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Ground Radio Telephone Sets

SCR-67

SCR-67-a

Communication

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SETS, RADIO TELEPHONE, TYPE SCR–67 AND SCR–67–A.

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THE TYPE SCR–67 SET is a two-way radio telephone set for use on the ground in communicating with a similar set, or with the airplane radio telephone sets type SCR–59, SCR–68 and other or similar sets. The type SCR–67–A set is an improvement of the type SCR–67 set, and differs from the latter in minor details only, which do not affect the method of operation, or the explanation of the theory of the circuits. The circuits given here are those of the type SCR–67–A set, and the points in which the circuits of the type SCR–67 set differ are noted in the text and indicated in the drawings, the type SCR–67 constants and other variations being indicated in parentheses and dotted lines in Fig. 2, except for the wiring of the three-position power switch.

The average working range of either set when used with one of the airplane sets mentioned above, is 2 to 3 miles. This range depends to a considerable extent on the adjustments of the set, the type antenna used, and on the quality and distinctness of the operator's voice. When communicating with a ground set, the range may be as great as 5 to 7 miles.

The range of wave lengths is from 250 to 450 meters when transmitting, and from 200 to 700 or 800 meters when receiving and making use of a suitable antenna. Some antenna constructions are given in a later paragraph.

Theory Underlying the Operation of the Set.

The complete theory of radio telephony is not taken up in this pamphlet. For this, reference is made to Radio Pamphlets No. 1 (2nd Edition), 20 (2nd Edition) and 40. The principle of transmission involves the generation of undamped oscillations of a frequency greater than that of audible vibrations in the antenna circuit, and the varying of the amplitude of these oscillations proportionally to the voice modulations to be transmitted. These modulated high frequency oscillations, when rectified in the receiving circuit, produce in the telephone receivers a current of amplitude varying proportionally to the voice modulations at the transmitting station, and therefore reproduce the speech. The process will be better understood after the description of the circuits has been given.

Operating Panel of Set Box Type BC-13 used in Set Type SCR-67 Showing Covered Panel Lid Partly Open.

A complete circuit diagram of the type SCR–67–A set is given in Fig. 1. By operating the three-position switch, marked on the panel, "Off, 12–V On, Power On," the set may be used either for receiving alone, or for receiving and transmitting. For the latter position of the switch, the transmitting circuit is connected by depressing a control push button, while the receiving circuit is connected when the push button is released. These two circuits are analyzed separately in the following paragraphs.

Theory of the Transmitting Circuit.—The circuit in use when transmitting is shown schematically in Fig. 2. The same letters and names are used as in Fig. 1, so that reference may be made to both diagrams if desired.

Undamped oscillations are generated by a type VT–2 three-electrode vacuum tube. The filament of this tube is heated by the current of a 12-volt storage battery. In series with the latter is a rheostat for regulating the current, and an ammeter. The negative side of the circuit is connected to ground.

A constant positive potential of about 350 volts is applied to the plate of the tube by means of a type DM-2 dynamotor, the low voltage side of which is run by the same 12-volt battery that furnishes the filament heating current. In series with the plate circuit is a short circuiting jack in which a plug connected to a milliammeter may be inserted to read the space current in the tube. The function of the choke coils marked B and D, and that of resistances R_1, R_2, and R_3 will be explained later. A filter circuit, comprising two coils and two condensers F is connected across the 350-volt terminals of the dynamotor for the purpose of minimizing the pulsations of current resulting from commutation.

A constant negative potential is impressed upon the grid of the oscillator tube, which is the voltage drop across a 100-ohm resistance connected between the filament and the grid. In series with this resistance is a 20,000-ohm resistance and a choke coil marked A. The latter prevents any high frequency oscillations from flowing through this grid circuit. The 20,000-ohm resistance is shunted by a condenser, and it provides the proper negative potential when the tube is oscillating. A short circuiting jack is also in series with the circuit. This permits the insertion of a plug for connecting in a milliammeter.

In the type SCR–67 set, resistance R_1 is 130 ohms instead of 100 ohms, and 10,000 ohms are used instead of 20,000 for the high resistance. The choke coil A and condenser C are also omitted.

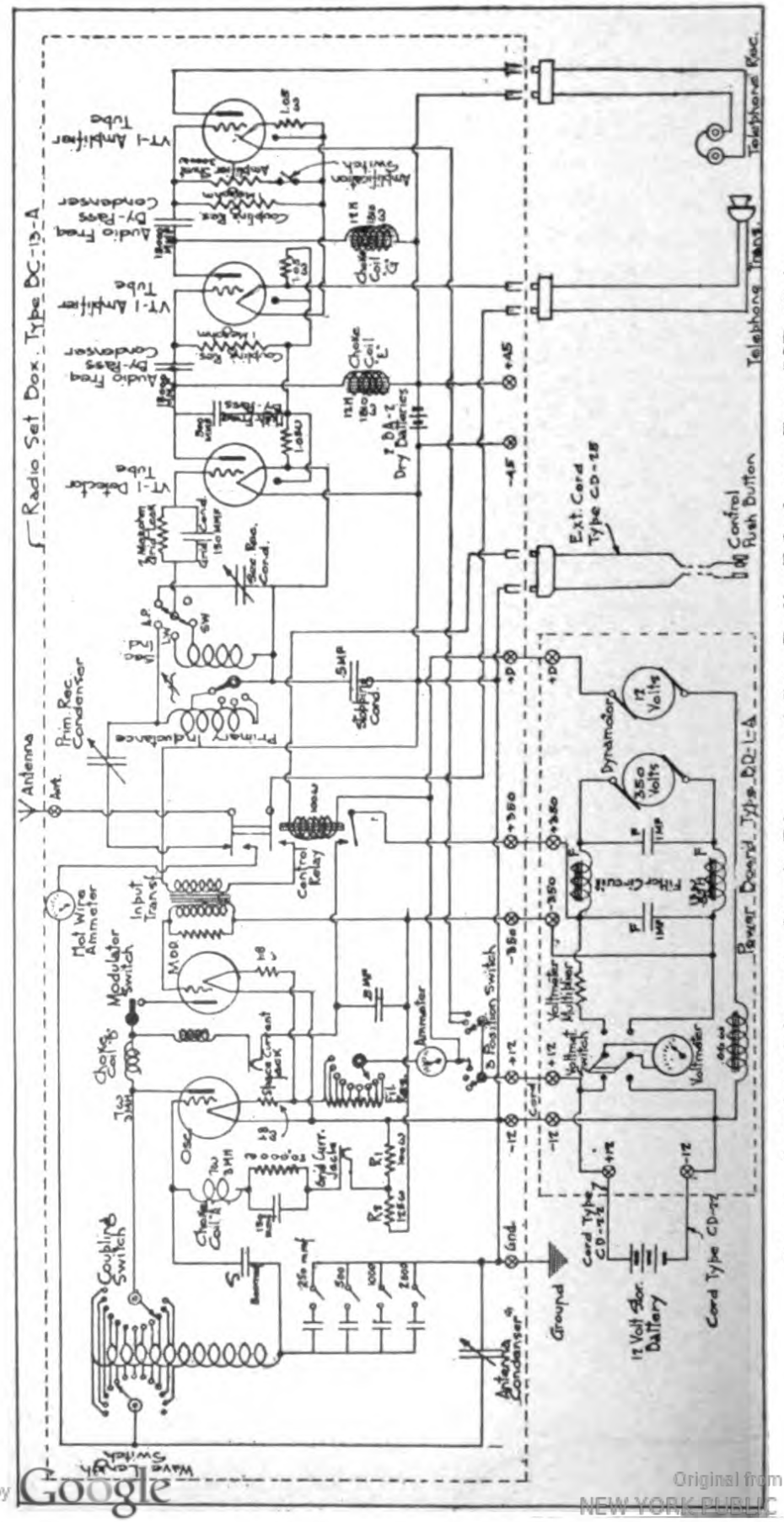


FIG. 1.—Complete Schematic Circuit Diagram of Set, Radio Telephone, Type SCR-67-A.

