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MONOCORD SWITCHBOARDS OF UNITS

TYPE EE-2 AND TYPE EE-2-A

AND

MONOCORD SWITCHBOARD OPERATOR'S SET

TYPE EE-64

Wire Communication Pamphlet No. 2
(Second Edition)

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The following publication, entitled "Monocord Switchboards of Units Type EE-2 and Type EE-2-A and Monocord Switchboard Operator's Set Type EE-64," Wire Communication Pamphlet No. 2, is published for the information and guidance of all concerned.

[062.1, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

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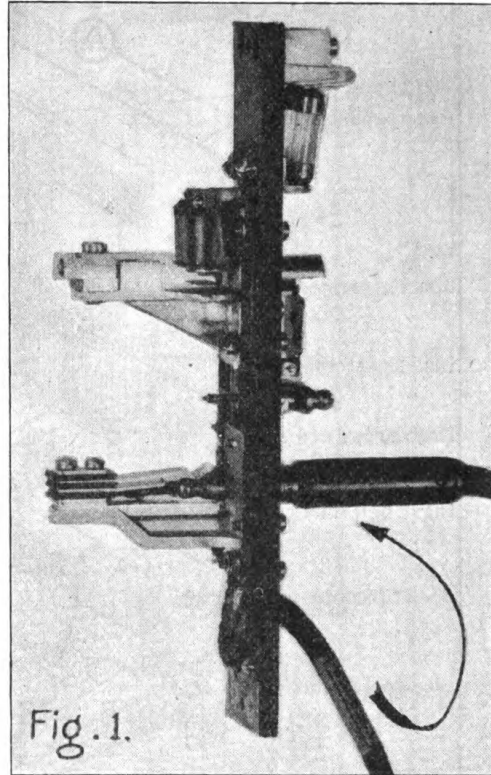
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MONOCORD SWITCHBOARDS.

1. Telephone intercommunication between Army units is frequently such that a temporary, quickly installed and flexible type of small central exchange 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 exchange in such a way as to make one switchboard if it is necessary to accommodate more lines than 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, which are described below. Type EE-2-A units will not be issued until the stock of Type EE-2 units is exhausted. A type EE-2 unit is shown in fig. 1.



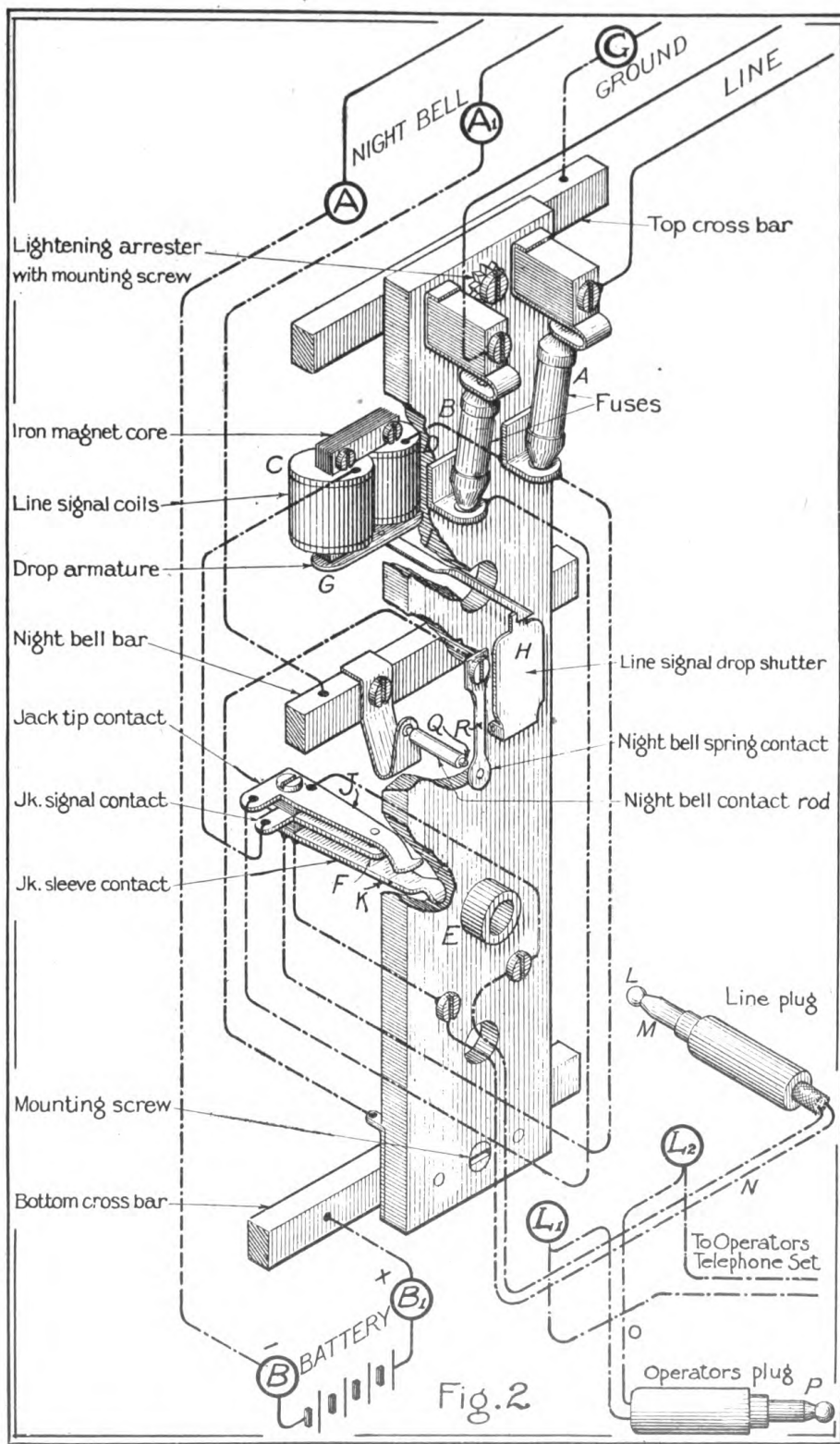
THE MONOCORD SWITCHBOARD UNIT TYPE EE-2.

2. Each unit comprises all the necessary apparatus for the exchange terminals of one line (two wires). A skeleton drawing of a unit is shown in figure 2 and the schematic wiring diagram in figure 3.

Terminals labeled A, A₁, G, B, B₁, L₁, and L₂, in the figures are not parts of the unit proper but are parts of the switchboard in which the units are assembled. The various parts are listed below according to their position on the panel from top to bottom:

- Two connecting blocks for the line wires.
- Lightning arrester between these blocks.
- Two fuses.
- Line number plate.
- Line drop signal and night bell contact.
- Spring clip for locking line drop.
- Jack.
- Cord and line plug.

