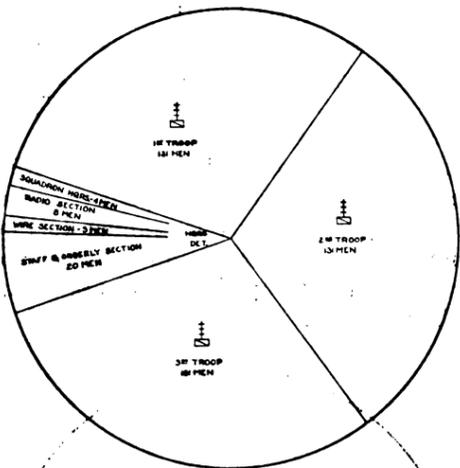


Fig. 8.—Cavalry squadron.



Two squadrons plus a headquarters troop and service troop equal one regiment of about 1,100 men commanded by a colonel. (See

Fig. 9. The symbol  will be noted and will always mean a regiment of Cavalry.)

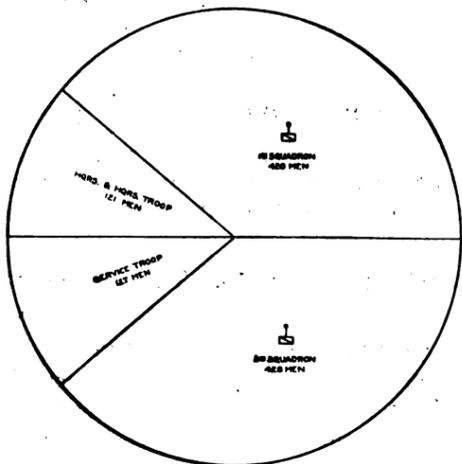


Fig. 9.—Cavalry regiment.



The headquarters troop furnishes the communications personnel for the regiment and has other smaller sections for particular duties at regimental headquarters during combat. Fig. 20 shows the various parts into which this troop is divided. These sections are: Regimental headquarters and troop headquarters; a staff platoon, which is divided into a staff and orderly section; an intelligence section; a plans and training section; and a pioneer and demolition section. The duties of these sections are similar to the duties of the corresponding units in the Infantry headquarters company.

The service troop is the troop that furnishes food, supplies, and equipment for the regiment.

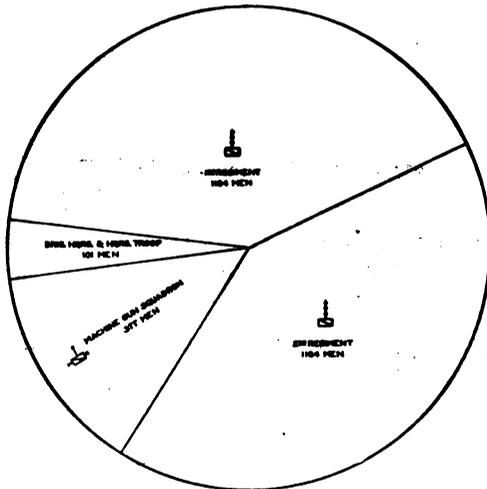
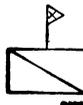


Fig. 10.—Cavalry brigade.

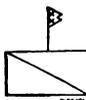


Two regiments plus a brigade headquarters troop and machine-gun squadron equal one brigade of about 2,800 men commanded by a brigadier general. (See Fig. 10. The symbol  will be

noted and will always mean a brigade of Cavalry.)

The machine-gun squadron, of about 400 men, is divided into three troops of about 100 men each. Each troop is further divided into three platoons of about 30 men and each platoon into two squads of 8 men and five pack horses.

Two Cavalry brigades plus one separate battalion of horse artillery and certain auxiliary organizations constitute a Cavalry division of about 7,500 men commanded by a major general. The auxiliary troops that, in addition to the Cavalry, make up the whole division of about 7,500 men, are: Engineers, Medical, special troops, and trains. These will be mentioned later. (See Fig. 11. The symbol

 will be noted and will always mean a division of Cavalry.)

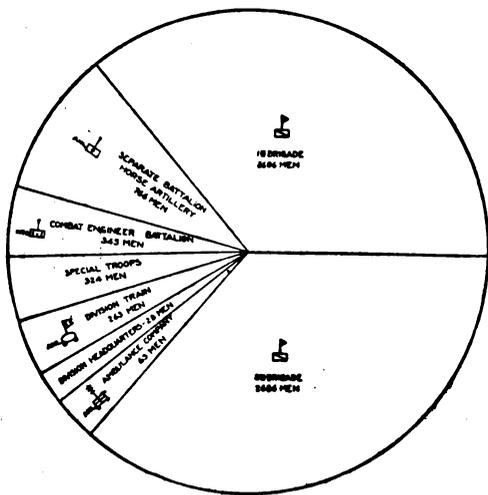
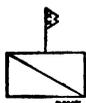
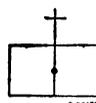


Fig. 11.—Cavalry division. 

FIELD ARTILLERY.

In the Field Artillery the smallest unit is the section which comprises from 15 to 21 men. Two sections form a platoon of about 35

men commanded by a lieutenant. The symbol  denotes a

Field Artillery platoon. Three platoons make up a battery of about 150 men commanded by a captain. (See Fig. 12. The symbol

 will be noted and will always mean an Artillery battery.

The difference between the symbol for Infantry, the symbol for Cavalry, and the symbol for Artillery will be noted.)

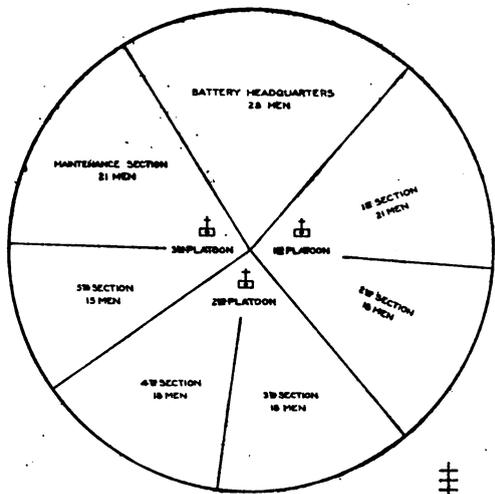


Fig. 12.—Field Artillery Battery.

The battery is a self-sustaining unit capable of replacing its losses in battle and corresponds to the Cavalry troop and Infantry rifle company.

The next larger unit is the battalion, which is composed of three batteries plus a headquarters battery, and is commanded by a

major. (See Fig 13. The symbol  will be noted and will

always mean an Artillery battalion.)

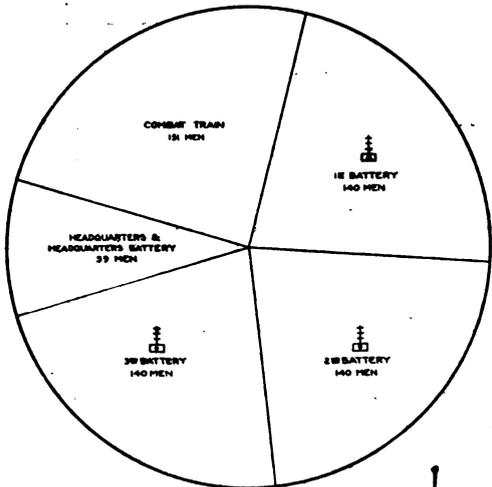
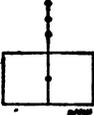


Fig. 13.—Field Artillery battalion.

The total number of men in an Artillery battalion is about 650 men as compared to about 850 men in an Infantry battalion and about 400 men in the corresponding cavalry unit (squadron).

The Artillery regiment of about 1,600 men is made up of two battalions plus a Headquarters battery and service battery. (See

Fig. 14. The symbol  will be noted and will always mean an Artillery regiment.)

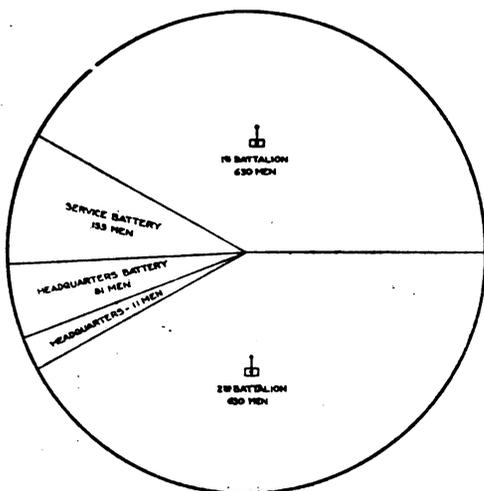
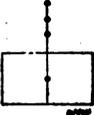


Fig. 14.—Field Artillery regiment. 

The service battery is the battery that furnishes food, supplies, and equipment for the regiment.

The headquarters battery furnishes the communications personnel for the regiment and has other personnel to perform particular duties at regimental headquarters. This battery is not divided up into various platoons as is done in the corresponding unit in the infantry and cavalry.

Two regiments plus a headquarters battery comprise a brigade of 3,400 men commanded by a brigadier general. (See Fig. 15. The

symbol  will be noted and will always mean a brigade of Artillery.)

The Field Artillery brigade is the largest artillery unit in an Infantry division. Its use is to help the basic arm (the Infantry), and occasionally it may be called upon to support other arms of the service, like the Engineers when they are building bridges or when used as Infantry troops, or as part of a Cavalry division.

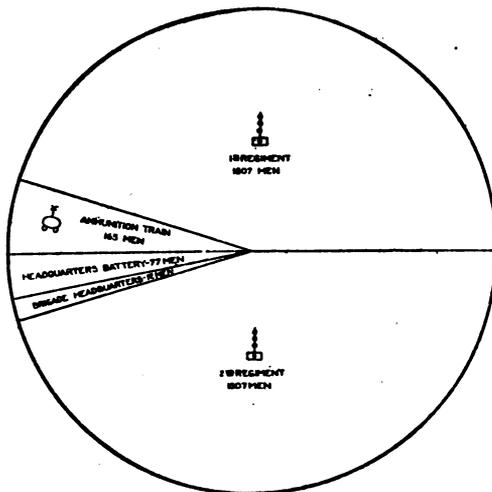
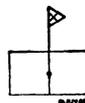


Fig. 15.—Field Artillery brigade.



SPECIAL TROOPS.

There are troops called special troops in the Infantry division to carry out particular duties, necessary to make the division as a whole function more smoothly. (See Fig. 16.) The symbols that designate the various companies will be noted. These special troops contain about 900 men and are divided into one headquarters company of 213 men, which does the administrative work and furnishes messengers for division headquarters; one signal company of 156 men, who furnish communications from division to brigades and such other units as require it; one light-tank company of 151 men, which is equipped with 25 light tanks and is used by the commanding general of the division whenever necessary to assist the Infantry's advance in the attack; one military police company of 155 men to regulate traffic and maintain discipline; one ordnance company of 112 men, to repair any ordnance equipment within the division; one service company of 102 men, to be used for general Quartermaster Corps duties, such as unloading and loading supplies.

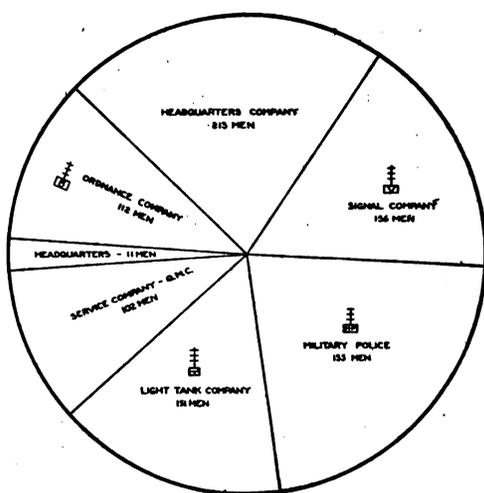


Fig. 16.—Special troops, Infantry division.

There are also troops in a Cavalry division called special troops. These special troops contain about 300 men and are divided into one headquarters troop of 161 men to do the clerical work and furnish messengers for division headquarters; one signal troop of 78 men, which furnishes communication from division to the brigade and looks after the signal supplies of the division; one ordnance company of 36 men to repair any ordnance equipment within the division; one veterinary company of 38 men to care for the horses.

TRAINS.

Another very important part of any division is the trains.

Each headquarters, each regiment, and each unit not part of a regiment has assigned to it a field train.

A field train is one which is employed to transport baggage, rations, and forage.

Each battalion and each unit not part of a battalion has either assigned or attached to it a combat train.

A combat train is one carrying reserve ammunition and special equipment required during combat, and in addition it includes rolling kitchens, water carts, and those vehicles required for the technical service of Engineers, Signal and Medical troops. Combat trains usually follow the units to which they pertain into action.

In addition to the field and combat trains as shown above, the Artillery brigade has an ammunition train and the division has a division train. The ammunition train is used to transport reserve

artillery ammunition for the Artillery brigade. The division train is used to transport reserve rations, grains, infantry ammunition, gasoline, and oil; the division train of an Infantry division includes motor and wagon transportation, while that of a Cavalry division includes pack and wagon transportation.

AUXILIARY TROOPS OF AN INFANTRY DIVISION.

The medical regiment of the division is divided into a hospital battalion, an ambulance battalion, a sanitary battalion, a veterinarian company, a medical supply section, and medical laboratory section. This fully equipped medical regiment takes care of the sick and wounded of the division.

The Air Service of the division might be called the eyes of the division. It can observe the movements of the enemy, locate dumps, carry messages between the various headquarters of the division, and in general help greatly in keeping all headquarters informed of enemy movements and to keep headquarters in touch with one another.