The grid and plate circuits just described are coupled so that the tube will generate oscillations. The oscillatory circuit comprises a grid coupling condenser, the antenna, and the transmitting inductance coil. The grid coupling is effected through a fixed condenser S in series with any one or all of four fixed condensers in parallel, which may be connected as required by closing the small knife switches in the covered panel. This condenser S also serves as a stopping condenser in preventing the 350-volt d. c. plate poten-

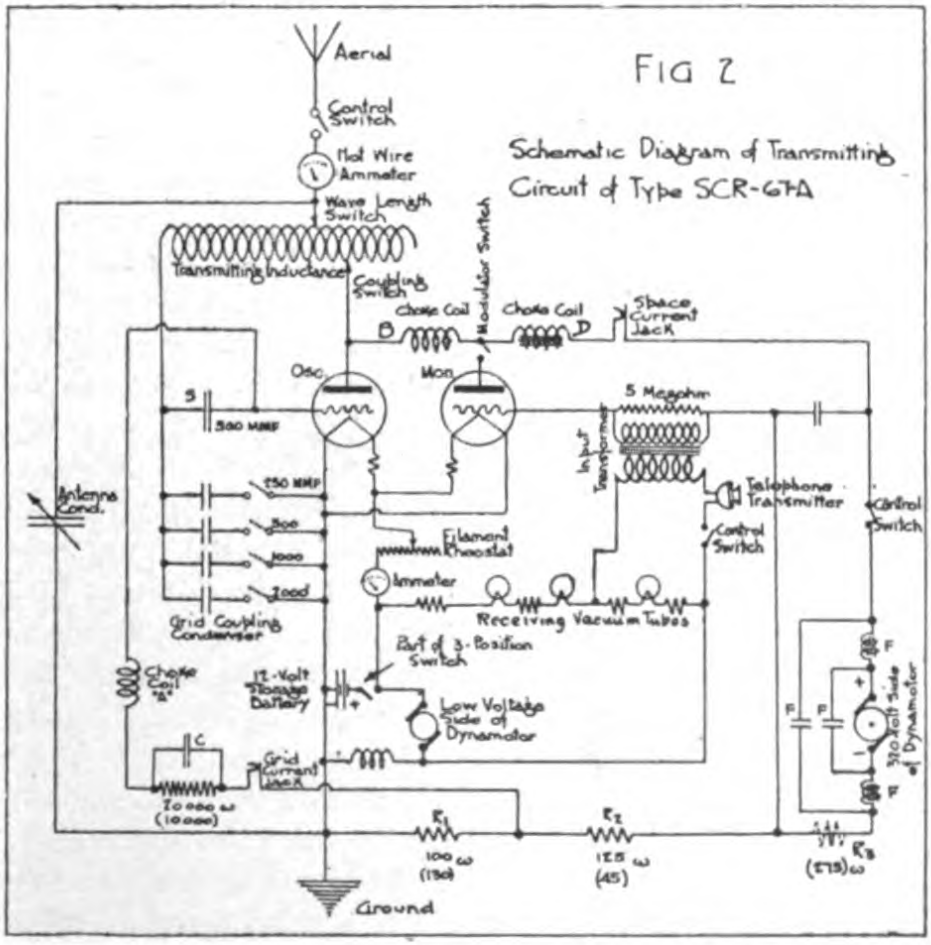


FIG. 2.—Schematic Diagram of the Transmitting Circuit of Set Type SCR-67-A.

tial from being applied to the grid through the transmitting inductance. The plate coupling is made through the antenna and the transmitting inductance. The latter is connected at one end between the condenser S and the four parallel grid coupling condensers. At the other end of the coil are twelve taps, connected to two 12-point dial switches, marked "Coupling" and "Wave Length," to which the plate and aerial are connected respectively. The operation of the plate dial switch alters the plate coupling,

while that of the aerial dial switch changes the transmitted wave length. A variable air condenser, marked "antenna condenser" in Fig. 2, shunts the antenna, and gives a continuous variation of wave length between any two consecutive taps of the wave length switch.

It may thus be seen from the above description how the direct current generated by the dynamotor is transformed by the oscillator tube into a high frequency undamped alternating current in the antenna circuit, which continually radiates energy into space. The amplitude of these oscillations is proprotional to the amount of current furnished by the dynamotor and flowing in the oscillator tube from the plate to the filament. A method of varying the amplitude of the oscillations is to vary the amount of direct current furnished to the tube. This is done in the type SCR–67 and SCR–67–A sets by means of a second three-electrode tube, called the modulator tube. The plate circuit of this tube shunts the plate circuit of the oscillator tube, as may best be seen from Fig. 2. The current generated in the 350-volt armature of the dynamotor will thus divide between the oscillator and the modulator tube in inverse proportion to their impedances.

In order to modulate the amplitude of the oscillations generated by the tube, the impedance of the modulator tube is varied by impressing upon the grid of this tube a potential the frequency and amplitude of which are determined by the strength and pitch of the voice. This is accomplished by connecting the secondary winding of a transformer, called the "input transformer," between the grid and the negative side of the filament of the modulator tube. The grid circuit also comprises resistances R_1 and R_2, which give to the grid a negative potential derived from the drop across these two resistances due to the current flowing through them. This grid potential is of such value as to make the tube operate on the point of its characteristic curve which is most suitable for modulation.

The primary circuit of the input transformer comprises a telephone transmitter. The current flowing in that circuit is obtained by connecting the circuit across the filament of one of the receiving tubes and two 1-ohm resistances. In case of the type SCR–67 set, the filament of the first amplifier tube is used, while for the type SCR–67–A set, the detector tube is used instead.

The entire transmitting circuit having now been described, its theory of operation may be explained as follows.

The circuit will be ready for operation when the main switch, push button control switches, modulator switch and the required grid coupling condenser switches are closed. The three-position switch will complete the filament heating circuit and the low voltage dynamotor circuit. The three control switches are closed by pressing the control push-button.

By suitable adjustment of the wave length switch, plate coupling, grid coupling, and antenna condenser, the oscillator tube is made to generate undamped oscillations. This adjustment is made, in accordance with the rules given in a later paragraph, for the greatest antenna current with as small a space and grid current as possible.

By closing the modulator switch, the plate circuit of the modulator tube is connected in parallel with that of the oscillator tube, so that the current from the dynamotor, instead of all flowing through the oscillator tube, will divide between the oscillator and modulator tubes. By talking into the telephone transmitter, an alternating emf. is induced in the secondary of the input transformer, and therefore on the grid of the modulator tube. This emf. is proportional to the voice modulations, and the impedance of the modulator tube is varied accordingly. The result is that a correspondingly greater or lesser part of the total constant current generated by the dynamotor will be shunted off the oscillator tube, by the modulator tube, and the amplitude of the oscillations is thus modulated. It is evident that the operation of this scheme will be satisfactory only if the current fed by the dynamotor is kept constant. This is insured by the presence of an iron core choke coil "D" in the plate circuit of the two tubes. A 0.5-megohm resistance is shunted around the input transformer secondary for improving its operation. The actual method of operating the transmitting circuit is explained under a separate heading.

Theory of the Receiving Circuit.—The circuits in use when receiving are shown schematically in Fig. 3. Reference may also be made to Fig. 1, where the same letters and designations are used. The primary (antenna) circuit comprises the aerial, a variable air condenser, an inductance coil variable in four steps, a large stopping condenser and the ground. The stopping condenser does not stop the incoming high frequency oscillations, but prevents a short circuit in the filament circuit of the tubes. Inductively coupled to this circuit is the secondary oscillatory circuit, comprising a variable air condenser and an inductance coil variable in two steps, the entire coil being used when receiving long waves, and only half the

coil being used for short waves. The secondary circuit may be entirely disconnected when the dial switch is placed in the aperiodic position, "AP." In this case, the detector tube is directly connected to the antenna circuit. This position cuts out the secondary tuned circuit and is used when searching for signals of unknown wave length.

