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INSTRUCTION BOOK

FOR

SWITCHBOARDS BD-76-T2 AND BD-82-T2

(MONOCORD)

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PREPARED AT  
SIGNAL CORPS LABORATORIES  
FORT MONMOUTH, NEW JERSEY

FEBRUARY 25, 1936

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SECTION I

GENERAL DESCRIPTION

1. Switchboards BD-76-T2 and BD-82-T2 are 6- and 12-line monocord switchboards with facilities for terminating and interconnecting telephone circuits in the field. Each switchboard is equipped with an operator's telephone, line units with drops for signaling the operator, cords for interconnecting the lines, a cord for connecting the operator's telephone to any line, batteries, a terminal strip, a night alarm circuit, and a light circuit. A panel is provided on which are mounted the necessary switches and binding posts for the head and chest set and external battery. Space and wiring are provided for repeating Coils C-75 in certain lines for simplexing telegraph circuits on those lines. The case is made of plywood. A Bag BG-49 is supplied for carrying four detachable wooden Legs LG-1 and a ground Stake GP-3.

2. Switchboard BD-76-T2 contains six Switchboard Units EE-2 and two Coils C-75 connected in the first two lines. The units are replaceable and provide the line termination, a drop for signaling the operator, a designation strip, and a cord with plug and a jack for connection to other circuits.

3. The operator's telephone set consists of a Telephone EE-5 without case, a Cord CC-59 (red) with Plug PL-35 attached, an improved barrier-button carbon transmitter of the breast type with horn-type mouthpiece, a single earpiece receiver with wire headband, and a suitable Tirex-jacketed cord. Two Batteries BA-17 in series (3 volts) are provided for the transmitter, light, and night alarm circuits.

4. The chest of Switchboard BD-76-T2 is made of plywood with the front hinged down in two sections. The first section may be fastened in the horizontal position by means of a chain to form a writing shelf. The second section may be opened to expose compartments for two Batteries BA-17, the cords, and the head and chest set. The back of the chest may be opened to expose the terminal strip and cable, and the repeating coils.

5. Fig. 1 shows the Switchboard BD-76-T2 packed and the Bag BG-49 containing the legs and ground stake. The chest is 9" deep, 14-1/2" high and 16" long. An adjustable web strap 1-1/2" wide is attached to the case for carrying. The switchboard, complete with batteries and coils, weighs 46 pounds. The bag and supplementary equipment weigh 7 pounds. Fig. 2 shows the switchboard set up for operation. Fig. 3 shows the back of the switchboard open, with the terminal strip, cable and coils in position.

6. Switchboard BD-82-T2 is similar to that described above except it has twelve Switchboard Units EE-2 and three Coils C-75 connected in the first three line circuits. The chest is 9" deep, 13-1/2" high and 24" long, and is fitted with a handle at each end in addition to the carrying strap. The switchboard, complete with batteries and coils, weighs 67 pounds. The bag and supplementary equipment weigh 7 pounds. Figs. 4, 5 and 6 show the three views of Switchboard BD-82-T2.

7. The wiring diagram of Switchboards BD-76-T2 and BD-82-T2 is shown in Fig. 7.

## SECTION II

### EMPLOYMENT

8. To prepare the switchboard for operation, place it upon a table or upon the floor or ground with the legs in the sockets and firmly planted. Open both hinged sections of the front of the switchboard and pull out the cords and the operator's head and chest set. Two Batteries BA-17 should be connected in series to the leads in the battery compartment. The lower section of the front should then be closed and fastened, and the upper section fastened with the chain to form the writing shelf. The signal drops on the face of the switchboard should be released by lowering the locking bars to a horizontal position. The operator's circuit, and the line, generator, night alarm, and light circuits should all be checked and tested as described in paragraph 16.

9. The back should be opened and the terminal strip and cable removed and fastened to a suitable support. If it is desired to use the terminal strip in position, it may be left clamped in the back of the switchboard. Lines on which simplex telegraph circuits are desired should be connected to the first two or three pairs of binding posts on the 6- and 12-line switchboards respectively. The telegraph lines should be connected to the "TELEG" binding posts on the Coils C-75. The ground Stake GP-3 should be driven into the ground at a suitable location and connected to the "GROUND" binding post in the rear of the switchboard by a short length of field wire.

10. The operator should be seated and adjust the head and chest set to a comfortable position with the transmitter close to the lips. The "TR. BAT." switch on the operator's panel should be turned on. To call a party the operator's plug (red) is inserted in the jack of the desired line unit and the generator crank turned with the right hand. To answer a call indicated by a signal drop, the operator inserts the operator's plug (red) into the jack of the indicated line unit and restores the drop to normal. Upon determining the called party, the operator should ring that party, hold the line until the party answers and caution him to hold the line until the call is completed. The operator should then disconnect his cord and connect the lines by inserting the plug from the line unit of the calling party into the jack of the line unit of the called party.

11. With the drop of the calling party restored to normal, it is ready for the ring-off signal when conversation is completed or when either party wishes to recall the operator. When such a drop signal is received, the operator should connect the red plug to the jack of the calling party and answer. If no reply is received, the cords should be disconnected. When a plug is inserted into the jack of a switchboard unit, the signal drop is disconnected from the line. This provides only one signal drop across two or more lines connected together so that the transmission loss is maintained at a minimum.

