## THE SCR–105 SET.

**Equipment.**

1 SCR–105 (set box BC–53–A).
1 wave meter SCR–61.
1 antenna equipment, type A–10–A.
1 10–volt storage battery.

## THE TRANSMITTER.

**Information.**

The SCR–105 (see Fig. 49) is a compact transmitting and receiving quenched spark radio set. It is designed to be used in communication over a distance of 5 miles. The set is intended for intermit-

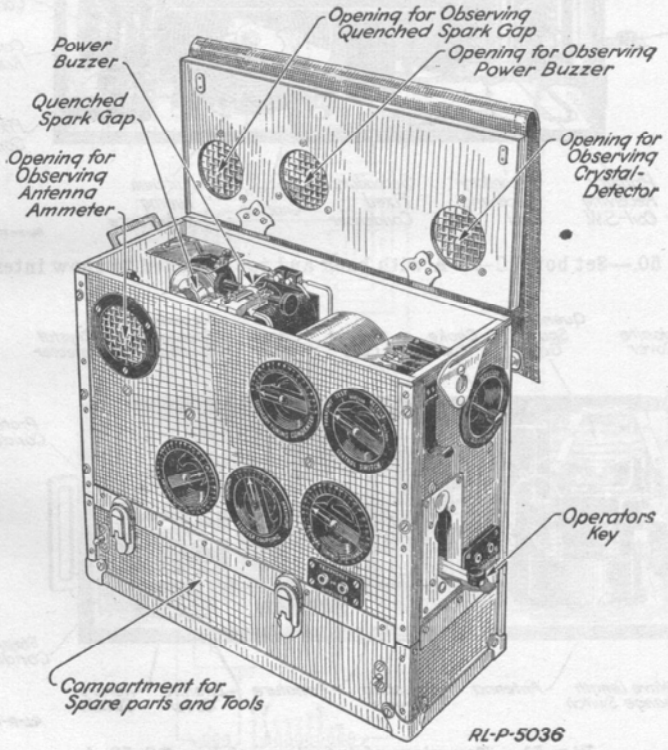


**Fig. 49.—Set box, type BC–53–A.**

tent duty only and should not be used for continuous sending. The power necessary to run the set is supplied by a 10–volt storage battery.

The parts of the transmitter consist of a special buzzer transformer, a quenched spark gap, an oscillation transformer, a thermo-

ammeter, a transmitting condenser, and a key. The purpose of the buzzer transformer is to change the low voltage direct current, supplied by the storage battery, into a high-voltage alternating current.