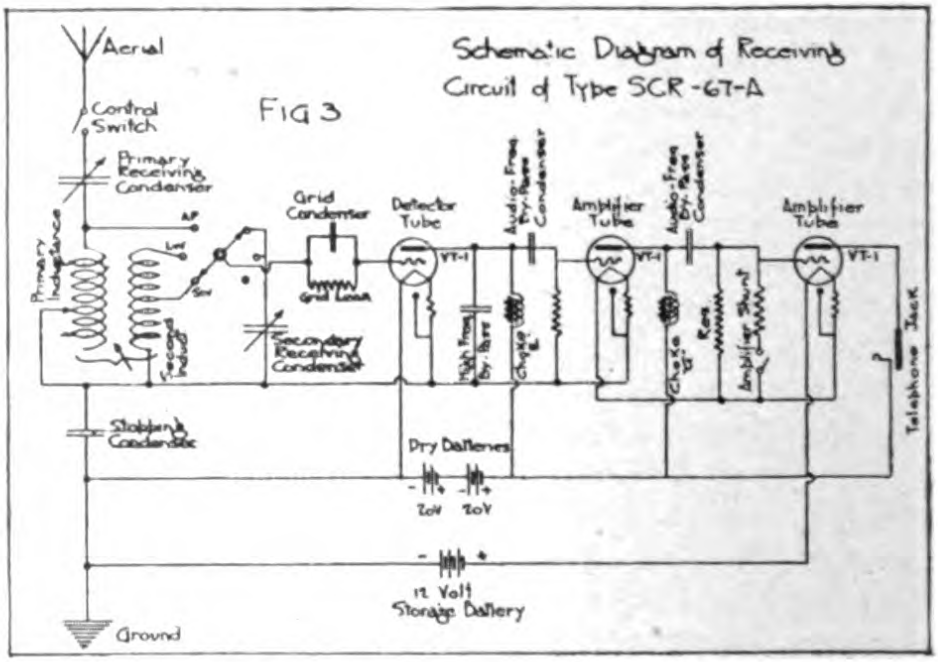


FIG. 3.—Schematic Diagram of the Receiving Circuit of Set Type SCR-67-A.

The detector tube is a type VT–1 three-electrode tube, having its filament and grid connected across the receiving inductance. A grid condenser shunted by a 2-megohm leak resistance is connected in series with the grid. The filament of this tube is in series with the filaments of the amplifier tubes, and is heated by the current from the 12-volt storage battery. The plate current of the detector tube is furnished by a 40-volt battery, made up of two type BA–2 dry batteries in series. In the case of the type SCR–67 set, one 20-volt BA–2 battery only is used for the detector tube. The high frequency currents are by-passed from the plate to the filament by a fixed condenser, while the audio frequency currents, in flowing through the choke coil E, induce in the latter a high alternating emf. This emf. is transferred through the grid stopping condenser to the grid of the first amplifier tube, correspondingly varying the plate current of that tube. The latter variations are therefore amplified repetitions of the detector tube plate current audio frequency variations. The charges induced on the grid of the first amplifier tube leak off to the filament through a 1-megohm resistance.

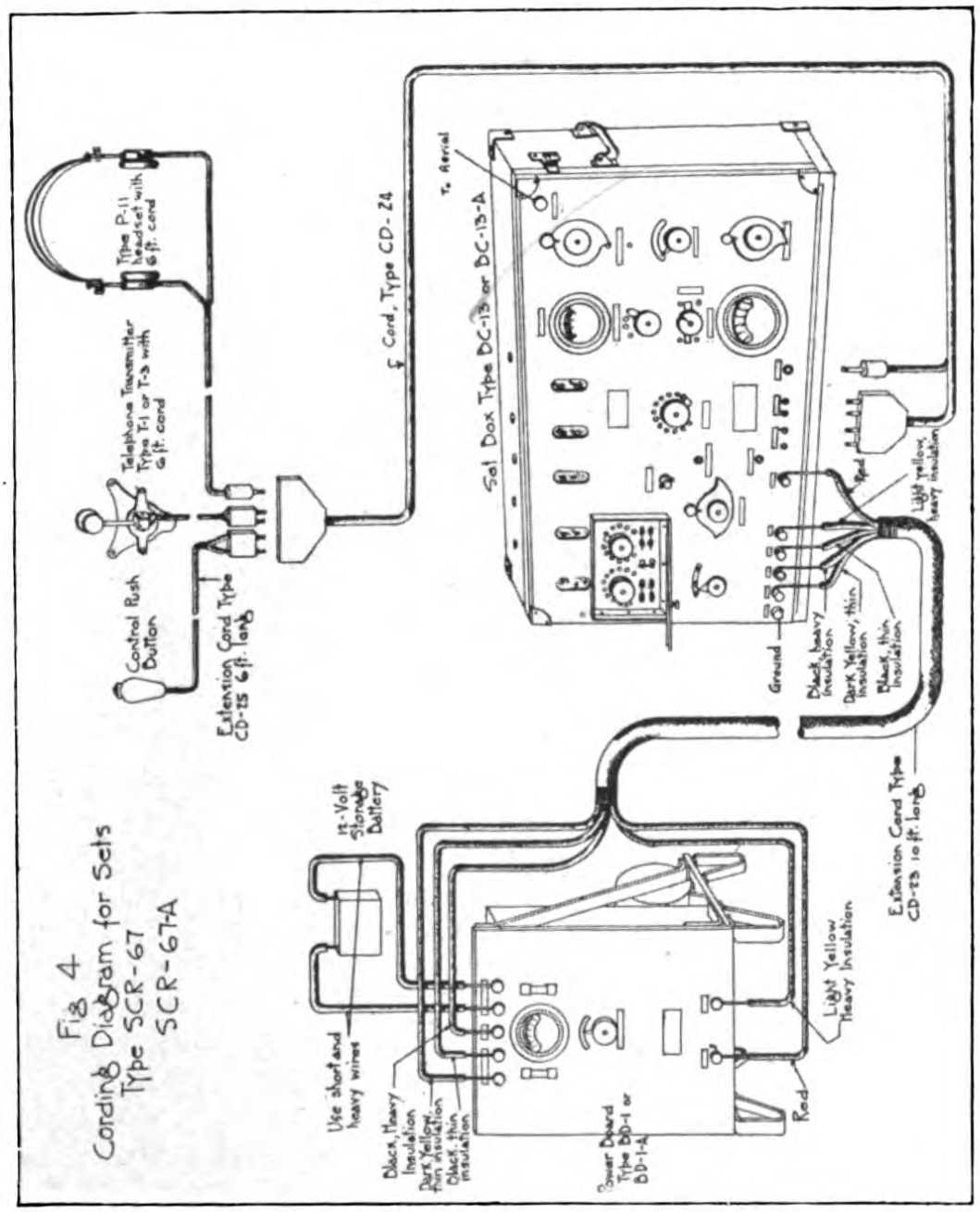
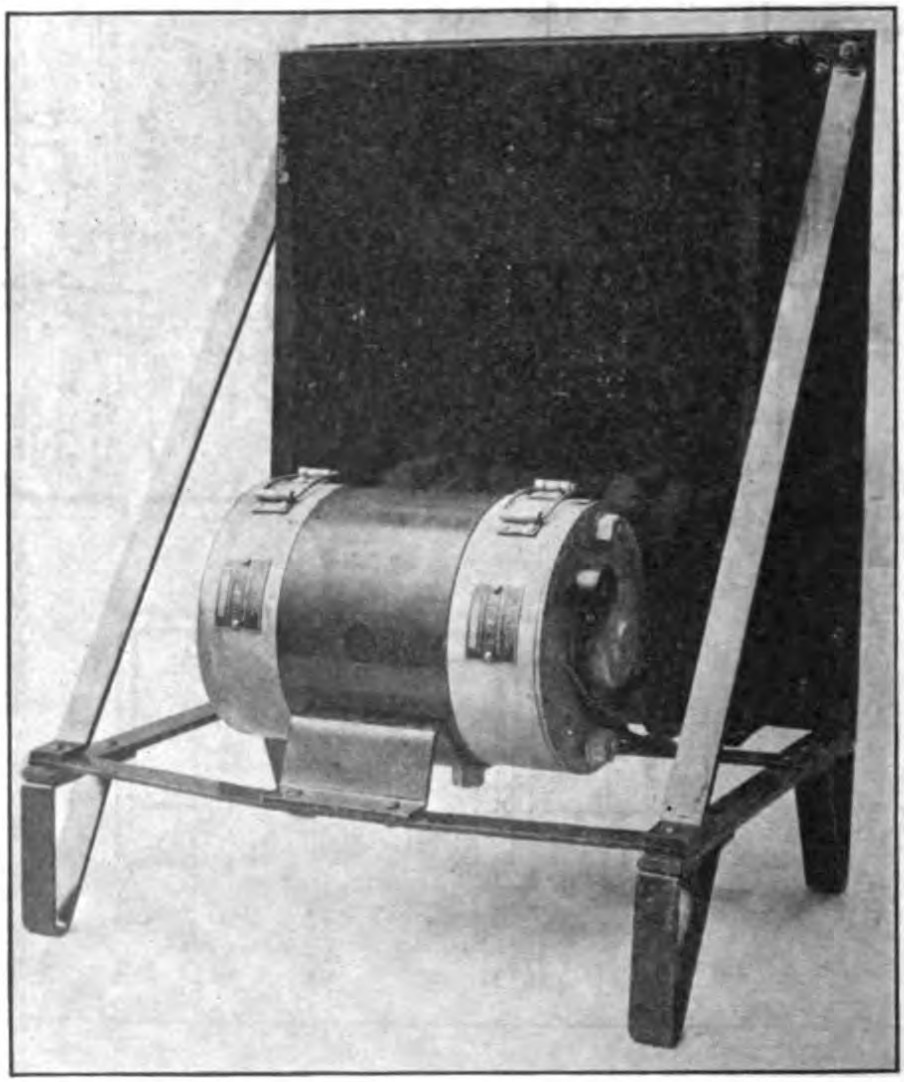


