

**TELEPHONE SWITCHBOARD YD-100
INSTRUCTION BOOK**

**NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS**

RESTRICTED

**DICTOGRAPH PRODUCTS, INC.
580 FIFTH AVENUE
NEW YORK 19, N. Y.**

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PART I—GENERAL DESCRIPTION

This equipment is a compact type of local battery, lamp signal operated switchboard. It is intended for indoor use only, but has been designed to withstand the high humidity of tropical climates.

Capacity of the switchboard is 50 connected lines, with 10 cord circuits. The line units are demountable in groups of 10, so that if full line capacity is not desired, space and weight may be conserved by removal of one or more line units.

Principal feature of this switchboard is the use of gaseous discharge lamps instead of mechanical drop signals. This accounts for the lighter weight of this equipment, contrasted to the considerably greater weight of a drop-signal switchboard. Greater resistance to shock is also a feature of this equipment, as there are no sensitive mechanical latches to vibrate loose, causing a false signal to appear.

Operation of the switchboard is simple and direct and is similar to the operation of other types of local battery switchboards. The switchboard is designed to work with standard two wire metallic lines and local battery telephone sets.

Each switchboard system comprises the following major units:

	Weight	Cubic Ft.
1 Fifty line, ten cord switchboard.....	45.3 lb.	1.70
1 Power Supply Unit (135-180 volts).....	22.2 lb.	.51
3 Air Cell Batteries (1.25 v. each).....	33.7 lb.	.65
1 Wall Mounting Bracket.....	18.7 lb.	.77
1 Spare Parts and Tool Kit.....	4 lb.	.1
3 Instruction Books	—	—
Total weight and cube packed for shipment.....	200	10.1

Power for operation of the switchboard lamps is furnished by the Power Supply Unit, which is provided with a plug for connection to a 117 volt 60-cycle, A.C. power line. Transmitter and night alarm current is obtained from the Air Cell Batteries.

PART II—UNPACKING AND INSTALLATION

A. REMOVAL OF UNITS FROM SHIPPING CASE

1. The Switchboard, completely assembled with cords and weights, the Wall Mounting Bracket, Power Unit Batteries, Spare Parts Box and the Instruction Book are packed in one container.
2. Normal precautions should be taken when unpacking, so that no damage will result. Particular care is necessary to prevent the cord weights from striking the unit, as they are lifted out of the case.
3. Check against list of components (Part I) and picture (Fig.1) to be sure all parts are on hand.

B. MOUNTING SWITCHBOARD

1. Select a switchboard location which will provide a convenient means for bringing in line wires. The switchboard may be mounted on a special desk (with an opening provided for the cords to hang through), or on the wall bracket furnished. If the bracket is used, the wall against which it is mounted must be dry and strong enough to support the switchboard. The switchboard should be mounted at a height convenient for use. This will depend upon the height of the chair or stool to be used by the operator and should be determined in each case by the installer.
2. If the location selected for the switchboard is on a wall, the wall bracket should then be mounted. Fig. 3 shows the proper mounting of the bracket. Care should be taken that it is approximately level. Figure 4 shows the layout dimensions for the bracket mounting holes.

The type of mounting screws used will depend upon the type of wall. The provision of the proper screws is left to the installer. After the bracket is installed it should be tested for strength and for smooth operation of the hinge.

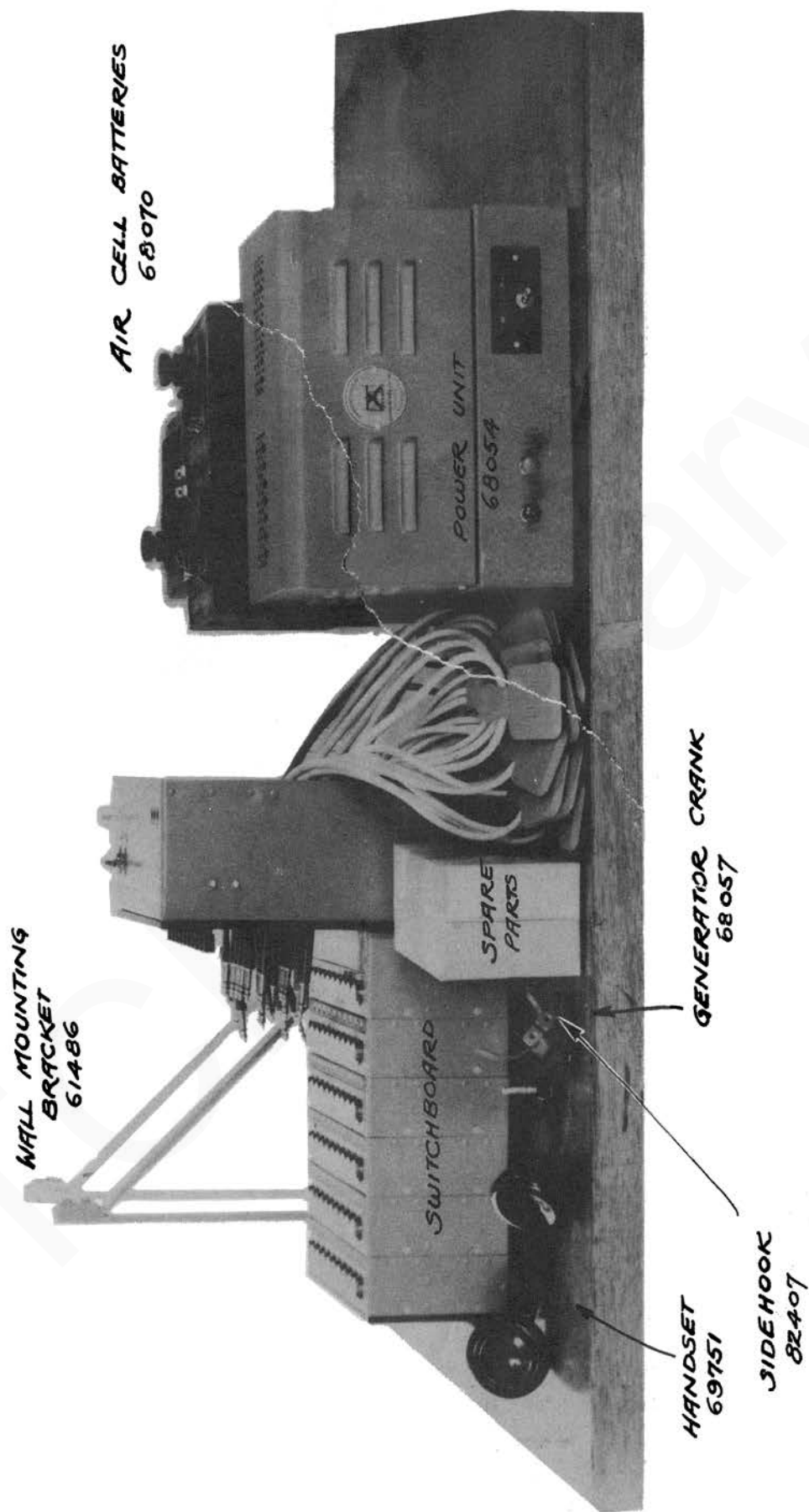
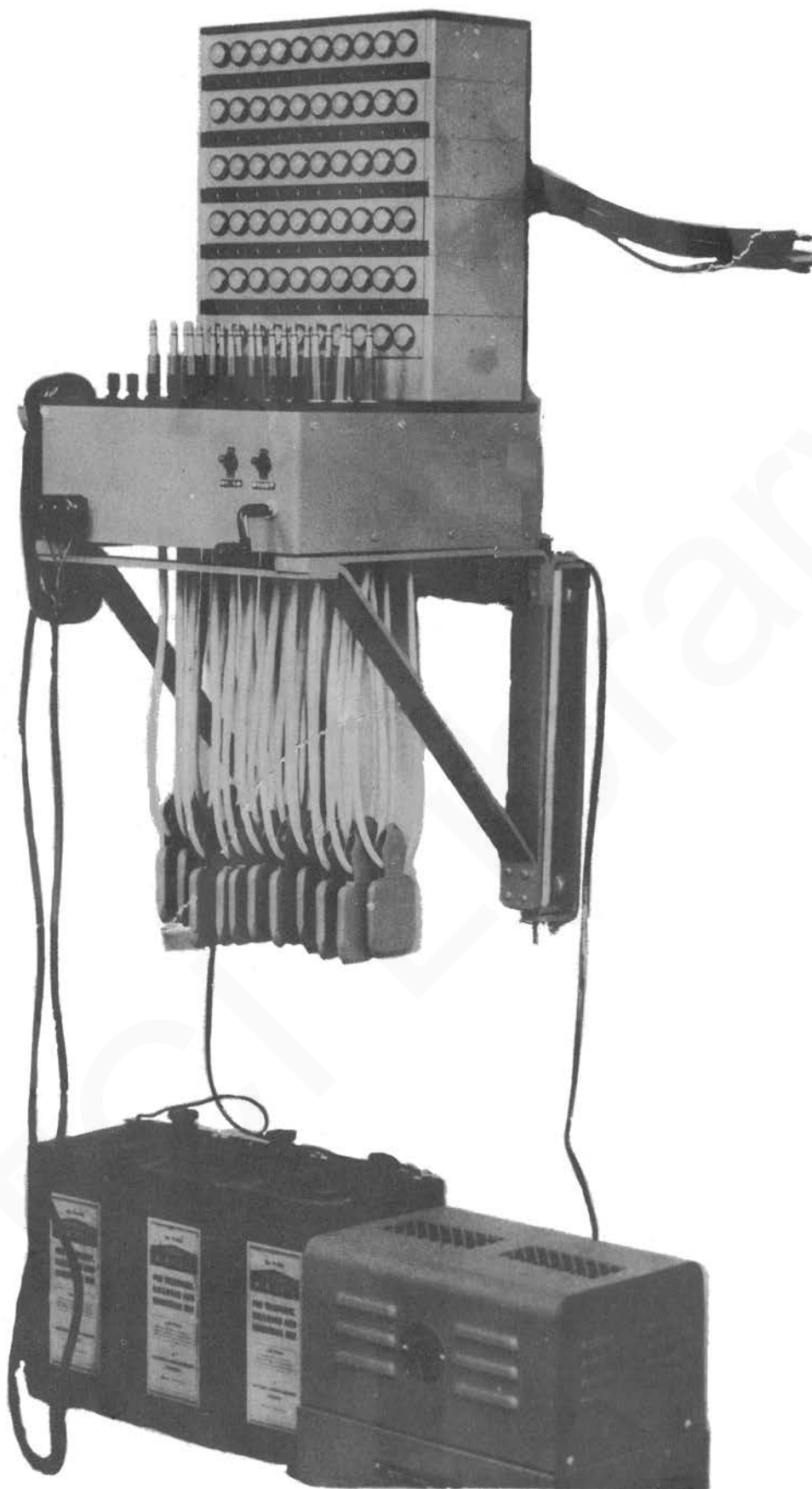