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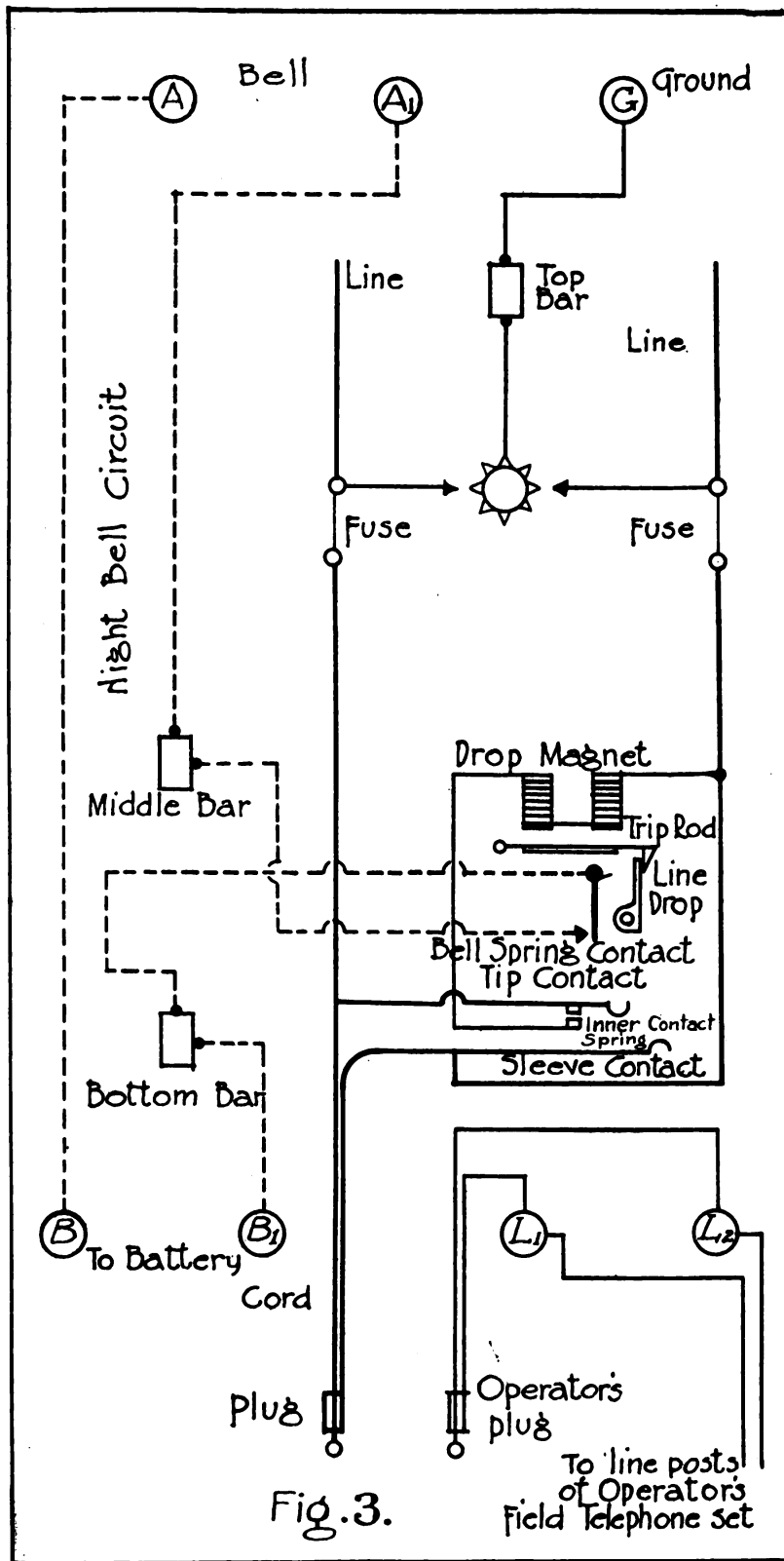
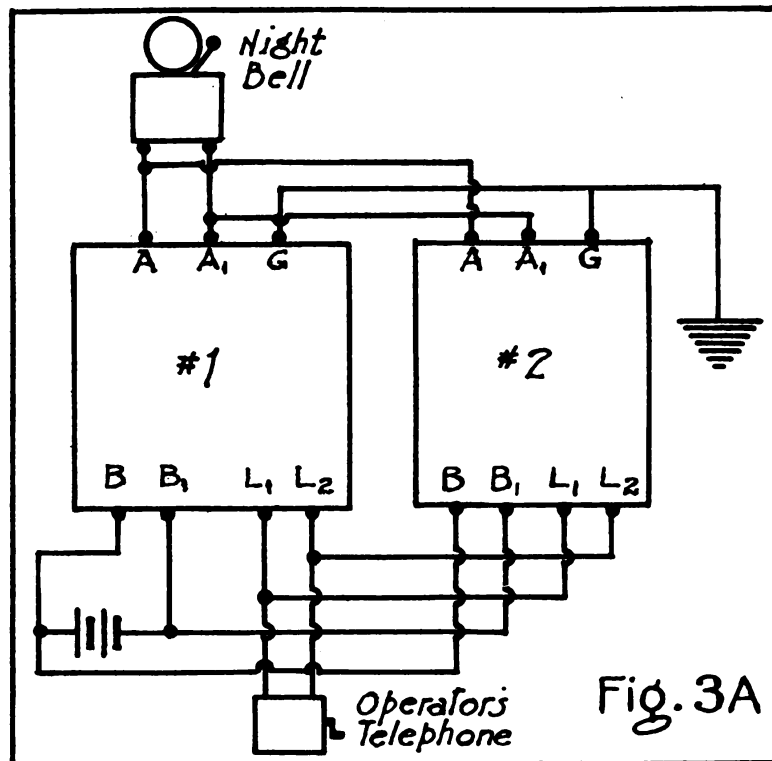


Fig. 3.

3. Each unit is held in the frame by means of two machine screws, one at the top and one at the bottom of the unit, which engage the brass bars in back of the switchboard and hold the unit firmly in place. Rigidity of construction is essential, as constant use and transferring from one place to another tend to loosen the units from the frame and disturb the sensitiveness of the adjustment of the line drop.

4. The lightning arrester is a simple toothed washer held against the panel by the upper supporting screw. This screw is grounded through the upper brass bar. If lightning comes in on the line



Connections of two switchboards of Type EE-2 units in parallel.

wires, the main portion of it jumps the small air gap from the binding post to the grounded washer and thence passes to ground, so that only a small portion of the high potential current flows through the switchboard apparatus. If the latter portion is at all heavy the fuses burn out, opening the circuit through the switchboard with a much wider gap and hence higher resistance than that in the circuit to ground across the arrester.

5. Two glass-inclosed removable fuses, which fit into spring connections, are provided to protect each side of the line from excessive currents. In order that burned-out fuses may be readily seen, the panel is painted white behind them. The glass is usually smoked

up more or less when a fuse burns out and this against the white background is quickly noticed.

6. The line number plate is a small white celluloid strip on which the line number is written. This number may easily be erased if it is necessary to change it.

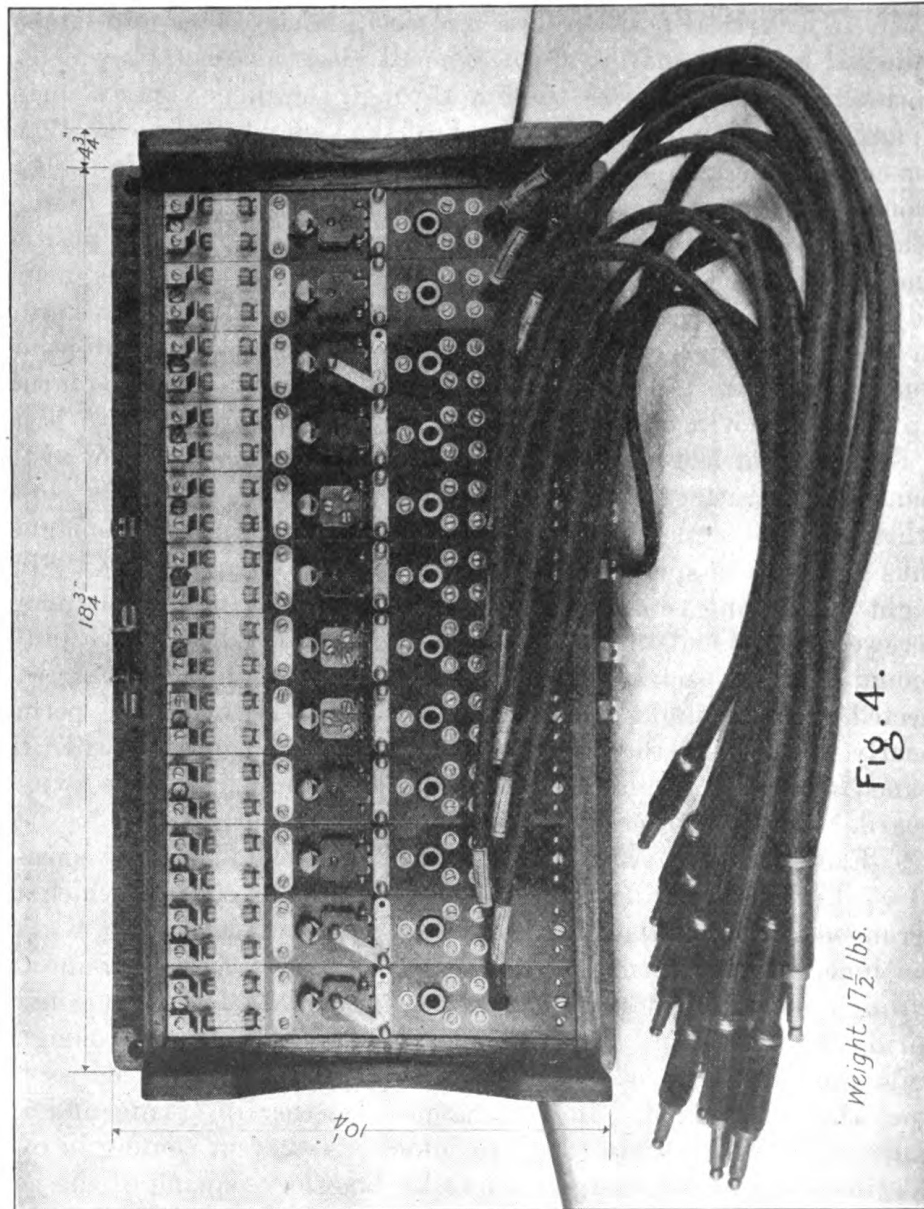
7. The line drop signal consists of a shutter H, figure 2, held normally in a vertical position by a brass trip latch. This trip latch is attached to the armature G of a small electromagnet C, which is normally connected across the line through the inner contact spring F, and the jack tip contact spring J, of the switchboard jack. When the coils of the magnet are energized by a current sent over the line from a calling station, the armature and trip latch are lifted, thereby releasing the shutter which falls by gravity to a horizontal position and attracts the attention of the operator. The electromagnet is adjusted to operate on a very small current. For locking the shutter in the vertical position and protecting it from mechanical injury during transport, a flat spring lever is provided which may be turned up from a pivot at one end to press against the shutter.