12. The night-alarm circuit is put in operation by turning on the "NT. ALM." switch, which connects a buzzer in circuit with the drop contacts. When a drop operates, it makes contact through the spring in back of its under side and the night-alarm signal is maintained until the drop is restored or the switch is turned off.

13. A light is provided above the face of the switchboard. It may be turned on by operating the "LIGHT" switch. A reflector is provided in front of the light.

14. When the operator is not busy, in order to conserve battery, all switches should be turned off unless the night alarm is desired to indicate incoming calls.

15. When closing station the signal drops should be locked in position with the spring clips. The cords and the head and chest set for the 6-line board should be stored in the lower left compartment and for the 12-line board in the lower center compartment. The lines should be disconnected and the cable coiled around the repeating coils in the back compartment. It will be necessary to remove the transmitter mouthpiece when packing. If the switchboard is not to be used for some time, the batteries should be removed. The sides of the switchboard should be securely closed and locked in position. The legs and ground stake should be placed in Bag EG-49 for carrying.

#### 16. Tests.

a. Ringin~~g~~ Circuit. The generator should turn easily when the operator's cord is not connected to a line unit. With a "short" across the tip and sleeve of the operator's plug (red), the generator should turn hard.

b. Operator's Circuit. Connect the operator's plug (red) to the jack of the line unit, short circuiting this line at the terminal strip, or use a unit with a long line or repeating coil connected to it. Tap or blow into the transmitter and the noise should be heard in the receiver.

c. Line and Signal Circuit. Connect a field telephone to each pair of line terminals in turn. Ring and talk from this telephone to the switchboard operator. The drop should fall when ringing and the operator should be able to hear and be heard by the person at the test telephone when the operator's cord is inserted in the jack

of the unit being tested. Also tests on the signal drops may be made by touching the tip and sleeve of the operator's plug (red) to the contact blocks at the top of the units and ringing.

d. Night Alarm Circuit. When testing the signaling circuit as above, have the "NT. ALM." switch on and as each drop falls it should start the buzzer. The circuits may also be tested by manually operating each signal drop in turn.

### SECTION III

#### DETAILED DESCRIPTION

17. Case. The cases of Switchboards BD-76-T2 and BD-82-T2 are made of 1/2-inch plywood. The front consists of two sections hinged together. The lower section hinges downward to expose the compartments for the cords, head and chest set, and batteries. The upper section may be fastened in a horizontal position by means of a chain to form a writing shelf. The rear of the case opens to expose the terminal strip, cable, and repeating coils. A web carrying strap is attached for carrying the switchboard. The strap is 1-1/2" wide and the length is adjustable. The 12-line switchboard also has a handle at each end. Sockets on each end are provided for the legs.

18. Switchboard Unit. The Switchboard Unit EE-2 has two fuse clips, two 3-ampere fuses, a lightning arrester, a designation strip, a signal drop with night-alarm contact, a jack, and a cord and plug. The Cord CC-59 (green) and Plug PL-11 are standard equipment furnished as part of the unit. Each unit is readily removed from the face of the switchboard by removing two screws. The lightning arrester consists of a star-shaped metal washer mounted between the two line connector blocks at the top of the unit. Three connections are made by the unit to the fixed bus bars in the switchboard case. The top bus bar is the connection for the lightning arrester ground, the middle bus bar for one side of the night-alarm circuit, and the bottom bus bar for the positive battery. The signal drop catch, which is operated magnetically when ringing current is received, is adjustable. A plug inserted into the line jack removes the signal drop from the line by opening a contact on the tip spring of the jack.

19. Telephone. A Telephone EE-5, less case, is mounted on the right of the switchboard. The line terminals are connected to the operator's Cord CC-59 (red) equipped with a Plug PL-35. The battery terminals of the telephone are connected to the Batteries BA-17 in the compartment below the telephone, so that a Battery BA-9 does not have to be inserted in the battery compartment of the telephone frame. The operator's head and chest set is connected to the telephone through the "TR. BAT." switch so that the switch opens and closes both the transmitter and receiver circuit.

20. Panels. The operator's panel is mounted at the left, facing the switchboard. It is made of 1/4-inch bakelite and contains three toggle switches and four Binding Posts TM-152. The switches

are for the light, night-alarm, and transmitter-battery circuits, respectively, from top to bottom, as marked on the panel (see Fig. 7). The first two binding posts are for emergency battery connections; "+3v." at the top, and "-TR" (transmitter) next. The "-TR" binding post is also connected to the transmitter lead of the head and chest set. The third binding post "COM" is for the common lead, and the fourth "REC" for the receiver lead of the head and chest set. At the right side a metal plate covers the operator's telephone.

21. Crank. The crank of the generator is of the folding type and must be folded back before the front of the case can be closed. When open it is easily accessible for use.

22. Head and Chest Set. This equipment consists of a standard commercial receiver and transmitter connected to the operator's panel by a 5-foot rubber-jacketed cable. The receiver is the Western Electric #528, single, watch-case, 80-ohm receiver which is furnished complete with a Western Electric #11-A Headband and Western Electric #1466 black leather Headband Pad. The transmitter is the Western Electric #396-A Transmitter consisting of a molded black bakelite housing on a triangular breast plate, with a detachable mouthpiece of molded semivulcanized rubber. The carbon button (W.E. #1-A Transmitter Unit) is of the double-barrier type with a resistance of approximately 175 ohms. A thin rubber membrane covers one side of the transmitter button to protect it from moisture created by the operator's breath. A neckband Strap ST-2 is furnished to fasten the transmitter in position.