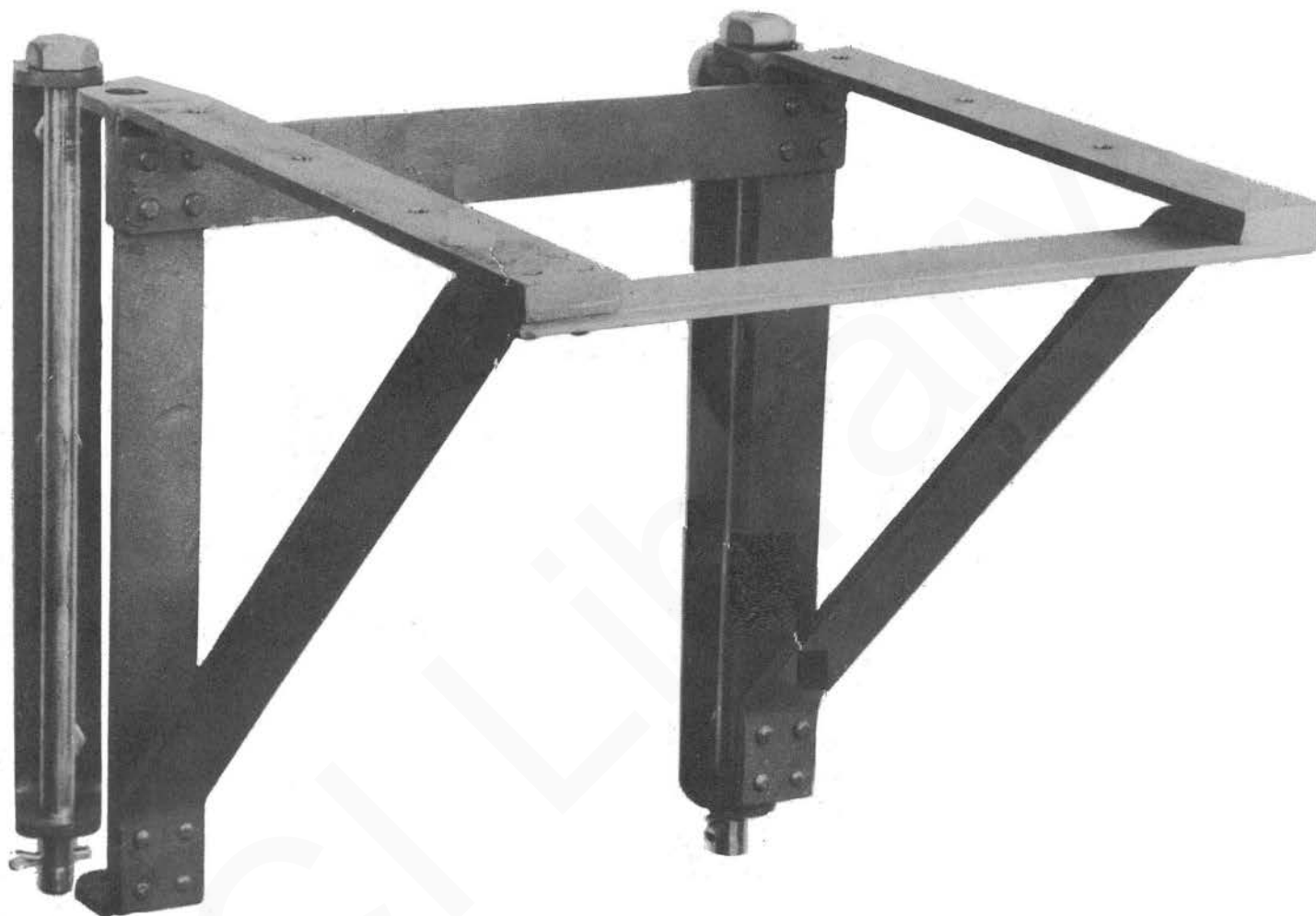
FIG. 1

COMPONENTS AS PACKED



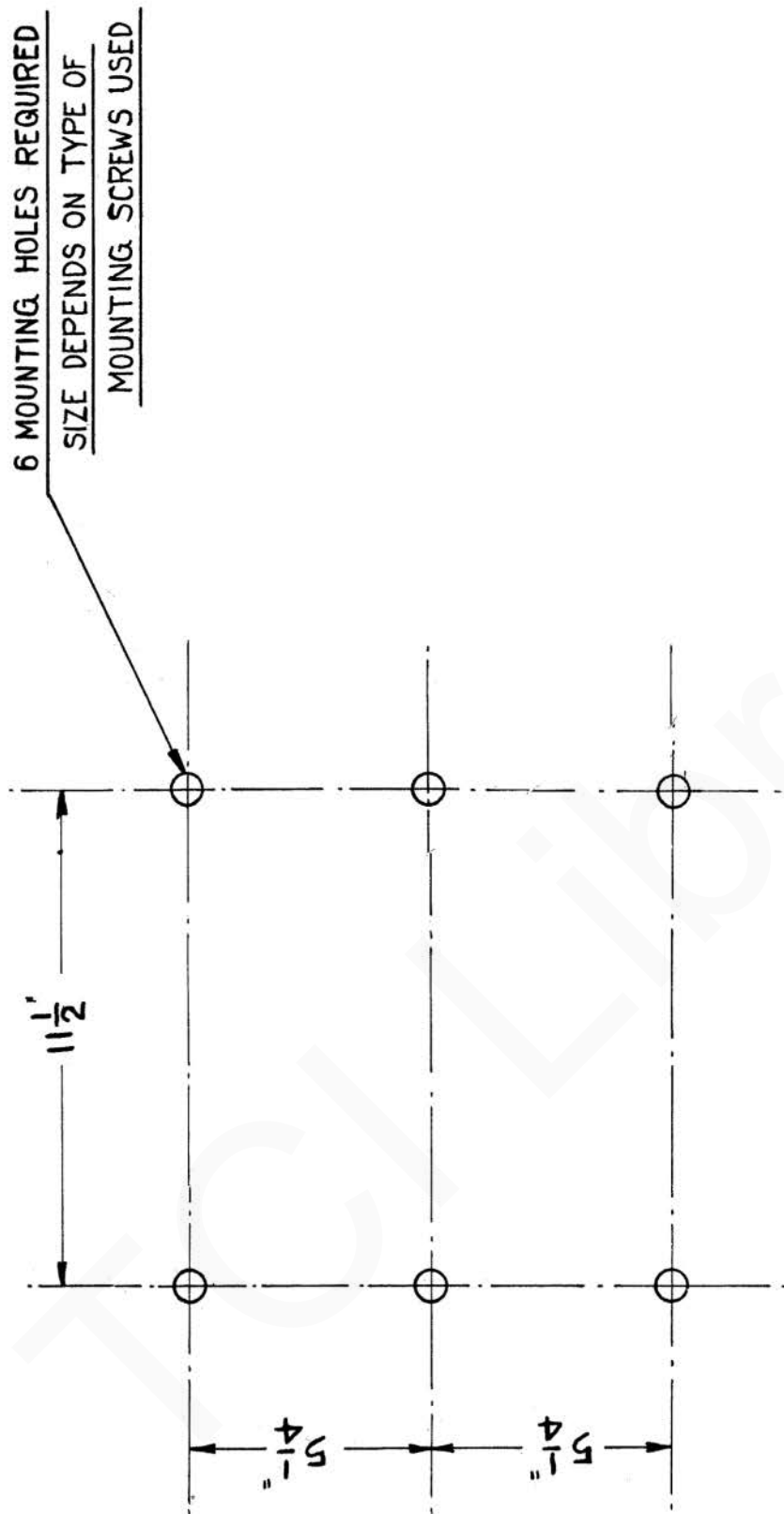
COMPLETED SWITCHBOARD SET-UP

FIG. 2



WALL BRACKET MOUNTED

FIG. 3



LAYOUT DIMENSIONS
FOR MOUNTING BRACKET HOLES IN WALL

FIG. 4

3. The switchboard is mounted on the wall bracket with six bolts provided with the switchboard. Four of these (two on each side) may be inserted by reaching under the switchboard, on the sides of the compartment in which the cords hang. The other two may be inserted by removing the back plate of the base section and inserting one bolt on each side. Nuts and lockwashers should be put on the bolts under the bracket, and tightened up.

The cords should be checked to see that they are not tangled and that the cord weights hang properly. The operator's set should be plugged into the jack on the front rail.

The generator crank should be screwed on and the side hook for the handset may be attached. If a head and chest set is used, the mounting of the handset hook may be omitted.

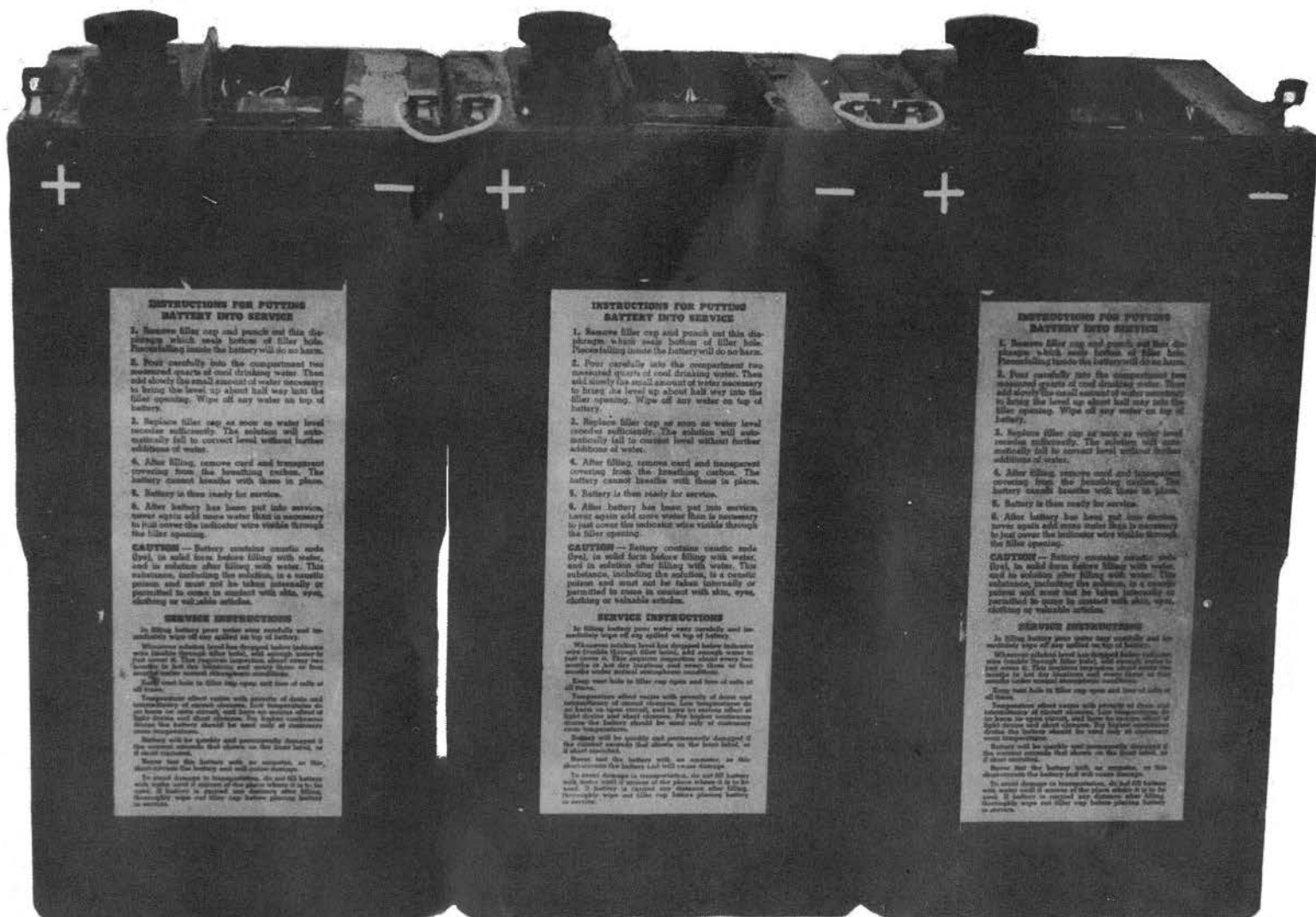
These parts are separately packed and are in the same container as the switchboard.