This Air Service squadron of about 200 men in an Infantry division is composed of one observation squadron, one photograph section, and one branch intelligence office.

The combat Engineer regiment of about 900 men in an Infantry division is composed of two battalions of three companies each. The Engineers are the bridge and road builders of the division.

COMMUNICATIONS.

One of the most important things within the division and probably the most difficult to maintain is the communication system. This communication system means the exchanging of messages and information between the various headquarters. Many different ways exist of enabling a headquarters to talk to or tell another headquarters something. A few of these means are telephone, telegraph, radio, messengers, airplane, pyrotechnics, and visual (signal lamps and flags).

To coordinate these methods of communication between headquarters and keep them working efficiently during combat is a tremendous task and only skilled operators can do it.

At the headquarters of all units message centers are located to handle the distribution of incoming and outgoing messages. The message center will have at hand nearly all the means of sending messages, so that in case one method or system is not working another system can be used.

In order to establish this large network of the various means of communications within the Infantry of a division a certain platoon at each headquarters has been provided. This platoon, called the communications platoon, is one of the platoons of the headquarters company, troop, or battery and is in command of the communications officer, usually a first lieutenant. This platoon furnishes all the installers, operators, and maintenance men necessary to furnish communications to all neighboring units.

COMMUNICATIONS PLATOONS, INFANTRY.

There is a communications platoon in the Infantry battalion, regiment, and brigade. This platoon is composed of the following sections:

- Wire section.
- Radio and panel section.
- Messenger section.
- Messenger center.
- Visual section.

Fig. 17 shows the relative sizes of the sections of the communications platoon of an Infantry regiment:

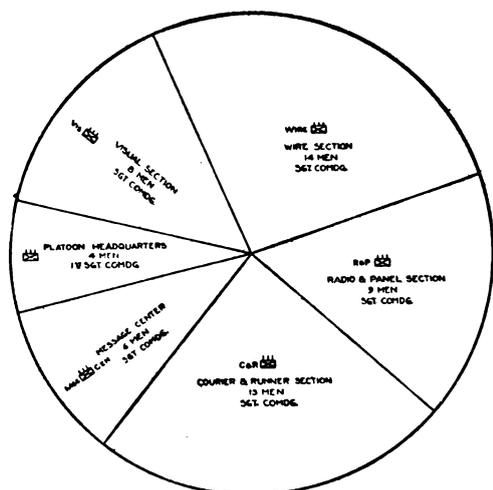
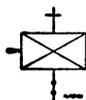


Fig. 17.—Communications platoon, Infantry regiment.



The message center, in general, receives, forwards, or delivers all official communications passing through its own headquarters.

The messenger section supplies the messengers, so that messages can be delivered by the message center promptly. The radio and

TELEPHONE SWITCHBOARD OPERATOR.

panel section operates the radio sets and also the panels by which messages are sent to airplanes. The visual section operates the signal-lamps and signal flags.

The communications platoons of the Infantry battalion and Infantry brigade are similar, except the number of men in the various sections is different.

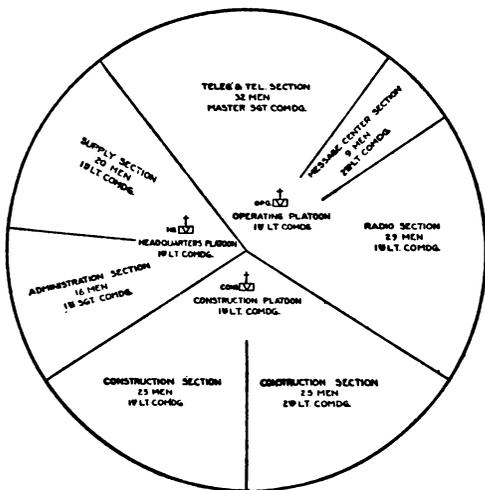
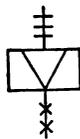


Fig. 18.—Division signal company.



These sections must work smoothly together to insure perfect communication. A headquarters without good communications is like a deaf and dumb man.

The Infantry division has at its headquarters a signal company, which establishes and maintains communications forward to the brigades and such other units as require it. This signal company is a company of the Signal Corps. (Fig. 18 shows the signal company of an Infantry division.)

Fig. 19 shows the headquarters company of an Infantry regiment. The five sections into which the communications platoon is divided are shown in Fig. 17. The duties of the platoons of this company are discussed under Figure 4.

These parts into which a communications platoon is divided, as given above, are the same throughout the Infantry, but differ slightly for the Cavalry. The Field Artillery has not divided its headquarters

battery into platoons or communications sections, but possesses in this battery sufficient personnel to perform the necessary communications work.

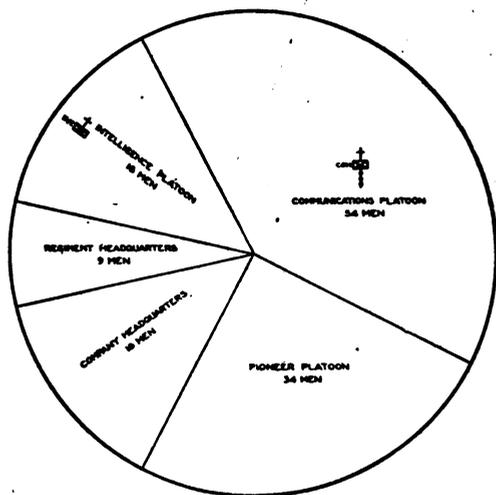
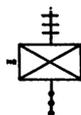


Fig. 19.—Headquarters company, Infantry regiment.



COMMUNICATIONS PLATOONS, CAVALRY.

There is a communications platoon in the Cavalry squadron, regiment, and brigade. This platoon is divided into three sections instead of five sections, as in the Infantry. These three sections are: A wire section, a message center section, and a radio section. Figure 20 shows the headquarters troop of a Cavalry regiment and its communications platoon. The duties of these communications sections are the same as the duties of the corresponding Infantry sections.

The communications platoons of the Cavalry regiment and Cavalry brigade are similar, except that the number of men in the various sections is different.

The Cavalry division has at its headquarters a signal troop, which establishes and maintains communications forward to the brigades and such other units as require it. This signal troop is a unit of the Signal Corps. Fig. 21 shows the signal troop of a Cavalry division. The other sections of this troop are discussed under Fig. 9.

TELEPHONE SWITCHBOARD OPERATOR.

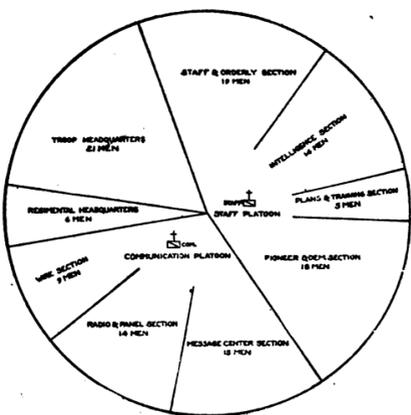


Fig. 20.—Headquarters and headquarters troop, Cavalry regiment. 

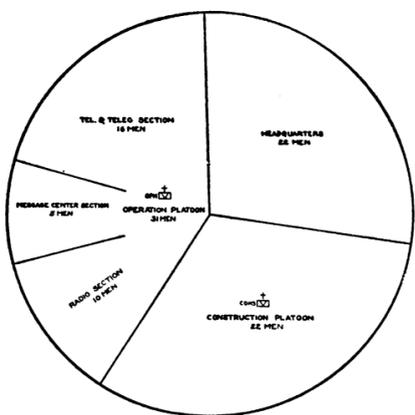
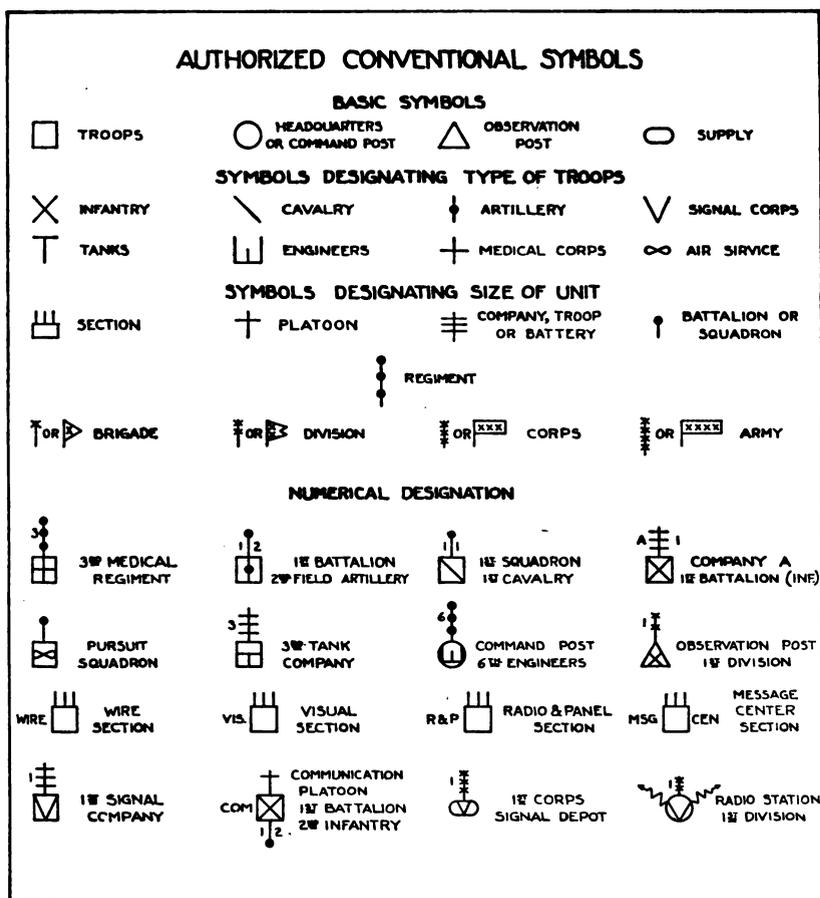


Fig. 21.—Signal Troop, Cavalry division. 

CONVENTIONAL SYMBOLS.

Often it is necessary for some officer to draw a map and mark on it the location of the various headquarters. Since there are so many different kinds of troops within a division, if it were necessary to write out the name of each unit the map, if small, would soon be



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Fig. 22.—Authorized conventional symbols.

unreadable. Therefore symbols have been adopted to be used instead of names. These symbols are called conventional signs and Fig. 22 shows the most important symbols.

COMMANDING OFFICERS.

In order for a large body of soldiers to be fed, clothed, trained, and directed in combat, they have leaders called *commanding officers*. Just as there are various sizes of units, so there are officers of different

rank who command these units. The rank of the several officers who command the various units is shown below:

| Unit. | Title. |
|-------------------------------|------------------------------|
| Platoon..... | Lieutenant. |
| Battery troop or company..... | Captain. |
| Battalion squadron..... | Lieutenant colonel or major. |
| Regiment..... | Colonel. |
| Brigade..... | Brigadier general. |
| Division..... | Major general. |

The officers commanding units from a battalion up have officers as assistants to help them. These officers make up what is called the *staff* of the organization commander, and are designated according to the duties they perform in the different units.

The division commander has a staff composed of a chief of staff, "C. of S.," who in smaller units is called the "executive officer"; an assistant chief of staff for personnel, who is called in the case of a division "G - 1"; an assistant chief of staff for intelligence, who is called "G - 2"; an assistant chief of staff for operations and training, who is called "G - 3"; and an assistant chief of staff for supply, who is called "G - 4." The executive officer is abbreviated and spoken of as "Ex."

The division is the only organization that has been discussed, but there are higher units, in which the division is only a smaller part. These higher units are Army Corps and Armies. These units have headquarters, at which message centers and other agencies for transmitting messages are maintained, that function exactly like those within the division, but because of more message traffic have a larger personnel.

In Fig. 1 can be found all the various parts into which the United States Army is divided. The Infantry, Cavalry, Field Artillery, Air Service, Engineers, Signal, Medical, and Ordnance troops have been mentioned. Other branches are the Coast Artillery, which guards our coasts with long-range guns; the General Staff Corps, which carries out the policies directed by the War Department; The Adjutant General's Department, which carries out the administrative work of the Army; the Inspector General's Department, which has the task to discover errors and recommend improvements in the functioning of the Army; the Judge Advocate General's Department, which takes care of the problems in law that arise; the Quartermaster Corps, which furnishes food, clothing, and shelter to the Army; the Finance Department, which handles the finances of the Army; the Chemical Warfare Service, which takes care of all matters that pertain to poisonous gases; and the chaplain, who takes care of all matters pertaining to religion.

TELEPHONE CENTRALS.

1. The most vital part of a telephone system is the telephone switchboard. Great care should be exercised in its location, operation, and maintenance. A switchboard is established at important junctions of wire lines and at each headquarters where two or more local telephones are installed.

2. A switchboard serves the following purposes:

- a. To afford local telephone subscribers a means of inter-communication and to afford these local telephone subscribers access to trunk lines leading from their own centrals to other centrals.
- b. To furnish a place from which lines and telephones can be tested and repair parties sent out.
- c. To afford a switching central at important junctions of wire lines.

3. The location for the telephone switchboard must be carefully chosen. It should be protected from shell fire and dampness and should be out of the way of traffic and noise as much as possible. Privacy is required to enable switchboard operators to concentrate their attention upon their work. As far as possible the switchboard should be centrally located with regard to its local subscribers.