23. Light. A miniature lamp socket is fastened to the case above the switchboard units. Lamp LM-19 (Mazda #14 or equivalent 3-volt flashlight type) is used in the socket. The reflector is mounted in front of the socket. The light is controlled by the switch on the panel marked "LIGHT."

24. Night Alarm. A vibrating buzzer is mounted in the switchboard and wired in series with the "NT. ALM." switch on the operator's panel, the battery, and the contacts operated by the signal drops.

25. Batteries. A compartment is provided below the telephone for housing two Batteries BA-17. Batteries BA-23 may also be used. These are equivalent to the standard commercial 1-1/2-volt No. 6 dry cells. The two batteries in series provide 3 volts for the transmitter, light, and night-alarm circuits. The positive side of the battery should be connected to the red lead and the negative side to the black lead. A short lead is provided in the compartment for connecting the two batteries together. 76-82

26. Terminal Strip. Terminal Strip TM-84-A contains 10 pairs of metal binding posts, each pair connected together by a metal strap. To form the terminal strips for the 6- and 12-line switchboards, the above strips or parts thereof are mounted on a bakelite base to present twelve or twenty-four pairs of binding posts. One of each connected pair is used for connection to the cable. The other end of the cable is wired to the line units and the repeating coils. The cable has a Tirex rubber jacket and for the 6-line board contains



six pairs, and for the 12-line board fifteen pairs (3 spare). The conductors are stranded copper #22 A.W.G. with special rubber insulation. The terminal strip has three metal brackets for support. Three studs are provided in the back of the switchboard for clamping the terminal strip in place.

27. Repeating Coil. Coils C-75 are provided in this switchboard. These coils have balanced line windings for simplex telegraph use, are of the talk-through, ring-through type, and provide a 1-to-1 ratio of approximately 600 ohms impedance. The coils are wired in place on the first 2 and 3 lines of Switchboards BD-76-T2 and BD-82-T2, respectively. The coils can be left out if not needed. In that case the pair of line leads from the line side of the coil should be connected to the pair of leads removed from the switchboard side of the coil.

28. Legs. Legs LG-1 are made of wood, are 13/16 inch by one inch in cross section and 34 inches long. One end is tapered slightly to fit into metal leg sockets on the ends of the switchboard.

29. Stake. The ground Stake GP-3 is of 1" x 1" galvanized angle iron and is 30 inches long. A wing nut and stud near the top provide for wire connections, and a cross-piece serves as a handle.

#### SECTION IV

##### SERVICING, REPAIR AND STORAGE

30. The wiring diagram, Fig. 7, should be followed closely in making tests and repairs on the switchboards. The drop and jack on each switchboard unit should be kept in proper adjustment. The jack, if not tampered with except for cleaning, should rarely get out of adjustment. Contacts can be cleaned by burnishing the points with a thin piece of soft wood. No attempts should be made to adjust the drop springs except by experienced personnel with the proper tools.

31. Before packing for storage all batteries should be removed from the battery compartment. The signal drops should be locked in position by the spring clips, and the cords and the head and chest set fitted into their compartment. It will be necessary to remove the transmitter mouthpiece before packing. The cable should be neatly coiled around the repeating coils, and the terminal strip placed on the studs and clamped in position in the rear compartment. All hinged sections of the case should be closed and securely fastened in place. The legs and ground stake should be placed in Bag BG-49.

## SECTION V

## SUPPLEMENTARY DATA AND PARTS LIST

32. Parts List.

<u>Nomenclature</u>	<u>Stock Item</u>	<u>Size (in.)</u>	<u>Weight (lbs.)</u>
Bag BG-49	2Z449	4 x 8 x 37	2.0
× Battery BA-17	3A17	6.5 x 2.5 d.	2.0
Binding Post TM-152	3Z252	1 x 0.5 d.	0.1
Buzzer, vibrating	4Z2802	1 x 3 x 3	0.5
Cable, Tirez, experimental		10 feet	1.5
Coil C-75 (repeating)	3C75	2.5 x 4.4 x 7	4.0
Cord CC-59 (red)	3E59	28 x 0.3 d.	0.3
Crank per Sig.C.dwg. 10110B1		1 x 1 x 2	0.2
Lamp LM-19 (Mazda #14)	6Z6759	0.9 x 0.5 d.	0.1
Leg LG-1	2Z6101	0.8 x 1 x 34	0.8
Plug PL-35	4C6235	3.5 x 0.5 d.	0.2
Receiver, W.E. #528	4C7592.8	1 x 2.5 d.	0.5
Diaphragm for W.E.#528 Rec.	2B312	1.75 d.	
Headband, W.E.#11-A		2 x 5 d.	0.1
Headband Pad, W.E.#1466		0.25 x 2 x 2	0.1
Socket, Bryant #9445		0.8 x 1.2 d.	0.1
Stake GP-3	2A3303	1 x 1 x 30	2.0
Strap ST-2	2Z9002	0.1 x 0.8 x 25	0.2
Strap, carrying		0.1 x 1.5 x 60	0.4
Switch, Arrow-H&H #20992		0.5 x 1 x 1.25	0.1
Switchboard Unit EE-2	4C9912	1.4 x 3 x 7.9	1.0
Cord CC-59 (green)	3E59.1	28 x 0.3 d.	0.3
Plug PL-11	4C6211	3.5 x 0.5 d.	0.2
Telephone EE-5, less case and handset	4B5005.1	3.3 x 4 x 9	7.0
Buzzer BZ-6	4B5005/1-6	1 x 2 x 2.5	0.4
Capacitor CA-88	3D88	0.5 x 2 x 4	0.4
Coil C-44 (induction)	3C44	1 x 1 x 3	0.3
Generator GN-27	4B827	3 x 3 x 6	4.5
Terminal Strip TM-84-A	4E9284A	0.3 x 2.5 x 8.8	1.2
Transmitter, W.E.#396-A	4C28396	5 x 5 x 6	0.5
Mouthpiece for W.E.#396-A			
Transmitter		5 x 1.7 d.	0.2
Transmitter Unit, W.E. #A-1		0.5 x 1 d.	0.2