Fig 4
Cording Diagram for Sets
Type SCR-67
SCR-67-A

A similar scheme is used for coupling the first and second amplifier tubes. Both amplifiers work at a plate voltage of about 40 volts derived from the same battery that is used for the detector tube. In the type SCR–67 set, this plate potential is obtained by means of a second type BA–2 battery in series with the one used for the detector tube. Telephone receivers are plugged in the plate circuit of the last tube, and the degree of amplification may be reduced by closing the "Amplifier" switch, which connects a low resistance across the input circuit of the last amplifier tube, thus reducing the intensity of the sound in the telephones.

Summary of Differences between the Type SCR–67 and SCR–67–A Sets.—The main differences between the type SCR–67 and SCR–67–A sets are the following. The choke coil A and condenser C, Fig. 2, do not exist in the type SCR–67 set. The grid resistance is 10,000 ohms in the type SCR–67 set, and 20,000 ohms in the type SCR–67–A set. Resistances R_1 and R_2 are 130 and 45 ohms respectively in the



Rear of Powerboard Showing Dynamotor Type DM–2.

SCR–67, and 100 and 125 ohms in SCR–67–A. Resistance R_3 exists in the type SCR–67 set only. The connections of the three-position switch are quite different. When in the middle position, all five tubes light with SCR–67, while the receiving tubes only are on in the SCR–67–A set. These differences may be noted in Figs. 5 and 6 at the end of the pamphlet.

Component Parts of the Set.

The apparatus making up the set comprises the radio set box, type BC–13 or BC–13–A which contains the radio circuits and operating switches; the power board, in back of which is mounted the dynamotor and dynamotor filter circuit, and which also has a voltmeter for reading the storage battery voltage and the voltage generated by the dynamotor; the 12-volt storage battery; the telephone head set and transmitter; the control push button; and the connecting cords. The set box measures 23¾ in. x 15¼ in. x 6¼ in. overall. The powerboard measures 17⅜ in. x 13¼ in. x 10¼ in. The various parts of the set are interconnected as shown in the cording diagram, Fig. 4. Heavy wire should be used to connect the storage battery to the powerboard, in order to reduce the resistance losses. This is an important point which affects the radiation to an appreciable extent.

Method of Operation.

Various types of antennae may be used with the ground telephone sets. Two factors which are of great importance in setting up the antenna are its resistance and natural wave length. The resistance should be as low as possible, preferably less than 20 ohms. The natural wave length must be smaller than the smallest wave length to be used for transmitting. The following types of antenna construction are suggested.

(*a*) An umbrella type antenna, 40 ft. high, with six 50-ft. aerial wires and six 90-ft. insulated counterpoise wires. The aerials are held in proper position by means of guy ropes 75 ft. long. The natural wave length is 250 meters.

(*b*) A "V" antenna, 24 ft. high, 100 ft. long on each side, using two 100-ft. insulated counterpoise wires or two buried ground mats. The natural wave length is about 250 meters.

(*c*) An inverted "L" antenna, 20 ft. high, 100 ft. long, with an insulated counterpoise wire 100 ft. long. This has a natural wave length of 200 meters.

(*d*) An inverted "L" antenna 20 ft. high, 150 ft. long, with an insulated counterpoise wire 150 ft. long. This antenna has a natural wave length of 325 meters, and is recommended for use when working at wave lengths greater than this value.

Transmitting.—The set having been fully connected up as per cording diagram, Fig. 4, and using a suitable antenna, the method of operation is as follows.

It is well to calibrate the set in advance for a number of wave lengths, with the set connected to the antenna to be used. The method of calibrating the transmitting circuit, or of operating the latter when not previously calibrated is given below.

1. Open the radio set box, and see that two type VT–2 tubes and three type VT–1 tubes are inserted in their proper sockets. The VT–2 tubes are at the left, the VT–1 tubes at the right of the box, as one faces the operating panel.

2. By means of a voltmeter, check the voltage and polarity of the dry batteries. The voltmeter should read not less than 36 volts, and should in general read 40 to 45 volts.

3. Close the set box and throw the voltmeter switch on the power board to "12" volts and check the storage battery voltage. This should be at least 12 volts, and may be 14 volts without damage to the apparatus. A voltage of 13 or 14 volts will, in fact, improve the operation of the set, but the latter limit should never be exceeded. After checking the voltage, throw the switch to "Off."

4. Place a type SCR–60–C or SCR–61 wavemeter near the left hand end of the radio set box and set it to the desired wave length. If the type SCR–61 wavemeter is used, insert type P–11 telephone receivers in the wavemeter jack, start the buzzer and adjust the crystal detector. Keep the buzzer running while adjusting the radio set. If the type SCR–60–C wavemeter is used, operate similarly, or better, simply read the galvanometer, without using the buzzer or telephone receivers.

5. Turn the filament current switch of the radio set box all the way to the left, to the position "Minimum."

6. Insert the milliammeter plugs in the jacks marked "Grid Current" and "Space Current." Two type I–7 ammeters may be used, with an extension cord type CD–57.

7. Open the modulator switch. This is the small vertical knife switch in the center of the covered panel.

8. Throw the three-position power switch all the way to the right, in the position marked "Power On." This should light the filaments of all five vacuum tubes, should give a reading on the filament current ammeter, and should start the dynamotor.

9. Adjust the filament current so that the filament current ammeter will indicate 2.6 to 2.7 amp.

10. Press the control push button. This will connect the control relay, Fig. 1, across the 12-volt storage battery, which in turn will close the three contacts, corresponding to the control switches of Fig. 2. The space current should be about 50 milliamp. if the oscillator tube is working properly.