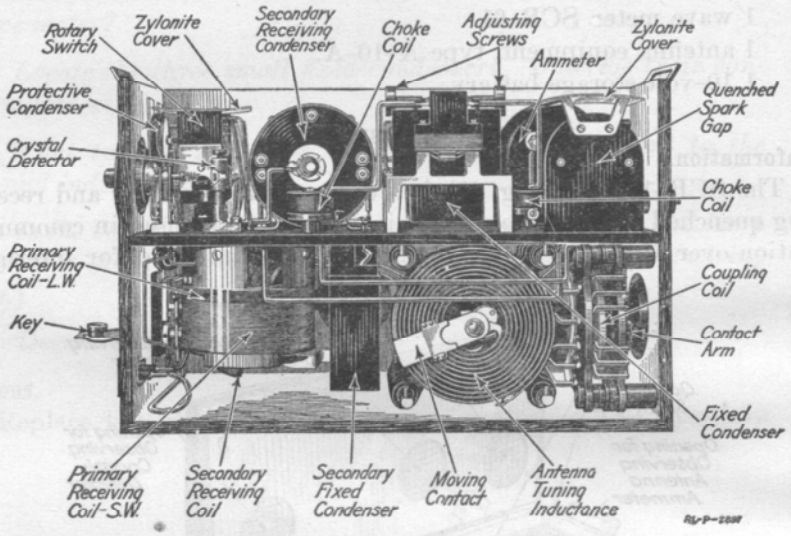


**Fig. 50.—Set box BC–53–A with back and top removed to show interior.**

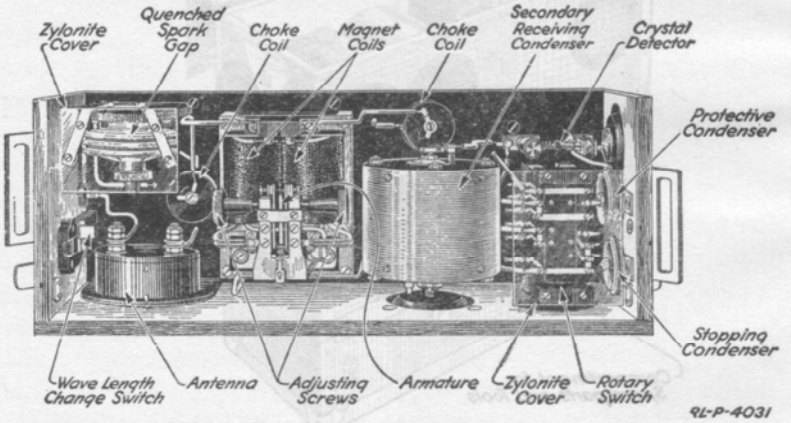


**Fig. 51.—Top view of interior, set box BC–53–A.**

The primary circuit of the transmitter includes the secondary or high-voltage spark gap, the transmitting condenser, and part of the oscillation transformer. The secondary or antenna circuit consists of the antenna, a series of inductance coils, a part of the oscillation transformer, the antenna thermoammeter, and the ground. Direct

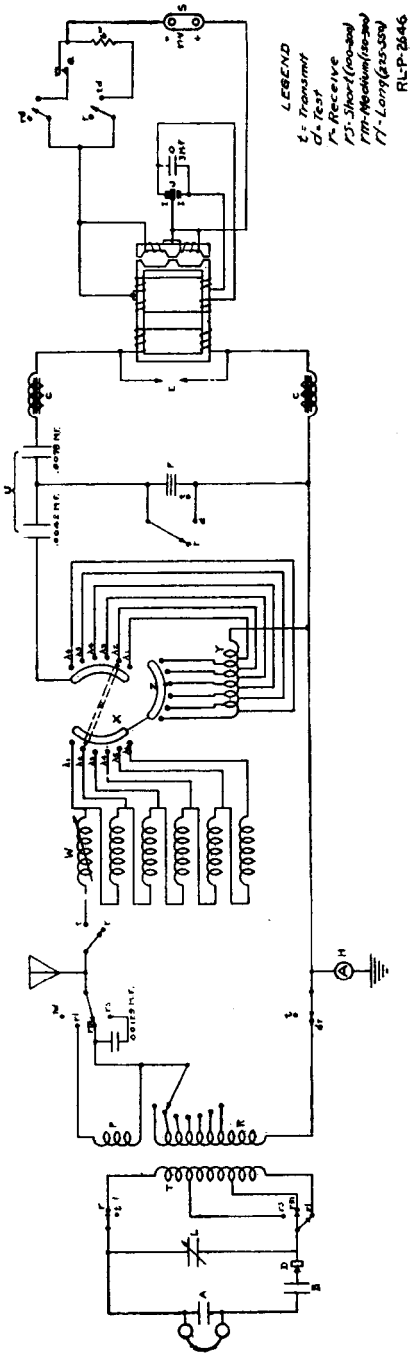


Fig. 52.—Schematic diagram of connections, SCR–105 set.

coupling is employed between the primary and secondary circuits of the transmitter. One of the inductance coils is permanently connected in the antenna circuit and is made continuously variable over its entire range by means of an adjustment controlled from the panel of the set. The primary and secondary are both tuned to the same wave length at the same time, by one switch, known as a "wave-change" switch. The primary circuit is accurately tuned to the desired wave length by this switch, but the secondary circuit is only roughly tuned to the same wave length. For this reason the calibrations of the wave-change switch refer to the wave length settings of the primary circuit. The fine tuning of the antenna circuit is accomplished by means of the variable antenna inductance. A handle located on the left side of the set box controls the coupling between the primary and antenna circuits.