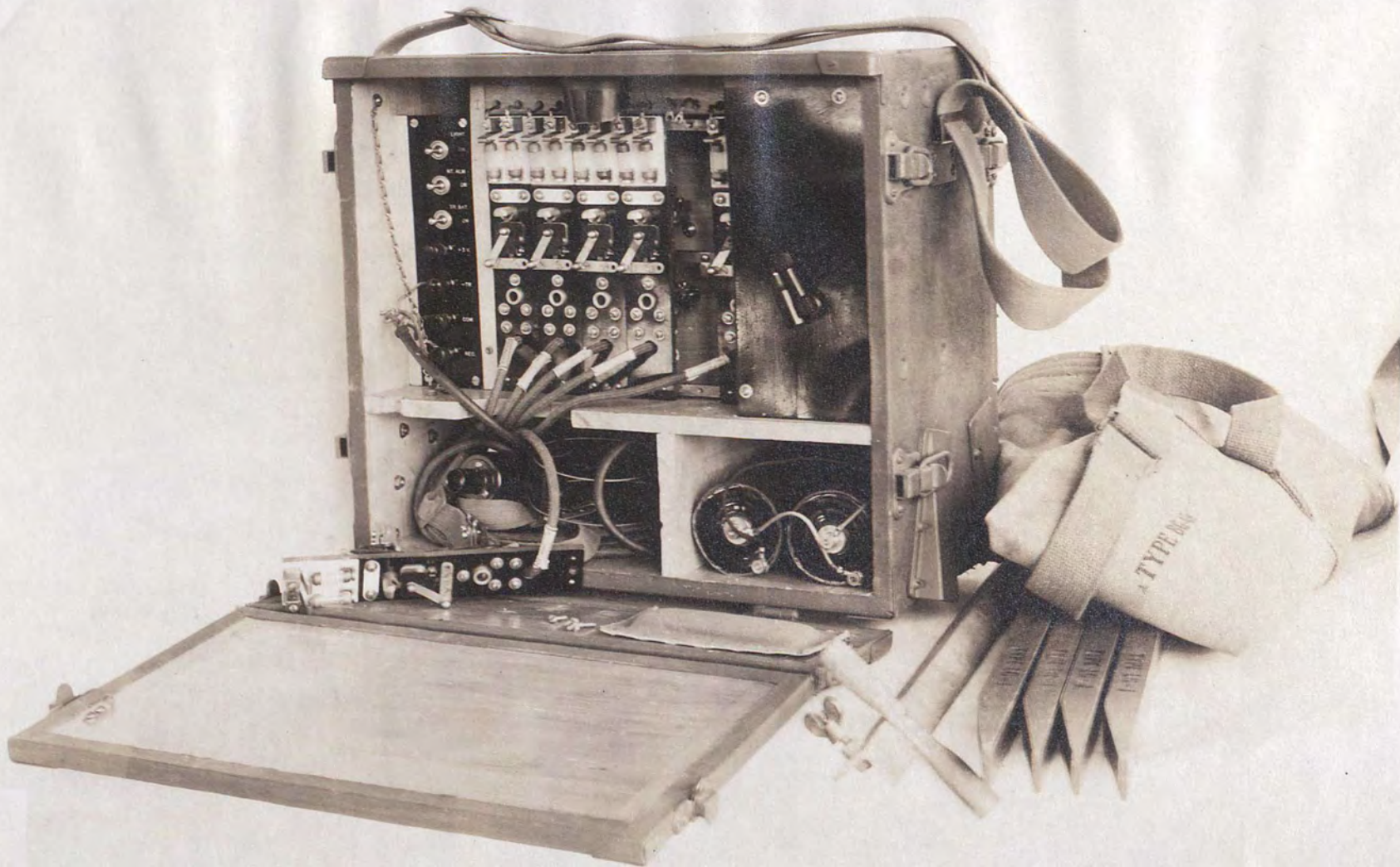


FIG. 1 - SWITCHBOARD BD-76-T2 AND SUPPLEMENTARY EQUIPMENT

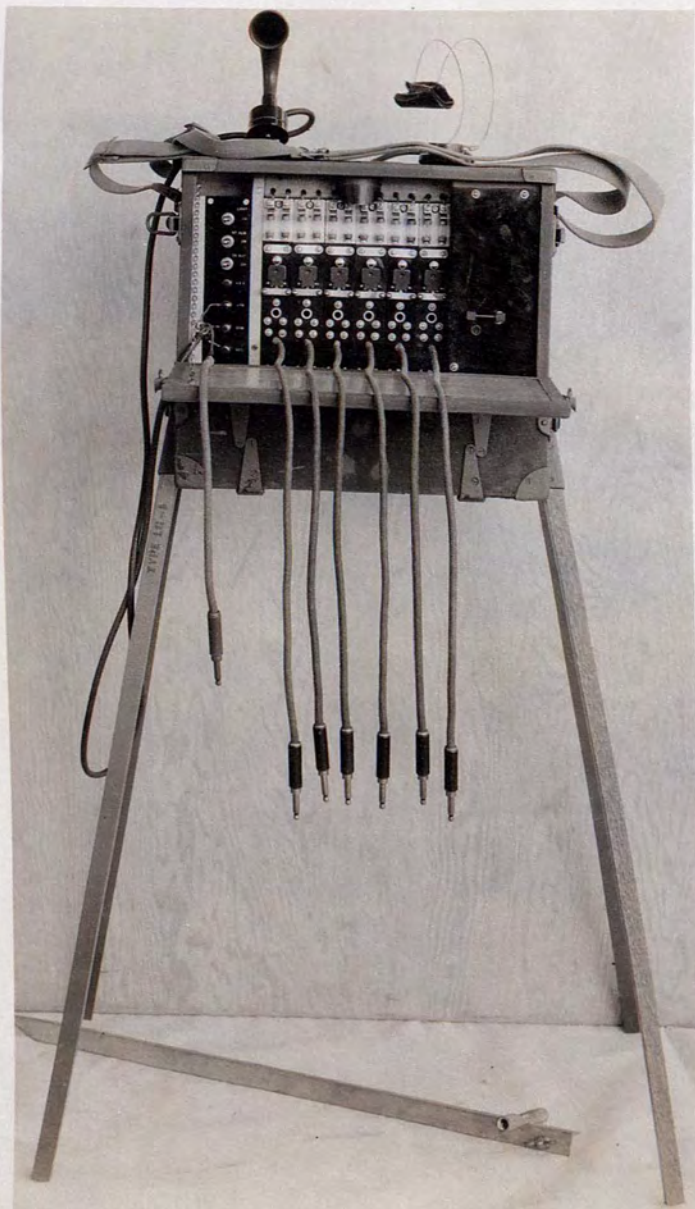