4. The wire section is in charge of installing, operating, and maintaining the telephone system. The operating detail of the wire section is in charge of installing and operating the telephone switchboard and installing the telephones under the immediate direction of the chief operator.

5. In units below a division the monocord switchboard is used on account of its simplicity, lightness, ruggedness, and the ease with which it can be installed. It may be hung on a tree, on a fence, on a stake, or any place wherever it is necessary to install a switchboard and it is ready to operate immediately.

6. When monocord switchboards were first used in the field they were used without any cable, terminal strip, or other devices. The line wires were simply brought in to the switchboard and attached directly to the terminals.

7. During the World War it was found that where lines entered in the above manner there was a jumble and mess of wires around the switchboard. Consequently anyone approaching or passing in that vicinity might stumble over the wires and often jerk them out of the switchboard terminals, thereby interrupting the service.

8. To correct the above conditions it was decided that it would be advisable to attach one end of a cable about 10 feet or more in length

to the switchboard and the other end to a terminal strip; this cable and terminal strip to remain a part of and always attached to the switchboard. Therefore whenever a switchboard is installed the terminal strip with cable attached is put up near by on a tree, board, fence, or other object and the line wires brought into another terminal strip located to the right of and about 14 inches away from the cable terminal strip, the circuits being jumpered across by means of short lengths of wire.

9. Where the switchboard is located in a building, room, or dugout, the terminal strip with the cable attached is installed in a protected location outside the building.

10. Where the switchboard is installed in the open, the cable terminal strip is installed at the point where the line circuits come together, so that no tangled jumble of lines interfere with movements of personnel around the headquarters and the switchboard. If the cable is not long enough to provide for this, the line circuits are cabled to the point where they separate. Line circuits will always be neatly arranged wherever there is traffic around them.

11. By using the method described above, the switchboard has no loose wires around it, there is less chance of interruption of service, and the installation becomes much neater in every way.

Questions.

(1) *What are the points to be taken into consideration when deciding on where a switchboard is to be placed? (Pars. 1, 2, 3, and 5.)*

(2) (a) *Under what circumstances should the monocord type of switchboard be used?*

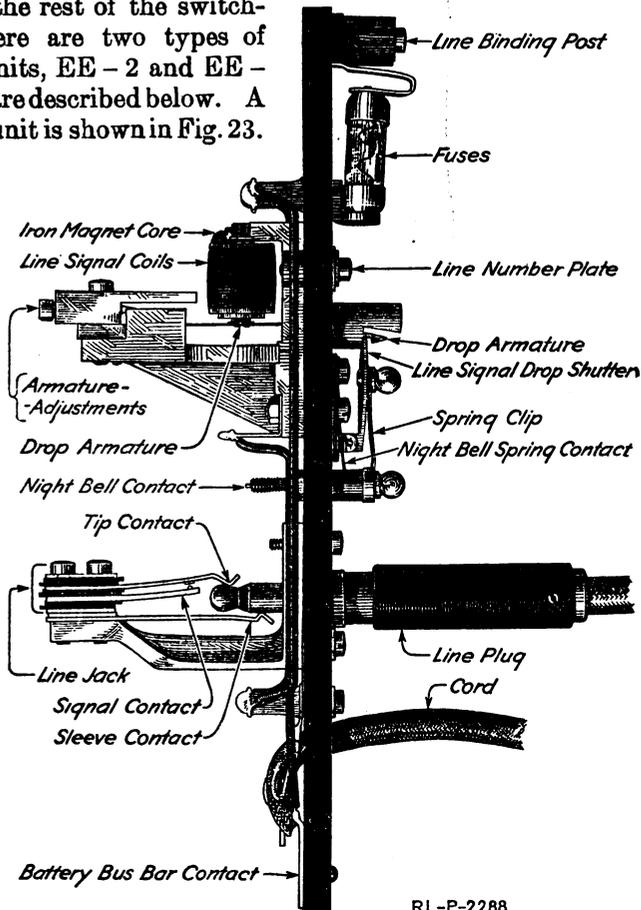
(b) *What are its particularly good points? (Par. 5.)*

(3) *Why is it worth while, especially in the field, to take the extra time and trouble to include a cable and terminal strip with the switchboard equipment? (Pars. 7 and 8.)*

(4) *What consideration should govern the choice of a location for the terminal strip? (Pars. 8, 9, and 10.)*

INSTALLATION AND OPERATION OF MONOCORD SWITCH-BOARDS.

1. Telephone intercommunication between Army units is frequently such that a temporary, quickly installed, and flexible type of small telephone central is essential. The switchboard which has been designed to meet this requirement is called the monocord switchboard. Monocord switchboards are made up to accommodate 4, 8, and 12 lines. They are small, light, and readily portable. Two of these switchboards may be installed at one central in such a way as to make one switchboard if it is necessary to accommodate more lines than can be handled by one board. Monocord switchboards are made up of units, there being a unit for each line. These units are easily removable, and if defective can be replaced by another unit without disturbing the rest of the switchboard. There are two types of monocord units, EE - 2 and EE - 2-A, which are described below. A type EE - 2 unit is shown in Fig. 23.

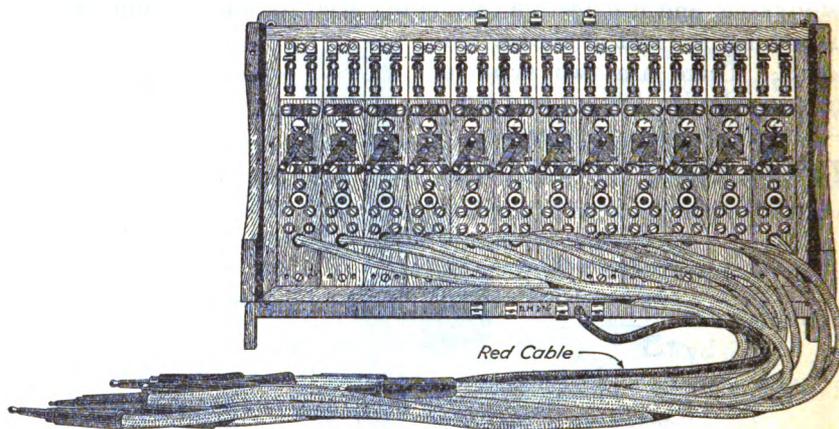


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Fig. 23.—Monocord switchboard unit, type EE - 2.

MONOCORD SWITCHBOARDS OF TYPE EE - 2 UNITS.

2. The monocord switchboard is made up of unit panels, on each of which is mounted all the apparatus necessary for one telephone line. These panels are made of insulating material and are mounted in special wooden frames in groups of 4, 8, or 12 units, thus making a 4, or 12 line switchboard. Each unit is removable from the frame, thereby lending flexibility to the board and facilitating repair and replacement. Generally this type of board is used only for a small number of lines, as the operating facilities do not permit speedy connections. It is good practice to use only 3 lines on a 4-unit board and 11 lines on a 12-unit board in order to have a spare unit immediately available.



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Fig. 24.—Twelve-line monocord switchboard of type EE - 2 units.

A 12-unit board is shown in Fig. 24 and a 4-unit board in Fig. 25. The circuit diagram for one of the units in this switchboard is shown in Fig. 26. The red cord coming from the bottom of the switchboard is the operator's cord. The complete board weighs 17½ pounds.

3. The switchboard frame is made of hardwood, varnished in order to make it moisture proof. Its function is to hold the various units together and to protect them from dust and mechanical injury. In back of the frame there are three horizontal brass bars extending the width of the board. In addition to providing a mechanical support for the various units the top bar serves as a common ground connection and the middle and bottom bars as common night bell and battery connections for all units.

4. Carrying cases made of fiber and provided with hand straps are furnished with monocord switchboards to provide a convenient means of carrying them and to protect them from damage during transportation. These cases are so made that they will hold not only the frame with assembled units but also the switchboard cords. When transporting the monocord switchboard the cable with terminal

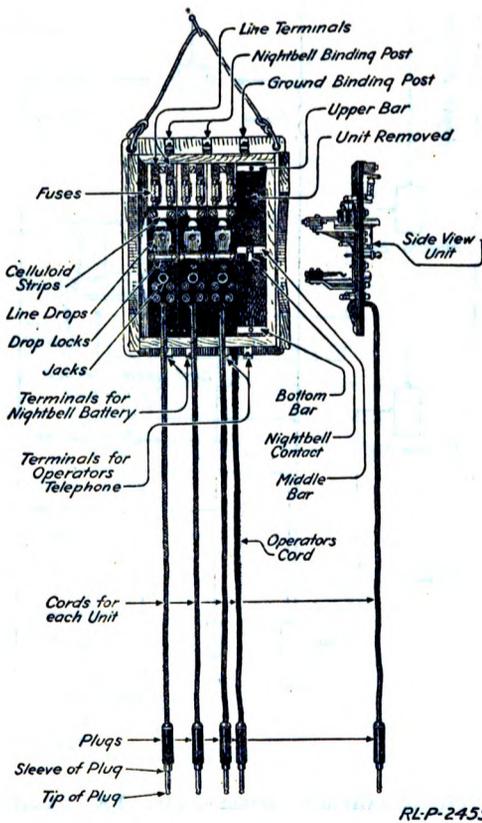


Fig. 25.—Four-line monocord switchboard of type EE - 2 units.

strip attached is left fastened to the switchboard. It is wrapped around the outside of the fiber case and securely tied.

5. In installing a switchboard, it should be hung from a suitable support in a dry place. The bottom of the switchboard should be securely fastened so that the plugs can be easily removed without disturbing the position of the switchboard or shaking down the drops. The line wires should be run direct to the line terminal strip, jumpered to the cable terminal strip, and extended to the switchboard units through a cable.

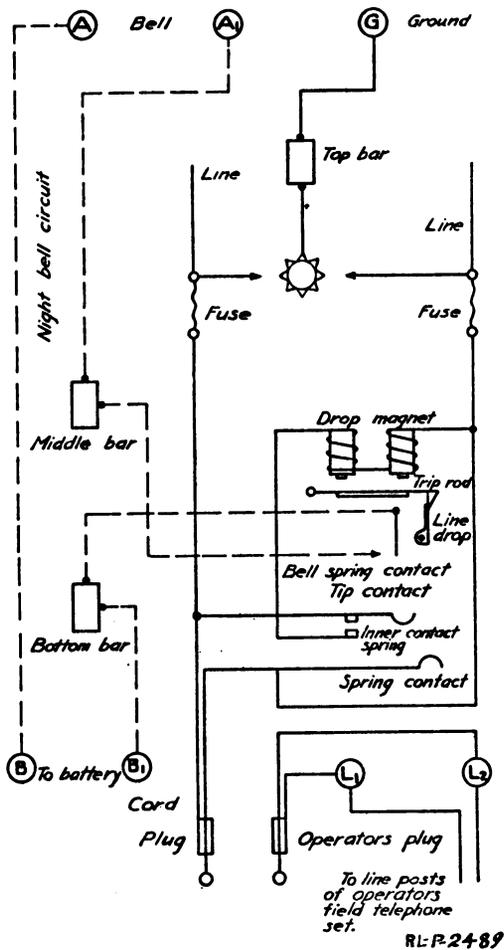


Fig. 26.—Circuit diagram of a type EE - 2 unit.

INSTALLATION OF MONOCORD SWITCHBOARD, TYPE BD - 9 OF TYPE EE - 2 UNITS, WITH CAMP TELEPHONE AS OPERATOR'S SET.

6. Any material needed at the central, not a part of the monocord switchboard as described in this Information Topic, is called the operator's equipment. This material consists of any complete local battery telephone set, night bell with its battery and wire for connections.

7. The night bell is connected by independent wires to the upper clips marked A and A₁. A good ground should be made and con-

connected to the upper clip marked G. The night-bell battery, consisting of two dry cells in series, is connected to the lower clips marked B and B₁. The line terminals L₁ and L₂ of the camp telephone are connected to the two lower clips marked L₁ and L₂ on the switchboard. The circuit diagram of the camp telephone is shown in Fig. 27.

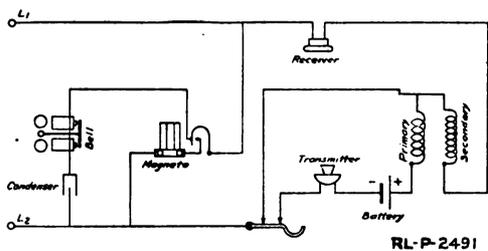


Fig. 27.—Circuit diagram of the camp-type telephone, type EE - 4.

The EE - 5 telephone, commonly known as the Field Artillery telephone, may also be used as an operator's set for the monocord switchboard. The connections are the same as described above. The circuit diagram of this telephone is shown in Fig. 28.

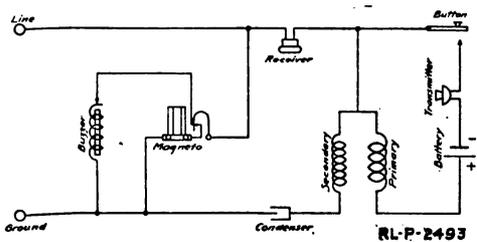


Fig. 28.—Circuit diagram of the Field Artillery telephone, type EE - 5.

8. If it is desired to use two or more monocord switchboards at one central, they may be connected so as to use only one night bell, one battery, one ground, and one operator's telephone for the whole installation. This is done by connecting the corresponding clips of each switchboard as shown in Fig. 29.