8. The night bell contact Q, figure 2, is located on the front of the panel. The battery and bell circuit through this contact is closed when the line signal drop shutter is released by the electromagnet, thus forcing the spring R, back against the contact point Q. The night bell spring contact R, consists of a narrow flat brass spring, screwed at one end to the top mounting plate. The contact pin is mounted on the back of the panel, the rear end of this pin being connected with the night bell bus bar through a heavy spring permanently mounted on the bar, against which the pin presses when the panel is screwed in place on the bars along the back of the switchboard. This construction is shown clearly in figure 2.

9. Each unit is provided with a jack and plug. The jack consists of a cylindrical opening E, in the panel of the unit, behind which are arranged the tip contact spring J, the sleeve contact spring K, and the inner contact spring F, figure 2. The tip spring is connected through one of the fuses to one of the line wires. The inner contact spring is connected to the other line wire through the electromagnet coils and the other fuse. The circuit is normally closed across the line when there is no plug in the jack, as the tip spring and the inner contact spring are then in contact. A current coming in over the line, then, would energize the coil. The sleeve spring of the jack is connected directly to the same line wire as the inner contact spring. It is a standard two-contact type, the tip and the sleeve making direct connection to the line.

MONOCORD SWITCHBOARDS OF TYPE EE-2 UNITS.

10. The monocord switchboard is made up of unit panels, on each of which is mounted all the apparatus necessary for the central exchange end of 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, 8, or 12 line switchboard. Each unit is removable from the frame, thereby lending flexibility to the board and facilitating repair and replacement. Generally, this

There are on hand a few units and switchboards of French manufacture. In these switchboards the clips are replaced by binding posts. The upper posts are marked S_1 , S_2 , and T, respectively; the lower binding posts are marked Zs, Cs, P₁, and P₂, respectively.

type of board is used only for a small number of lines, as the operating facilities do not permit speedy connections, and it is good practice to use only three lines on a four-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 figure 4. The first two drops are locked as for transportation; the second two as in normal operation; the third two down as in normal ring down. The upper Fahnestock clips from left to right are those represented in figures 2 and 3 by A, A₁, and G; the lower clips from left to right are those represented in figures 2 and 3 by B, B₁, L₁, and L₂. The cord coming from the bottom of the switchboard is the operator's cord. The complete board weighs 17½ pounds.

11. The switchboard frame is made of hard wood, 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.

12. 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 made so that they will hold not only the frame with the assembled units, but also the switchboard cords.

13. In installing a switchboard it should be set up in a dry place. It may be hung from a suitable support or may be placed on a table or stand. The bottom of the switchboard should be securely fastened so that the plugs can be easily removed without disturbing the position of the switchboard. The line wires should be run direct to the line terminals on the several units. If terminal strips or additional arresters are used, they should be run first to the terminal strips or arresters and then cross connected to the switchboard. On long aerial lines, some type of protection should be used in addition to the small arresters on each unit.

INSTALLATION OF MONOCORD SWITCHBOARDS OF TYPE EE-2 UNITS—NOT USING THE MONOCORD SWITCHBOARD OPERATOR'S SET.

14. Any material needed at the exchange not a part of the monocord switchboard as described in this pamphlet 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.

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

ected to the upper clip marked G. The night bell battery is connected to the lower clips marked B and B₁. The line terminals of the telephone used are connected to the two lower clips marked L₁ and L₂.

16. If it is desired to use two or more multi-unit switchboards at one exchange, they may be connected so as to use only one night bell, one battery, one ground, and one operator's telephone for the whole exchange. This is done by connecting the corresponding clips of each switchboard. Figure 3A shows the necessary connections.

CARE AND ADJUSTMENT OF SWITCHBOARDS OF TYPE EE-2 UNITS.

17. 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.

18. 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 previously described.

19. 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 across 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 other end of the fuse in the upper spring contact, forcing it upward until the bottom end will slip into place.

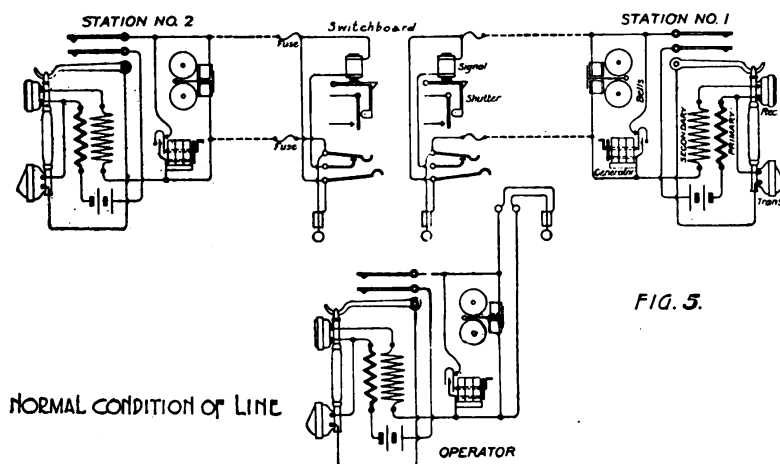
20. Care should be taken to keep the small air gap between the toothed washer and the line terminals clean. If this precaution is not taken, and the air gap is allowed to clog up with dust and dirt,

it will introduce a leak to ground or between wires with resulting poor transmission.

21. 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.

OPERATION OF MONOCORD SWITCHBOARDS OF TYPE EE-2 UNITS—NOT USING THE MONOCORD SWITCHBOARD OPERATOR'S SET.

22. 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

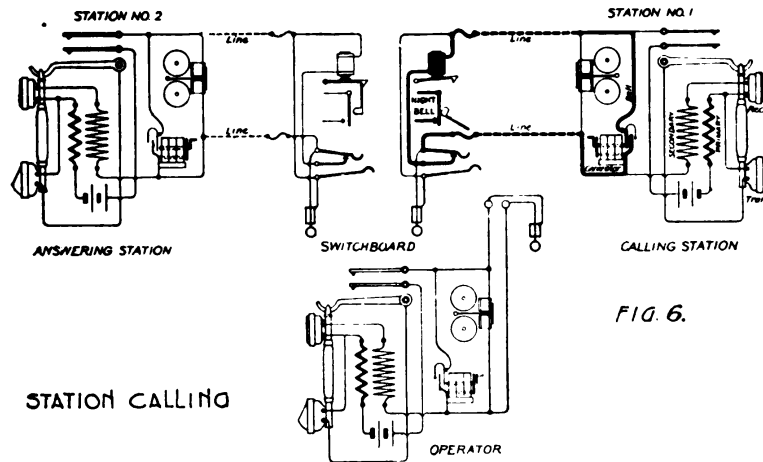


likelihood of breaking the internal connections and wearing out the wires will be reduced to a minimum.

