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RADIO TELEGRAPH TRANSMITTING SET

Type SCR-69

(Confidential)

Radio Pamphlet
No. 14

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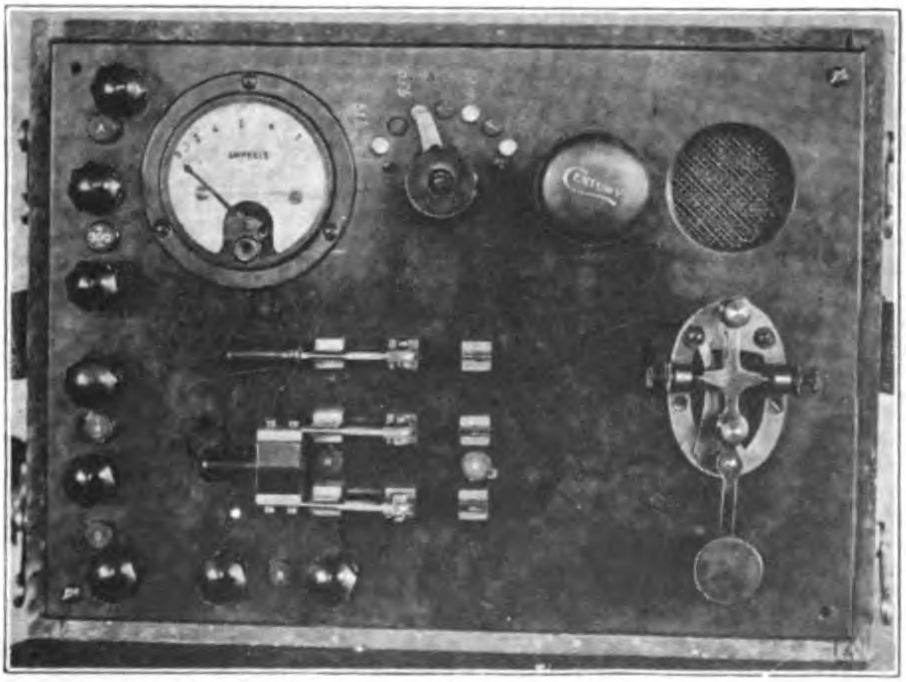
Radio Telegraph Transmitting Set Type SCR-69

THE RADIO telegraph transmitting set, type SCR-69, is an undamped wave set which is intended primarily for use as an instruction unit. It is designed to serve somewhat the same purpose as the French E-3 or E-10 sets and is issued only to organizations in training. Light weight, high efficiency and sharp tuning are its special characteristics. Three kinds of undamped wave sending may be used with the one set, making it possible to communicate with a receiving station, whether the latter is equipped with a heterodyne or an ordinary rectifying detector set. This feature makes it more or less universal in character and particularly



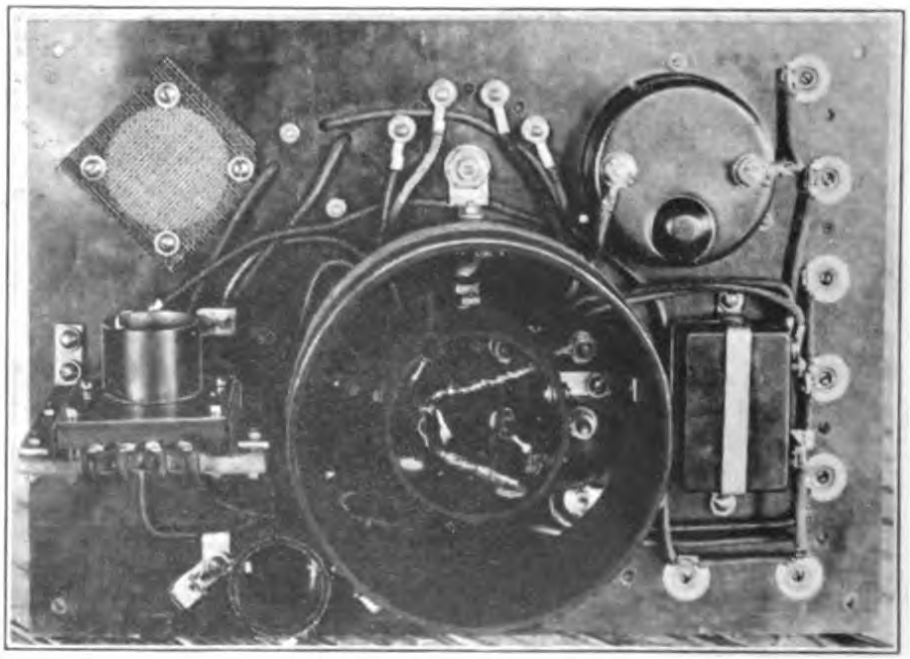
Operating Panel of Type SCR-69 Transmitting Set