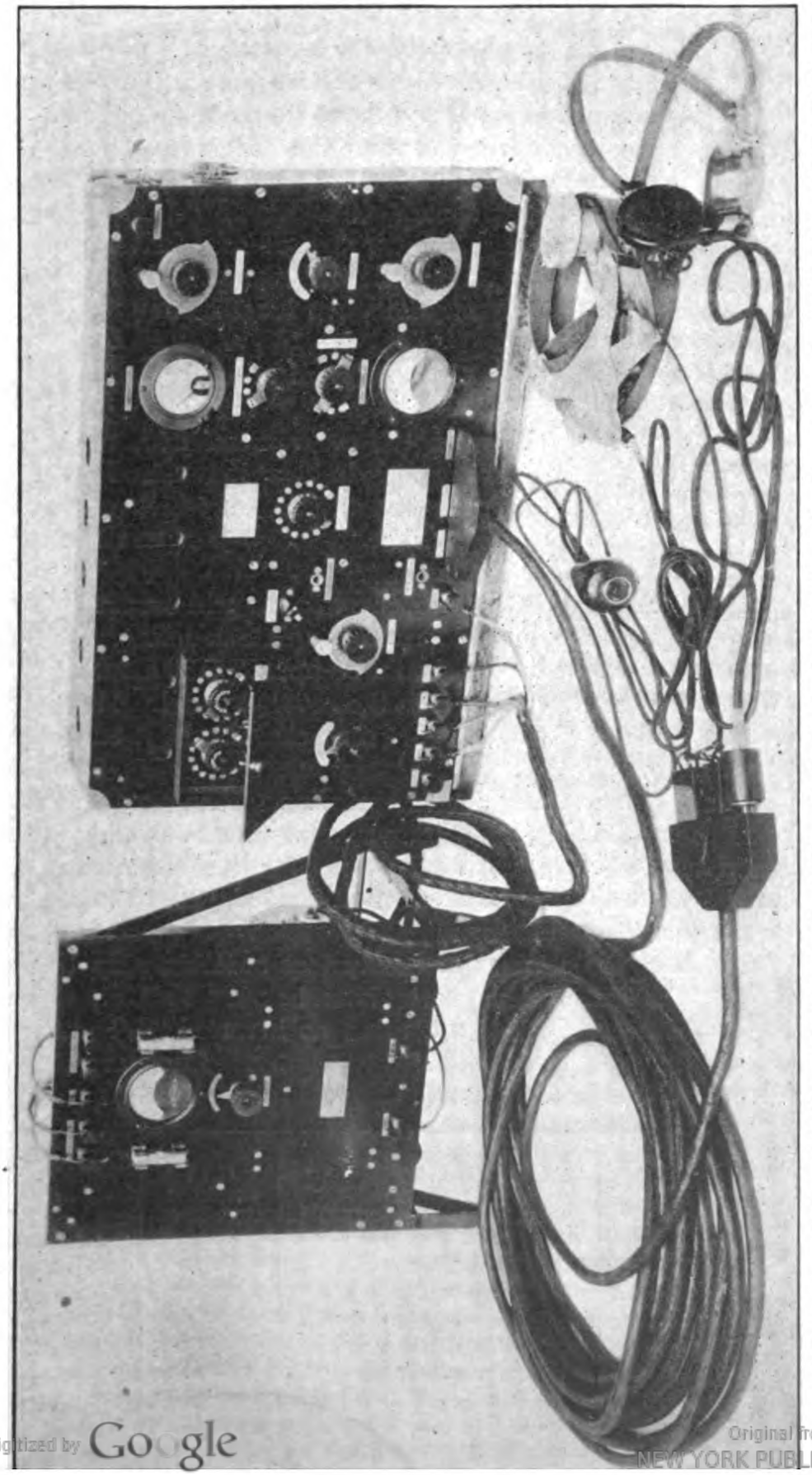


Fig. 4.—Box and Powerboard, Showing Extension Cords Used When It Is Desired to Remove the Dynamotor from Close Proximity of the Set Box to Reduce the Noise.

11. Connect the 750 or the 1000 micro-mfd. grid coupling condenser, by closing the corresponding knife switch in the covered panel, and set the 12-point "Coupling" dial switch so that the tube will oscillate, as indicated by a reading on the antenna ammeter.

12. Adjust then, in rotation and in the order mentioned, the "Wave Length" switch, antenna transmitting condenser ("Cond. Trans."), and "Coupling" switch until maximum response is obtained on the wavemeter. Also try various combinations of the four grid condenser switches, so that the grid current will be between 2 and 7 milliamp. The greater the wave length, the greater the grid condenser to be used.

13. Readjust the wave length switch and antenna condenser to perfect the tuning.

14. Readjust several times, in the order mentioned, the plate "Coupling" dial switch, grid coupling knife switches, and antenna transmitting condenser to secure that adjustment which will give, at the desired wave length, greatest radiation and smallest grid and space current possible.

15. If the grid current is too high, increase the grid condenser. If the space current is too high, increase the plate coupling. With a suitable antenna, the radiation should be from .3 to .6 amp.

16. Close the modulator switch in the covered panel. The space current will be 60 to 70 milliamp. In no case should it exceed 80 milliamp.

17. The set is now ready for transmitting. Remove the wavemeter and the grid and plate milliammeters. When talking, speak in an even tone of voice, not too high nor loud, and with the lips close to the transmitter. It is essential that the push button be kept closed while transmitting.

18. An idea of the settings of the various switches may be obtained from the calibration chart given below. This chart was obtained with a type SCR–67 set, using an inverted "L" antenna having a natural wave length of about 200 meters. Such an antenna is not very well suited for use with this set.

Wave length	Antenna switch point	Coupling switch point	Antenna transmitting condenser	Grid coupling condenser
235	1	12	100	500
250	2	12	100	750
300	5	12	70	1000
350	8	11	80	1000
400	11	11	26	1000
450	12	10	100	1000

Caution.—Do not touch the modulator and grid condenser switches with bare hands while the power is on.

Receiving.—The receiving circuit may be calibrated, after the set has been connected to the antenna, by means of a wavemeter which is set to a number of wave lengths, the set being tuned in as explained below, and the settings of the various switches recorded. If not calibrated in advance, or if the wave length to be received is unknown, the procedure is as follows.

1. Follow the instructions given in paragraphs 1, 2, 3 and 5 of the previous section.

2. Close the three-position power switch of the radio set box in the middle position, marked "12 Volts." This should light the filaments of the three receiving tubes. The circuits in use are shown in Fig. 3. The antenna control switch, Fig. 2, is closed and it is not necessary to close the push button. If it is desired to transmit and receive, set the three-position switch to "Power On." When transmitting, press the push button; when receiving, release the push button. In case of the type SCR–67 set, all five vacuum tubes will light simultaneously when the power switch is in the 12-Volt or Power On position.