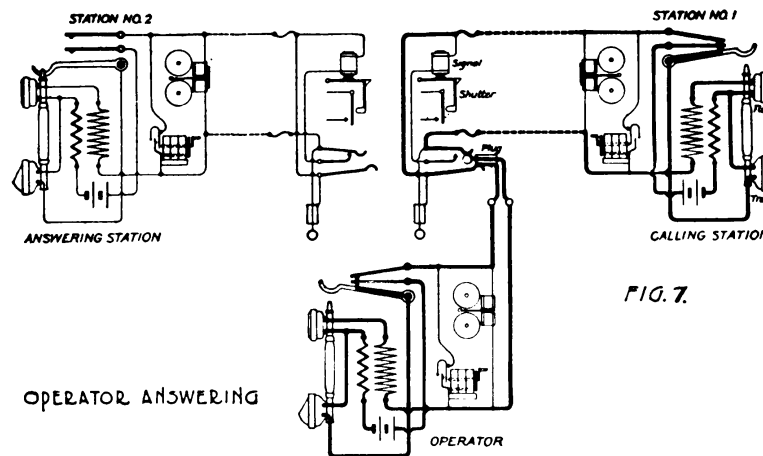
23. In the following paragraphs, the operation of a monocord switchboard is outlined in detail, showing how the operator is called, how two stations are connected, and how the board is cleared after a conversation. In each of the wiring diagrams referred to, the heavy lines indicate the metallic circuit in use when the connections shown in the various diagrams are made.

24. The normal condition of the line is shown in figure 5. Stations 1 and 2 are each connected to their respective monocord switchboard units. These units are parts of a complete board which, together with the operator's apparatus, is installed at a central telephone exchange. All receivers being on the telephone hooks, the lines are clear. Bridged across the lines are the signal drop electromagnets of the central switchboards and the call bells and magnetos of the local stations.

25. When the party at station No. 1 desires to call the operator, he turns the crank of the magneto or uses his buzzer. This sends current through the electromagnet of the monocord switchboard unit to which it is connected, figure 6. The moment the magnet is energized the trip latch is lifted, the signal shutter drops and the aux-



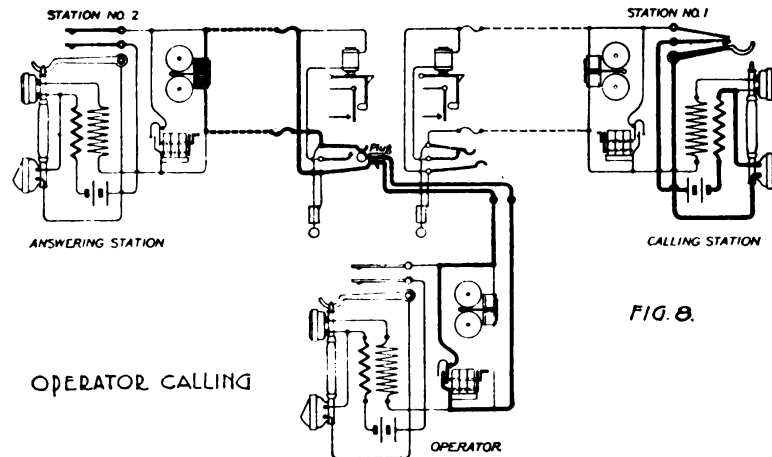
iliary night-bell circuit is closed. When an operator is constantly on duty at the board, the night bell is not used. The signal is then given simply by the dropping of the shutter. However, there may be periods when but few calls are made and the use of the night bell permits the operator to give his attention to other things.



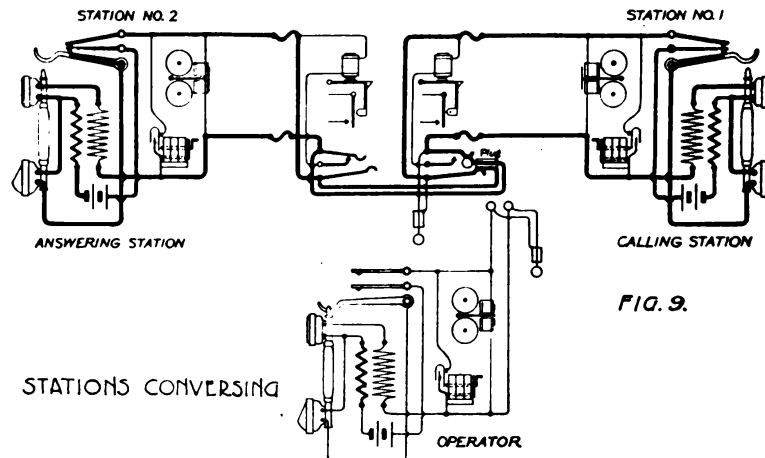
26. The operator, having received the call signal from station No. 1 (dropping of the shutter and ringing of the night bell), inserts his plug in the jack of the calling station panel and closes the drop shutter. This gives the connections shown in figure 7. The operator's plug is shown inserted and the signal magnet circuit open, as the tip spring of the jack is lifted off the inner contact spring by

the plug. At the same time, the calling station and operator having taken their receivers off the hooks, the circuits are closed in such a way that both telephone sets are in metallic connection with each other and the calling party can converse with the operators.

27. *The operator*, receiving from the calling station the number desired, *removes his plug from the switchboard jack of the calling*



station and inserts it in the jack corresponding to station No. 2, the station called. He then replaces his receiver on the hook and turns his magneto crank in order to ring the bell of station No. 2. This operation gives the connections as shown in figure 8. During this time, the calling station still has the receiver off the hook. The party at the called station takes the receiver off the hook and answers with



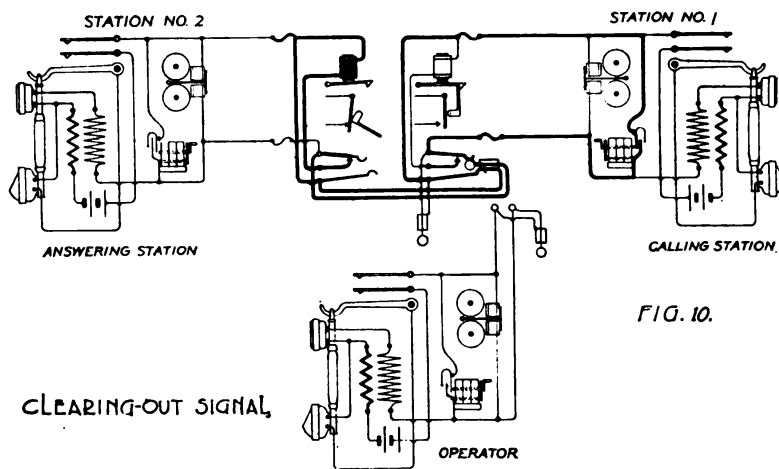
the number of the line or name of the military organization connected.

28. After having received an answer from station No. 2, *the operator removes his plug from jack No. 2, and inserts the plug of the station called in the jack of the calling station. This employs the circuit indicated in figure 9 showing both stations in direct connec-*

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tion with each other. Conversation may now be carried on. It will be noticed that the bells of the calling and answering stations and the drop magnet of the answering station remain connected across the line while the conversation is carried on. This does not interfere in any way with the operation of the line, as the impedance of the bell winding and magnet coils is considerable at frequencies corresponding to voice modulations, and the voice impulses take the path of least impedance and follow the circuit indicated by the heavy lines.