FIG. 2 - SWITCHBOARD BD-76-T2, FRONT, OPEN

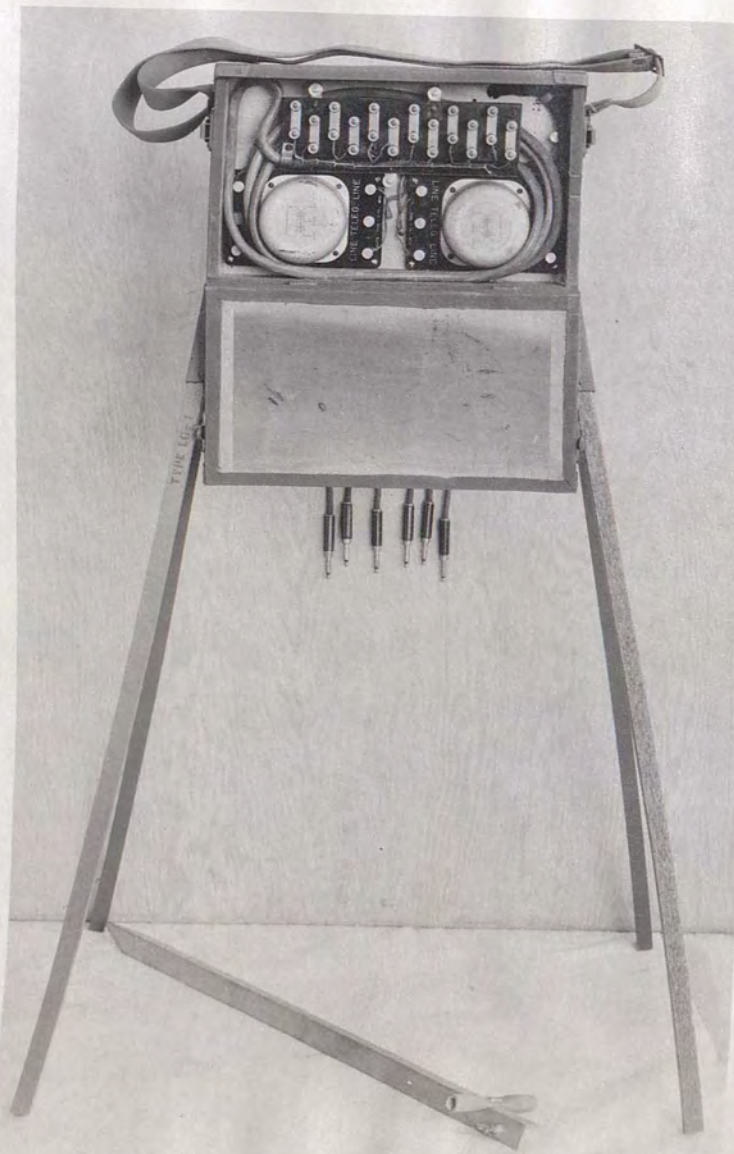


FIG. 3 - SWITCHBOARD BD-76-T2, BACK, OPEN