3. Set the three-point dial switch located above the filament current ammeter in the position "AP."

4. Adjust the receiving "Primary Inductance" and the "Primary Receiving Condenser" until the signals are heard loudest.

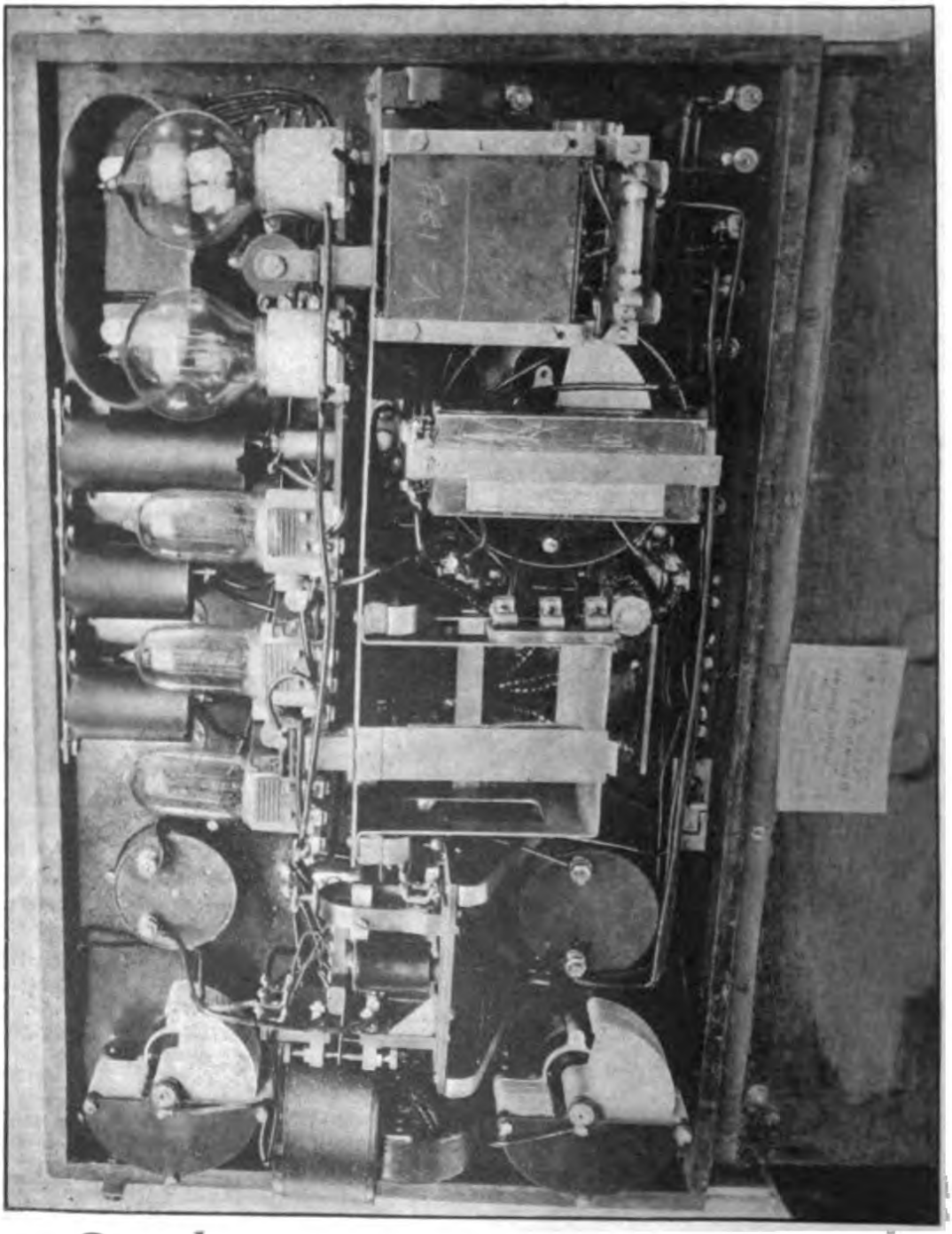
5. Set the three-point dial switch to "LW" or "SW", and adjust the secondary receiving condenser for loudest signals, using maximum coupling if required.

6. If the signals are too loud, set the "Amplifier" key to "Minimum." If they are not loud enough, set it to "Maximum." Also, reduce the coupling for protection against interference.

Possible Sources of Trouble.

Frequently, the set does not operate satisfactorily on account of incomplete adjustment of the transmitting circuit. In making adjustments, each setting affects all the others, and it is therefore necessary to go over all adjustments in the same order, until proper conditions are obtained. Once the set is adjusted, it will therefore save time to record the settings and corresponding wave length These settings will of course change if the antenna is changed.

With a set properly adjusted, the results are still dependent on the voice of the operator. The speech should be clear, rather slow and in an even, moderate tone, and with the lips close to the telephone transmitter.



Mounting of Apparatus on the Back of the Panel of Set Box Type BC-13.

In general, it may be said that the set is operating properly when, with the switch on "Power On" and the control push button closed, and the amplification switch on "Minimum", the operator hears himself distinctly in the telephone receiver while talking in the transmitter in a low tone of voice. The explanation of this test is that the modulated oscillations of the transmitting circuit induce currents in the receiving inductance. The test is therefore a check on the working condition of the circuits, but may not be considered as a conclusive proof that the circuits are perfectly adjusted.

Some of the troubles which may be encountered in operating the set are mentioned below. The wiring diagrams of Fig. 5 and 6 may be helpful when tracing the circuits in the set box.

Noise in Receiver.

(*a*) Worn out dry batteries. Voltage should not be less than 17.5 volts per battery.

(*b*) Noisy leak resistances.

(*c*) Loose connections in plate, filament or grid circuits. Inspect soldered connections, especially of long wires which may vibrate loose. Inspect connection clips of grid leak and telephone jack.

(*d*) Poor contact between vacuum tube and spring contacts in socket.

(*e*) Broken down grid leak condenser. Remove condenser and test for click using telephones.

(*f*) Noisy detector vacuum tube.

(*g*) Sparking at dynamotor commutator, due to poor brushes or dirty commutator.

Failure to Receive.

(*a*) Tap on the detector tube. If a loud ringing noise is heard, the trouble is probably in the antenna primary and secondary circuits. If no noise is heard, the trouble is probably between the detector and telephones.

(*b*) Failure of filaments to light; due to broken filament in one of the receiver tubes (VT–1) or open in filament circuit. May also be due to broken down antenna stopping condenser.

(*c*) Blocking of detector tube; due to too high resistance grid leak or open in grid circuit. Examine grid leak connecting clips.

(*d*) Receiving condenser short circuited, due to buckled plates; or antenna stopping condenser broken down.