29. In actual field work the operator may not wait for an answer from station No. 2, but insert the plug of station No. 2 as soon as he has rung it in the jack of station No. 1, assuming that the call will be answered. Then if other calls do not claim his attention, he may leave his operator's plug in the jack of station No. 2 and listen in for the expected answer. If it is not received promptly, he will ring



again, first making sure to remove the plug of station No. 2 from the jack of station No. 1, otherwise the party at station No. 1 will also get the ring in his telephone. The operator can supervise the line at any time by inserting his plug in the jack of the station called.

30. When the conversation is finished the receivers of both stations are placed on the hooks. The calling station party operates his magneto which energizes the line drop magnet of the other switchboard unit, figure 10. The operation is then the same as outlined for the calling signal. *The shutter drops, and the operator then removes the plug from the switchboard jack and closes the line drop signal.* This clears the line and puts it in readiness for subsequent calls.

31. Conversation between more than two parties can be effected on the monocord switchboard. In the event that stations Nos. 1, 2, 3, and 4 desire to converse simultaneously, plug No. 1 is inserted in

jack No. 2, plug No. 2 in jack No. 3, and plug No. 3 in jack No. 4. The clearing out signal may then be given by any one of the four stations.

MONOCORD SWITCHBOARD UNIT TYPE EE-2-A.

32. The monocord switchboard unit type EE-2-A is an improvement on the type EE-2 unit. There are no fuses nor arresters in the new design. Fahnestock clips are replaced by a spring type binding post. 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. Figure 11 shows several views of the type EE-2-A units. The type EE-2 units and the type EE-2-A units are not interchangeable.

33. The night bell contact differs from the old model as follows: The spring, mounted on the middle bar of the type EE-2 unit, has been discarded and the contact (Q, fig. 2) wired to a plate at the bottom of the unit. The other contact of the night alarm is wired to a similar plate at the top of the unit. These connections are plainly shown in the schematic wiring diagram of the unit, figure 14.

34. The jack is arranged so that when a plug is inserted three contacts may be made and two may be broken. When no plug is in the jack, the circuit is from the line terminal, Ground, through the tip contact spring J, through the upper inner contact spring F, through the line drop signal magnets, and thence to the other line terminal. The plug attached to each unit has no ring, but the sleeve of the plug, M, makes contact with both the sleeve of the jack, K, and the ring spring, R. Inserting the plug in the jack, therefore, produces contact between the sleeve of the plug, M, and the sleeve of the jack, K, and also between the sleeve of the plug, M, and the ring spring of the jack, R. It also produces contact between the tip of the plug, L, and the tip contact spring, J. At the same time the contact between the tip contact spring, J, and the upper inner contact spring, F, is broken, thus disconnecting the electromagnet from the rest of the circuit. The contact between the ring spring, R, and the lower inner contact spring, H, is also broken. It is seen that in this case the jack and plug act as if they had two contacts. The three contacts of the jack are used in connection with the monocord switchboard operator's set. This will be described later.

MONOCORD SWITCHBOARDS OF TYPE EE-2-A UNITS.

35. Monocord switchboards of type EE-2-A units differ from those of type EE-2 units in the fact that each unit is mounted so as to be removable without the use of any tools. Also a hinge cover and a carrying strap have 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