**Directions.**

1. Remove the eight screws from the back of the set box, also the canvas cover from the front of the box. Unlatch the lid of the box and remove the top, back, and bottom of the set box. This will expose the parts to view as shown in Fig. 50 and in Fig. 51.

2. Move the various adjusting knobs on the front of the box and note carefully what they control inside of the box.

3. Observe the various parts in Figs. 49, 50, 51, and the wiring diagram in Fig. 52. Answer the following questions:

**Questions.**

(1) *Locate the wave-change switch inside the set box. What are the calibrations marked on the indicator of this switch?*

(2) *What contacts move when the wave-change switch is adjusted?*

(3) *Locate the antenna tuning inductance. How is it made continuously variable?*

(4) *Locate the control switch. What is its purpose?*

(5) *Locate the antenna ammeter. What is the range of its scale? How is it connected in the circuit?*

(6) *How are the transmitting inductances constructed?*

(7) *Why are the coils of the oscillation transformer insulated so heavily?*

(8) *How many turns has the antenna tuning inductance?*

(9) *How is the coupling of the transmitting circuit varied?*

(10) *How many coils are there in the primary of the oscillation transformer?*

(11) *How is the key connected in the circuit?*

(12) *Can the key be adjusted easily? How?*

(13) *How many sections form the primary winding of the buzzer transformer?*

(14) *How many sections in the secondary winding?*

(15) *To what is the moving armature of the interrupter connected?*

(16) *How many stationary contacts has the interrupter?*

(17) *Of what material are the contacts made?*

(18) *Why are the adjustment screws of the stationary contacts heavily insulated?*

(19) *What is the purpose of the safety gap?*

(20) *Where and how are the secondary condensers connected?*

(21) *How is the quench gap constructed?*

(22) *How are the spark disks insulated from each other?*

(23) *How is the quench gap connected in the circuit?*

(24) *How many contacts has the rotary switch? (Count them on the instrument).*

(25) *How are they insulated from the pin passing through them?*

## THE RECEIVER.

**Information.**

The receiving side of the set contains two tuned circuits, one, the antenna or primary circuit, and the other, the secondary circuit. The antenna circuit consists of the inductance (which is varied by the handle on the front of the set marked "primary tuning inductance"); either a small fixed condenser or another inductance known as a loading coil, depending on the position of the "change over" switch; and the antenna system. For the reception of short waves the change over switch is placed on the receiving position marked "100–200." In this position the loading coil is not used and the small fixed condenser is connected in series with the antenna. For the reception of medium length waves the switch is placed on the

receiving position, marked "150–300." In this position the series condenser is cut out and the antenna is connected directly to the primary inductance coil. The third position on the receiving side, marked "275–550," is the long wave position, and when used the loading coil is connected in series with the antenna.

The secondary circuit of the receiver consists of a secondary inductance and a variable condenser. Connected across the variable condenser are the crystal detector, two small fixed condensers, and the head set. The secondary inductance has two taps so that approximately one-third, two-thirds, or all of the inductance may be used. The amount of inductance used is controlled by the change over switch. The switch positions correspond to the three positions used to control the primary inductance. Inductive coupling is employed between the primary and secondary circuits and is varied by the handle on the front of the set box marked "Receiver coupling." A head set is connected in the circuit by means of a plug supplied with the set which fits in the double jack in the front of the set box marked "Telephone or Amplifier." The adjusting handle of the crystal detector protrudes from the right side of the set box so that the detector may be adjusted with the lid of the box closed.

