

### THE SCR-77-B SET.

#### Equipment.

- 1 set box, type BC-9-A.
- 1 equipment box, type BE-48.
- 1 loop type LP-2.
- 1 battery case, type CS-17.
- 1 head set, type P-11.
- 3 tubes, type VT-1.
- 9 batteries, type BA-2.
- 1 battery, type BB-41.

#### Information.

*Purpose of Set.*—The SCR-77-B set is a modification of the SCR-77-A set. It was designed to furnish radio telegraph communication between units whose headquarters are usually from three to five miles apart. Reliable communication may be maintained up to three miles. Under favorable conditions, such as open terrain, etc., this distance is increased to approximately five miles. The average working wave length of this set is about 65 meters (about 4,600 kilocycles) and the set is so arranged that there are nine different wave-length settings available. It will be noted that the working wave length has been changed, and that the modified sets will therefore not work with the original SCR-77-A set which use the 74 to 76 meter band.

*Reasons for Modification.*—The original SCR-77-A set has been modified in order to remedy certain faults. As the sets were transmitting at full power at the time they were receiving, only nine sets (corresponding to nine available tuner settings) could be operated at one time within the distance range of the set, without setting up excessive interference. Due to the constants of the circuits the sets were very critical in operation and only a small percentage of tubes would operate satisfactorily as oscillators. Also trouble was experienced with the mechanical adjustment of the key. The modified sets have been developed overcoming these difficulties and are now being issued for service trial.

*Special Features of the Set.*—Similar to the SCR-77-A set the SCR-77-B set is very portable and is quickly set up. A moving unit furnished with the SCR-77-B set can keep in constant communication within its transmitting range, with every unit furnished with a like set. The break-in system of the SCR-77-B set is more efficient and reliable than the SCR-77-A set, especially at maximum distances. This greatly facilitates communication. There is no change

in adjustment needed to reverse the direction of communication. The set is oscillating weakly with the key up and strongly when the key is pressed. This reduces interference while receiving. Consequently it is possible to operate all stations in a net on a common tuner setting. As an entire net requires only one tuner setting it is possible to operate a number of sets simultaneously.

**Questions.**

- (1) *What is the purpose of the SCR-77-B set?*
- (2) *For what reasons was the SCR-77-A set modified?*
- (3) *State the two most important features of the SCR-77-B set.*

**Information.**

*Principles of operation.*—Similar to the SCR-77-A set the SCR-77-B set uses three type VT-1 vacuum tubes. One of these is connected as an oscillator, using capacity coupling between the plate and grid. The other two tubes are used as audio frequency amplifiers. The oscillating circuit is so designed that when receiving it is oscillating weakly, consequently the oscillator tube will act as a detector. It is evident from this that the SCR-77-B set does not emit strong continuous waves at all times but only when the key is pressed.

Connected across the loop is the grid condenser and the plate condenser, which supply the coupling between the plate and grid. A condenser of large capacity is connected in the lead from the plate to the oscillating circuit. This condenser prevents the 120-volt direct current potential from passing through the loop to the grid. A small, single leaf or screw-driver condenser is connected across the loop to permit an adjustment for calibration. A variable condenser is also connected across the plate coupling condenser. This condenser, controlled by the tuner knob on the front of the panel, is used to vary the wave-length adjustment of the set.

The plate voltage of the oscillator tube is supplied by a 120-volt battery which is also connected to the filament. When the transmitting key is up for receiving the plate current passes through a 100,000 ohm resistance. This greatly reduces the voltage on the plate so that very weak oscillations will be obtained. The small plate current thus obtained passes through the transformer primary and the milliammeter. Across the resistance is connected a fixed condenser which acts as a by-pass for the audio frequency current. When the transmitting key is pressed the circuit, including the 100,000 ohm resistance, the primary and the milliammeter becomes short-circuited. The full plate voltage is then impressed on the

plate. The short-circuiting of the transformer primary avoids passing the large current through the winding which might cause the winding to become open-circuited in time. It is necessary to short-circuit the milliammeter when transmitting because of the low range of the meter.