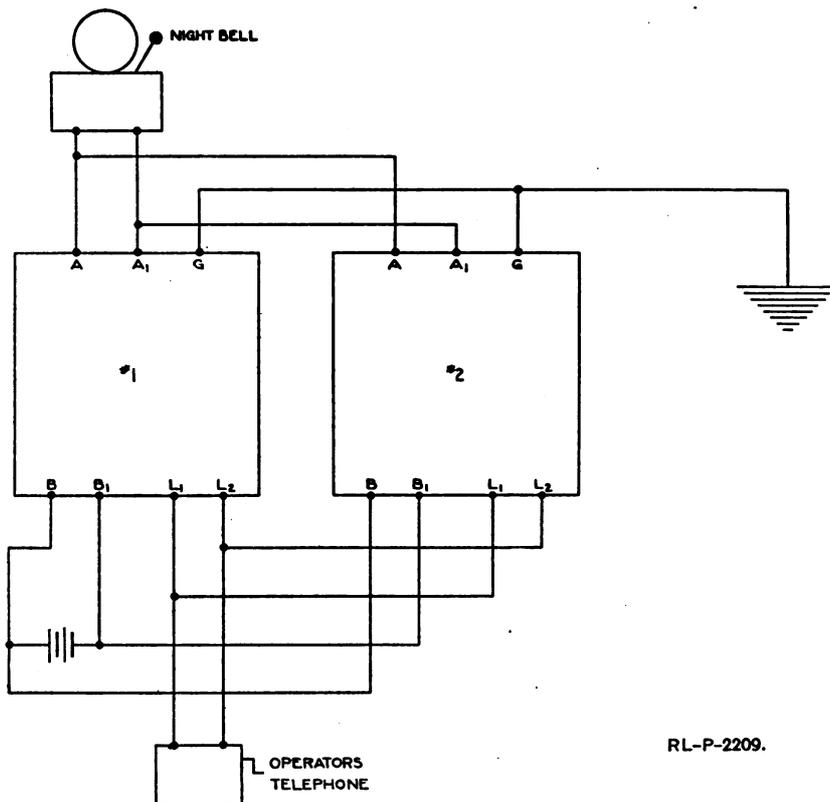


Fig. 29.—Diagram of the connections between two monocord switchboards of type EE - 2 units installed as a single unit.

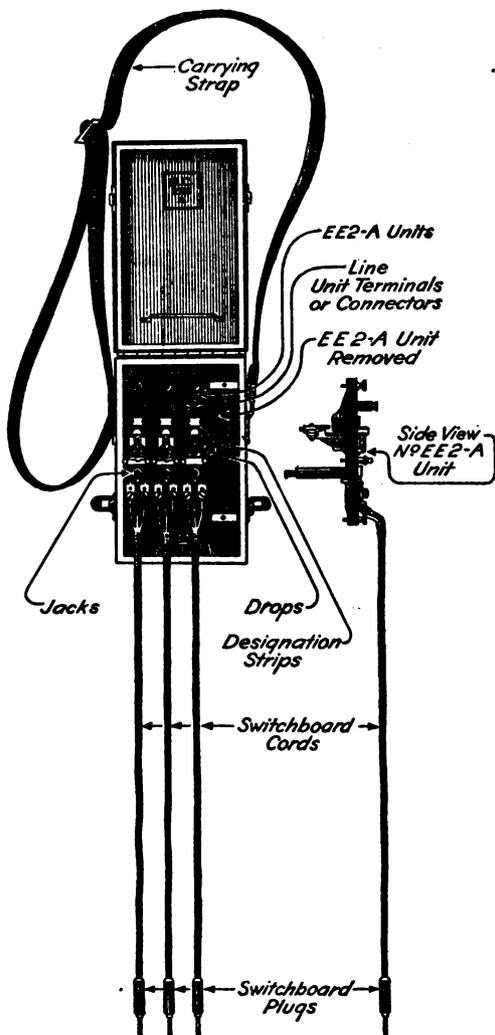
MONOCORD SWITCHBOARDS OF TYPE EE - 2-A UNITS.

9. In monocord switchboards of type EE - 2-A units each unit is mounted so as to be removable without the use of any tools. A hinge cover with a carrying strap has been added to the containing case so that it can be closed for transportation. No outside carrying case therefore is necessary. Only two horizontal brass bars are used, one at the top and one at the bottom. There is no operator's cord attached to this switchboard. There are no fuses, lightning arresters, or ground connections provided.

10. Monocord switchboards of type EE - 2-A units are made in the 4-line and 12-line sizes. The 4-line switchboard weighs 9 pounds, and its dimensions are $10\frac{1}{2}$ by $5\frac{1}{2}$ by $6\frac{1}{2}$ inches. The 12-line switchboard weighs 22 pounds, and its dimensions are $17\frac{1}{2}$ by $10\frac{1}{2}$ by $5\frac{1}{2}$ inches. A 4-unit switchboard of type EE - 2-A units is shown in

Fig. 30. The circuit diagram for one of the units of this switchboard is shown in Fig. 31.

11. The monocord switchboard unit of type EE-2-A is a development of the type EE-2 unit. There are no fuses nor arresters in



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Fig. 30.—Four-line monocord switchboard of type EE-2-A units.

the new design. Stock clips are replaced by spring type binding posts. Knurled-head screws are used to fasten the units in place in the switchboard, so that no tool is required to replace one unit with another. The cord terminals are on the front of the unit, so that it

TELEPHONE SWITCHBOARD OPERATOR.

is not necessary to remove a unit from its board to replace a defective cord. The line drop signal with its locking spring is not changed, but changes have been made in the connection of the night-bell contact, in the jack and plug, and in the circuits. Fig. 30 shows a view of the switchboard of type EE - 2-A units. The type EE - 2 units and the type EE - 2-A units are not interchangeable.

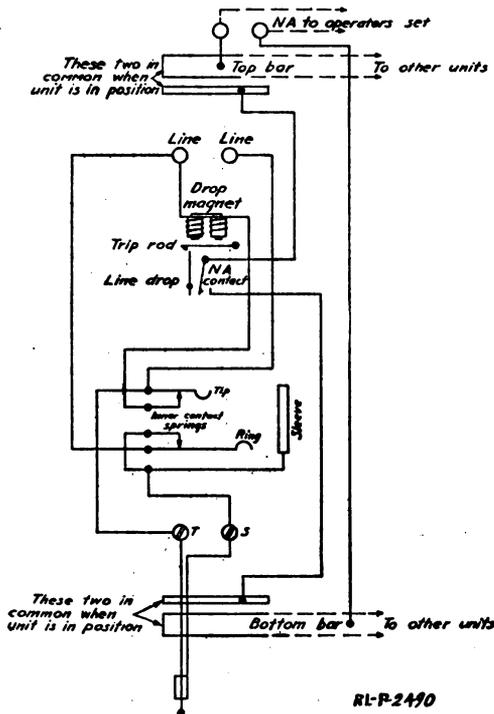
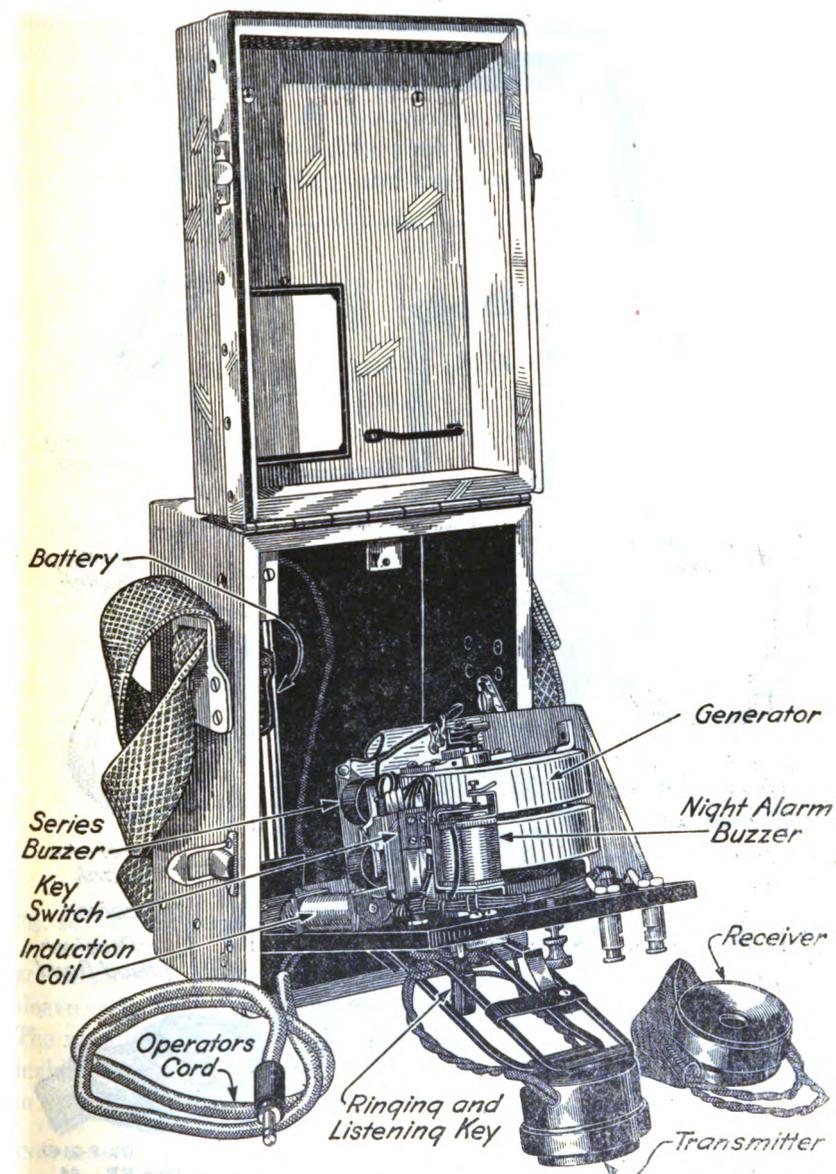


Fig. 31.—Circuit diagram of a type EE - 2-A unit.

MONOCORD-SWITCHBOARD OPERATOR'S SET, TYPE EE - 64.

12. The monocord-switchboard operator's set contains all the auxiliary apparatus necessary at a telephone central employing a monocord switchboard. This apparatus is all mounted in one container which has a cover and a carrying strap. It consists of a telephone receiver, transmitter, induction coil, hand generator, series buzzer, night-alarm buzzer, two type BA-1 batteries, the necessary switches, and connecting cord and plug. The series buzzer is similar in action to a polarized bell. The night-alarm buzzer is a loud-sounding buzzer of approximately 4 ohms resistance. The set weighs 15 pounds, and its dimensions are 6 by 7½ by 10 inches. Views of the set are shown in Figs. 32 and 33. The circuit diagram is shown in Fig. 34.

13. In Fig. 32 the induction coil is in the foreground. Immediately behind the induction coil from left to right are the series



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Fig. 32.—View of the interior of a monocord switchboard operator's set, type EE - 64.

buzzer, the key switches, and the night-alarm buzzer. The two-bar magneto-generator with its automatic contact mechanism lies to the

rear of the apparatus. The BA-1 batteries with their clips are not visible.

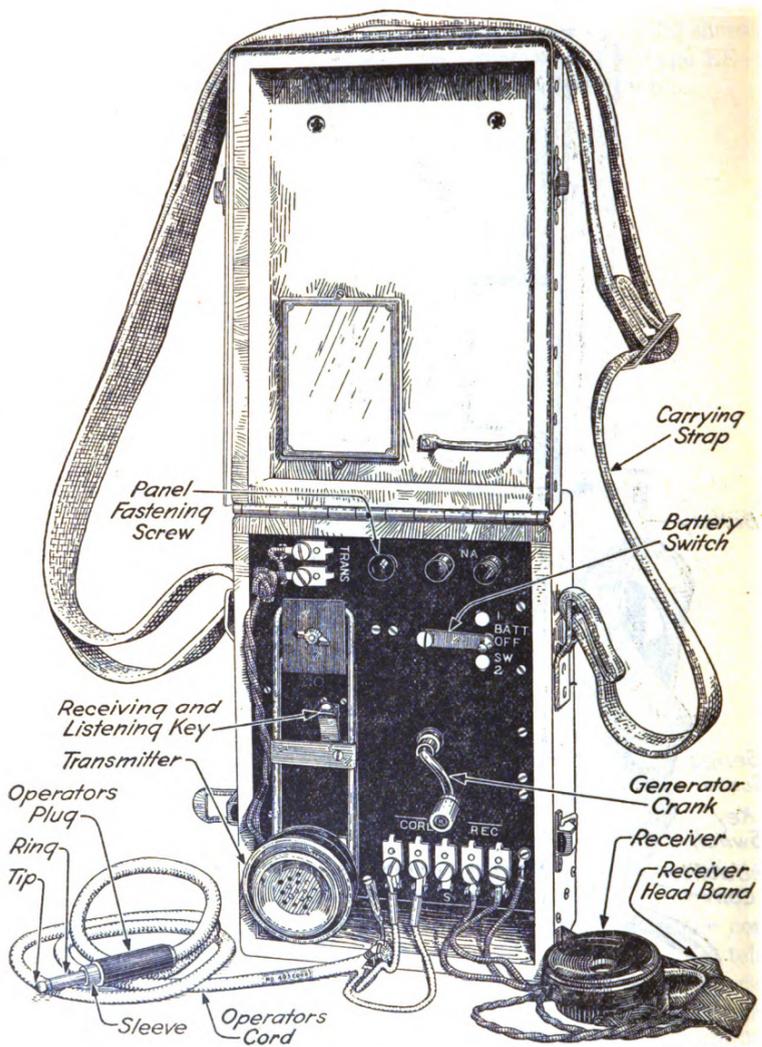
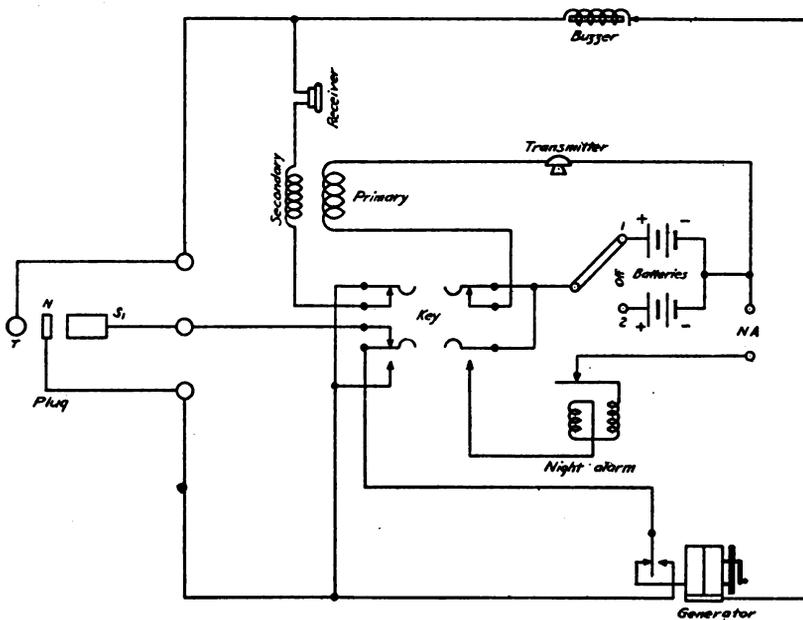


Fig. 33.—Front view of a monocord switchboard operator's set, type EE - 64.