C. CONNECTING POWER UNIT AND BATTERIES

1. The Power Unit and batteries may now be put in place on the floor, or on a shelf near the switchboard. A receptacle into which the Power Unit is to be plugged must be provided within reach of the line cord of the Power Unit. Cool drinking water should be added to the Air Cell Batteries before use. See instructions on batteries.
2. Connect Batteries as shown in Fig. 5. Field wire or other available copper wire may be used, providing it is 18 gauge or over and is well insulated.

The terminal marked + (positive) on the battery connects to + A on the back of the switchboard. The outside battery terminal marked — (negative) connects to — A on the back of the switchboard.

3. The Power Supply terminals should likewise be connected to the switchboard. The RED terminal on the Power Unit is + B, and the BLACK terminal is — B. After connecting the Power Unit to the switchboard its linecord may be plugged into the receptacle.



INSTRUCTIONS FOR PUTTING BATTERY INTO SERVICE

1. Remove filler cap and punch out the diaphragm which seals bottom of filler hole. Pouring liquid inside the battery will do no harm.
2. Pour carefully into the compartment two measured quarts of cool drinking water. Then add slowly the small amount of water necessary to bring the level up about half way into the filler opening. Wipe off any water on top of battery.
3. Replace filler cap as soon as water level reaches sufficiently. The solution will automatically fall to correct level without further addition of water.
4. After filling, remove cord and transparent covering from the breathing cap. The battery cannot breathe with these in place.
5. Battery is then ready for service.
6. After battery has been put into service, never again add more water than is necessary to just cover the indicator wire visible through the filler opening.

CAUTION — Battery contains caustic soda (lye), in solid form before filling with water, and in solution after filling with water. This substance, including the solution, is a caustic poison and must not be taken internally or permitted to come in contact with skin, eyes, clothing or valuable articles.

SERVICE INSTRUCTIONS

In filling battery pour water very carefully and immediately wipe off any spilled on top of battery. Whenever solution level has dropped below indicator wire (visible through filler hole), add enough water to just cover it. This requires inspection about every two months or less for heating and every three or four months under normal atmospheric conditions. Keep vent hole in filler cap open and free of scale at all times. Temperature affect varies with purity of water and temperature of stored solution. Low temperatures do no harm on open circuit, and have no serious effect at high discharges and short circuits. For highest continuous service the battery should be used only at moderate room temperatures. Battery will be quickly and permanently damaged if the vent hole is closed or the level of the liquid is too low. Never fill the battery with or remove, or fill, short-circuit the battery and will cause damage. To avoid damage to transportation, do not fill battery with water until it is removed from the place where it is to be used. If battery is stored any distance after filling, thoroughly wipe and filler cap before placing battery in service.

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BATTERY CONNECTIONS

FIG. 5

A switch is provided under the cover of the Power Unit to permit adjustment for variations in line voltage. If the line voltage is between 110 and 125 volts, the switch should be connected to the side marked "117 volts". If the line voltage is between 125 and 140, the switch should be connected to the other side (marked "132 volts"). The Power Unit will be shipped with the switch on the 117 volt side, so no further adjustment need be made if the line voltage is between 110v. and 125v.

4. If an external ringing converter (such as the "Sub-Cycle") is to be used, its output terminals should be connected to the terminal posts marked "RING" on the the back of the switchboard.
5. NOTE: The negative "B" terminal (B —) must now be grounded to a water pipe, a good ground rod, conduit ground, or the like.

D. TESTING

1. Before proceeding to test the switchboard, Part III of this manual, covering operation of the switchboard, should be read and thoroughly understood. Actually the operation of this equipment is nearly the same as for the familiar drop signal, local battery type switchboard.
2. Each line on the switchboard should be tested before connection of outside line wires in the following manner.

NOTE: The "B" voltage is dangerous (135 to 180 volts). Be careful not to touch this, or to touch the line terminals when ringing, as the ringing voltage is also high.

Using a local battery telephone set, connect a pair of wires between its terminals, and a pair of line terminals on the back of the switchboard. On connection, ring into the switchboard in the regular way. The corresponding line lamp should light, and the call should be answered as described in Part III. If the answering circuit operates satisfactorily, this plug should be removed and a calling plug inserted in the same jack. The operator of the switchboard should now call out to the Test Telephone Set in the manner described in Part III.

After calling out, the operator should put his key in the stand-by position, with the plug still inserted. The Test Telephone Set should ring off. This should operate the supervisory lamp corresponding to the cord circuit in use.

This process should be repeated on each line. Different answering and calling cords should be used when going through these test calls so that all cord circuits will be tested simultaneously.

Any failures to test properly should be noted and corrected in the manner described in Part IV.

E. CONNECTING LINES

1. When the foregoing tests are completed, line wires may be connected. The usual procedure for this work should be followed.

WARNING: WHEN CONNECTING LINES OR WORKING ON THE BACK OF THE SWITCHBOARD, REMOVE LINE PLUG OF POWER UNIT. VOLTAGE FURNISHED BY THE UNIT IS 135 TO 180 VOLTS.

2. Make a test call to each connected line in the manner described in Part III. After the connection is established, the operator should have each party ring off, while the key of the cord circuit being used is in the stand-by position. Change from one cord to another when making this test so as to simultaneously check cord circuits.
3. Before putting the switchboard in operation, be sure that all cord ends are hanging properly on the hooks under the switchboard, as the cords may shake off in transit and be hanging on their leads.

F. MULTIPLING TWO SWITCHBOARDS

1. Two switchboards may readily be multiplied (giving an available line capacity of more than 50) by wiring jumpers between the boards, providing cross-connecting jacks. Procedure is as follows:

Set up the two switchboards side by side, completely connecting each as previously described. When connecting lines, leave two sets of terminals, lines 0 and 1, clear. Now wire the terminals of line 0 on Board A to the terminals of line 0 on Board B, **IMPORTANT**—Polarity must be observed. Connect the upper terminals together and connect the lower terminals together. Connect together the terminals of line 1 on each board, in the same manner.

The jacks of lines 0 and 1 on each board should be specially marked, as with a red crayon, as these are now special cross-connecting jacks. See Section III—D-4 for method of operation with these jacks.

More than two lines may be used for cross-connecting if this traffic is heavy.

PART III—OPERATION

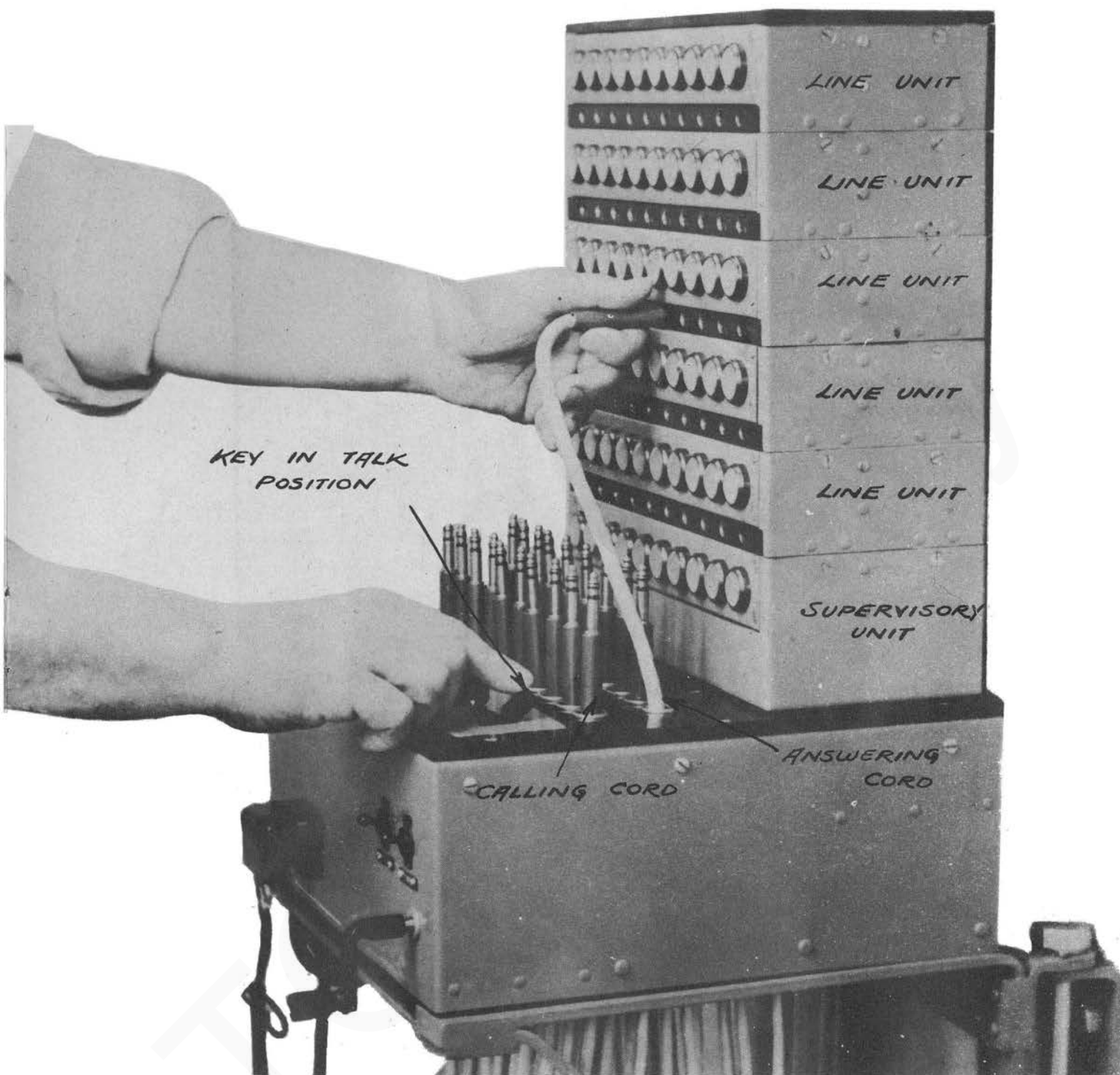
A. ANSWERING A CALL

1. An incoming call is indicated by the lighting of the line lamp corresponding to the calling station.
2. To answer the call, the operator picks up the answering cord of any cord pair not in use. The answering cord of each pair is the one away from the operator. The plug of this cord is inserted in the jack opening immediately beneath the lighted lamp. This extinguishes the line lamp of that circuit, previously lighted. The operator presses the corresponding cord key away from him to the position marked talk. The key will stay in this position until restored by the operator. (See Fig. 6).
3. This establishes communication between the operator and calling station.