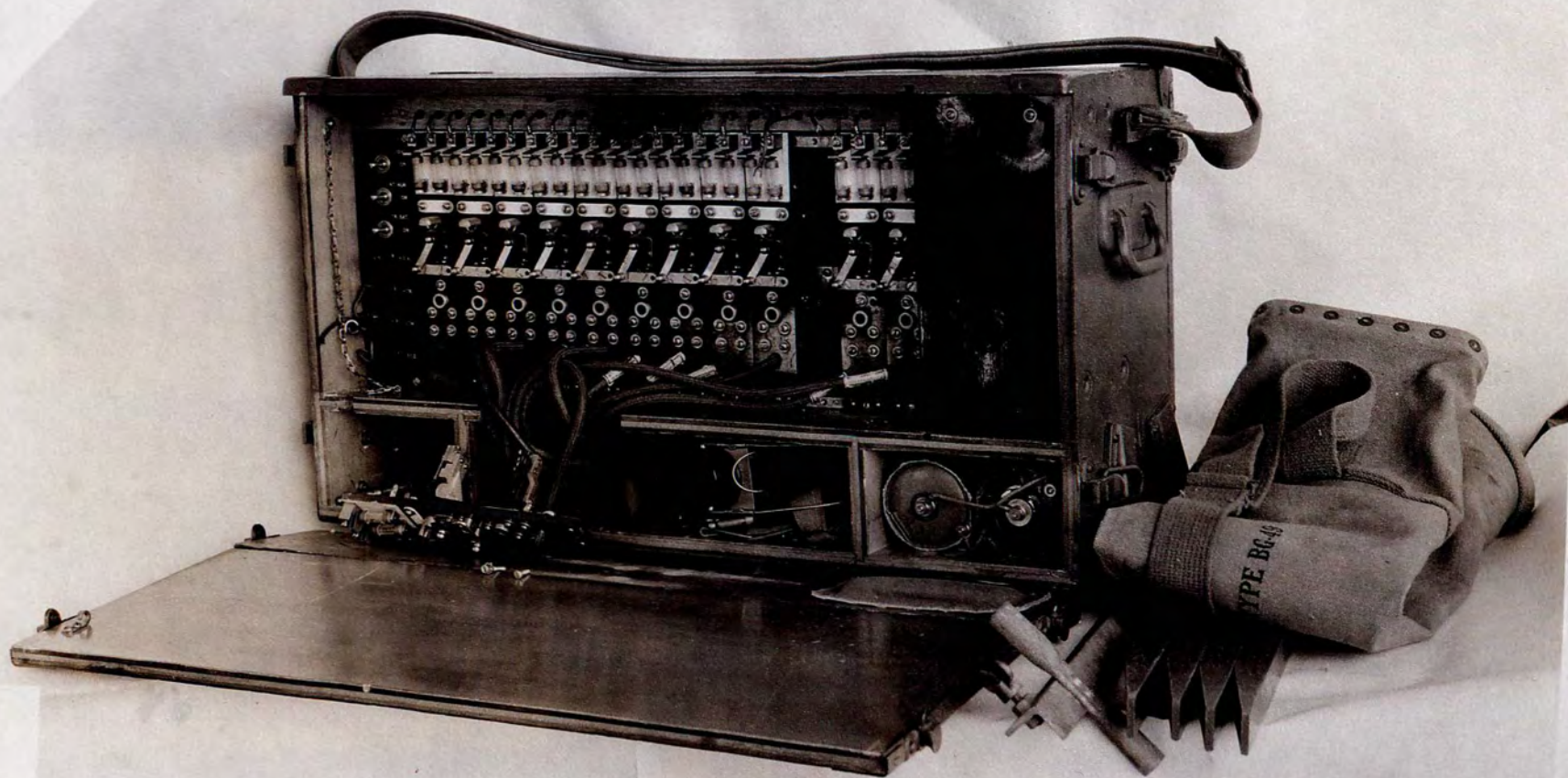


FIG. 4 - SWITCHBOARD BD-82-T2 AND SUPPLEMENTARY EQUIPMENT

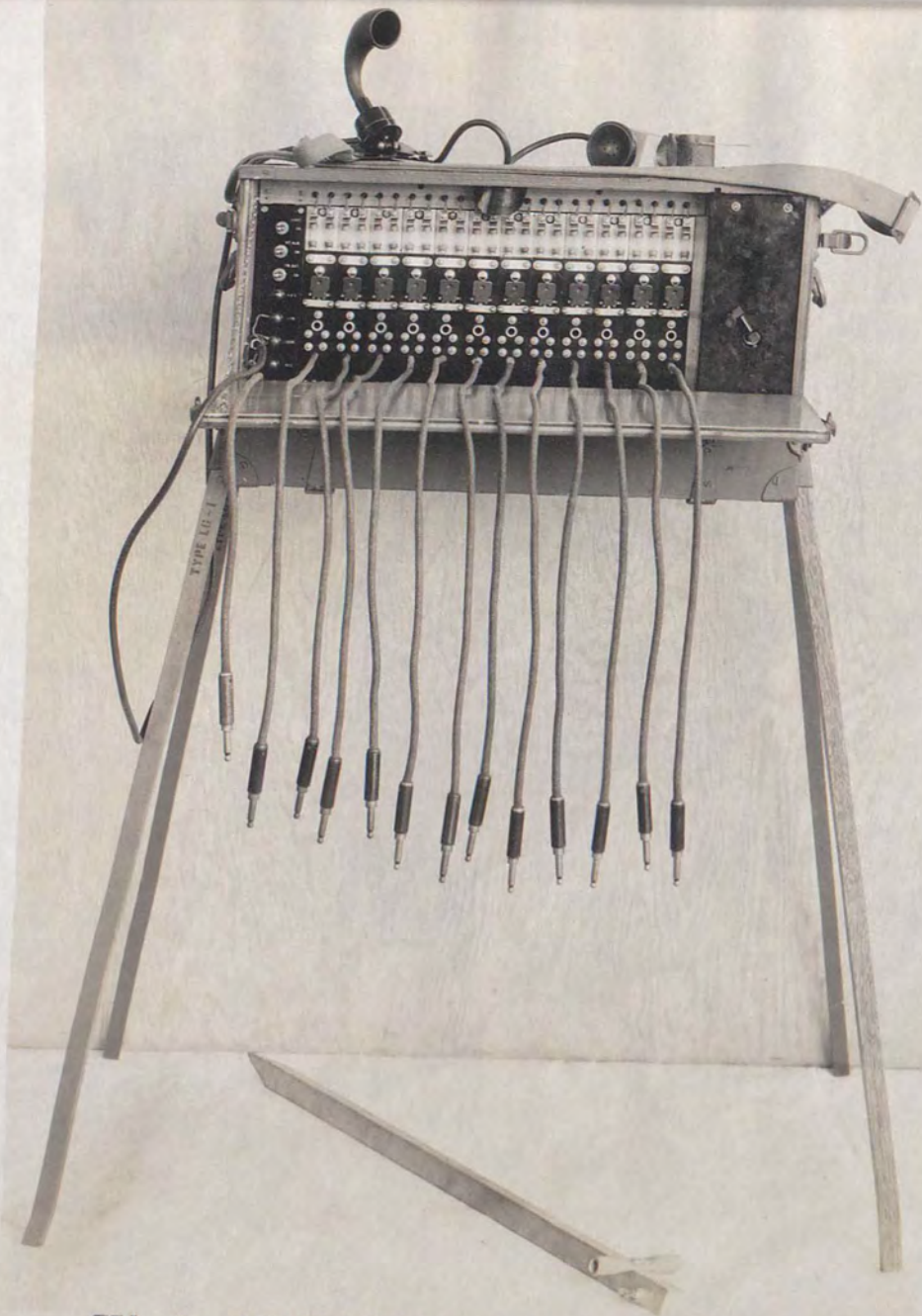