suited to use under training conditions where several types of receiving sets may be employed. In case the batteries of a heterodyne or autodyne receiving unit working with this transmitting set should fail, it would still be possible to use this same set by sending buzzer-modulated waves and receiving by ordinary crystal detection.

As the operating characteristics of this set have not been satisfactory, only a comparatively small number of sets will be manufactured, and it is anticipated that these will be displaced in the near future by the type SCR-79 set, described in Radio Pamphlet No. 17.

Description of the Set

The type SCR-69 set consists essentially of a three-electrode vacuum tube, type VT-12, having its grid and plate circuits inductively coupled together and to the antenna. The three coupling coils (antenna, plate and grid coils) are mounted on the same axis. The antenna and grid coils are about 7 in. in diameter and the plate coil is about 3 in. in diameter, and these coils are so wound that the capacitance between the turns is reduced to a low value. The wave length of the set may be changed by means of the four taps on the antenna coil, whereby four different wave lengths ranging between the limits of about 600 meters and 1500 meters with a type A-6 antenna, can be secured. A definite specification as to the type of antenna to be used with this set has



Mounting of Apparatus on Under Side of Panel

not been made. Its operation with the type A-6 antenna is somewhat improved by opening the "V" to a greater angle than the standard 60 deg., in order to increase the capacitance of the antenna. The greatest capacitance is obtained when the angle is 180 deg. The three masts should then be erected in a straight

line with the station it is desired to signal, the lead-in wires being connected as usual at the center.

The vacuum tube plate current is supplied by a dynamotor running on a 10-volt storage battery to supply 325 volts potential between the plate and the filament. The high voltage side of this dynamotor is shunted by a condenser which serves the double purpose of smoothing out the small variations in the 325-volt direct current supply, and of providing a path for the high frequency oscillations generated by the tube which would otherwise be choked out by the impedance of the dynamotor windings. A negative grid potential of about 20 volts is supplied by a BA-2 dry battery which is contained inside the case. The filament is heated by a 4-volt storage battery which forms part of the auxiliary apparatus accompanying the set. The filament circuit includes an adjustable rheostat which should be set to limit the filament current to 1.36 amp. This corresponds with the VT-12 tubes to a reddish yellow glow and with the VT-2 tubes, should these happen to be used in