B. COMPLETING A CALL

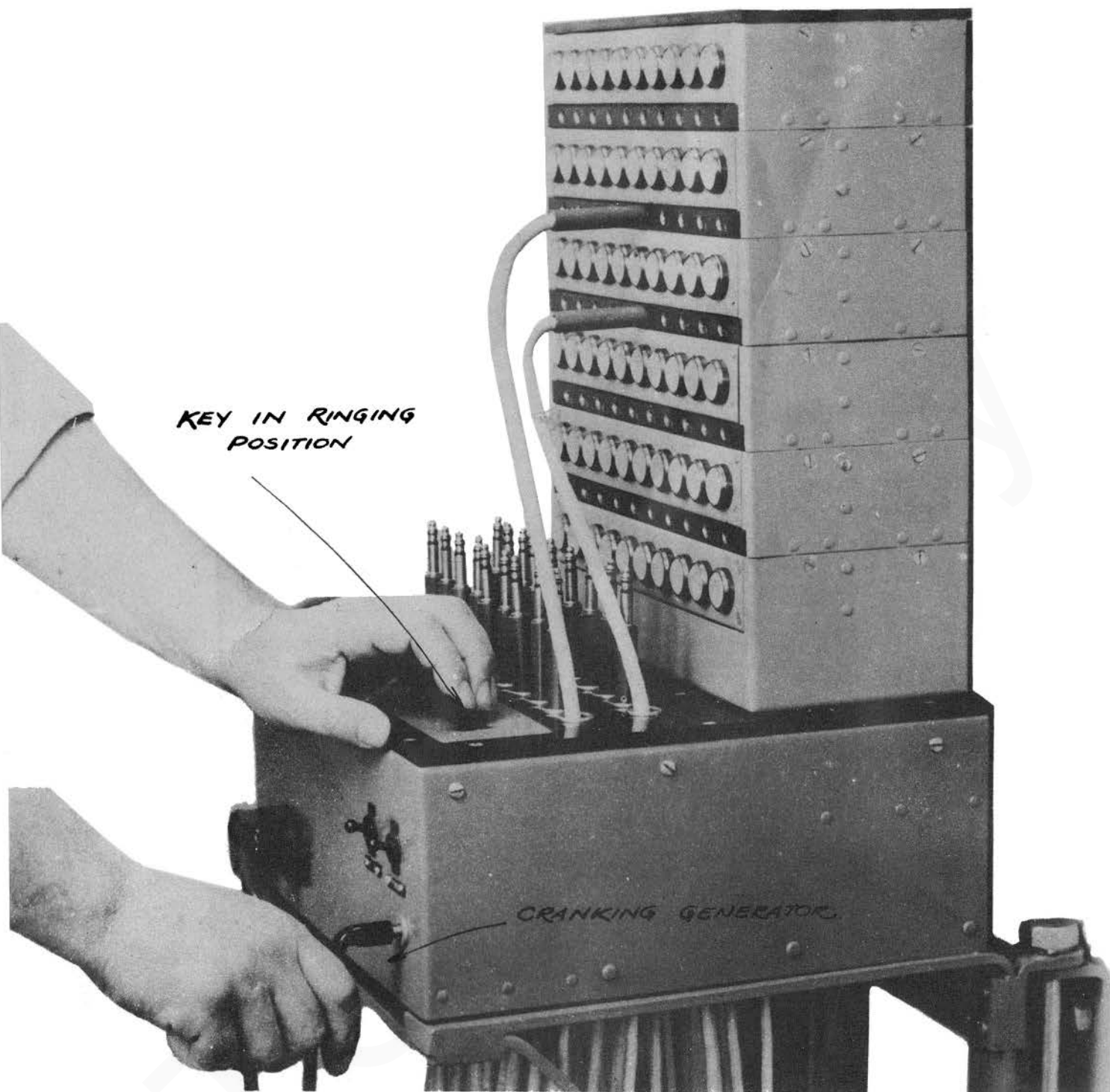
1. The calling station tells the operator the number of the line with which he wishes to be connected. The operator takes the calling cord of the pair (the one nearest him) and plugs it in the jack corresponding to the number being called. (See Fig. 7).
2. The operator changes the position of the key from the talking position to the ringing position, by pressing it towards him. **While holding the key in the ringing position** the operator turns the generator crank, ringing the called station.

If a ringing converter, such as a "Sub-cycle" or "Telering" is connected to the switchboard, the hand generator is not used, and the called station will be rung automatically as soon as the key is pressed in the ringing position.
3. The operator returns the key to the "Talk" position (away from him) and listens for the called station to answer. If no answer is heard, the operator should ring again, pressing the key toward him and turning the generator crank while holding the key in that position. If an answer is heard when the key is returned to the "Talk" position the operator should return the key to the stand-by position (handle vertical).



ANSWERING A CALL

FIG. 6



COMPLETING A CALL

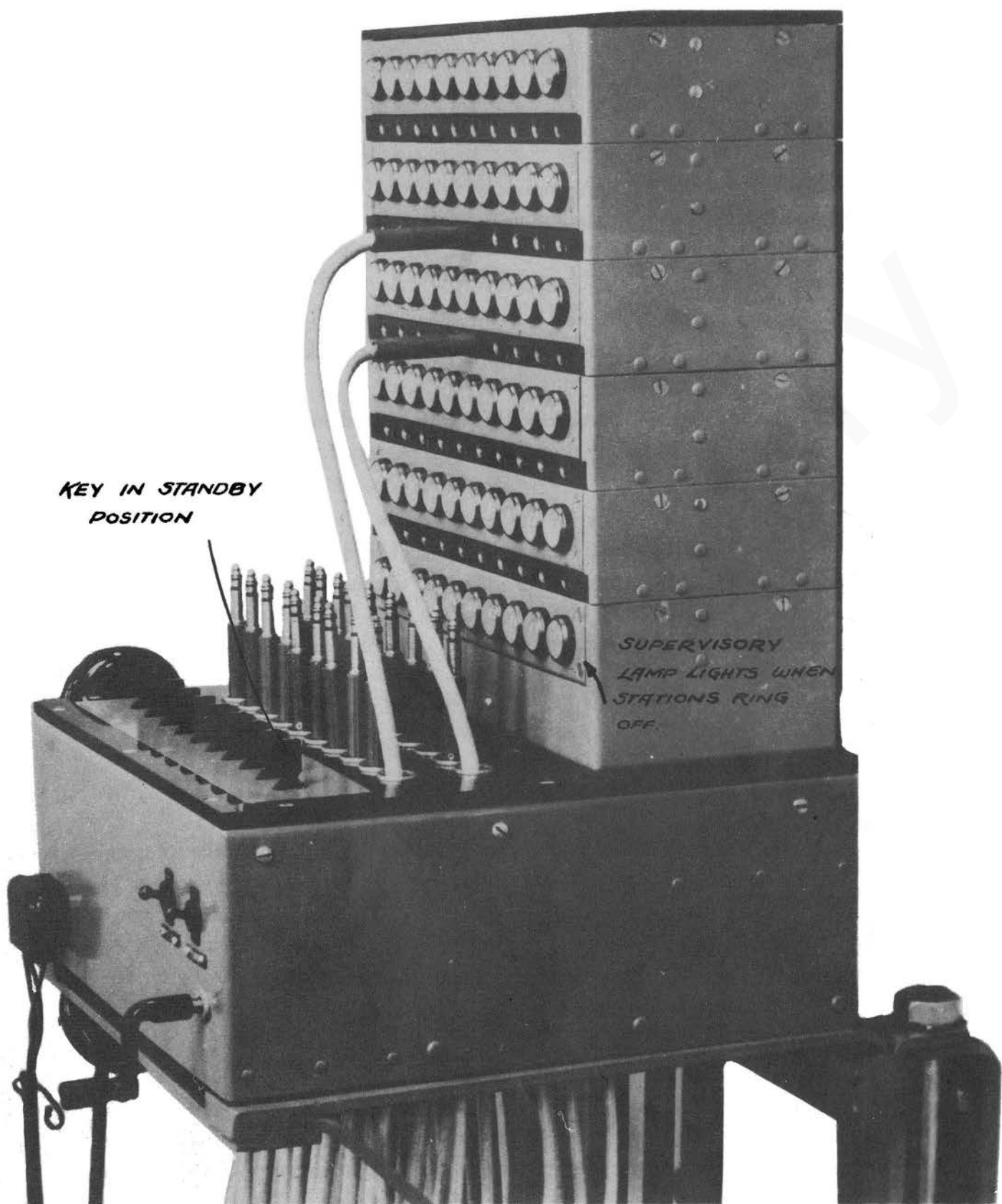
FIG. 7

C. SUPERVISING A CALL

1. At the end of the conversation, one or both of the stations will ring off. The **Supervisory Lamp** corresponding to the pair of cords in use will light up. (See Fig. 8).
2. The operator should then press the corresponding key to the talk position to see if either station has further instructions or is finished talking.
3. If there are no further instructions, the pair of cords should be removed from the station jacks and allowed to drop back to the plug shelf.
4. These cords are now ready for use on other calls. The supervisory lamp is extinguished by this operation. Any unused pair of cords may be used in making a connection. Since there are 10 pairs of cords, this means that ten conversations may be carried on over the switchboard at one time. The keys on all unused cord pairs should be kept in the stand-by position (handle vertical).

D. MISCELLANEOUS INSTRUCTIONS

1. A power switch and a night alarm cut-off switch are provided on the front rail of the switchboard. When board is shut down and absolutely no service required, the power switch should be in the "Off" position. This makes the board completely inoperative. If a large number of line lamps are lighted simultaneously, due to electrical disturbances, they can be extinguished simultaneously by momentarily operating the power switch to the "Off" position.
2. A night alarm bell is provided to indicate the lighting of either a line lamp or a supervisory lamp. **The night alarm should always be turned on when the switchboard is not under direct supervision so that prompt telephone service can be given. This is important.** When the operator does not require this alarm, the night alarm switch should be placed in the "Off" position.