A potentiometer or controller on the panel of the set box controls the grid potential of the oscillator tube. A change in this grid potential will produce a change in the plate current of the oscillator tube. This adjustment is needed so that the plate current in the oscillator tube, when receiving, will be as weak as possible. When transmitting the potentiometer has very little effect on the power.

A single-pole knife switch is mounted on the face of the panel. When closed the switch short-circuits the 0.5 ohm resistance in series with the oscillator tube. This has very slight effect on the receiving adjustment but greatly influences the transmitted signal. This is particularly helpful when the storage battery is nearly discharged as the switch may be closed in order to make use of the additional current. However, with the filament resistance short-circuited when using a fully-charged battery, the filament current is high and as a consequence the life of the tube filament will be considerably shortened. The switch should therefore only be closed when it is necessary, as in working with a distant station.

The SCR-77-B set is operated in much the same manner as the SCR-77-A set, the beat note method of reception being used. It is not necessary, however, to close the lever on the side of the key for reception. To establish communication it is only necessary to set the wave-length control to the allocated tuner setting and to begin sending. If for any reason it is desired to interrupt or "Break" the sending operator, simply send a series of dots with the key. The sending operator will hear the dots during the intervals when his key is up. He then immediately stops sending to receive the message from the interrupting station.

#### SETTING UP THE SCR-77-B SET.

##### Directions.

1. *Preparing the Equipment Box.*—*a.* Place the battery case (type CS-17) containing the 120-volt unit in its compartment in the equipment box. Connect the terminals of the binding post marked "—120 volts+," being sure to observe the correct polarity and make firm connections.

*b.* Place two BA-2 batteries in the smaller compartment on the same side of the equipment box. Connect the terminals of one bat-

tery to the left-hand pair of binding posts marked “-20 volts+,” and the terminals of the other battery to the right-hand pair of connectors. Close and fasten the cover of this side of the equipment box.

c. Open the other side of the equipment box, remove the telephone headset and also the vacuum tube (if same are not already in the operating chest). Plug in the plate battery cord (the one attached to the lower right side of the operating chest). Having run the cord through the slot provided in the cover of the equipment box, close and fasten it. Place the box on a level spot of ground with its fasteners up.

2. *Preparing the Operating Chest.*—a. Place the operating chest on the top of the equipment box and fasten it in place by means of the catches provided. If the operating chest is not absolutely firm it will rock when the key is operated, causing an unsteady beat note. Open the cover of the operating chest, allowing it to rest on the end of the equipment box. Turn the “Off-On” switch to the “Off” position. Turn the handles of the two fasteners at the top of the box to a horizontal position and pull the panel forward. Place a BA-2 battery in its holder alongside of the vacuum tube. Connect its terminal to the binding posts located alongside the holder. Observe the correct polarity and make tight connections. Secure the battery in place by means of the clamp. Place a VT-1 vacuum tube in each of the three sockets. Close the front panel and lock it in place by turning the handles of the fasteners downward. Pull the top of the telegraph key downward to its operating position. Plug in the telephone headset.

b. Place the storage battery carrying case near the operating chest and connect to one of the storage batteries the terminals of the cord which extend from the left-hand side of the operating chest. Observe the correct polarity as marked. The cover of the operating chest should then be closed.

c. Remove the loop from its case and unfold it. Jam the ends of the loop firmly into the sockets in the end of the operating chest. Tighten up all wing nuts on the loop. The set is now ready for operation.

3. *Adjustment For Reception.*—Turn the filament circuit switch to the “On” position. Slowly turn the potentiometer adjustment in a clockwise direction from the “Off” position until the circuit starts oscillating. When the circuit is oscillating a click is heard in the head set when the loop is touched with the bar finger and an equally loud click is heard when the finger is removed. If the circuit is os-

cillating strongly a slight decrease in reading of the plate current milliammeter is obtained when the loop is touched. If the circuit is oscillating weakly the decrease of plate current obtained when the loop is touched is too small to be perceptible. Even this weak oscillation will be radiated and will cause interference over a considerable distance and it is therefore desirable that the oscillation be made as weak as possible. If necessary, while receiving signals, the potentiometer can be turned back until the signal just begins to weaken. This precaution is necessary only when one station is located near another station in the same net and consequently uses the same tuner setting. The set should now be in proper adjustment for receiving. Turning the tuner adjustment slowly will bring in the signals transmitted from other modified SCR-77-A sets within the distance range of the sets. Slight readjustment of the potentiometer is necessary from time to time as the storage battery is discharged.