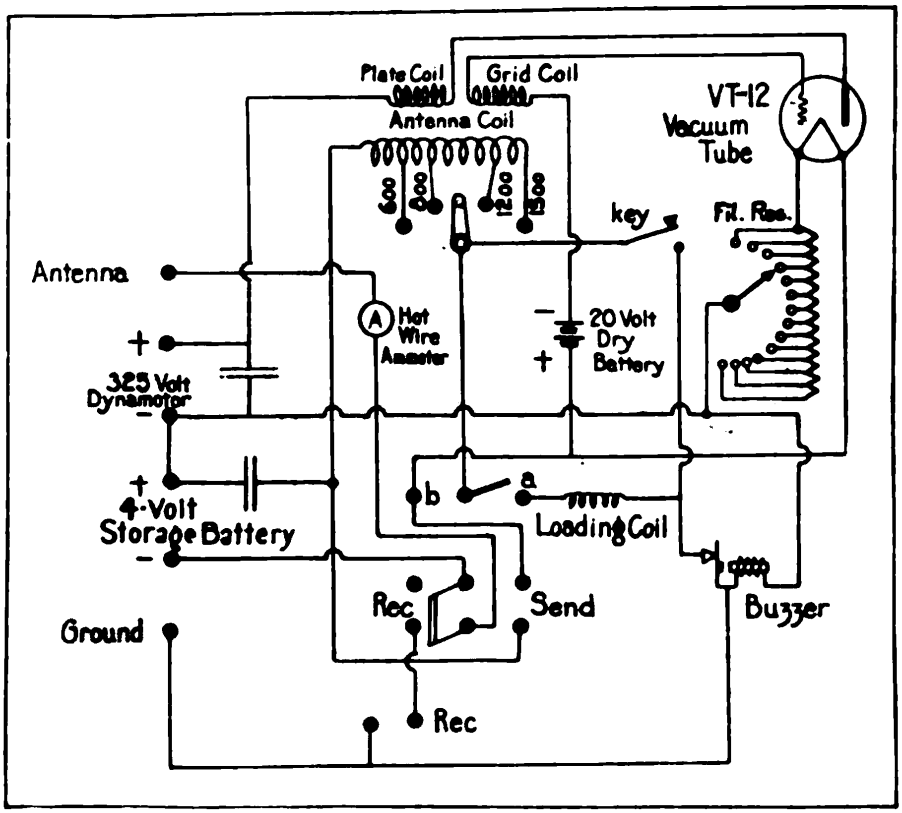


Fig. 1—Wiring Diagram of the Type SCR-69 Set

emergency, to a dull red glow. The rheostat is not shown in the cut of the panel, but it forms part of the panel equipment on the sets now under construction.

A sending key and hot wire ammeter are inserted in the antenna circuit. The latter indicates whether or not the vacuum tube is oscillating. A double pole double throw switch mounted on the panel provides a connection such that the antenna and ground of the sending set may be readily connected to any receiving set which may be connected to the "Receiving" terminals on the panel of SCR-69.

Method of Operation

The set being properly connected up to the antenna, ground, dynamotor and batteries, and the d. p. d. t. switch closed to the right (sending position), there are three methods of radiating the oscillations generated by the tube which correspond to the three positions of the single pole double throw switch marked ab, Fig. 1, and mounted on the panel of the set. The character of waves radiated, corresponding to each of the three positions of this switch, is as follows:

Compensated Wave Sending

S. P. D. T. Switch Closed to the Right.—Closing the switch to the right places the small loading coil in parallel with the sending key. The equivalent circuit is shown in Fig. 2, first diagram, for simplicity. With these connections, the oscillations generated by the tube are radiated continuously from the antenna, and are of a wave length λ_1, determined by the size of the antenna and the tap used on the antenna coil. When the key is now closed, in sending signals, the small loading coil is short circuited, thus reducing the inductance of the antenna and shortening the wave length to a value λ_2. This condition is shown in Fig. 3, first series of waves. The small loading coil, which has about ten turns of wire and a diameter of about 2 in., is so calculated that the difference between the wave lengths radiated with the key open and with the key closed is from 5 to 10 meters. As these waves are undamped, they are received by the heterodyne method which affords very sharp tuning and thereby makes it entirely possible to tune the receiving set to the shorter signal wave λ_2, and cut out the interference from the longer wave λ_1, corresponding to the key open. It is also possible to receive both waves simultaneously if so desired. With this adjustment, two notes are heard in the receiver, a high pitched note for the spaces and intervals and a low pitched note for the dots and dashes. This method of sending is called the "compensated wave" or "detuning" method.