LIGHTING OF SUPERVISORY LAMP

FIG. 8

3. If there is a definite need for three or more stations to be connected together for conference calls, and spare jack positions are available, a group of three or more jacks may be connected together to provide this facility. In this operation a cord pair is required to connect each of the stations to the conference grouping jacks.
4. When two switchboards are provided, with connecting lines between them, a call from a station on one board to a station on the other board may be made as follows:

Answer the call on Board A in the usual manner. Plug the calling cord of the pair being used into one of the cross-connecting jacks. On Board B, plug an answering cord into the corresponding cross-connecting jack on that board. Plug the mate of this cord into the called line jack and ring as usual. The two stations will now be connected through the two switchboards. When they ring off, both pairs of cords must be taken down.

PART IV—MAINTENANCE

Most difficulties experienced in the operation of this telephone system can readily be corrected by non-technical personnel if a logical sequence of trouble shooting is followed. The following is suggested in locating and rectifying trouble.

A. GENERAL CHECK

1. If no lamps operate on calls to the switchboard, be sure the power switch on the front of the switchboard is turned on. Then check the power unit. First be sure the unit is plugged into a line 117 AC receptacle. Check the output terminals of the unit and the "B" terminals of the switchboard with a DC voltmeter. A reading of about 180 volts should be obtained. If there is no output voltage, remove the cover of the unit and check the fuse. Replace if burned out. See also Section 3, below.
2. If operator can hear, but cannot talk out, and if night alarm does not operate, check the Air Cell Batteries. The voltage of the three should be between 3.0 and 3.75 volts, DC. A voltage reading should be taken both at the batteries and at the terminals on the back of the switchboard. If there is voltage at the batteries, but none at the switchboard, trouble in the connecting wires is indicated. If the night alarm operates, but the operator cannot talk out, trouble in the operators handset or handset plug is indicated. Try a new handset and plug.
3. If night alarm fails to operate when turned on, but operator can talk out, try replacing relay or adjusting buzzer. To do this, remove backplate of switchboard base. If no lamps light, as described in Section 1, above, trouble may be open relay winding or poor socket connection. Tighten relay in socket or replace relay as required.
4. If one line lamp fails to light when the corresponding station calls the switchboard, check the line in the following manner. Remove line to be tested from the switchboard terminals, and connect to terminals of a good local battery telephone set. Try making a call to and from this test phone to the station in trouble. If this cannot be done, trouble is in the line or in the sub-station. If proper operation can be made between the station being tested and the test set, trouble is probably in the switchboard. In this case, the line may be connected to any other set of terminals in use. To make certain that the trouble is in the switchboard, con-

nect to the terminals of the defective position on the board a good local battery telephone test set and attempt to make regular call tests. If line lamp fails to operate carry out the balance of the test to establish talking connection if possible. Also operate the plug into the line jack several times to determine whether the trouble is in jack springs. If the circuit talks up properly but the line lamp cannot be made to operate, then replace the lamp.

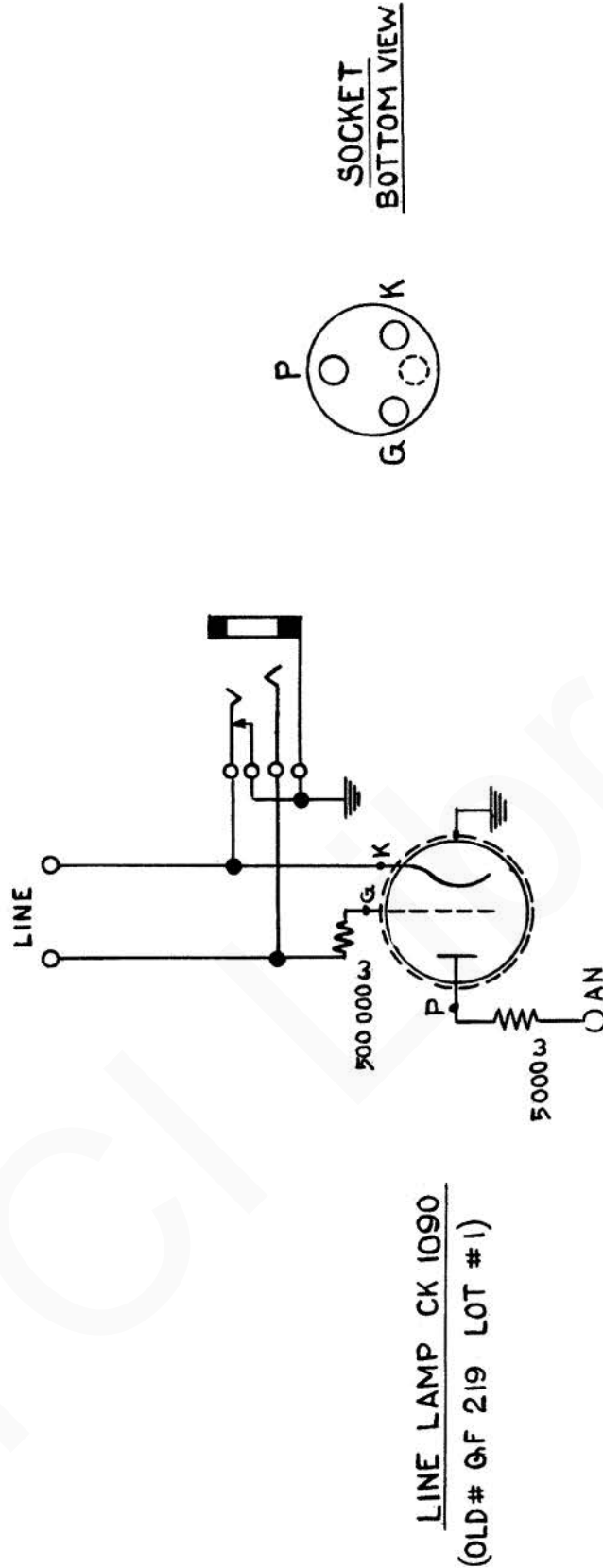
It will be necessary to remove the opal mounting plate on the front of the switchboard in order to replace this lamp. If neither line lamp or talking connection can be established, circuit trouble is indicated and should be repaired by a technically qualified person.

5. If one cord circuit fails to complete a connection satisfactorily, the following procedure should be followed to locate the trouble. First try to establish a talking connection between the operator and a line by plugging in the answering cord with the operator's key thrown and working the cord vigorously to attempt to locate a defective cord. If no trouble is found, do the same with the calling cord. If a talking connection cannot be established with either cord, there is a short in one or both of the cords, or circuit trouble is indicated.
6. In case the supervisory lamp fails to light even though stations have rung off, be certain that the trouble does not exist in the line or the telephones by replacing the line with a good telephone set and ringing off in the regular way. If after this test, the supervisory lamp does not light, it should be replaced. If replacing the lamp does not clear the trouble, circuit trouble is indicated.

NOTE: If the trouble persists after the tests and repairs suggested above are made, the assistance of technically qualified persons should be requested.

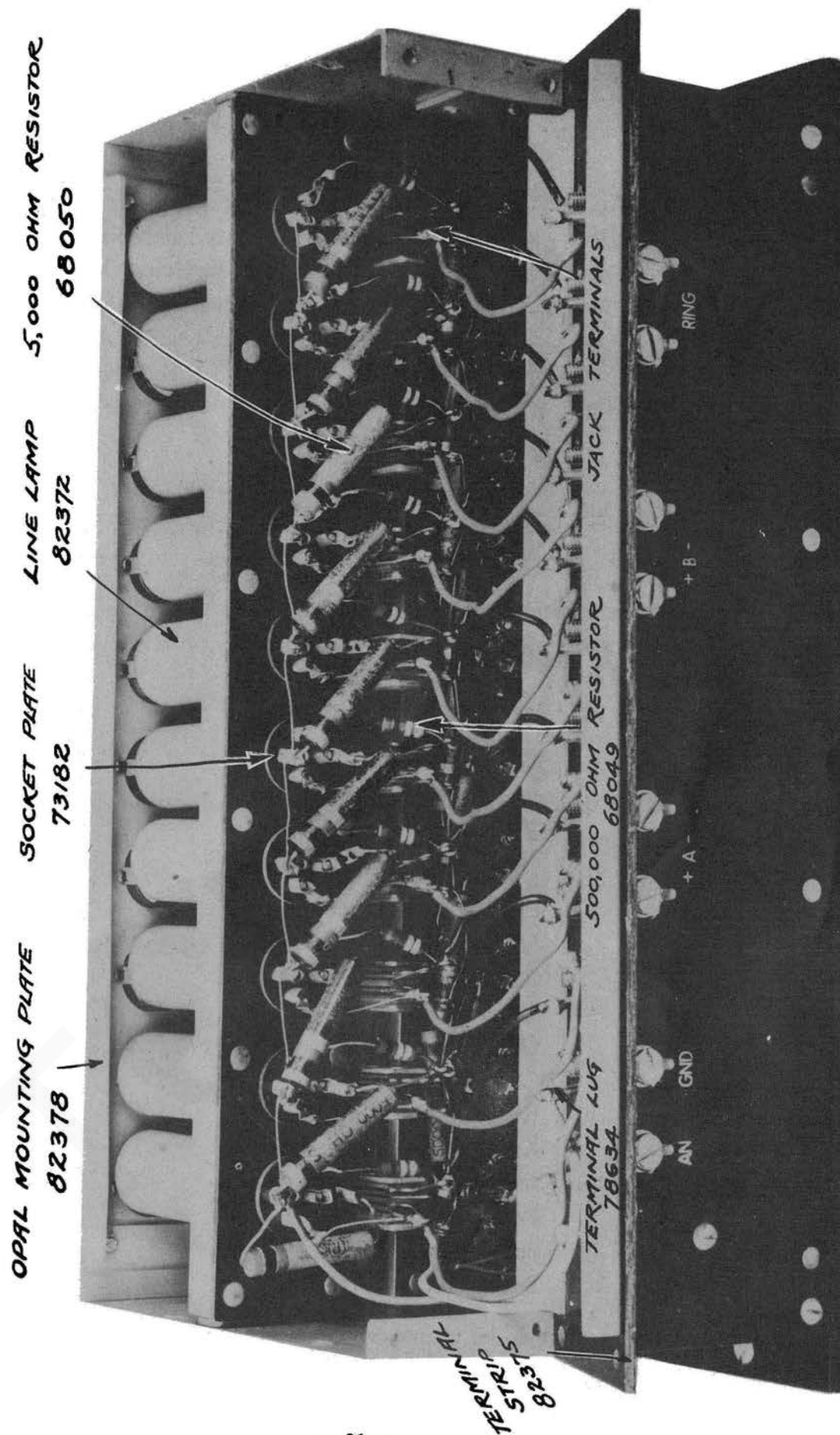
B. CIRCUIT OPERATION

1. **Line Unit**—Refer to Fig. 9 for the schematic circuit and to Fig. 10 for the inside view of a line unit. Note that the grid (G), through a 500,000 ohm current limiting resistor, and the cathode (K) of the line lamp are always connected to the line. Positive potential (AN) is applied to the plate (P) of the line lamp through the current limiting resistor (5000 ohms). When ringing voltage appears on the line, the lamp is ionized and a current flows through the lamp to ground, causing the lamp to glow. When the answering plug is inserted in the jack, this circuit is opened by the break contact on the jack and the lamp goes out.