FIG. 5 - SWITCHBOARD BD-82-T2, FRONT, OPEN

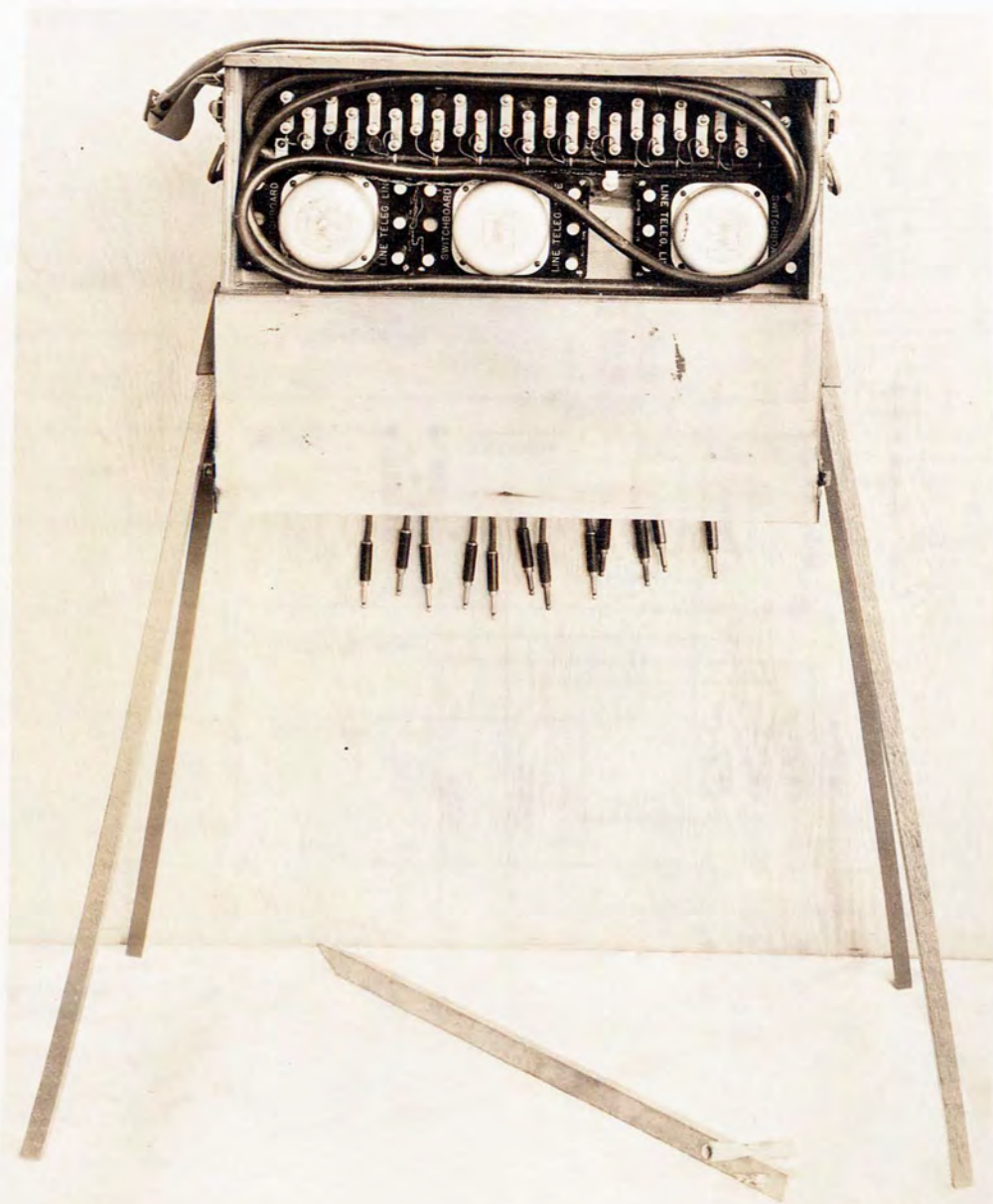


FIG. 6 - SWITCHBOARD