14. Fig. 33 shows the exterior of the set and Fig. 34 shows the circuit diagram of the set. The binding posts marked NA are the terminals of the night-alarm circuit. The knob to the left of these is

a screw for fastening the panel in its closed position. The transmitter is mounted on a movable arm which is so arranged that the transmitter is always held in the correct vertical position for good operation. The ringing and listening key is just below the mounting of the transmitter. A metal projection on the transmitter arm is arranged so that when the transmitter is put down for transportation, the key is pushed up. In this position of the key the battery circuit is disconnected. The binding posts at the bottom of the panel are for the cord, with its plug, and the receiver. The three to the left



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Fig. 34.—Circuit diagram of a monocord switchboard operator's set, type EE - 64.

are marked T, R, and S and are the terminals of the tip, ring, and sleeve, respectively, of the cord and plug, which has three contacts. The watchcase receiver has a band to extend around the head, thus making it unnecessary to support the receiver with the hand while in use.

INSTALLATION AND OPERATION OF MONOCORD SWITCHBOARDS OF TYPE EE - 2 UNITS, USING THE OPERATOR'S SET.

15. The general directions given in Par. 5 should be followed. The operator's sets are wired for use with the new unit, and a few changes must be made in the sets when they are to be used with the

TELEPHONE SWITCHBOARD OPERATOR.

type EE - 2 unit switchboard. The ring and sleeve terminals, R and S, at the bottom of the panel must be electrically connected by a short length of wire. The tip terminal T must be electrically connected to the line terminal L₁ of the switchboard, and the sleeve terminal S connected to the line terminal L₂ of the switchboard. Any flexible wire may be used. The night-alarm terminals NA on the operator's set are connected by suitable wires to the night-alarm clips of the switchboard, A and A₁ and the B and B₁ terminals are connected together. The operator upon receiving a call will not use the plug on the operator's set, but answers with the operator's cord on the switchboard. This set may also be used with a type EE - 2 unit switchboard as follows: The operator's cord on the set must be removed and replaced by a two-conductor cord similar to the operator's cord on the switchboard of type EE - 2 units. The two conductors of the cord are connected to the T and R terminals of the operator's set and the R and S terminals of the operator's set are connected together. When this change has been made, the operator upon receiving a call will answer with the plug on the operator's set; the operator's cord on the switchboard is not in use.

16. The method of operating, after either of the changes have been made, is practically the same as when using a camp telephone as operator's set. After receiving the number desired the operator removes the plug from the calling line, inserts it in the jack of the called line, throws the ringing and listening key of the operator's set to the lower nonlocking position, and rings with the hand generator of the operator's set. Having received an answer from the called party, connections are made by inserting the plug of the called line into the jack of the calling line. On ascertaining that the two parties are conversing the operator's plug may then be removed.

INSTALLATION AND OPERATION OF MONOCORD SWITCHBOARDS OF
TYPE EE - 2-A UNITS, NOT USING THE OPERATOR'S SET.

17. The general directions given in Par. 5 should be followed. It is necessary to provide operator's equipment consisting of a small vibrating bell or buzzer, one or two standard dry cells, an additional cord and plug, and a complete magneto-telephone. The plug and cord may be taken from a unit not in use if there are no extra ones on hand. The bell and dry cells are connected in series with the terminals on the switchboard marked NA. The terminals of the cord are connected to the terminals of the operator's telephone. The tip is connected to one terminal and the ring and sleeve to the other terminal. The method of operating is identical with that used with the type EE - 2 unit switchboard.

**INSTALLATION AND OPERATION OF MONOCORD SWITCHBOARDS OF
TYPE EE - 2-A UNITS, USING THE OPERATOR'S SET.**

18. The general directions given in Par. 5 should be followed. The only necessary connection to be made is to connect by suitable wires each of the terminals of the operator's set marked NA to the corresponding terminals on the switchboard also marked NA. Proper outside line protection should be used when necessary.

19. When the calling party turns the crank of his magneto, the current passes through the line drop and the drop falls. The operator inserts the plug of his set in the jack of the calling line and ascertains the party desired. The key is in the normal (center) position. The operator, upon ascertaining the party desired, inserts the plug of the calling line into the jack of the called line and turns his generator crank. The series buzzer should sound. If it does not, the circuit is broken either on the line to the called party or in the apparatus of the central. If necessary, the operator may ring the calling party. To do this, he throws the key to the lower position and turns the generator crank. When connections have been established, the operator removes his plug.

20. When it is desired to use the night alarm, the key of the operator's set is thrown to the upper position. This breaks the circuit of the battery through the telephone transmitter and connects the battery to the top and lower brass bars of the switchboard through the night-alarm buzzer. The falling of any shutter on the switchboard closes the circuit from the top to the lower brass bar of the unit and the night-alarm buzzer sounds. When summoned by the night alarm, the operator must throw the key to the center position before answering the call.

CARE OF MONOCORD SWITCHBOARD OF TYPE EE - 2 UNITS.

21. Care must be exercised when a board is installed to make sure that the frame is in a vertical and level position. When assembled at the factory, all adjustments are made with the board in a vertical position, and all operations conducive to satisfactory service depend on this prerequisite being observed.

22. The line signals of monocord switchboards are of the gravity type and require careful adjustment. Any adjustment further than that done at the factory should be made by an expert who is thoroughly familiar with this work. During transportation and installation of the board the line-drop shutters should be held closed by the flat spring provided.

23. The burning out of a fuse when excessive current comes in on a line is detected by an open circuit on that line. A bad fuse

generally shows up plainly against the white background on the panel. However, if it is not possible to see whether or not the fuse is burned out, the line may be short-circuited momentarily by means of a piece of bare copper wire placed across the two line terminals. The operator's plug is then inserted in the jack of the unit under test and the magneto crank turned. If the fuse is burned out, the crank will turn over easily; if not, it will turn hard, indicating that the open circuit is elsewhere on the line. A burned-out fuse should be replaced immediately in order to keep all lines working. Several spare fuses should be kept on hand at all times, but in case no fuse is available a strand of small copper wire may be connected between the upper and lower fuse clips. To remove a fuse, take the bottom metal cap of the fuse between the thumb and finger and push upward against the spring holder on the line terminal block, at the same time pulling outward. To install a fuse, hold it in the same manner and put the upper end of the fuse in the upper spring contact, forcing it upward until the bottom end will slip into place.

24. Care should be taken to keep the small air gap between the toothed lightning arrester and the line terminals clean. If this precaution is not taken, and the air gap is allowed to clog up with dust and dirt, it will introduce a leak to ground or between wires with resulting poor transmission.

25. All mounting screws and all wire connections should be kept tight. Whenever a unit is damaged, it should be replaced by another one, the damaged unit being sent for repair. To remove a unit from the frame, it is only necessary to disconnect the line terminals and remove the top and bottom screws which engage the brass bars behind the board.

26. In handling the switchboard cords they should be grasped by the plug, not by the cord. The connection of the wires to the tip and sleeve of a plug will break if subjected to undue strain or abuse, and by taking hold of the plug when inserting it and pulling it out, the likelihood of breaking the internal connections and wearing out the wires will be reduced to a minimum.

CARE AND ADJUSTMENT OF MONOCORD SWITCHBOARDS OF TYPE EE-2-A, UNITS AND OF MONOCORD-SWITCHBOARD OPERATOR'S SET.

27. Many parts of the discussion of the care and adjustment of Type EE-2 units in Pars. 21 to 26 are applicable, and these paragraphs should be read in this connection. Care should be taken to see that the operator's sets are equipped with fresh batteries at all times. If the set is packed for any length of time, both batteries should be removed, as local action very often sets up in these cells. This is liable to corrode the terminals and possibly other parts of the instrument.

28. Periodical tests should be made to ascertain if the operator's set is in proper working order. If it is found that the conversation cuts off from time to time, it may be due to a broken operator's cord which can be tested by means of short circuiting the end of the plug, listening in the receiver, shaking the cord, and if it is a swinging "open" a grating noise will be heard. The receiver cord may be tested by disconnecting the cord and receiver from the set and connecting the cord terminals to a cell and shaking the cord throughout its length. If the receiver cord is partially broken, there will be a grating noise in the receiver. If the receiver cord is entirely broken, there will be no click in the receiver when the connection of cord and battery is made or broken. The transmitter circuit may be tested by short circuiting the T and R cord terminals and tapping lightly on the transmitter. This will be distinctly heard in the receiver if the talking circuit and battery are in good condition. The night alarm may be tested by short-circuiting the binding post marked NA and throwing the switch to the upper or locking position. This should cause the buzzer to operate. The generator circuit may be tested by short circuiting the R and S cord terminals, leaving the key in the center position. If the generator circuit is in proper position, turning the generator crank should cause the series buzzer to respond, and it can also be heard in the receiver.

29. When packing the operator's set for storage or transfer, the batteries should be removed, the transmitter should be folded down against the front of the switchboard, the battery switch should be turned to the off position, the operator's cord and receiver should be stored in the lower compartment of the case, and the case closed and locked.

Questions.

(1) *What are the more important advantages of a monocord switchboard, type EE-2-A units over one with type EE-2 units? (Pars. 9 and 11.)*

(2) *What are the principal items included in the monocord-switchboard operator's set? (Par. 12.)*

(3) *What special care should be taken of the drop shutters both when installing the board and when transporting it to a new position? (Pars. 21-22.)*

(4) *How are the fuses tested? (Par. 23.)*

(5) *How is a bad fuse replaced? (Par. 23.)*

(6) *What should be done if there are no spare fuses available? (Par. 23.)*

(7) *Why is it important to keep the air gap between the lightning arrester and the terminals clean? (Par. 24.)*

(8) *What should be done in case one unit only is damaged? (Par. 25.)*

(9) *What special care should be taken in handling the switchboard cords? Why? (Par. 26.)*

(10) *How is the operator's set tested to see if it is in good working order? (Par. 28.)*

(11) *Just how should the operator's set be packed for storage or transportation? (Par. 29.)*

(12) *If a number of switchboards and operator's sets were being issued for field work, just what points should be specially examined and in what order?*

TELEPHONE NETS.

1. One telephone central alone would simply give service between local subscribers; that is, officers around the same headquarters. Therefore a telephone central is merely one part of a whole telephone system. At each headquarters there is a central with trunk lines connecting to other centrals, and local lines extending to various officers at that headquarters. This enables any local subscriber to call any other subscriber in the telephone net. Fig. 35 illustrates what an Infantry brigade telephone net might be during a battle. The circles indicate centrals and the dots indicate local telephones. Trunk lines are the lines between centrals, and local lines are the lines from a central to local telephones.

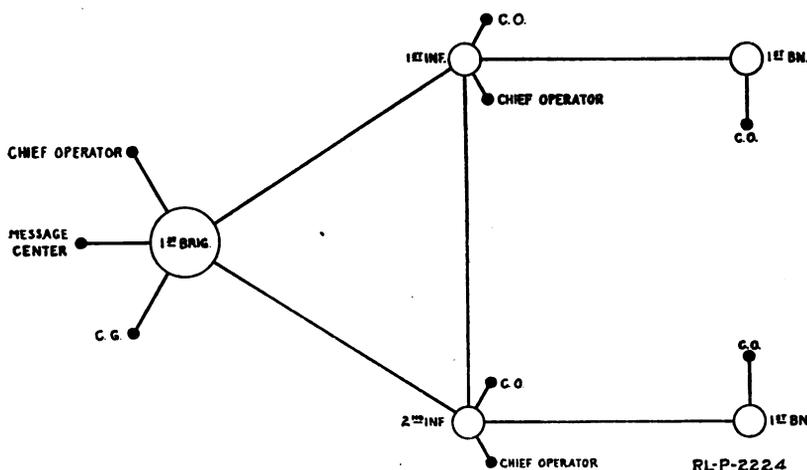


Fig. 35.—Diagram of an Infantry brigade telephone net.