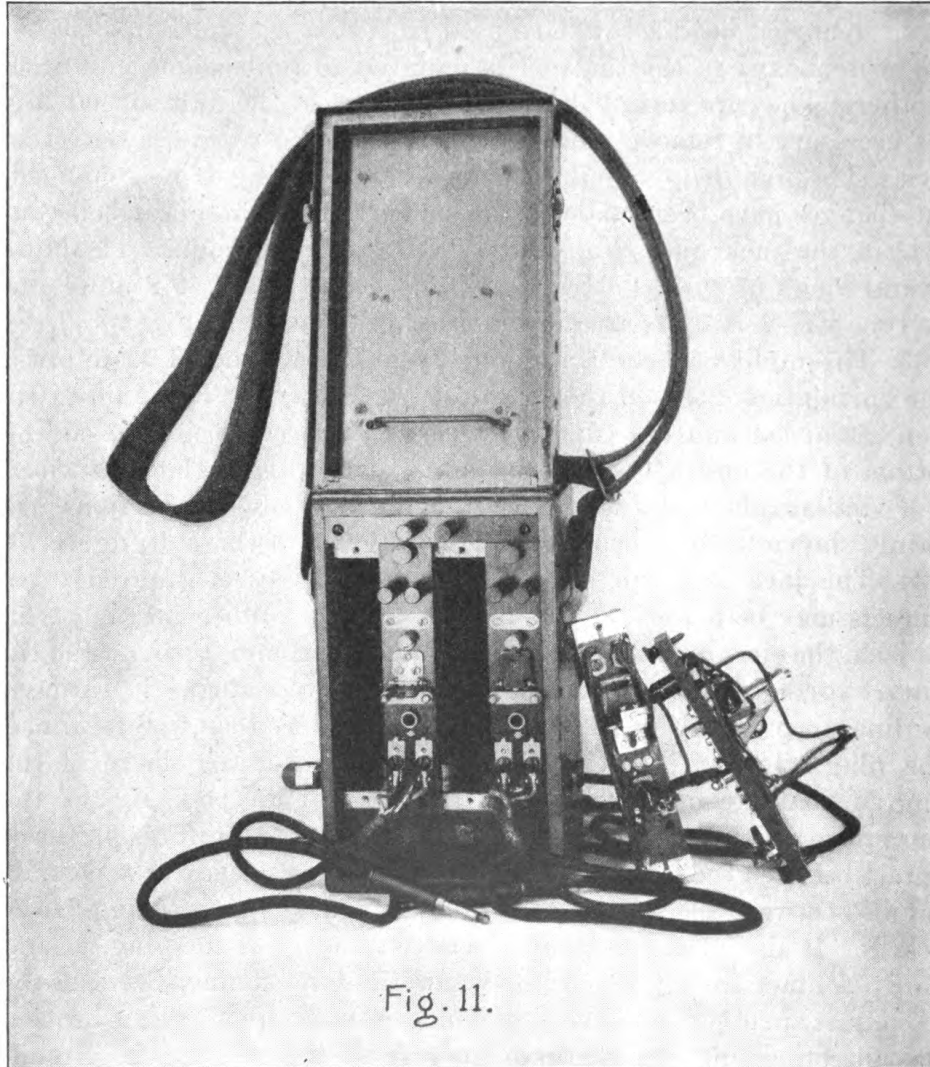


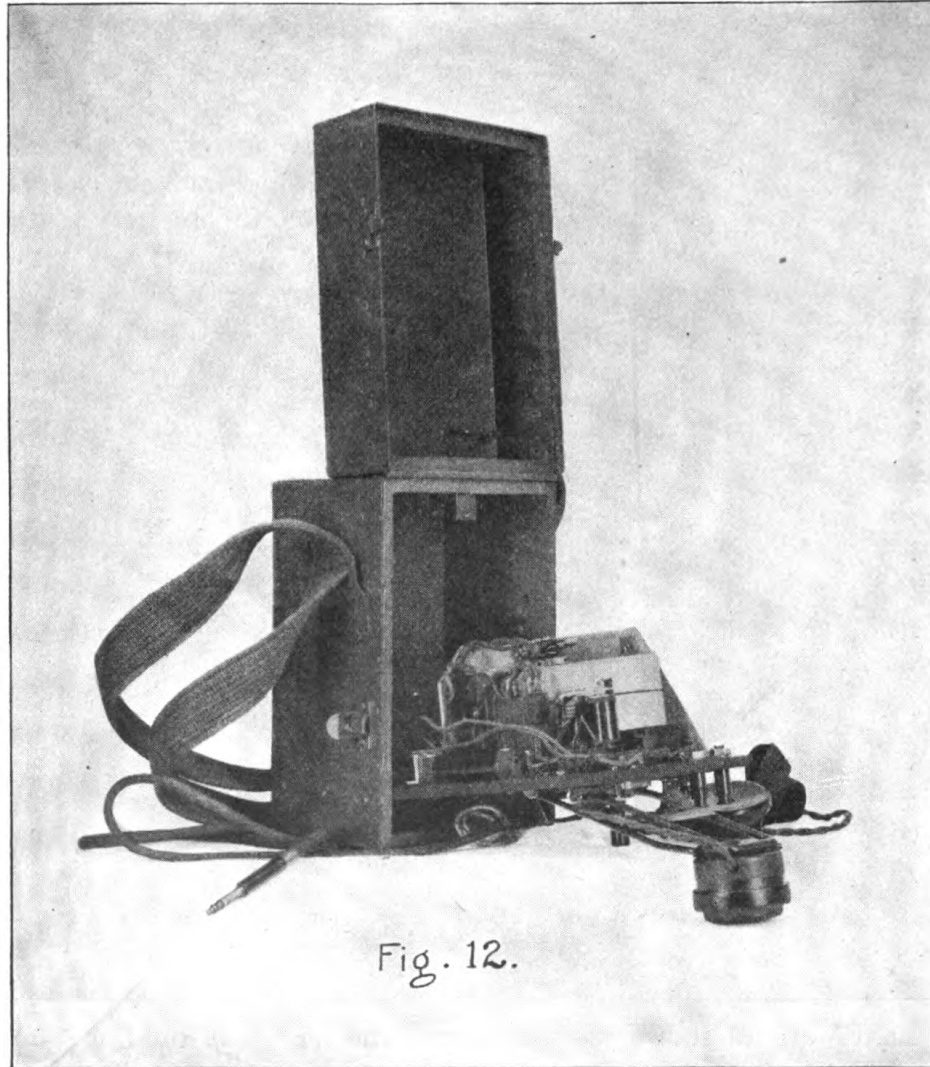
Fig. 11.

the top and one at the bottom. There is no operator's cord attached to this switchboard.

36. 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 $6\frac{1}{4}$ 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 four-unit switchboard is shown in figure 11.

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

37. The monocord switchboard operator's set contains all the auxiliary apparatus necessary at a telephone exchange 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. This is all apparatus of stock type. 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 $6\frac{1}{4}$ by $7\frac{1}{8}$ by 10 inches. Views of the set are shown in figures 12 and 13.

38. In figure 12 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-magnet generator with its automatic contact mechanism lies to the rear of the apparatus. The BA-1 batteries with their clips are not visible. They are, however, mounted inside the box.

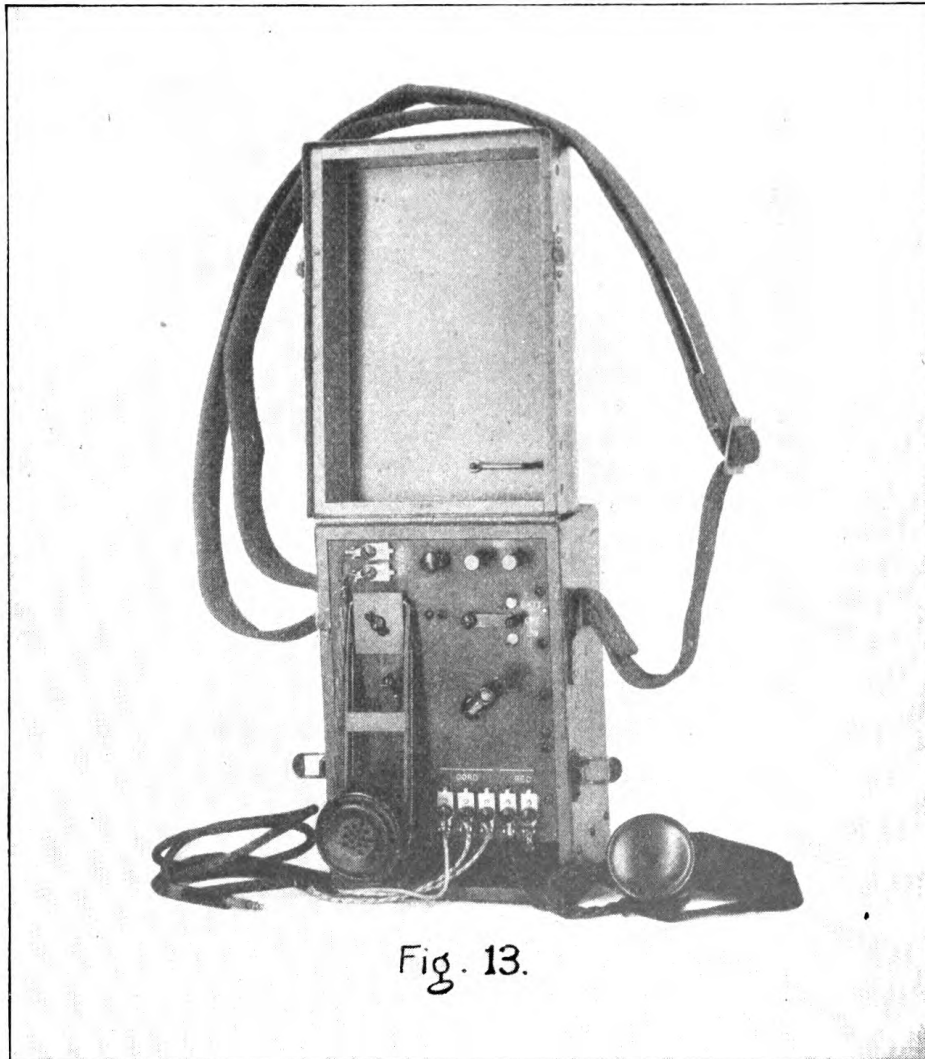


Fig. 13.

39. Figure 13 shows the exterior 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 front of the box 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 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 as 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 watch-case receiver has a band to extend around the head, thus making it unnecessary to support the receiver with the hand while in use. The wiring diagram will be shown in the discussion on the operation of the set.

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

40. The general directions given in paragraph 13 should be followed. The operator's sets are wired for use with the new unit and a few easily made 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 . Any flexible wire may be used. The night alarm terminals on the operator's set, NA, are connected by suitable wires to the night alarm clips of the switchboard, A and A_1 .

41. The method of operating, after these changes have been made, is practically the same as described in paragraphs 22 to 30. The operator upon receiving a call *will not use the plug on the operator's set* but answers with the operator's plug on the switchboard. After receiving the number desired, the operator removes his 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 non-locking 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.

42. The general directions given in paragraph 13 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, a single point switch, 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, dry cells, and switch 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 method of operating is identical with that described in paragraphs 22 to 30.

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

43. The general directions given in paragraph 13 should be followed. The only necessary connection to be made is to connect by suitable wires each of the terminals on 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.