**Directions.**

4. Note the various receiving controls and their markings.

**Questions.**

(26) *Locate the control switch. What are the wave-length markings?*

(27) *How many points has the receiver primary inductance switch?*

(28) *How is the receiver coupling control calibrated?*

(29) *How is the secondary condenser control calibrated?*

(30) *How is the crystal detector adjusted from the outside of the set box?*

(31) *How many headsets may be used with the receiver of the SCR–105 set?*

**Directions.**

5. Turn the various controls and note what moves in the rear of the panel. Note the various stationary parts.

6. From observations made and a careful study of the diagram shown in Fig. 52 answer the questions below.

**Questions.**

(32) *How is the crystal detector adjusted?*

(33) *How is a new crystal put in?*

(34) *How is the long wave coil of the receiving circuit wound and where is it located?*

(35) *From the diagram of connections (Fig. 52) when is the long-wave coil in the circuit?*

(36) *Where is the short-wave condenser?*

(37) *When is the short-wave condenser in the circuit?*

(38) *Would the coils of the set be damaged if the battery was plugged in the wrong place?*

(39) *Is it possible to put the battery lead plug in the telephone or amplifier jack?*

(40) *How would you connect other telephone receivers if it were necessary?*

(41) *How is connection made with the movable plates of the secondary condenser?*

**Directions.**

7. Replace the back and bottom of the set. Replace the screws. Leave the top open.

## EXPERIMENT No. 1.

### TRANSMITTING.

**Information.**

Successful transmission with the SCR-105 set depends to a very great extent upon the ability of both the transmitting and receiving operators. The transmitter must be properly adjusted and tuned for steady, reliable operation. Also great care must be exercised when tuning the transmitter in order to obtain a sharp wave of a desired length and thus avoid interference.

Other than tuning adjustments, the only adjustment needed in the transmitting side of the set is that of the buzzer transformer. This instrument is adjusted by means of the two large insulated thumbscrews on either side of the vibrating contact and by means of the small screw near the upper pivot of the armature which controls the position of the armature. The buzzer transformer should be so adjusted that it will operate smoothly and evenly with very

little sparking. When the control switch is placed in the *test* or *transmit* position the buzzer transformer should start operating and should not require tapping on the armature.

The control switch in addition to changing from transmit to receive, also has a position marked "Test." When in this position the receiving side of the set is in operation and the buzzer transformer should be vibrating feebly. The reason for this is to allow adjustment of the crystal detector. The switch should be left in this position only when the detector is being adjusted.

**Directions.**

8. To place the transmitting side of the set in operation and to tune it for transmission on a given wave length proceed as follows:

*a.* Erect the standard antenna system of the set.

*b.* Place the set box on the ground in one of the three following positions:

(1) If it is desired to transmit in one direction only, the antenna wire should be erected pointing in that direction with the lead-in end toward the station with which it is desired to communicate. The lead-in wire should be stretched out as a continuation of the antenna wire in the direction of the desired station and the set box placed on the ground at the end of the lead-in wire.

(2) Where directional effects not quite so pronounced (as in direction 1) are required, the set box should be placed on the ground near the foot of the mast supporting the lead-in end of the antenna wire.

(3) Where transmission in all directions is desired the set box should be placed on the ground underneath and as near the center of the antenna wire as the length of the lead-in wire will permit.

*c.* Connect the antenna lead-in to the post on the left side of the set box marked "Ant." and ground lead to the post marked "Gnd."

*d.* Connect the battery terminals of the battery cord to the 10-volt storage battery and insert the plug in the jack just below and to the right of the key on the right side of the box. Open up the key.

*e.* Set the wave-length change switch inside of the box to the desired wave length.

*f.* Set the antenna coupling switch on the left side of the box to the No. 1 position.

*g.* Throw the control switch to the transmit position. The buzzer transformer should now start operating, and when the key is pressed sparks should be visible in the quenched spark gap.

*h.* Keeping the key closed, vary the antenna tuning inductance until the maximum possible reading is obtained on the thermoammeter. (Remember that in order to cover the entire range of the antenna

tuning inductance approximately eight complete turns of the controlling handle are required.) The set should now be transmitting on the desired wave length with the sharpest possible wave, that is, the wave which will produce a minimum amount of interference.