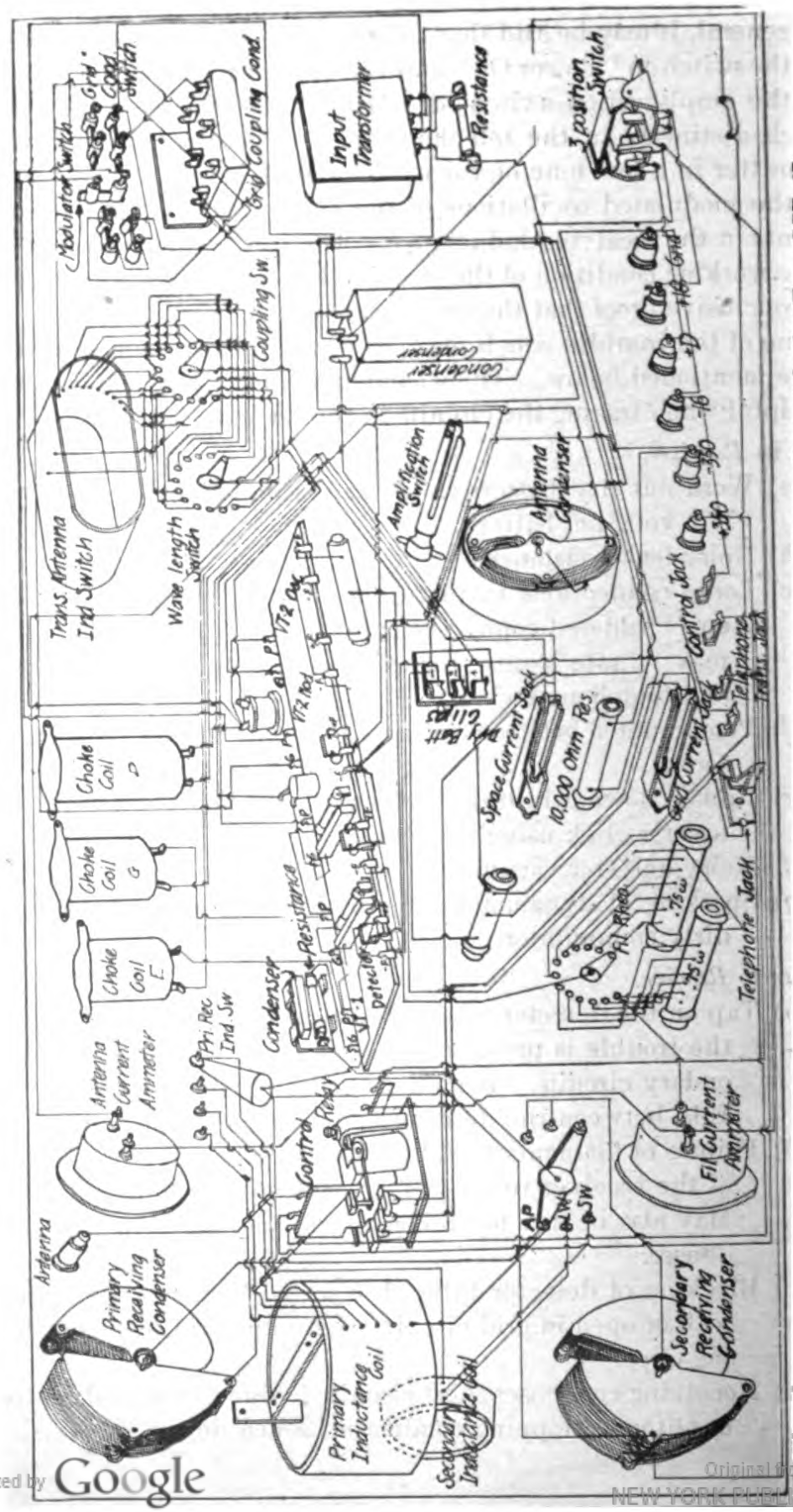


FIG. 5.—Actual Wiring Connections Within the Set Box Type BC-13, Which Forms Part of the Set Type SCR-67.

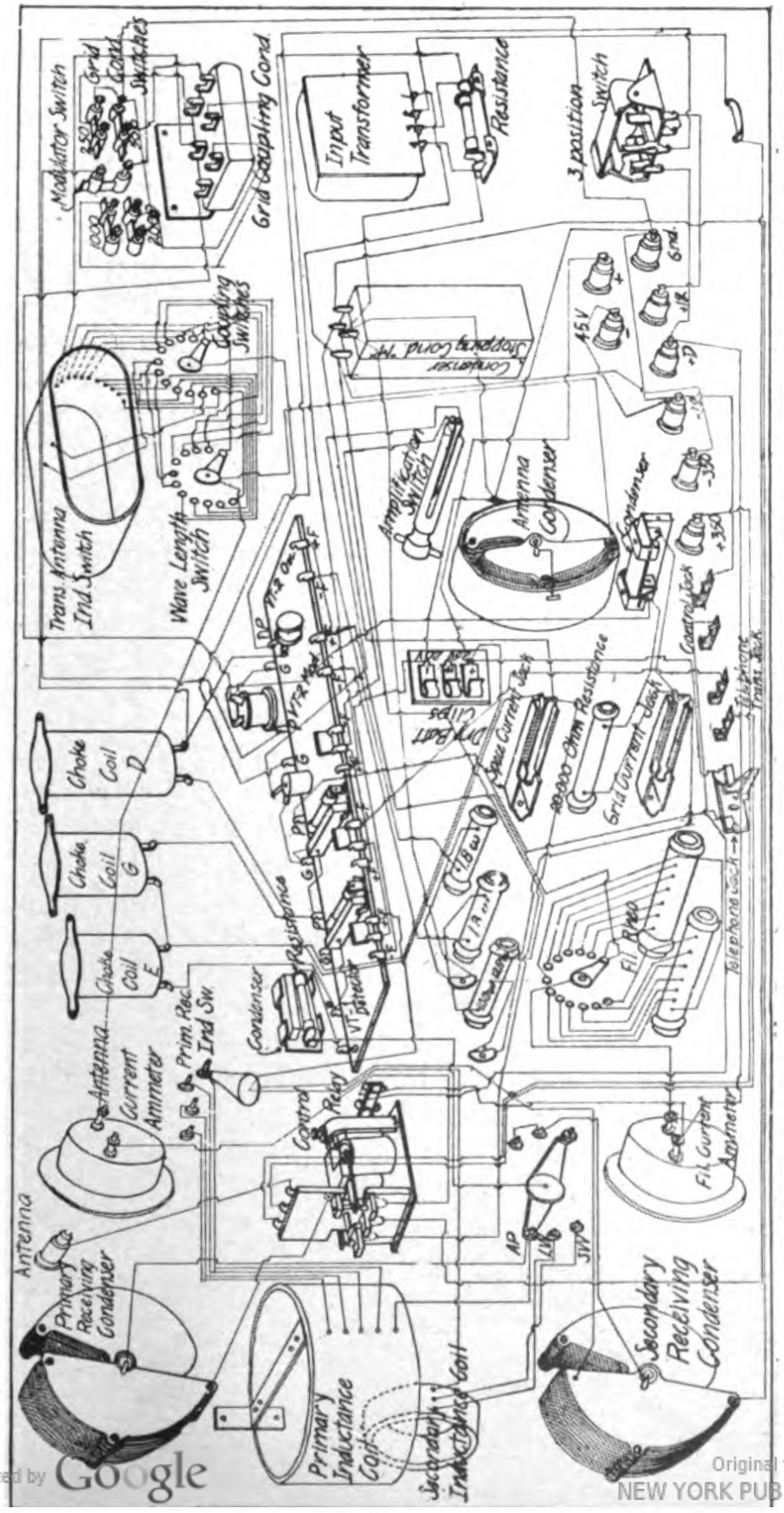


FIG. 6.—Actual Wiring Connections Within the Set Box Type BC-13-A, Which Forms Part of the Set Type SCR-67-A.

Failure of Amplifier.

(*a*) Amplifier resistances may be burned out, or short circuited, or the connections may be broken.

(*b*) Condenser terminals grounded to metal frame.

(*c*) Loose connections. Condenser terminal connections broken off.

Failure to Oscillate.

(*a*) Failure to have any space current with modulator switch open may be due to a failure to impress the plate voltage on the tube. Test d.c. plate circuit for an open by shunting the plate and filament terminals of the tube socket with a buzzer or receiver. Test dynamotor voltage on power board. The milliammeter circuit may be open. Inspect space current jack and plug. The contacts on the control relay may not operate properly. Too small a space current may be due to too small a filament current.

(*b*) Failure to have any grid current may be due to a burned out grid resistance. Test the latter by clicking through with the telephones. It may also be due to a burn out or open in the R_2 and R_3 resistance (Fig. 2), to an imperfect grid current jack, or burned out ammeter.

(*c*) Oscillator tube filament may not light due to an open in the filament circuit.

(*d*) No reading on antenna ammeter may be due to an open in the antenna circuit. Ammeter may be burned out, or antenna inductance coil may be open. Test by buzzer. Antenna condenser may be shorted. Antenna switches may be faulty.

(*e*) Test grid coupling condenser by buzzer.

(*f*) Circuit may not be adjusted properly.

(*g*) Antenna insulator may leak, or antenna may be grounded.

Over-heating of Oscillator Tube.

(*a*) Too much plate voltage.

(*b*) Improper adjustment of circuit.

(*c*) Lack of grid current or excessive grid current due to improper adjustment of circuit.

(*d*) Faulty tube.

Failure to Modulate.

(*a*) Receiving tube filaments may not light.

(*b*) Control relay contacts may not work.

(*c*) Open in modulator plate circuit. Modulator knife switch should be closed. If the latter is open, space current ammeter should read 40 to 50 milliamp. When closed, space current should be 60 to 70 milliamp.

(*d*) Iron core choke coil may be short circuited.

(*e*) Faulty or burned out input transformer.

(*f*) Short circuit on input transformer secondary.

(*g*) Open circuit between transformer and grid of modulator tube.

(*h*) Faulty telephone transmitter.

(*i*) Faulty tube.