2. The operating section installs the switchboard at a central and also installs such local telephones as are necessary at that headquarters. Monocord switchboards are used at all centrals below division headquarters; at a brigade headquarters a 12-line monocord switchboard is usually installed; at a regimental headquarters a 12-line monocord switchboard is also usually used; at a battalion headquarters a 4-line monocord switchboard is used. All units must have additional switchboards to use when advancing in order that the continuity of telephone service can be maintained. The installation of a monocord switchboard is prescribed under Unit Operations.

3. The chief operator's telephone is for the use of the switchboard chief operator, or any other member of the communication personnel; it is used as an information and service telephone so that the operator's

telephone or operator's set will not have to be used for service matters. The chief lineman will also use this telephone when issuing orders or instructions to his linemen. This telephone should be located far enough from the switchboard so that in giving orders to and directing linemen the use of this telephone does not interfere with the switchboard operator.

4. The installation of local telephones consists of running a properly protected line from the central to wherever the subscriber is located and attaching a telephone to the end of the line.

5. *a.* The priority in which telephones are installed at a command post varies with the situation and with the orders of the commander. The message center is the first office connected by telephone. Other telephones are installed normally in the following order of priority:

- (1) The commander and his chief of staff or executive.
- (2) The signal officer.
- (3) The plans and training officer.
- (4) The intelligence officer.
- (5) The supply officer.
- (6) The adjutant.
- (7) A general utility telephone for the use of officers whose offices are not connected by telephone.
- (8) Other staff officers and activities as necessity requires.

b. In small commands, such as battalions, regiments, and brigades, one telephone may serve two or more staff officers.

c. At the rear echelons of units telephones are installed as necessity requires.

Questions.

(1) *What is the chief operator's telephone? Where is it located and by whom is it to be used? (Par. 3.)*

(2) *What is the order of priority for installing telephones at a command post? (Par. 5.)*

CODE NAMES AND TRAFFIC RULES.

1. In a telephone net there are a number of centrals as noted in Information Topic No. 5. These centrals are almost always located at or near a headquarters and are therefore known by the name of that headquarters. For example, the central at the First Brigade is known as the First Brigade central, etc.

2. It can be seen that there would be some rather long names, as for instance: First Battalion, First Infantry. Also there are local lines to subscribers at each station. Suppose a subscriber wanted the message center at the Second Battalion, Second Infantry; he would have to give all that long title to the operator. Therefore for simplicity, accuracy, and speed, a telephone code is usually used. This code is not for purposes of secrecy.

3. A telephone code has two parts, code names for organizations and code numbers for officers and offices at each headquarters. For example, suppose the code name for the First Brigade is Mobile, then the commanding officer of that brigade is Mobile - 1, the brigade adjutant is Mobile - 2, and so on, each officer being given a number which is added on to the code name of his organization when calling for him. These code names and numbers are used exclusively by both subscribers and operators when calling for other centrals or subscribers.

4. An example of a telephone code for a division is shown below.

Telephone Code—First Division.

ORGANIZATIONS.

| Unit. | Code name. | Unit. | Code name. |
|-------------------------------|------------|-------------------------------|------------|
| Headquarters, 1st Division.. | Magic. | 1st Medical Regiment—Con. | |
| Special troops, 1st Division. | Magpie. | 1st Santuary Battalion.. | Mentor. |
| Headquarters Company, | | Division train, 1st Division. | Mercy. |
| 1st Division..... | Makepeace. | 1st Field Artillery Brigade.. | Mermaid. |
| 1st Military Police Com- | | Ammunition train..... | Mess-Kit. |
| pany..... | Mallet. | 1st Field Artillery..... | Metal. |
| 1st Ordnance Company. | Mandate. | 1st Battalion..... | Meteor. |
| Service Company, 1st | | 2d Battalion..... | Middy. |
| Division..... | Maple. | 2d Field Artillery..... | Minute. |
| 1st Signal Company.... | Market. | 1st Battalion..... | Mirror. |
| 1st Tank Company.... | Mason. | 2d Battalion..... | Mitten. |
| Division Air Service, 1st | | 1st Brigade (Infantry)..... | Mobile. |
| Division..... | Massive. | 1st Infantry..... | Modern. |
| 1st Engineers (combat).... | Master. | 1st Battalion..... | Mogul. |
| 1st Battalion..... | Maxim. | 2d Battalion..... | Mohawk. |
| 2d Battalion..... | Mecca. | 3d Battalion..... | Molar. |
| 1st Medical Regiment..... | Medford. | 2d Infantry..... | Moment. |
| 1st Ambulance Batta- | | 1st Battalion..... | Monarch. |
| lion..... | Melon. | 2d Battalion..... | Mortar. |
| 1st Hospital Battalion.. | Memphis. | 3d Battalion..... | Moses. |

TELEPHONE SWITCHBOARD OPERATOR.

Telephone Code—First Division—Continued.

ORGANIZATIONS—continued.

| Name. | Code name. | Name. | Code name. |
|----------------------------|------------|----------------------------|------------|
| 2d Brigade (Infantry)..... | Motive. | 2d Brigade (Infantry)—Con. | |
| 3d Infantry..... | Mountain. | 4th Infantry..... | Muster. |
| 1st Battalion..... | Murmur. | 1st Battalion..... | Mutton. |
| 2d Battalion..... | Muscle. | 2d Battalion..... | Myron. |
| 3d Battalion..... | Mustang. | 3d Battalion..... | Myrtle. |

OFFICERS AND OFFICES.

| Name. | Code No. | Name. | Code No. |
|---|----------|---|----------|
| Commanding officer..... | 1 | Chaplain..... | 19 |
| Adjutant (not G-1)..... | 2 | Postal officer..... | 20 |
| Chief of staff, C. of S., or executive officer..... | 3 | Quartermaster (not the supply officer) | 21 |
| G-1, administrative officer..... | 4 | Chief of artillery, or artillery officer.. | 22 |
| G-2, intelligence officer..... | 5 | Contract officer..... | 23 |
| G-3, operations officer, or plans and training officer..... | 6 | Gas officer..... | 24 |
| G-4, supply officer..... | 7 | Liaison officer..... | 25 |
| Ordnance officer..... | 8 | Munitions officer..... | 26 |
| Inspector..... | 9 | Pigeon loft..... | 27 |
| Signal or communications officer.... | 10 | Provost marshal, commanding of- ficer, special troops or headquarters commandant..... | 28 |
| Message center..... | 11 | Radio station..... | 29 |
| Machine-gun officer or machine-gun and howitzer officer..... | 12 | Reconnaissance officer..... | 30 |
| Aid-de-camp..... | 13 | Telegraph officer..... | 31 |
| Aviation officer..... | 14 | Telephone chief operator, "trouble" or "complaints" or "service telephone"..... | 32 |
| Engineer officer..... | 15 | Veterinarian..... | 33 |
| Surgeon or medical officer..... | 16 | Public telephone..... | 34 |
| Judge advocate..... | 17 | | |
| Finance officer..... | 18 | | |

5. The switchboard operator must be a specially trained man. His work requires his constant attention. Accuracy, speed, and courtesy are his chief requirements. His attention must not be taken from his work by unauthorized conversations.

6. The switchboard operator should not hold unnecessary conversations with subscribers. The operator's duty is to connect subscribers with the least possible delay. If he stops to hold a conversation with a subscriber, some other calling subscriber will be delayed. Any inquiries about the central or the telephone service should be referred to the chief operator and other inquiries to the message center. There are always a number of unwarranted complaints that will be made to the operator. He may even be reprimanded by some officer subscriber when he does not deserve it. In every case he should refrain from argument and unnecessary conversation. He should be courteous and give the subscriber the

connection desired as quickly as possible. If he has been treated unfairly by any subscriber, he may report this to his next superior.

7. Normally the operator answers calls in the order that they come in and does not disturb a connection until the subscribers are finished with their conversation. There are cases, however, when this procedure can not be strictly followed. One case is when several drops fall at the same time; another is when an urgent call is placed for a busy line. It is evident that some set rule must be followed. In the first instance given above, the priority goes to the higher unit calling. For example, if three drops at a division central fall at the same time, one from corps, one from a subscriber at division, and one from one of the brigades, the operator answers the corps call first. The second instance in priority is when it is necessary to put through urgent calls for certain officers. Normally the officers allowed priority in a division are:

Commanding general.

Chief of staff.

Operations officer.

Likewise, the same priority exists for the corresponding officers of brigades and lower units.

8. In each case the operator will interrupt a call to put through an urgent call for one of the above officers only after he has notified that officer that the line wanted is busy and has received instructions to put the call through immediately. He will then interrupt the conversation by saying, "I must interrupt—priority call." The persons using that line will immediately hang up, and the operator will proceed with the connections for the priority call.

9. If one priority call is to interrupt another priority call, the operator will first ascertain if the second officer calling has authority to interrupt the first call. If so, he will interrupt in the same manner as before, adding after the words "priority call" the code designation of the officer calling, as "Table-1."

Questions.

- (1) *Why is a telephone code used in the field? (Par. 2.)*
- (2) *What is the system by which such a telephone code is constructed? (Pars. 3 and 4.)*
- (3) *What order of priority should the operator observe in answering calls? (Par. 7.)*
- (4) *When is an operator justified in breaking in and interrupting a telephone conversation? (Pars. 8 and 9.)*

TRAFFIC AND CIRCUIT DIAGRAMS.

1. It is necessary in order to install a telephone system in the field to have a line-route map and a circuit diagram; the line-route map simply shows the geographical location of the centrals, the number of circuits laid, and the route taken without giving the electrical connections. The circuit diagrams show the actual con-

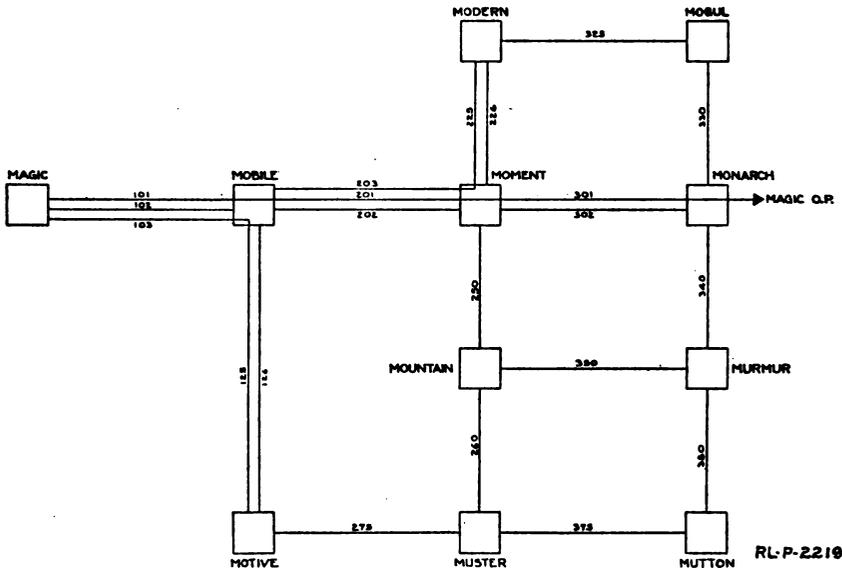
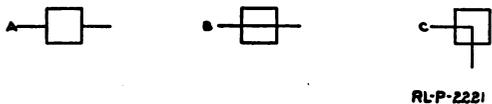


Fig. 36.—Circuit diagram of a division telephone net.

nections, the number of circuits, and the code names of the centrals; also the numerical designation of the circuits. An example of a circuit diagram is shown in Fig. 36.



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Fig. 37.—Conventional symbols for the circuits entering and passing through centrals.

2. It can be seen by examining Fig. 36 that where a circuit goes into a switchboard it is shown like A in Fig. 37; where it simply goes through the line terminal strip and does not go into the switchboard it is shown like B or C in Fig. 37. Each circuit that comes to a terminal strip should be tagged with its number as given on the circuit diagram.

3. It is the duty of the operator to connect one subscriber to another, when the first calls, in the shortest possible time and by using the least length of the axis. It is not always possible to get prompt service over the shortest circuit as this circuit may be busy, so it then becomes necessary to route the call over a different circuit or set of circuits. To assist the operator in handling a large volume of business, he has before him a sheet showing the circuits over which the various centrals and organizations can be reached. This may show the circuits graphically, or it may be in the form of a tabulation, or it may be both. Such a sheet is called a traffic diagram.