9. Closely couple the SCR–125–A wave meter to the ground lead of the set and measure the wave length which is being transmitted. (See Fig. 53.) Note carefully over how much of the wave-meter scale the signal can be heard.

10. Change the coupling to No. 6, readjust the antenna tuning inductance until a maximum reading is obtained on the ammeter, and again measure the wave length with the SCR–125–A wave meter, noting over how much of its scale the signal can be heard.

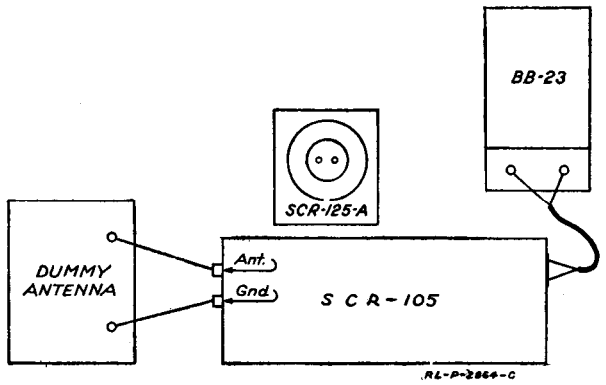


**Fig. 53.—Method of coupling the SCR–125–A wave meter to set box BC–53–A.**

**Questions.**

(42) *Does this set cause less or more interference than the signals obtained with loose coupling in Experiment No. 2 of Unit Operation No. 3?*

(43) *What is the advantage of using the spark gap of the quenched type?*

(44) *In what position of the coupling control should this set be operated? Why?*

(45) *Are the wave lengths, as marked on the wave length change switch, accurate according to the wave meter?*

(46) *Was greater antenna current obtained with close coupling or with loose coupling?*

## EXPERIMENT No. 2.

### CALIBRATING THE RECEIVER.

**Directions.**

10. With the antenna, ground, and battery connected to the set as in Experiment No. 1, proceed with the following directions:

*a.* Insert the plug of a head set in the jack marked "Telephone or Amplifier" and adjust the head set to fit the head comfortably.

*b.* Turn the control switch to the test position. The buzzer should operate feebly.

*c.* Adjust the crystal detector until a sensitive spot is found on the surface of the crystal.

*d.* Turn the control switch to the 100–200 wave-length mark in the receive position.

*e.* Couple an SCR–125–A wave meter to a few turns in the ground lead of the set. Start the buzzer of the wave meter in operation. Set the wave meter to transmit on 150 meters.

*f.* Set the receiver coupling control so that the arrow points to the 30° mark.

*g.* Turn the primary tuning inductance switch to about the No. 5 mark.

*h.* Slowly rotate the secondary tuning condenser control until the wave-meter signal is heard with maximum intensity in the head receivers.

*i.* Readjust the coupling, primary inductance, and secondary condenser in the order mentioned until any small change in the adjustment of any one of the controls will cause the signal to disappear.

*j.* Prepare a table similar to the one shown below. Readjust the wave meter to the next wave length indicated in the table and tune the receiver to the signal using the method outlined in the above directions. Proceed in this manner until adjustments have been made for each of the wave lengths listed. Record the control settings in the table.

| Wave length (wave meter). | Wave length setting "control" switch. | Receiver coupling. | Primary tuning inductance. | Secondary tuning condenser. |
|---|---|---|---|---|
| 150 | | | | |
| 180 | | | | |
| 210 | | | | |
| 240 | | | | |
| 270 | | | | |
| 300 | | | | |

**Questions.**

(47) *Was there any change in the signal strength when the primary inductance switch was slightly readjusted?*

(48) *When final tuning adjustments were being made, was the signal heard over a large or a small portion of the secondary condenser scale?*

(49) *Does the test position of the control switch give an indication as to the sensitivity of the detector?*