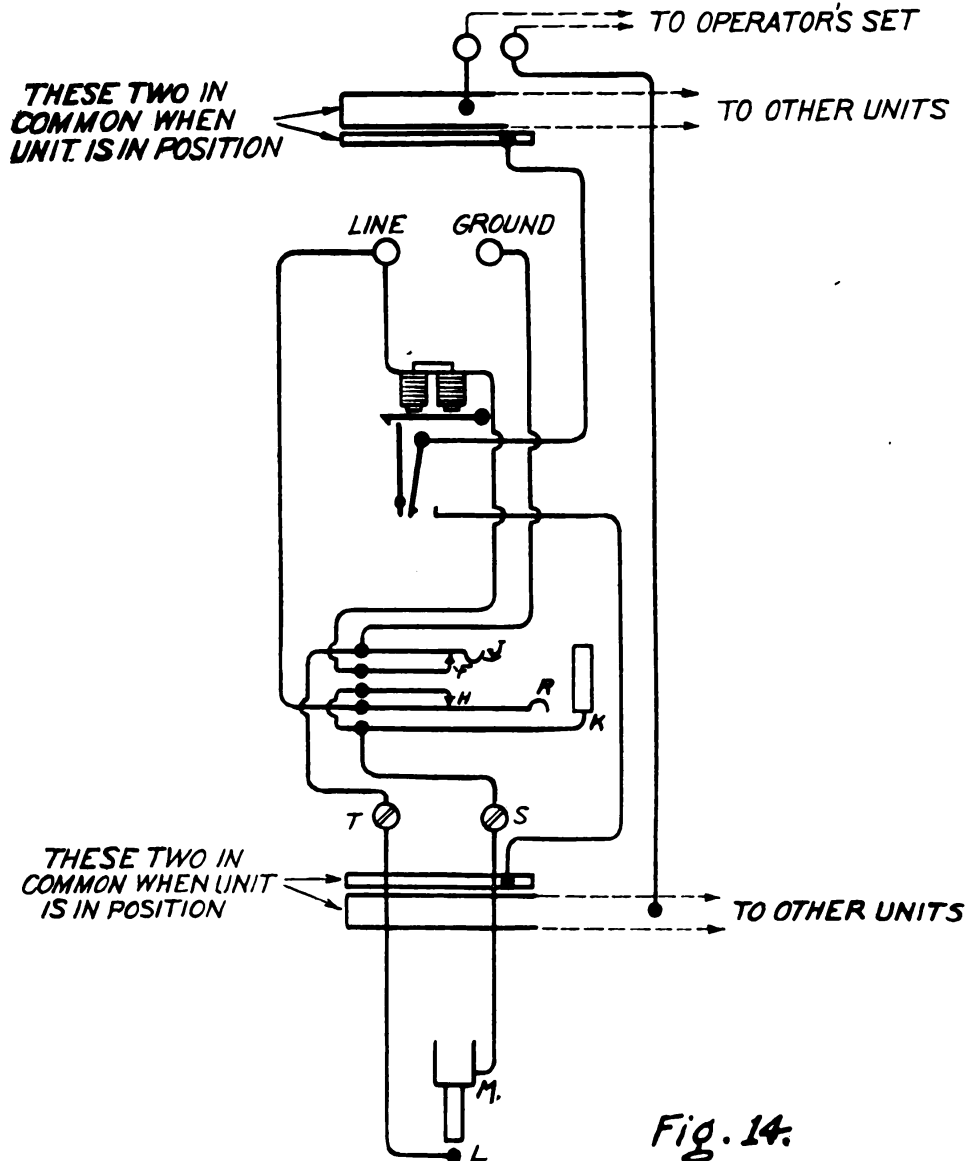
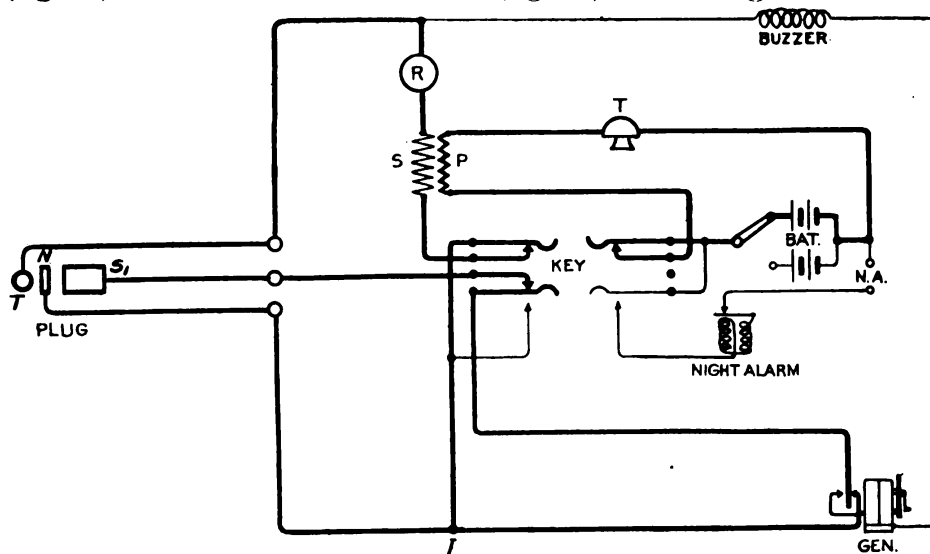


Fig. 14.

44. When the calling party turns the crank of his magneto the current passes through the line drop signal as described in paragraph 34. 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 insertion of the plug breaks the circuit between J and F, and also between H and R, figure 14, at the same time making the tip, ring, and sleeve contacts between the jack and plug. The

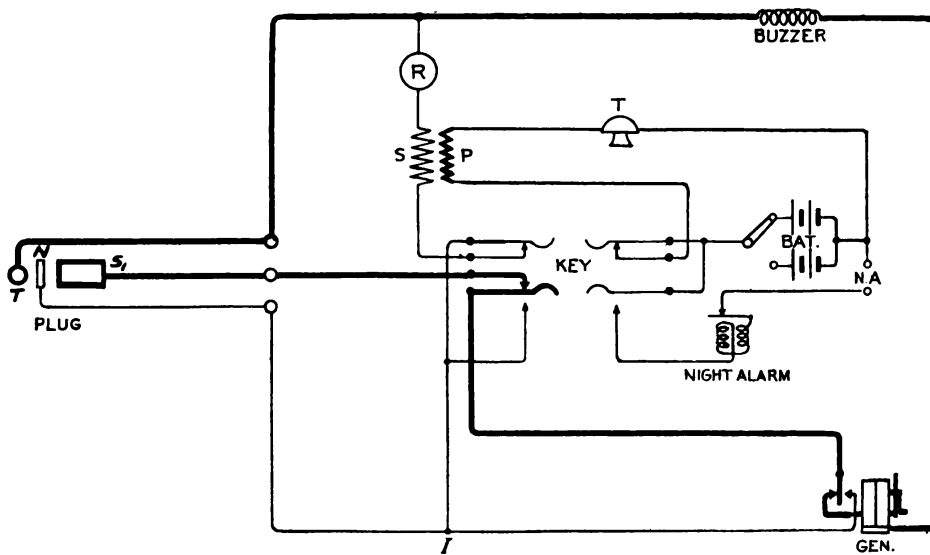
circuit now is GROUND-J (fig. 14) T-R-S-I-N (fig. 15) R-Line (fig. 14). It is to be noted that at I (fig. 15) the talking circuit of the



TALKING CIRCUIT

Fig. 15.

operator's set divides, one branch of it going to the sleeve of the plug. This circuit is not in use when the operator talks to the calling party. *The operator, upon ascertaining the party desired, inserts the plug of*



RINGING CIRCUIT

Fig. 16.

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 exchange apparatus. The ringing circuit in the operator's set is shown in figure 16.

From T the circuit is to J to L in the unit of the calling party (fig. 14) to J to GROUND of the called party's unit; through the line and ringer of the called party to Line—to R of the called party's unit—to M to K of the calling party's unit—to S_1 of the operator's set. The circuit of the called party's unit is identical with that shown in figure 14. It is to be noted that turning the generator crank automatically breaks one contact and makes another in the operator's set.

45. The operator may now talk to either the calling or the called party. The talking circuit between operator and calling party has been outlined in the preceding paragraph. The talking circuit between operator and called party is, starting from the secondary of the induction coil, S to R to T (fig. 15) to J to L in the unit of the calling party (fig. 14) to J to GROUND of unit of the called party