4. The traffic diagram is made up from the circuit diagram for the convenience of the operator so that he can readily see how many

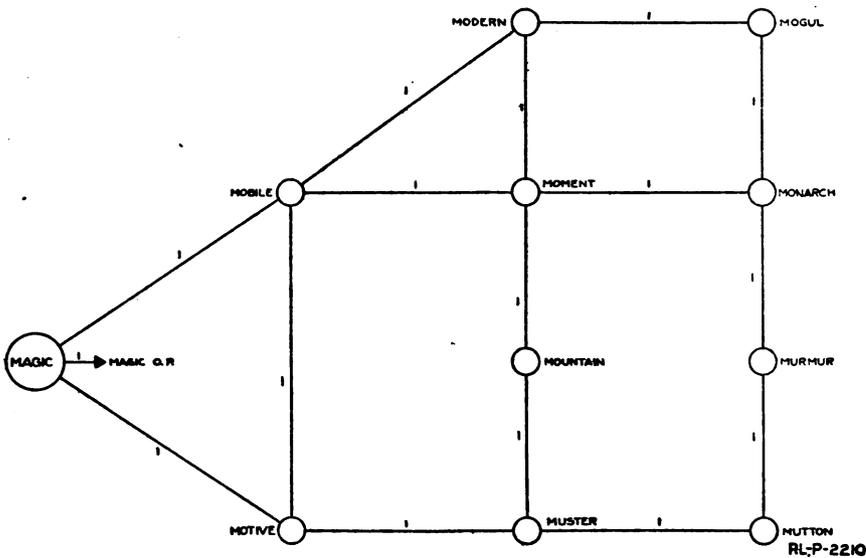


Fig. 38.—Traffic diagram of a division telephone net.

circuits he has to other centrals and thereby route his calls by the most direct route, or in case of circuits being busy or out of order, by alternate routes. The traffic diagram of the above circuit diagram is shown in Fig. 38. There is one mistake in Fig. 38; see if you can find it.

5. Refer for a moment to the traffic diagram shown in Fig. 39. Magic - 11 calls Motive - 11. The usual routing would be direct to Motive, but at the time this line is busy. The Magic operator then calls Mobile and says "Motive - 11." The Mobile operator calls Motive on the lateral; and repeats "Motive - 11." The Motive

operator calls Motive - 11, and when they have answered, says "Here's your party," and the connection is completed.

6. The method outlined above makes each operator responsible for the route to be followed only as far as the next central. Of course, he is responsible that the call goes through and that the circuit is held until the call is completed or a report is received that all lines are busy; but it does not put excessive routing plans on any one individual person.

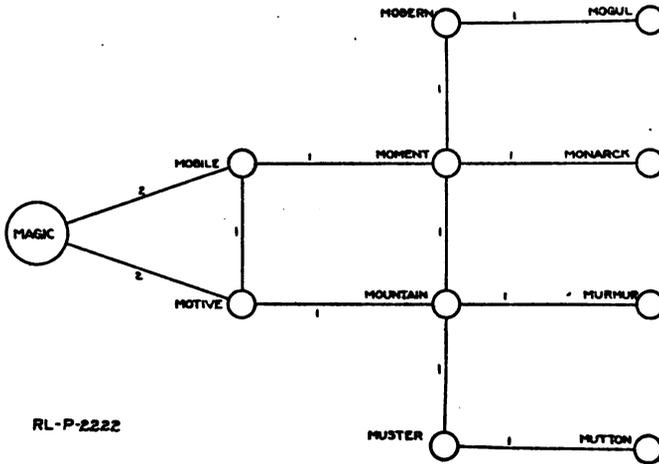


Fig. 39.—Traffic diagram of a division telephone net.

7. It is the duty of the operator to handle calls promptly, and the more satisfactory the service he renders the better operator he is.

Questions.

(1) *How will the circuit diagram be of assistance in installing a telephone system in the field? (Pars. 1 and 2.)*

(2) *Just how can the operator decide upon the best method of routing messages over a busy and congested system? (Pars. 3, 4, 5, and 6.)*

THE STATION LOG AND THE TEST AND TROUBLE RECORD.

1. At each telephone central a record is kept which is known as the station log. This record is kept by the switchboard operator under the supervision of the chief operator. The station log should cover the following points:

- a. Time station opened.
- b. Time station closed.
- c. Time of connecting or removing a circuit.
- d. Interruptions and how long circuits are out of order.
- e. Schedule of operators.
- f. Signature, with name of chief operator.

A sample blank form for a station log is shown below:

STATION LOG.

Station

| | |
|--|--|
| Opened: .....(Place.).....(Date.) .....(Hour.) | Closed: .....(Place.).....(Date.) .....(Hour.) |
| | |
| | |
| | |

Schedule of operators:

.....

.....

.....

| Circuit No. 1. | Time connected. | Time removed. | Interruptions of service. | | Nature of trouble. | Remarks. |
|----------------|-----------------|---------------|---------------------------|-------|--------------------|----------|
| | | | From— | To— | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

.....
Signature of chief operator.

2. In addition to operating, it will often be necessary for the operator to make tests on the lines from his switchboard; this is especially true at lower units. Each circuit should be tested every half hour or less, as orders require. The operator, when he is in charge of testing, keeps the test and trouble record. The operator (for example, at "Magic") tests each circuit simply by ringing the next station; when the next station answers, the operator testing simply says, "Magic testing," and goes on to test the next circuit. If conversation is going on over a circuit at the time for a test, nat-

usually the circuit is all right, and the operator does not test it. The operator should never interrupt a conversation to make a test. In case of trouble, he notifies the chief operator, or if the chief operator is not present he notifies the man in charge of the linemen. When the trouble is cleared, it is reported to the operator who records time cleared, by whom, and the nature of the trouble. The operator does not enter anything on the test and trouble record unless there is trouble of some kind. A sample blank form for a test and trouble record is shown below:

TEST AND TROUBLE RECORD.

Station Date
Circuits tested every minutes.

| Circuit in trouble. | Time tested. | Test by— | Time clear. | Cleared by— | Remarks (nature of trouble, etc.). |
|---------------------|--------------|----------|-------------|-------------|------------------------------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

.....
Chief operator.

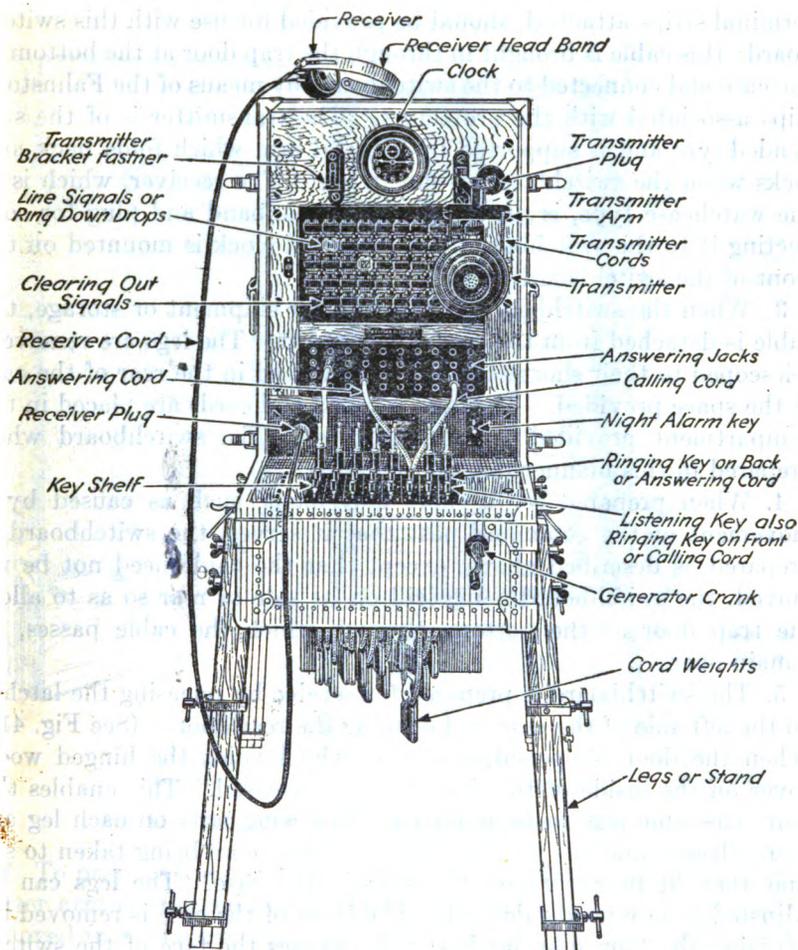
3. The troubles that occur on field lines are usually very simple. In active operations lines in forward areas are frequently broken by shell fire and traffic, which, of course, makes it necessary to keep up a constant testing and repairing of the circuits. This may be partially obviated by trying to avoid shelled areas and putting wires out of the way of traffic; special care should be taken at road crossings to either bury the circuits or put them overhead. Troubles may sometimes occur, especially in rainy weather, from faulty insulation of the wires. In that case it is best, if possible, where much trouble occurs, to lay new circuits of good wire.

Questions.

- (1) *What is the station log? What items should be entered therein? (Par. 1.)*
- (2) *When and by whom should circuits be tested? (Par. 2.)*
- (3) *What record should be kept of tests? (Par. 2.)*
- (4) *What should the operator do in case of trouble? (Par. 2.)*
- (5) *What precautions should be taken to avoid trouble? (Par. 3.)*

INSTALLATION AND OPERATION OF THE CAMP SWITCHBOARD.

1. The camp switchboard (Fig. 40) is intended for use at division headquarters or at other centrals where the monocord switchboard would not give satisfactory service on account of the number of lines, local and trunk, terminating at the switchboard.



Rc-P-2467

Fig. 40.—A front view of the camp-type switchboard.

2. The case which contains the switchboard is of basswood, lined inside and out with fiber. All of the component parts of the switchboard proper are mounted upon an iron frame, which may be withdrawn from the case by removing four screws. When this switchboard is set up for operation, it is supported by four legs which are

telescopic and consequently adjustable. The cord weights and cords are allowed to hang through an opening in the bottom of the case, in the usual position of the cords of the ordinary commercial switchboard. The rear of the switchboard case is hinged, which when opened permits access to a very compact form of telephone line protectors. Each protector consists of two carbon block lightning arresters and a suitable fuse. A 40-pair cable, with necessary terminal strips attached, should be provided for use with this switchboard; this cable is brought in through the trap door at the bottom of the case and connected to the switchboard by means of the Fahnstock clips associated with the protectors. The transmitter is of the suspended type and is supported by a metal arm which folds back and locks when the switchboard is not in use. The receiver, which is of the watchcase type, is provided with a headband and plug for connecting it to the switchboard. A rim wind clock is mounted on the front of the switchboard.

3. When the switchboard is prepared for shipment or storage, the cable is detached from the rear of the board. The legs are removed, telescoped to their shortest length, and placed in the rear of the case in the space provided. The cord weights and cords are placed in the compartment provided for that purpose. The switchboard when prepared in this manner resembles a chest.

4. When prepared for a short movement, such as caused by a movement of the command post that it serves, the switchboard is prepared as described above, except that the cable need not be removed, the switchboard being laid on its side or rear so as to allow the trap door at the bottom, through which the cable passes, to remain open.

5. The switchboard is prepared for service by releasing the latches on the left side of the case and opening the rear door. (See Fig. 41.) When the door is opened, the hook which holds the hinged wood cover on the inside of the door must be released. This enables the four telescopic legs to be removed. The wing nuts on each leg are then released and the legs placed in position, care being taken to see that they fit properly into the slots in the case. The legs can be adjusted to any height desired. The front of the case is removed by releasing the four snap latches; this exposes the face of the switchboard and the key shelf. The trap door in the bottom of the case is then opened and the cords and weights are pulled down so as to hang in a vertical position. A ground rod is driven into the ground and connected to the clip provided on the protector panel.

6. When attaching the cable to the switchboard, it should be brought up through the trapdoor at the bottom of the case and through the opening at the bottom of the protector panel to the

Fahnstock clips associated with the protectors. The terminal strips attached to the end of the cable are mounted in a convenient position. The line terminal strips are then mounted about 14 inches to the right of the cable terminal strips. The line wires are connected to the line terminal strips and jumpered across with short wires to the cable terminal strips.

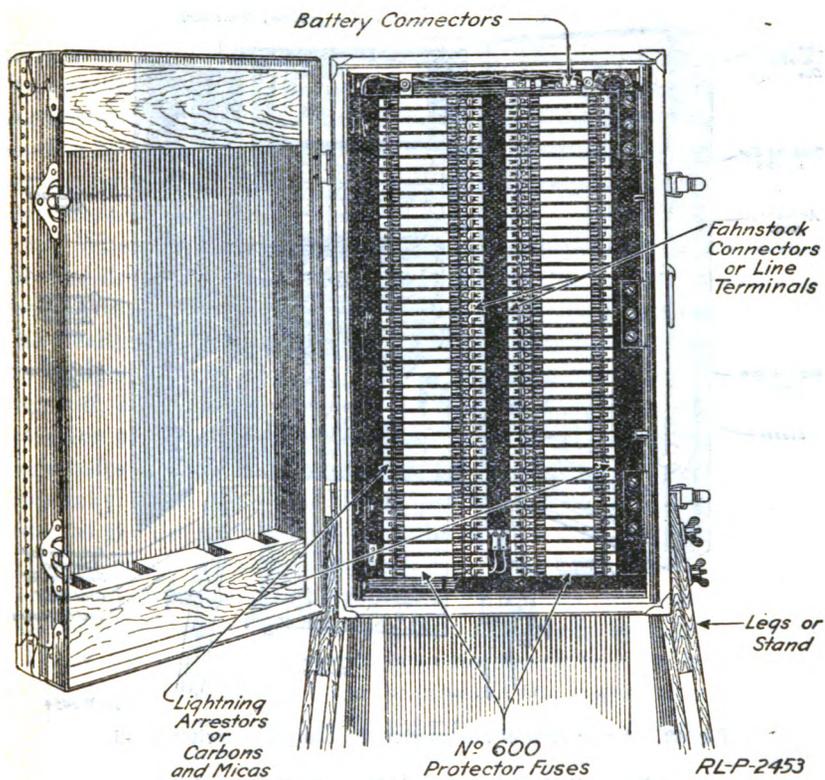


Fig. 41.—The protector panel of the camp-type switchboard.