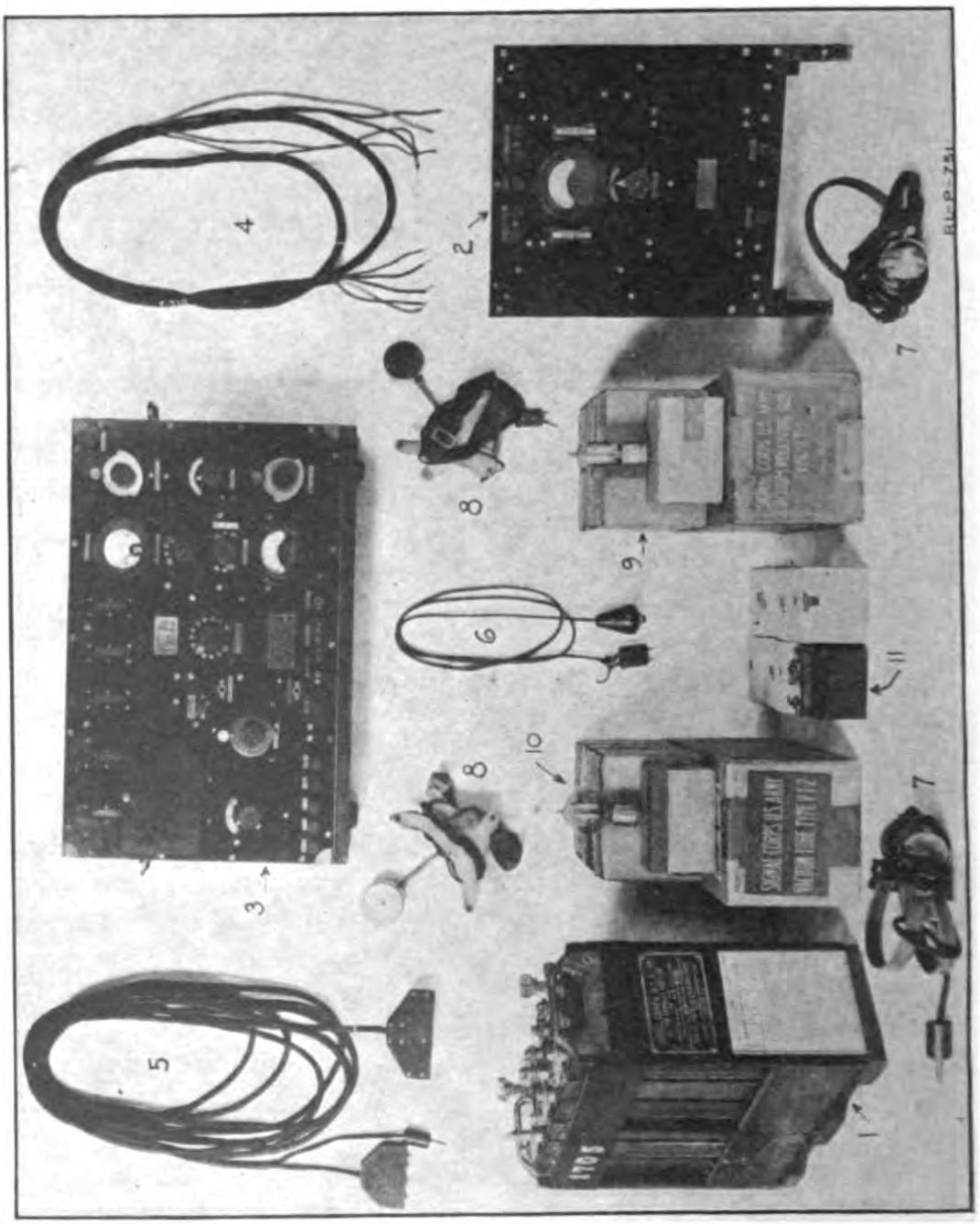
(*j*) Blocking of modulator may be due to too high or too low a space current, or to improper resistances in plate circuit. A tendency of the tube to block will be evidenced by a high and unsteady reading on the space current ammeter when blowing or whistling on the telephone transmitter. Blocking of the modulator is also evidenced by the fact that when the operator talks into the transmitter while sending, he hears his speech interruptedly. A remedy, if the tube is not faulty, is to interchange the oscillator and modulator tubes.

PARTS LIST.

In ordering this set or parts of this set specification must be made by names and type numbers as listed below, exactly. The designation printed in bold face type *only*, will be used in requisitioning, making property returns, etc.

In ordering complete sets, it is not necessary to itemize the parts; simply specify "Set, Radio Telephone, Type SCR-67." If all the parts listed under a group heading are desired, it is not necessary to itemize the parts; simply specify, for example, "1 Equipment Type PE-2."

The set is not complete unless it includes all of the items listed in the component parts table below.



Set, Radio Telephone, Type SCR–67.

1 Equipment Type PE–2; power.
- **4 Batteries Type BB–5**; 2 in use, 2 spare.
- **1 Powerboard Type BD–1.**
- **1 Cord Type CD–22.**

1 Equipment Type RE–2; radio.
- **1 Set Box Type BC–13.**
- **1 Cord Type CD–23**; powerboard to set box.
- **1 Cord Type CD–24.**
- **1 Cord Type CD–25.**
- **2 Head Sets Type P–11**; 1 in use, 1 spare.
- **2 Transmitters Type T–1**; 1 in use, 1 spare
- **16 Tubes Type VT–1**; 3 in use, 13 spare.
- **16 Tubes Type VT–2**; 2 in use, 14 spare.
- **8 Batteries Type BA–2**; 2 in use, 6 spare

1 Equipment Type A–9; antenna.
- **6 Insulators Type IN–5.**
- **6 Insulators Type IN–7.**
- **6 Couplers Type FT–2.**
- **3 Mats Type MT–3.**
- **750 ft. Wire Type W–1.**
- **2 Reels Type RL–3.**
- **300 ft. Wire Type W–6.**
- **6 Mast Sections Type MS–5**
- **2 Bags Type BG–14.**
- **12 Stakes Type GP–3.**
- **1 Bag Type BG–8.**
- **50 ft. Wire Type W–4.**
- **1 Hammer Type HM–1.**
- **½ lb. Marlin Type RP–2.**
- **300 ft. Cord Type RP–3.**

Set, Radio Telephone, Type SCR–67–A.

1	**Equipment Type PE–2–A**; power	*
6	**Batteries Type BB–5 or Type BB–14**	(1)
1	**Powerboard Type BD–1–A**	(2)
1	**Cord Type CD–48.**	
2	**Cords Type CD–38**; 1 in use, 1 spare.	
1	**Equipment Type RE–2–A**; radio.	
1	**Set Box Type BC–13–A**	(3)
1	**Cord Type CD–23**; powerboard to set box	(4)
1	**Cord Type CD–25**; set box to operator's cut-in switch	(5)
1	**Cord Type CD–24**; set box to operator's jack	(6)
2	**Head Sets Type P–11**; 1 in use, 1 spare	(7)
2	**Transmitters Type T–3**; 1 in use, 1 spare	(8)
16	**Tubes Type VT–1**; 3 in use, 13 spare	(9)
16	**Tubes Type VT–2**; 2 in use, 14 spare	(10)
8	**Batteries Type BA–2**; 2 in use, 6 spare	(11)
1	**Equipment Type A–9**; antenna.	
6	**Insulators Type IN–5.**	
6	**Insulators Type IN–7.**	
6	**Couplers Type FT–2.**	
3	**Mats Type MT–3.**	
750 ft.	**Wire Type W–1.**	
2	**Reels Type RL–3.**	
300 ft.	**Wire Type W–6.**	
6	**Mast Sections Type MS–5.**	
2	**Bags Type BG–14.**	
12	**Stakes Type GP–3.**	
1	**Bag Type BG–8.**	
50 ft.	**Wire Type W–4.**	
1	**Hammer Type HM–1.**	
½ lb.	**Marlin Type RP–2.**	
300 ft.	**Cord Type RP–3.**	

*Numbers in parenthesis at the right refer to the corresponding part in the illustration on the adjacent page.