LINE CIRCUIT FOR NAVY SWITCHBOARD
CCT. #5101

FIG. 9



LINE UNIT, INTERIOR VIEW

FIG. 10

2. **Supervisory Unit**—Refer to Fig. 11 for the schematic circuit and to Fig. 12 for the inside view of the Supervisory Unit. Note that Supervisory Lamps have two grids, although triggering action is otherwise the same as in line lamps. Grids are connected to tip and ring of the plugs and hence across calling and called lines when cord circuit is in use. The purpose of the 500,000 ohm resistors and 100 mmfd. condensers is to filter out parasitic line currents, which might cause false operation of lamps. Negative potential is applied to the tube through the talking key and plug sleeve.
3. Details of other components of the switchboard are shown in Figs. 13, 14, 15 and 16. Fig. 18 is an interior view of the Compartment in which the common equipment is mounted. Fig. 17 is an interior view of the Power Unit.
4. Fig. 19 is the complete switchboard schematic and combines the circuits previously described. Technical personnel may, with these circuits, locate and repair more complicated troubles.

C. SPARE PARTS

1. A kit of spare parts and tools (See Fig. 20) is provided with each system. The following items are included:—

Quantity	Description
10	Line Lamps
5	Supervisory Lamps
4	Cords with Plugs attached
1	Generator Crank
5	Glass Opals
2	Cord Weights
1	Relay
2	Key Cam Handle Assemblies
1	Induction Coil
2	Power Unit Fuses
1	Spring Bender
1	Bell Adjusting Wrench

The Spare Parts Kit should be maintained by submission of requisition to proper Supply Agency.

CORD CIRCUIT FOR NAVY SWITCHBOARD
CCT. #5102

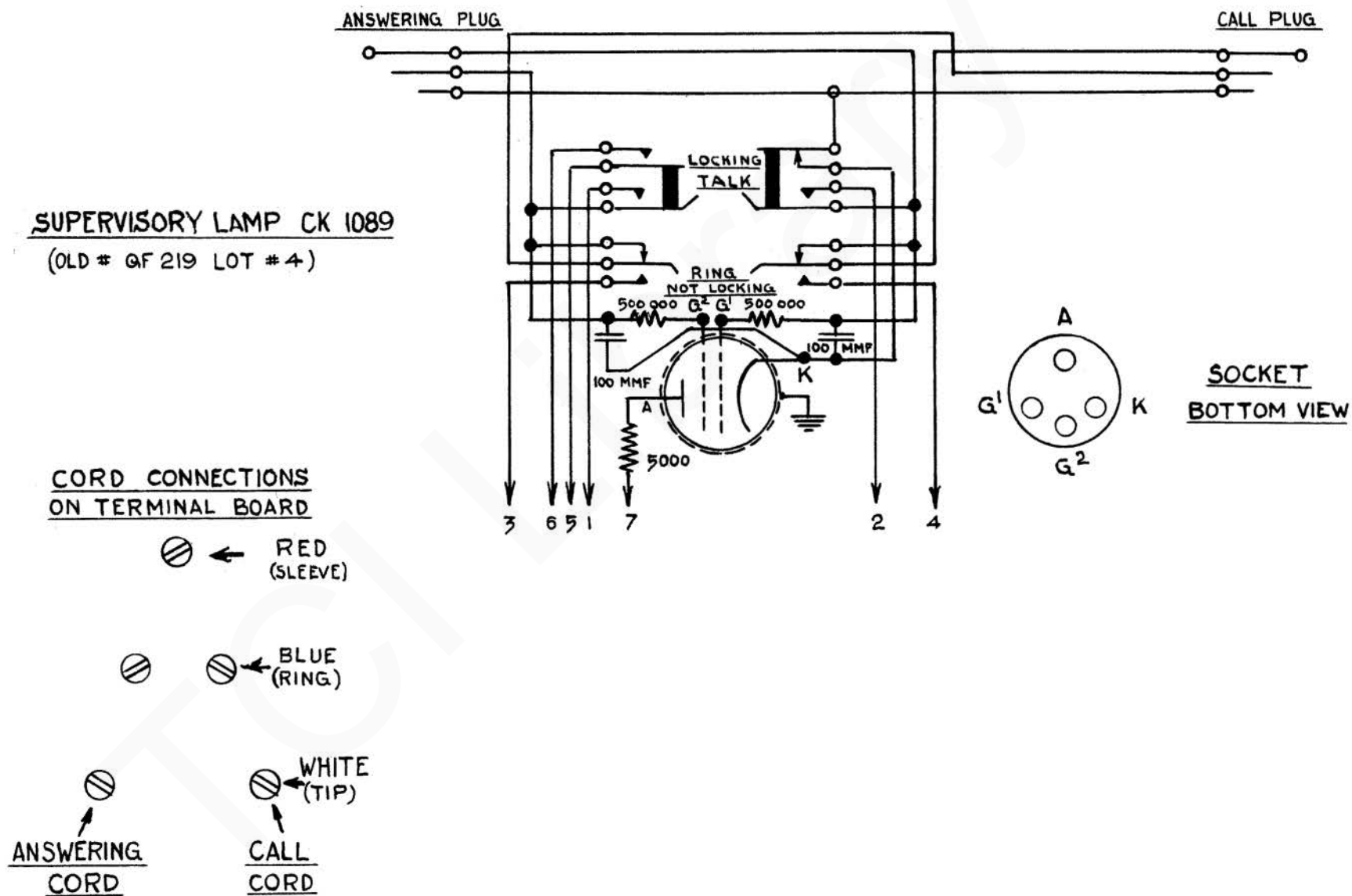
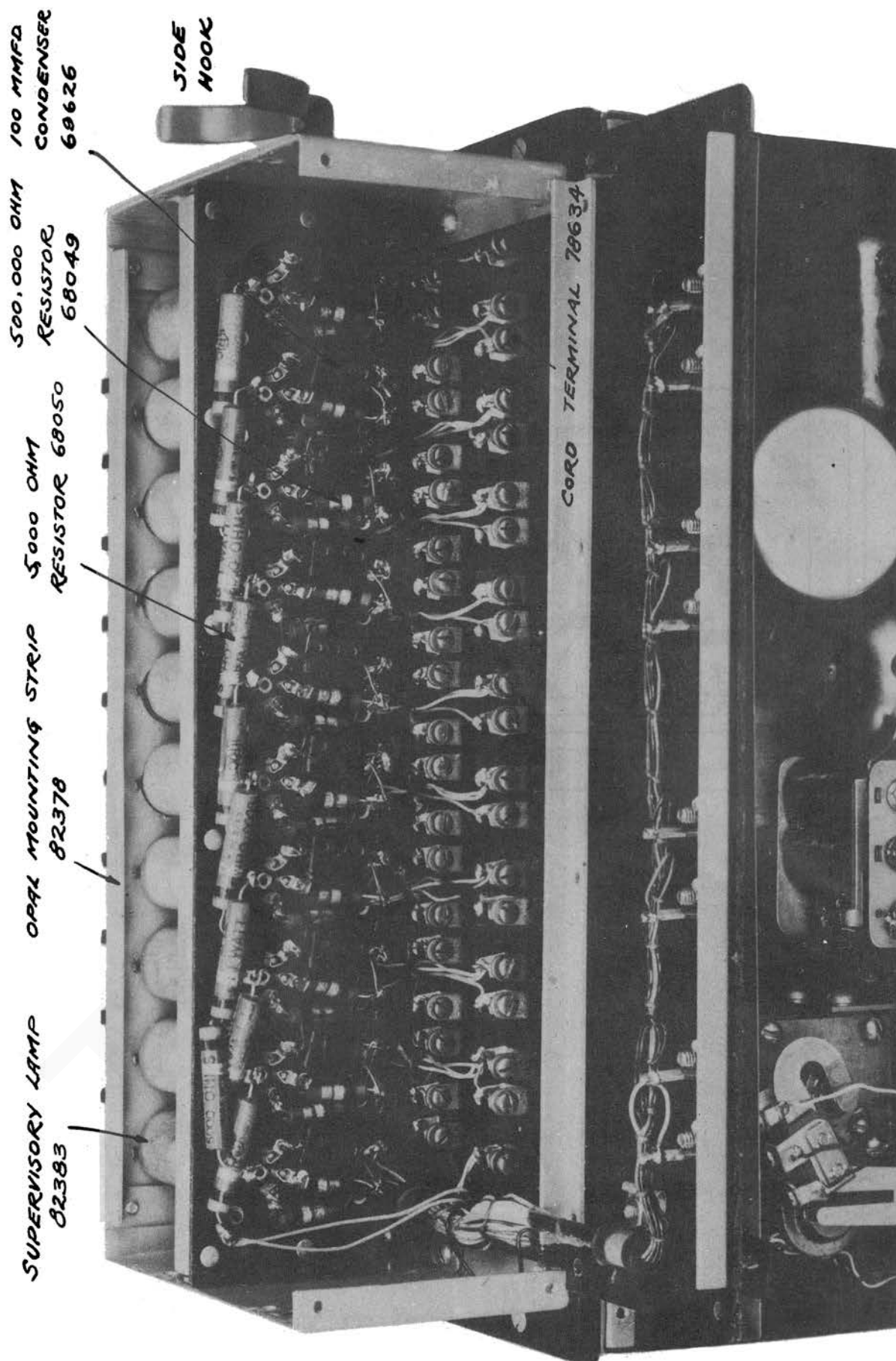
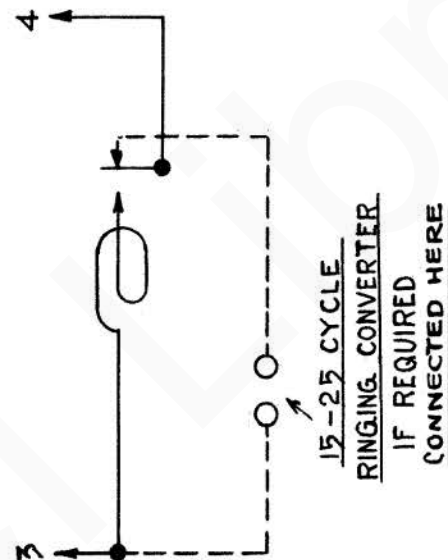
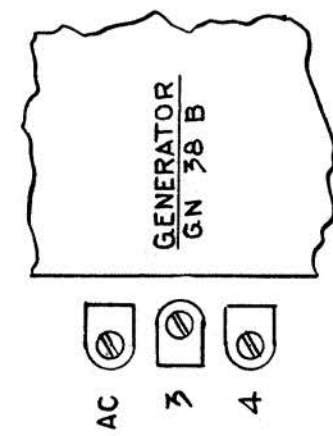