7. To prepare the operator's set for service, the latch on the transmitter arm is released and the arm is pulled out; the transmitter is removed from the compartment in the front of the case, attached to the transmitter arm by means of the cords provided, and adjusted to the proper height. Next the plug on the end of the transmitter cord is inserted into its jack in the upper right-hand corner of the face of the switchboard. Likewise the plug on the end of the receiver cord is inserted into its jack in the lower left-hand corner of the face of the switchboard. The handle is then placed on the generator. The operator's set should be tested by pushing a listening key forward,

shorting one plug of the cord corresponding to the key pushed, and blowing in the transmitter.

8. If at any time it becomes necessary to make repairs to drops, jacks, or cords, access may be had to the interior of the switchboard by removing the three thumb nuts on the protector panel and swinging it open. (See Fig. 42.)

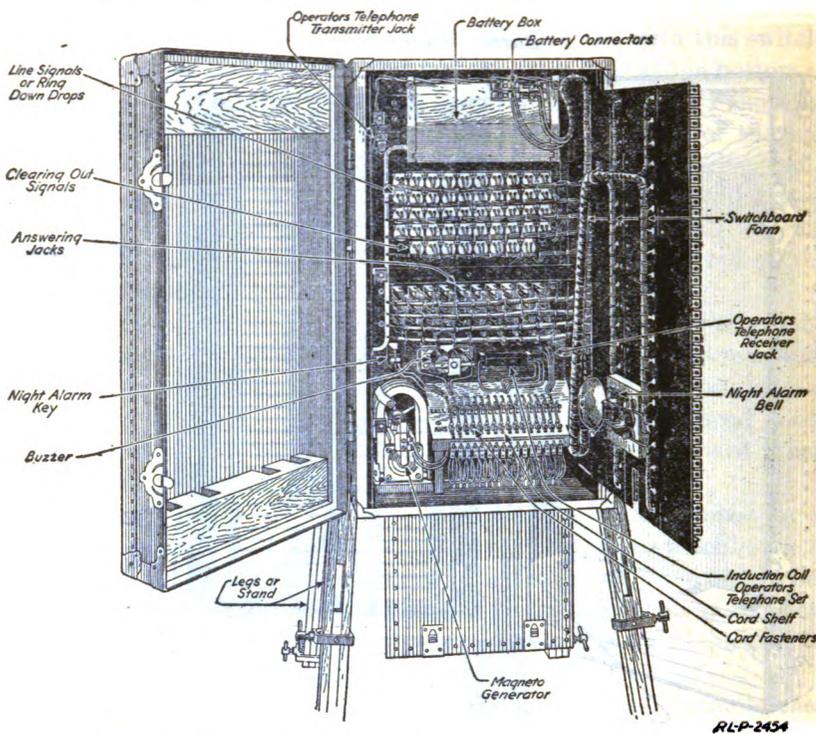


Fig. 42.—A rear view of the interior of a camp-type switchboard.

OPERATION OF THE CAMP SWITCHBOARD.

9. When a subscriber (the calling party) wishes to place a call, he turns the crank of his telephone. This energizes the drop magnet corresponding to the line terminals to which his station is connected, releases the shutter, which falls, attracting the attention of the operator.

10. To answer this call, the operator plugs into the jack corresponding to the drop which has fallen, using the rear plug of any pair of cords and at the same time restores the drop. He then operates the listening key (front key is pushed away from him) corresponding to the cord used, which connects the operator's set to the cord and to the calling party. He ascertains the number desired from the calling party.

11. Having ascertained the number desired (the called party), the operator places the front plug of the same cord, which was used in answering, into the jack connected to the line of the called party, and throws the listening key into the ringing position (key is pulled toward him) and turns the generator crank. This rings the called party, at the same time disconnecting the calling party in order to prevent ringing back in his ear. If the call is more than one ring, the signal is made by operating the key the desired number of times; meanwhile turning the generator crank. The key when released by the operator springs back to its normal center position and the two parties are connected. The operator can then supervise the connection by merely pushing to the listening position, the listening key pertaining to the cord circuit in use, which bridges his set across that cord circuit.

12. When the plugs are placed in the line jacks of the two parties, the line-drop magnets are automatically cut out of the circuit, and the line drops will not fall, even though one or both parties ring again. The clearing-out magnets, of which there is one for each pair of cords, are bridged across the cords. They are energized when either party rings off, allowing the clearing-out drop to fall, thus attracting the attention of the operator. The operator should, however, always challenge before breaking a connection, for the falling of the clearing-out drop may mean that one of the parties has rung his telephone in order to get the operator back on the line for some reason.

13. After the clearing-out drop has fallen and the operator has challenged twice without response, he breaks the connection by removing both plugs and allowing the cords to slip back in their holes.

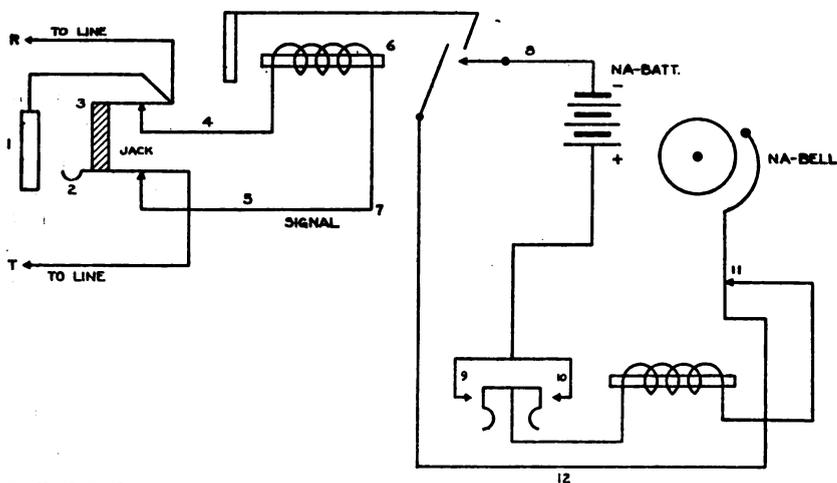
14. If for any reason it becomes necessary to ring back on the calling party, this can be done by pushing the ringing key (rear key) away from the operator and turning the generator crank. This disconnects the called party during the ringing and rings the calling party. This should only be done after the operator has ascertained that the calling party has left his telephone.

15. A night alarm is provided in this switchboard for use at night and during slack periods when it is not necessary for the operator to be constantly on duty in order to answer calls. It is connected in for use by means of the key lever located on the face of the board in the lower right-hand corner; when this is done, any drop in falling makes the necessary connection and operates the alarm.

LINE AND NIGHT-ALARM CIRCUITS.

16. Fig. 43 shows the line circuit and the auxiliary night-alarm circuit. The line circuit is as follows: From the tip (T) side of the line, through jack springs 2 and 5, through terminal 7 of drop magnet,

thence through winding of drop, through jack springs 4 and 3 to ring side of line (R). When the generator of the calling party is operated, the alternating current follows the path just described, causing the drop armature to rapidly move forward and backward and allows the drop to fall, thus attracting attention to this particular signal. The inner face of the signal displays a number corresponding to the associated jack. The drop in falling closes the night-alarm circuit at 8. When the night-alarm key 9 is in the operated position, the local battery flows from the positive terminal, through the key springs 9, through magnet of bell 10, through contact 11, through the drop to the negative terminal of the battery, thus causing the bell to ring. Restoring the drop opens the circuit and silences the bell.



RL-P-2352

Fig. 43.—The line and night-alarm circuits of a camp-type switchboard.

CIRCUIT WITH OPERATOR ANSWERING, KEY IN LISTENING POSITION.

17. Fig. 44 shows the circuit when the operator is answering a call with the key in the listening position. The circuit is as follows: From tip (T) side of line, through jack springs 2, through tip of cord, through key spring A, through inside spring B, through spring C, through spring D, through contact spring E, to operator's receiver, through receiver to one side of secondary of induction coil, through coil to contact spring F, through spring G, through spring H, through spring I, through spring L, to sleeve of jack 1, to ring side of line (R). It will be noticed that the clearing-out signal is bridged across the answering cord at the springs B and I.

18. The operator's transmitter circuit (full detail is not shown) is from local battery to transmitter, to primary of coil, through primary winding, through spring J, through spring K, to battery. The springs J and K are operated by the rubber contact piece between springs E and J when the key is in the listening position, in order to prevent a waste of current from the local battery when the operator's set is not in use.

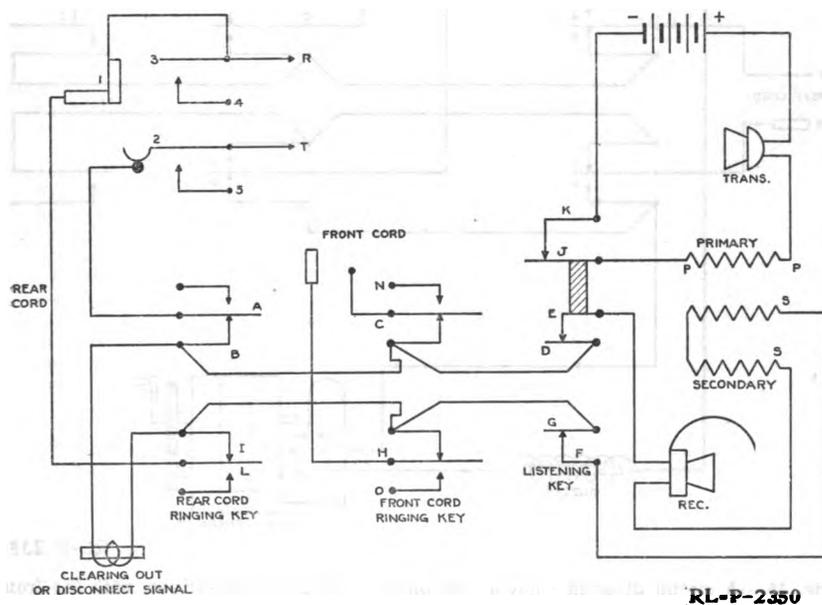
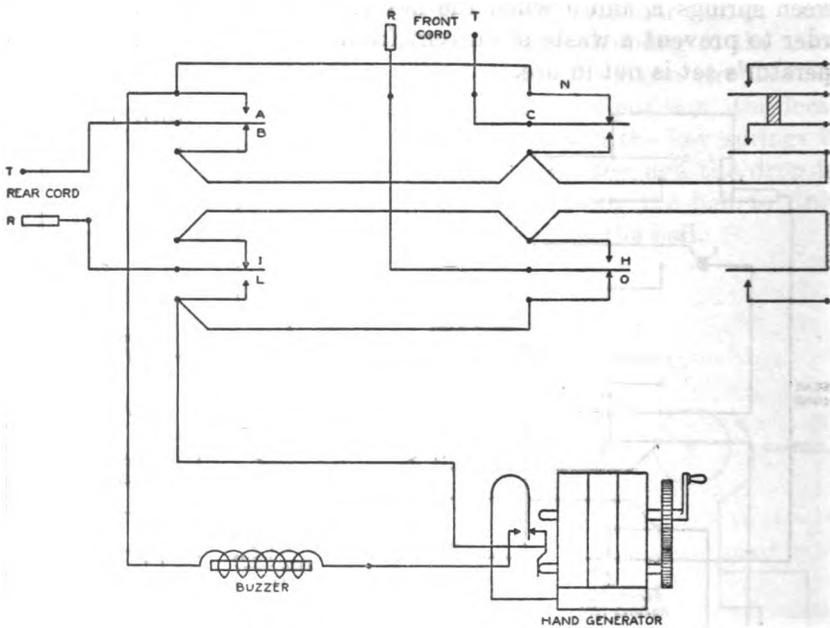


Fig. 44.—A circuit diagram showing the operator answering a call, with the front key in listening position, on a camp-type switchboard.

CIRCUIT WITH THE OPERATOR'S CALLING KEY IN THE RINGING POSITION.

19. Fig. 45 shows the calling end of the operator's cord circuit with the ringing key in position for ringing the called party, the operator's calling plug being in the desired jack. Turning the crank of the generator closes the contact on the automatic shunt circuit, placing the generator armature across the cord circuit. One side has a buzzer in series with the generator to notify the operator when the circuit is closed. When the listening key is pulled forward into the ringing position and the generator crank turned, the circuit may be traced as follows: From tip side of line (T) of front cord, through contact springs C and N, to contact spring A, through series buzzer, through generator to contact spring L, through contact O, to ring side of line (R). It may be seen that during the ringing the calling party (rear cord) is disconnected. Releasing the key opens the gen-

erator circuit and places the clearing-out drop across the cord circuit. The completed circuit for a conversation is as follows: From subscriber, through line jack, through answering cord, through calling cord, through line jack to subscriber.



RL-P-235

Fig. 45.—A circuit diagram showing the operator calling a subscriber, with the front key in the ringing position, on a camp-type switchboard.

Questions.

- (1) Under what circumstances is it necessary to use a camp switchboard? (Par. 1.)
- (2) How is the camp switchboard prepared for storage or transportation? (Pars. 3 and 4.)
- (3) How is the camp switchboard set up and prepared for service? (Pars. 5, 6, and 7.)
- (4) How does the operation of this type of switchboard differ from that of the monocord type? (Pars. 9, 10, 11, 12, 13, 14, and 15.)

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(Corrected to July, 1923.)

No.

20. Basic Signal Communication—Students Manual.
21. Basic Signal Communication—Instructors Guide.
22. Telephone Switchboard Operator—Students Manual.
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