4. *Adjustment for Transmission.*—The only operating adjustment of the set is that required for receiving, described in Direction 3. In order to transmit after this adjustment has been obtained it is simply necessary to press the key.

**Questions.**

(4) *Why is it necessary to have the oscillator tube oscillating very weakly when receiving?*

(5) *Has the adjustment of the controller, any effect on the transmitted signal?*

**Information.**

*Operation of a Single Net.*—When only one net is to be operated no special tuner calibration is required. All stations in a net work on the same tuner setting. The Net Control Station operator should adjust his tuner to the number 5 setting and should then send a series of long dashes. All other station operators should adjust their tuners until the signal from the NCS is picked up and a beat note of readable pitch obtained. This adjustment can be marked on the white celluloid dial by means of a lead pencil. Each station then reports in regular order to the NCS and the net is ready for traffic, which is carried on in accordance with specified net regulations. Any station can then work with the NCS without readjustment of the tuner. When working a station other than the NCS it may be desirable to slightly readjust the tuner in order to obtain a beat note of readable pitch. Only one message at a time is handled in the net.

*Operation of a number of nets.*—When a number of nets are required to operate at the same time each net is assigned an individual tuner setting. All stations in each net are then to be tuned to the same tuner setting. All sets to be used as Net Control Stations should be brought together for calibrations. One set should be placed in operation, oscillating weakly with the key up. The tuner pointer should be adjusted to the number 5 position. The other sets should be operated, one at a time, not less than 20 feet from the master set and with the loop at right angles to the loop of the master set. Each of these sets, as they are operated, should also be adjusted to oscillate weakly with the key up. The tuner of each set should be adjusted carefully until a very low beat note or zero beat adjustment is obtained. The single plate condenser should then be adjusted by means of the screw provided in the back of the set, until beat adjustment is obtained as near as possible to the number 5 mark on the scale. The exact point located should be marked by a pencil on the white celluloid dial. The tuner of the master set can then be placed on points 1 to 4 and 6 to 9 in turn and corresponding points marked in pencil on the tuner dial of the set being calibrated. It will be noted that a total of nine nets can be operated at once, all operating on different tuner settings. Use of a greater number of nets than nine makes necessary the use of more than one net having a certain tuner setting. Care must then be taken that two nets using the same tuner setting are not located sufficiently close to each other to cause mutual interference. It may be found by experience that some other set is more satisfactory for use as a master set than the one first selected. This would be true if most of the sets tune in with the master set when their tuners are either above or below the number 5 mark. All sets in each net can be calibrated by the NCS to operate at the tuner setting assigned the net as described previously. If it is required that any set in a net other than the NCS be able to communicate with a set in a different net, the additional calibration required can be obtained by comparison with the NCS.

*Trial Operation.*—After all sets that may be required to work have been calibrated it is well to try out intercommunication between the different sets while the sets are all in the same vicinity. Any faulty calibration can then be checked up and corrected without the confusion that would result if the sets were taken into the field before the faulty calibration were discovered.

*Permanency and Limits of Calibration.*—The calibration of the set, as described above, is quite permanent and reliable. However, any heavy jar or shaking up of the set is liable to disarrange the ad-

justment. If the set is operated at a station where the surroundings or earth conditions are different from those under which the set was calibrated the wave length adjustment of the set will probably be slightly altered. This is most apt to occur when the loop of the set is near some object. The position of the set should be changed if practicable. In some cases it will be necessary to recalibrate the set in the location at which it is to be used. This should be done under the direction of the officer in charge of the net. In extended operations the calibration of the sets should be checked up at least every day by comparison with the master set. This may be done by the operator transmitting for a definite length of time with his tuner upon each position. The other stations should then, one at a time, make any corrections to the markings on their scale that may be necessary.

**Questions.**

(6) *How many SCR-77-B sets can be operated, each with a different tuner setting?*

(7) *Is it possible to operate more than one set in the same net on the same tuner setting? Explain.*

(8) *Is it possible to have more nets in operation than there are tuner settings on the tuner dial? Explain.*