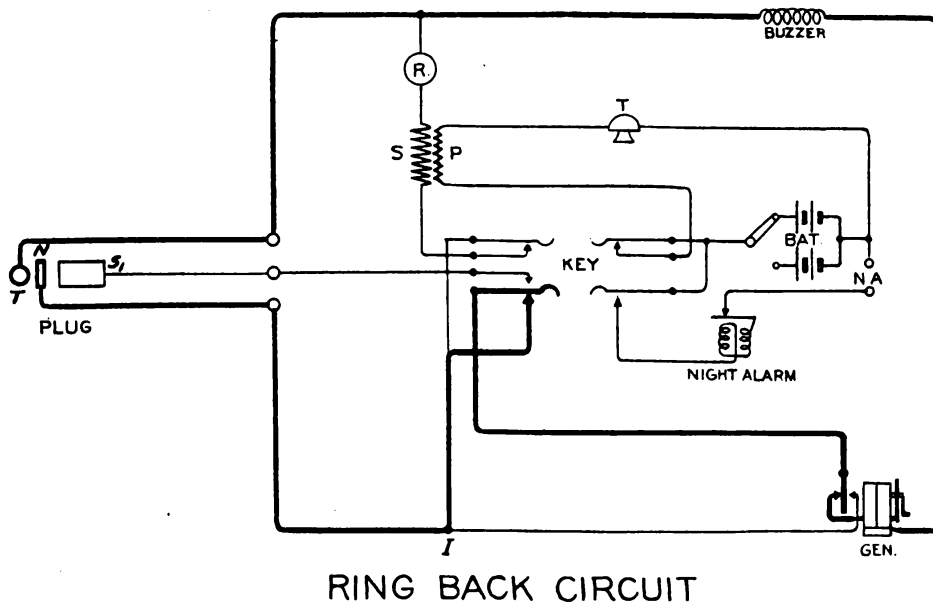


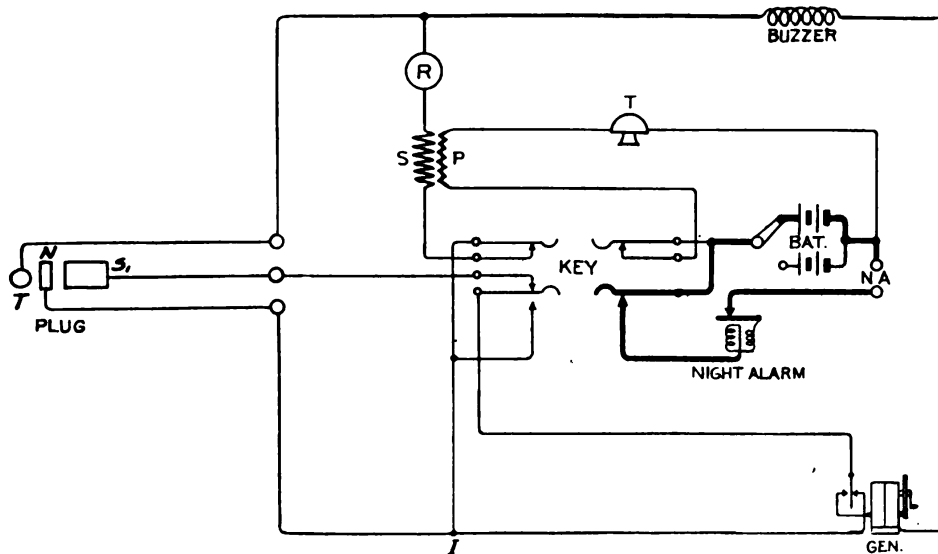
Fig. 17.

(same as fig. 14) through the outside line and telephone to Line to R of the unit of called party to M to K to unit of calling party to S_1 (fig. 15) to lower switch to I to upper switch to S. 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. Figure 17 shows this "ring back" circuit in the operator's set. The reader should be able to trace the rest of the circuit by referring to figure 14.

46. When connections have been established the operator removes his plug. The calling and called stations are connected both when the operator's plug is and is not in the jack of the calling party's unit. When the operator's plug is not in the jack the circuit is Ground to J to L of the calling unit (fig. 14) to J to GROUND through outside line to Line to R of the called party's unit (same as

fig. 14) to M to H to Line of calling party's unit. When the operator's plug is in the jack of the calling party's unit, it must be remembered that the contact between H and R (fig. 14) of this jack is broken. The reader should trace the circuit referring to figures 14 and 15. The knowledge that this circuit uses the branch passing through the sleeve of the operator's jack (fig. 15) will aid in tracing out the circuit.

47. 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 closes it through the night alarm buzzer. The whole circuit can be easily traced by the reader. The falling of the shutter of the switchboard unit closes the open circuit from the top to the lower brass bar of the unit



NIGHT ALARM CIRCUIT

Fig. 18.

(fig. 14). The night alarm circuit in the operator's set is shown in figure 18. When summoned by the night alarm, the operator must throw the key to the center position before answering the call.

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

48. Many parts of the discussion of the care and adjustment of type EE-2 units in paragraphs 17 to 21 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.

49. 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, this may be due to a broken operator's cord, which can be tested by means of battery and telephone receiver, and replaced if necessary. It may also be due to a broken receiver cord. 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.

50. 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.

PARTS LIST.

51. The following parts lists give the drawing number and also the type number when one has been assigned. The drawing number serves to identify the part to the Office of the Chief Signal Officer only. Essential parts have been marked with an asterisk. In general, when a unit becomes unserviceable, it should be replaced by another unit and the unserviceable one returned to a post designated by the Chief Signal Officer for repair. The minor parts will not be issued for repairs.

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

	Drawing No.
Case.....	15004D2
*Generator.....	10101C1
*Induction coil.....	10201A1
*Key.....	15004B7
Switch parts.....	15004B8
*Transmitter, complete.....	15004D9

	Drawing No.
*Transmitter arm, detail 100.....	15004D9
*Transmitter arm, clamps, detail 101 and 103.....	15004D9
*Transmitter clamps, detail 102 and 104.....	15004D9
*Transmitter clamp screws, No. 8, 32 by $\frac{1}{8}$ inch, R. H. B. machine.....	15004D9
Night alarm binding post, type TM-34.....	10401B1
*Cord binding post, screw, detail No. 1.....	10403B1
*Night alarm buzzer.....	15004A10
*Series A. C. buzzer.....	11101C1
*Receiver, type R-11.....	11002D1
*Receiver cord, type CC-310.....	10501C1
*Transmitter cord, type CC-304, 8 inches long.....	10501C1
*Plug cord, type CC-56.....	10602C1
*Plug.....	10152B1
*Battery, type BA-1.....	
Mounting plate thumb screw, detail 31.....	15004B3
*Carrying strap with fittings, part No. 2.....	51901C1

SWITCHBOARD TYPE BD-9-A-4 LINE.

*Switchboard unit, type EE-2-A.....	15003D4
Case.....	15003D3
*Carrying strap with fittings, part No. 2.....	51901C1
*Suspension bracket, detail No. 11.....	15003D3

SWITCHBOARD TYPE BD-11-A-12 LINE.

*Switchboard unit, type EE-2-A.....	15003D4
Case.....	15009D2
*Carrying strap with fittings, part No. 2.....	51901C1
*Suspension bracket, detail No. 11.....	15003D3

SWITCHBOARD TYPE BD-11-12 LINE.

*Switchboard unit, type EE-2.....	15001B6
Carrying case.....	15001D2
Cabinet.....	15001D3
*Operator's cord, type CC-59.....	10602C1
*Operator's plug.....	15001B7

SWITCHBOARD UNIT TYPE EE-2.

*Jack, complete with mounting screws.....	15001D5
*Drop, complete with mounting screws.....	15001D5
*Number plate, detail 72.....	15001D5
*Fuse, detail 76.....	15001D5
Night alarm contact spring, detail 82.....	15001D5
Drop guard, details 84, 85, 87, and 88, assembled.....	15001D5
Lightning arrester, detail 90.....	15001D5
Fuse spring, detail 74.....	15001D5
Lightning arrester screw, detail 94.....	15001D5
*Unit mounting screw, detail 105.....	15001B6
*Cord binding screws, detail 103.....	15001B6
*Line binding screws, detail 92.....	15001B6
*Cord, type CC-59.....	10602C1
*Plug.....	15001B7

SWITCHBOARD UNIT TYPE EE-2-A.

	Drawing No.
*Jack-----	10161A1
Jack mounting screw, No. 6, 32 by $\frac{1}{4}$ inch, R. H. B. machine screw with hexagon nut-----	
*Drop, complete-----	15003D4
*Unit mounting screw, detail 14-----	15003D4
*Cord anchor, detail 33-----	15003D4
*Number plate, detail 22-----	15003D4
Night alarm contact spring, detail 28-----	15003D4
Drop guard, details Nos. 24, 25, 26, and 27, assembled-----	15003D4
*Line binding post-----	10401B1
*Cord binding post screw, detail No. 1-----	10403B1
*Cord type CC-59 with No. 8 terminal on tie cord-----	10602C1
*Plug-----	15001B7