FIG. 11



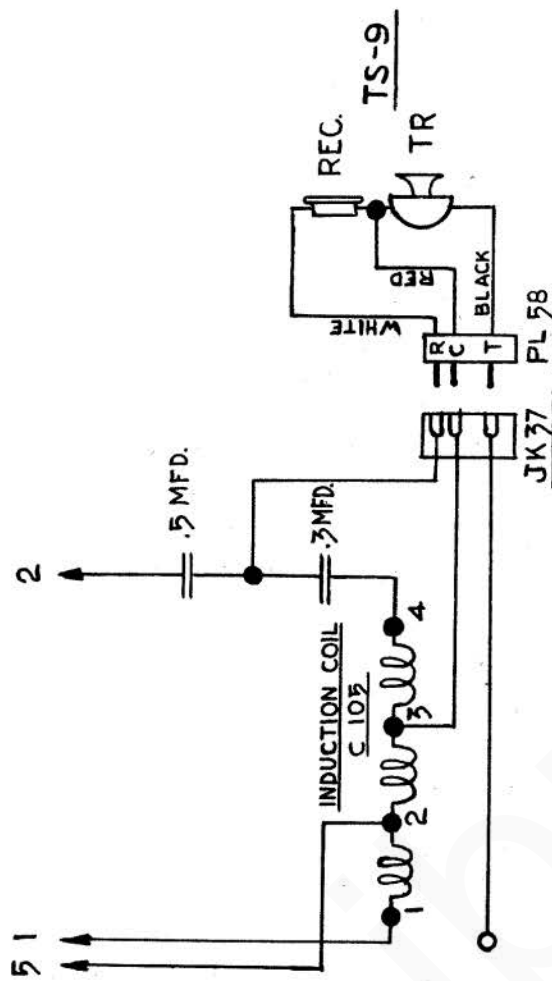
SUPERVISORY UNIT, INTERIOR VIEW

FIG. 12



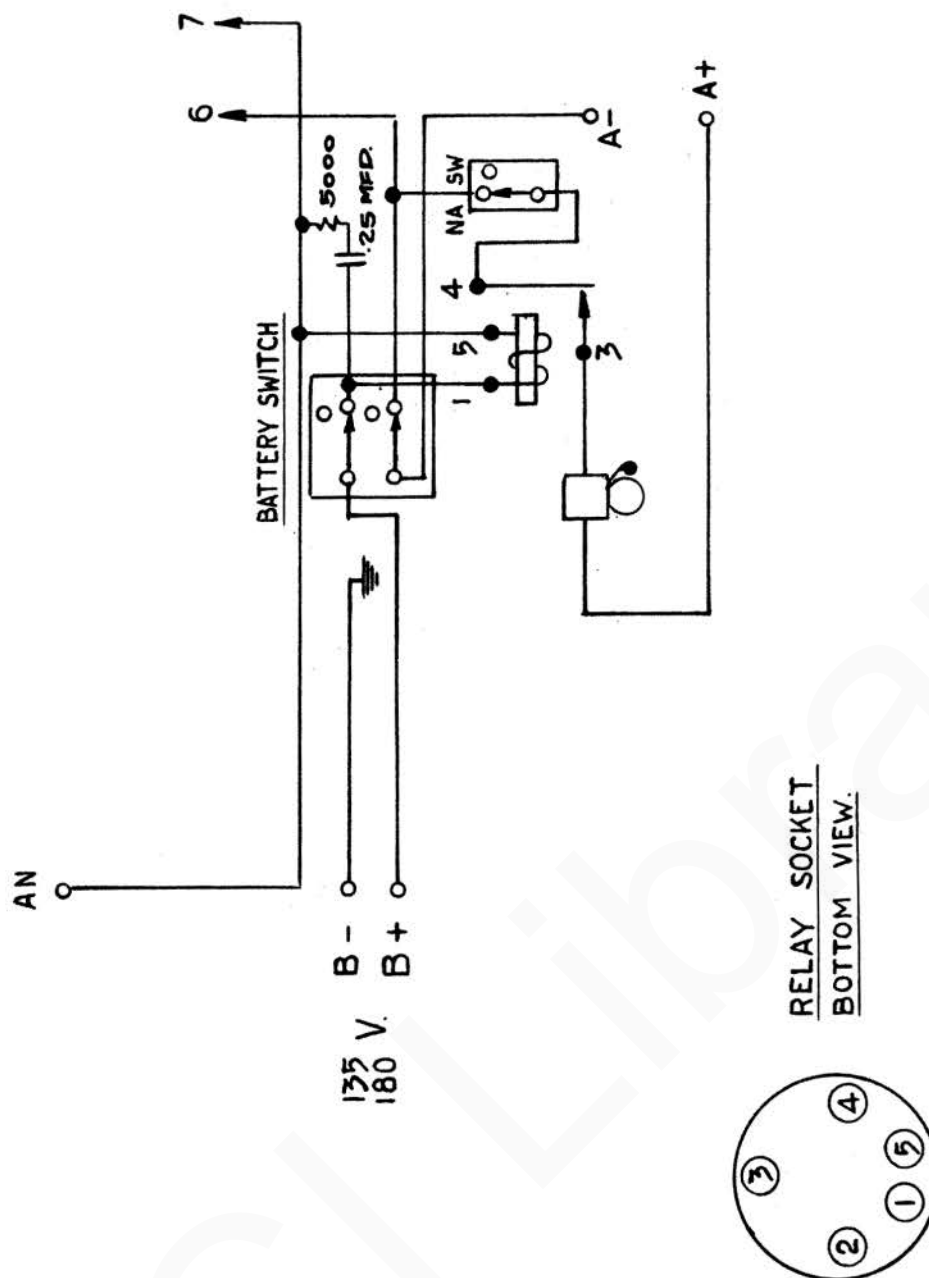
GENERATOR CIRCUIT FOR NAVY SWITCHBOARD
CCT. #5103

FIG. 13



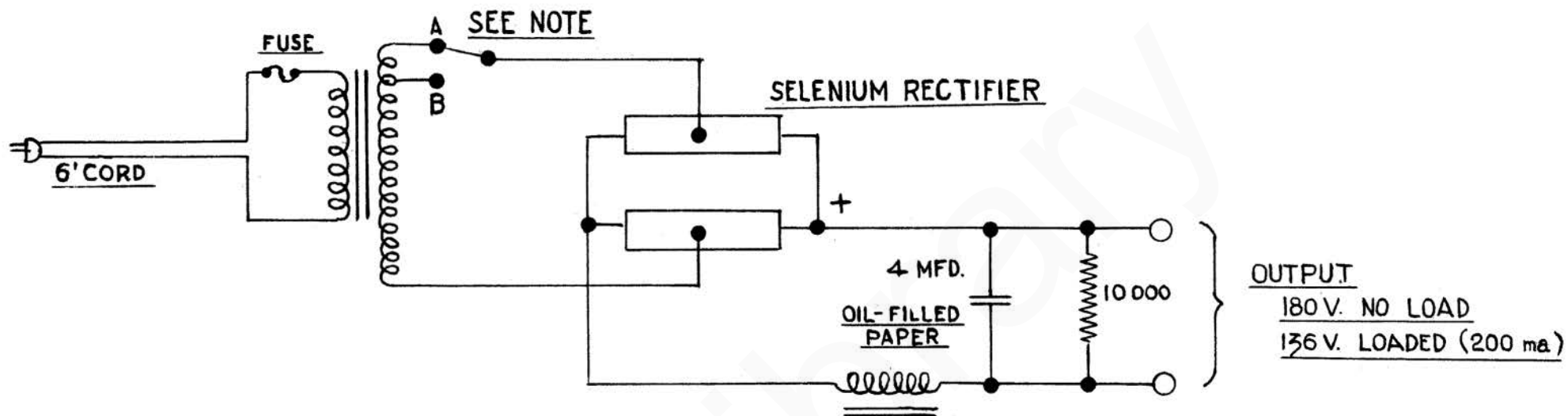
OPERATORS TELEPHONE CIRCUIT FOR NAVY SWITCHBOARD
CCT. #5104

FIG. 14



NIGHT ALARM AND BATTERY CIRCUIT FOR NAVY SWITCHBOARD
 NIGHT ALARM AND BATTERY CIRCUIT
 FOR NAVY SWITCHBOARD
 CCT. #5105

FIG. 15



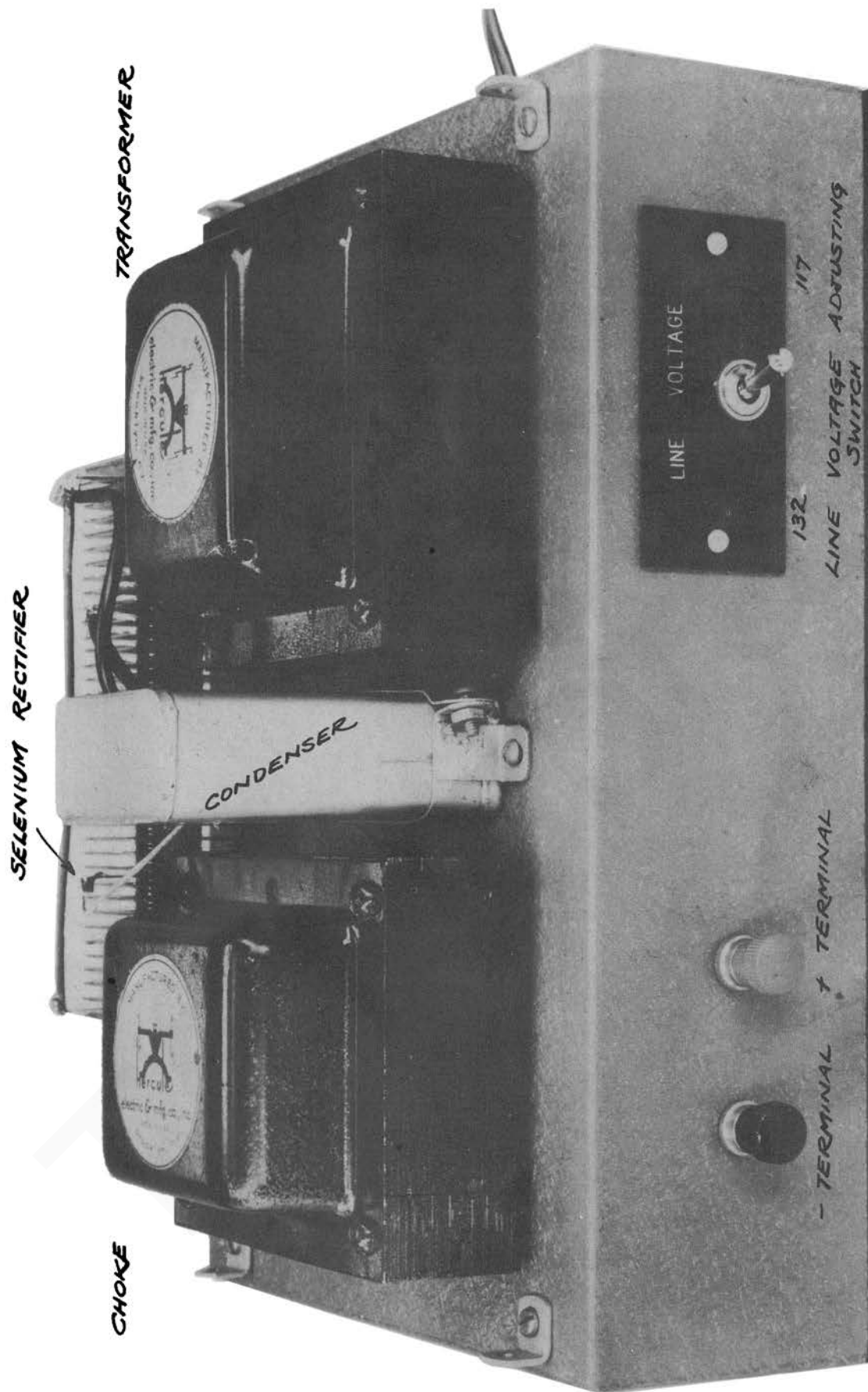
NOTE:

MARK TOGGLE SWITCH



POWER UNIT

FIG. 16



POWER UNIT, INTERIOR VIEW

FIG. 17

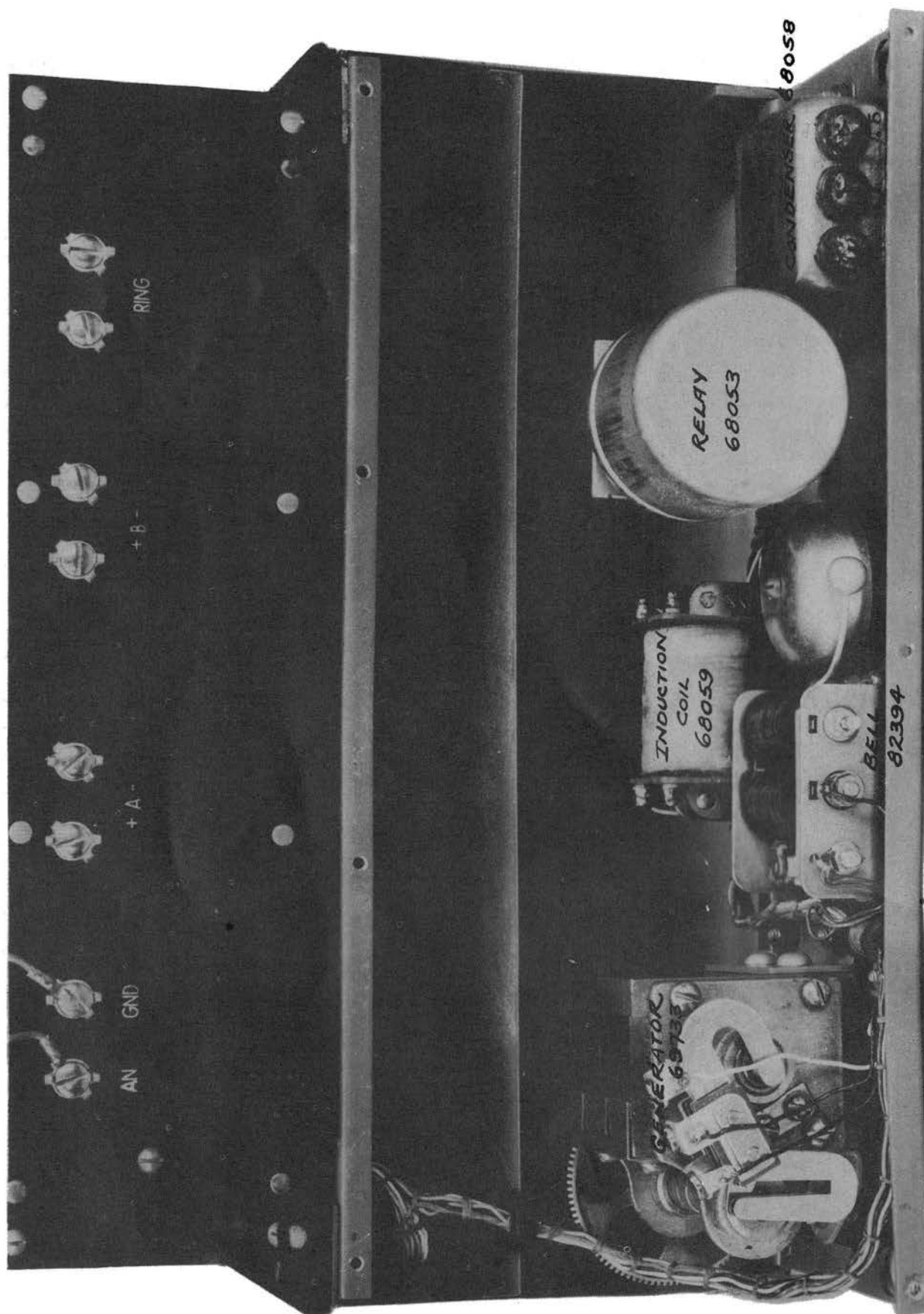


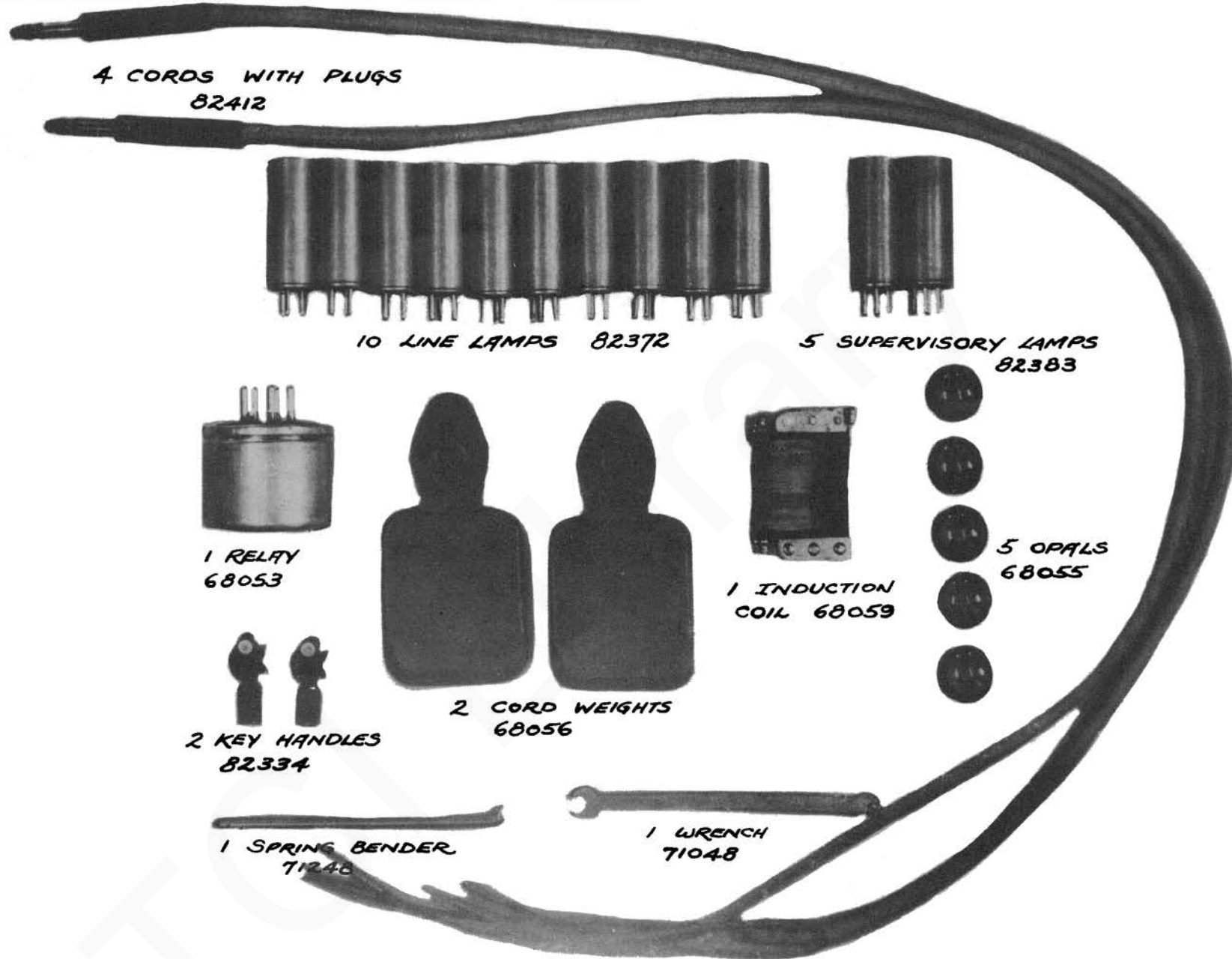
FIG. 18

COMMON EQUIPMENT COMPARTMENT, INTERIOR VIEW



COMPLETE SCHEMATIC FOR NAVY SWITCHBOARD

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SPARE PARTS

FIG. 20

PART V—PARTS LIST

NAME	DESCRIPTION	MANUFACTURER	MFR'S NO
Relay Socket.....	Type S 5 Prong.....	Amphenol.....	78-55
Cord Fastener.....		Western Electric Co.....	#9
Resistor.....	5 Meg. 1/2 watt.....	Erie Resistor Co.....	#504
Resistor.....	5000 ohm 1 watt.....	Erie Resistor Co.....	#518
Plug.....		Western Electric Co.....	#310
Relay.....	200 ohm 4 ma.....	Sigma Relay Co.....	Type 5AH
Rectifier.....	Special.....	Hercules Mfg. Co.....	
Crank.....		Western Electric Co.....	158949
Toggle Switch.....	SPST.....	Cutler Hammer.....	
Toggle Switch.....	DPST.....	Cutler Hammer.....	
Air Cell.....	1.25 Volts.....	Eveready.....	T1600
Condenser.....	100 MMF.....	Micamold.....	
Operator's Plug.....	PL-58.....		
Handset.....	TS-9.....		
Cord.....	3' for Plug 310.....	Runzell.....	#8A-RC
Cord Weight.....		Western Electric Co.....	#119
Fuse.....	1 amp. 250 V.....	Wholesale Radio Service.....	#k-12378
Opal.....		Dial Light Co. of Amer.....	#65-JS
Jack Strip.....		Western Electric Co.....	#136 with 10 Jacks #141
Induction Coil.....		Dinion Coil Co.....	#C-105
Condenser.....	3-5 MFD 600 V.....	Cornell Dubilier.....	#2523
Generator.....	GN-38-B.....		
Operator's Jack.....	JK-37.....		
Wall Mtg. Bracket.....		Dictograph.....	61486
Line Lamp.....		Dictograph.....	82372
Supervisory Lamp.....		Dictograph.....	82383
Bell.....		Dictograph.....	82394
Key Handle.....		Dictograph.....	82334
Spring Bender.....		Dictograph.....	71248
Wrench.....		Dictograph.....	71048