Cut-In Sending

S. P. D. T. Switch Open.—The equivalent circuit for this connection is shown in the second diagram of Fig. 2. In this case, the key is placed directly in the antenna circuit so that it opens and closes that circuit. The result is that the oscillations generated by the tube are radiated from the antenna only when the key is

FIGURE 2

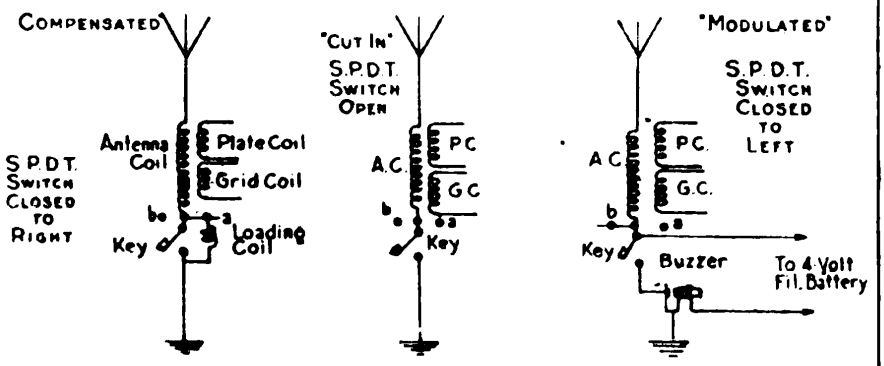


FIGURE 3

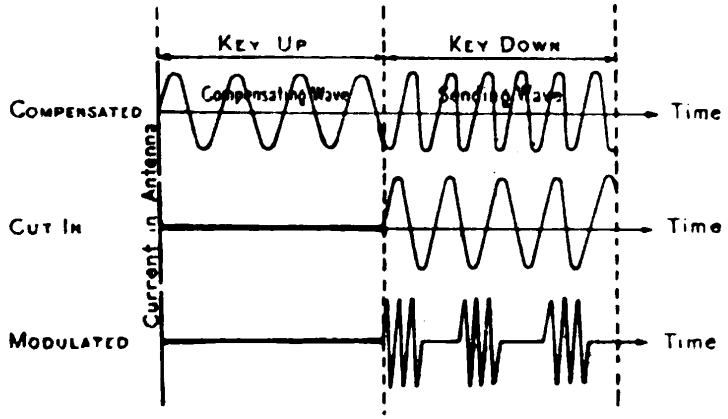


Fig. 2 and 3—Schematic Representation of Different Sending Connections and Waves Radiated

closed, no energy leaving the antenna when the key is open. A dot or dash will then be sent out as a train of undamped waves (Fig. 3, second series of waves), while a space will correspond to no energy sent out. As for the compensated method, reception of these signals must be made by the heterodyne method, the only difference in the signals heard at the receiving station being that no note will be obtained for spaces or intervals. This method of sending is called the "cut-in" method.

Modulated Sending

S. P. D. T. Switch Closed to Left.—The equivalent circuit for this position of the switch is shown in the third diagram of Fig. 2. In this case, the antenna circuit is opened when the key is up, and no energy is radiated. When the key is down, energy is radiated in a manner similar to that of the cut-in method, except that the closing of the key not only completes the antenna circuit, but also a circuit through a small buzzer, the vibrator of which opens and closes the antenna circuit. The undamped wave thus sent out is interrupted at regular intervals by the buzzer vibrator and a dot or dash is consequently made up of a series of short trains of undamped oscillations (Fig. 3, third series of waves). While the frequency of the oscillations is above audibility, the wave train or group frequency is equal to the buzzer vibrator frequency and therefore within the range of audibility. These waves can therefore be received by an ordinary receiving set and rectifying detector, just as damped wave signals. This method of sending is called the "modulated" method.