BD-82-T2. BACK, OPEN



# SWITCHBOARDS BD-76-T2 & BD-82-T2 WIRING DIAGRAM

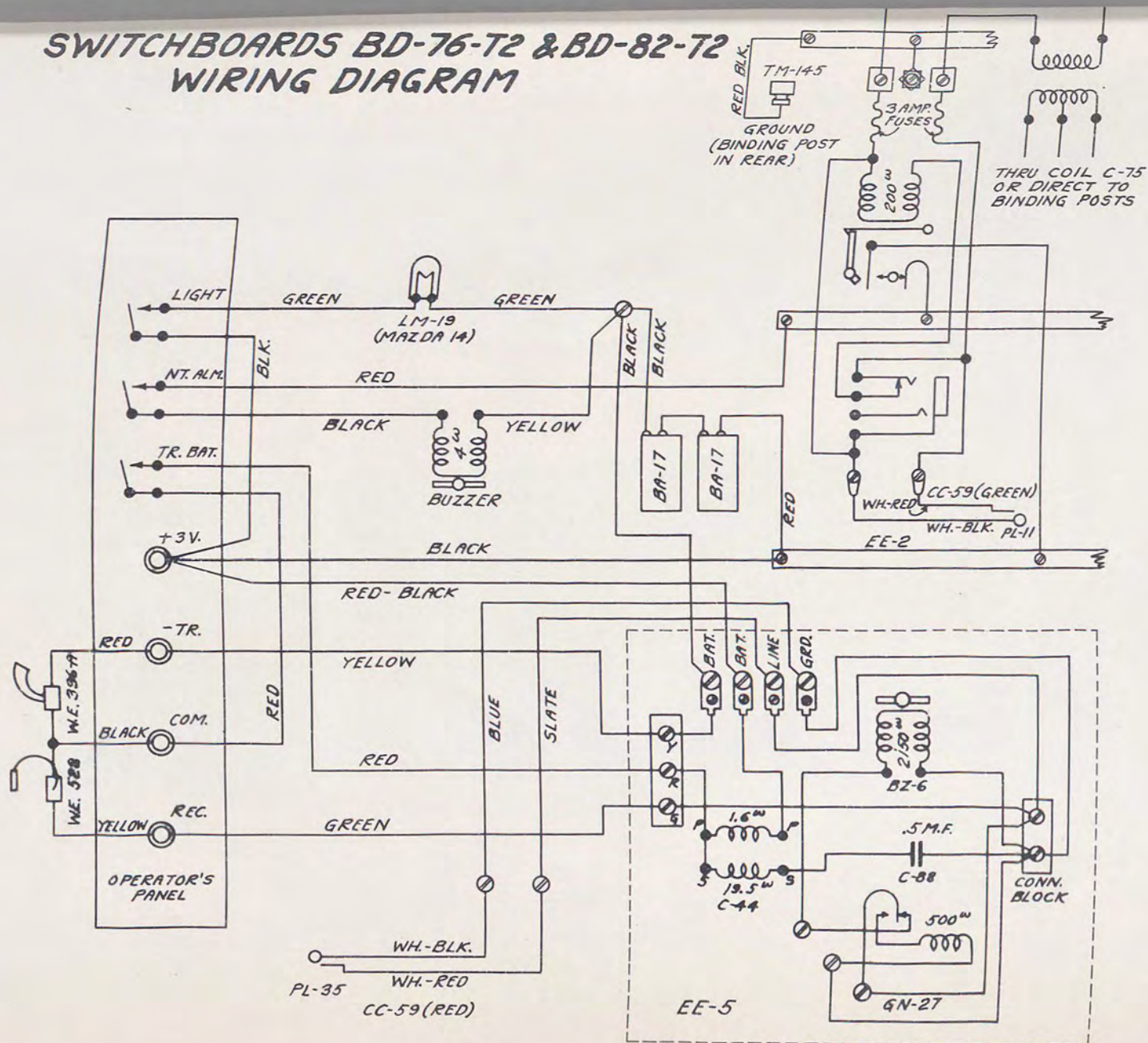


Fig. 7

SC-D-1856-A