Choice of the Method of Sending

Each of the above sending methods has its respective advantages and disadvantages which determine and limit its use. The compensated method is the best of the three, in that the constants of the various circuits are changed very little by the closing of the key and there is therefore no danger of the tube being stopped from oscillating. The ammeter in the antenna circuit should give a practically constant reading whether the key is closed or open. This method has the disadvantage that it requires a certain amount of skill on the part of the operator, as no sound is produced by the transmitter and he must therefore make his dots and dashes purely by touch and not at all by ear. At the receiving end, it is not always possible to completely tune out the compensating waves, that is, the waves corresponding to the spaces, and the signals may be somewhat harder to read and cause an untrained operator some trouble. In tuning a set to receive waves sent out by the compensated method, it is important that the sending and not the compensating wave should be tuned in, as the former is made up of the signalling dots and dashes, while the latter is made up of the spaces between the dots and dashes.

The cut-in method gives no radiation of electric waves when the key is up. When the key is closed, the antenna circuit is suddenly coupled to the tube circuit. This is generally sufficient to produce an initial change in the potential of the grid of the tube

and thus start it oscillating. However, due to various conditions, it sometimes happens that the resulting change is not sufficient, and oscillations may not take place when the key is closed. This method is therefore not as reliable as the compensated method, but it may be more easily read at the receiving station, as it produces only one note in the receiver. It has the same disadvantage for the sending operator as the compensated method—no sound to aid the hand.

The modulated method of sending has the same defects and advantages as the cut-in method. It has the additional advantage that the buzzer emits a sound which may assist the operator in sending. However, due to the breaking up of the waves, less energy is radiated by the antenna. The modulated method is the only one of the three by which signals can be received by means of an ordinary crystal detector such as is supplied with the SCR-54 receiving set.

Particular care should be taken that the antenna and lead-in wire are completely insulated from the counterpoise and the ground, as a leak from antenna to ground, due to contact with a tree or shrubbery, or even leakage due to rain or damp weather, will not only cut down the radiation considerably, but may also prevent the tube from oscillating. Care should be taken that the counterpoise wire is heavily insulated from ground. A poorly insulated or partially grounded counterpoise will increase the antenna resistance and may prevent the tube from oscillating. The resistance of the antenna and lead-in wires should be kept as low as possible.

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, purchasing, etc.

In ordering *complete* sets, it is not necessary to itemize the parts; simply specify, "2 Sets, Radio Telegraph Transmitting, Type SCR-69." 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-8."

The Type SCR-69 set is not complete unless it includes all of the items listed below:

SET, RADIO TELEGRAPH TRANSMITTING, TYPE SCR-69

EQUIPMENT, TYPE PE-8; Power

2 Batteries, Type BB-1; Edison storage; 7 cells, 10 volts, 37.5 amp-hr.: 1 in use, 1 spare.

2 Batteries, Type BB-2; Edison storage; 3 cells, 4 volts, 75 amp-hr.; 1 in use, 1 spare.

1 Dynamotor, Type DM-1; Westinghouse; 10-300 volts, 50 watts.

EQUIPMENT, TYPE RT-6; Transmitting.

1 Set Box, Type BC-34; Radio telegraph transmitting; complete with carrying strap.

5 Tubes, Type VT-12; vacuum; 1 in use, 4 spare.

EQUIPMENT, TYPE A-6; Antenna; (old type SCR-53 set).

3 Mast Sections, Type MS-1; without tubes.

12 Mast Sections, Type MS-2; with tubes.

3 Caps, Mast, Type MP-5.

3 Insulators, Type IN-1; hard rubber, with hooks.

9 Reels, Type RL-3; hand.

1 Antenna, Type AN-5; two lengths of braided antenna cord 150 ft. long, and one length of lead-in wire 40 ft. long, all carried on three hand reels.

9 Guys, Type GY-3; No. 5 sash cord, each 36 ft. long, with metal tent slide and hook; a set of three guys to be carried on each of three hand reels.

1 Counterpoise, Type CP-4; two lengths of wire 150 ft. long, and one lead-in wire 40 ft. long, all joined together at their intersection; to be carried on three hand reels.

3 Hammers, Type HM-1.

9 Stakes, Type GP-2; guy.

3 Cords, No. 5 Sash; Pieces, 3 ft. Long

1 Chest, Type BC-35; carrying; used for packing antenna equipment for transportation.
