

THE SCR-109-A AND SCR-159 SETS.

DESCRIPTION OF ANTENNA EQUIPMENT.

1. *a The V antenna (used in the SCR-109-A set).*—This antenna is a V-shaped antenna supported on three masts, each 20 feet high. The length of each leg is 175 feet. There is a lead-in wire 25 feet long. Each mast is made of three spruce sections, which are fitted with a spike at one end and a steel tube at the other to join with the next section. Six hundred feet of heavily insulated counterpoise wire is provided, which should be made in a V-shaped counterpoise with a third leg bisecting the V. The auxiliary antenna equipment comprises spare parts and such carrying rolls, reels, guy ropes, etc., as are needed to support or pack away the antenna. Ground mats, which may be used in place of the counterpoise under favorable conditions, are also a part of the antenna equipment.

b The umbrella antenna (used in the SCR-159 set).—The umbrella antenna consists of six antenna wires each 50 feet long spread radially from the top of a 40-foot mast. At the end of each antenna wire there is attached a properly insulated guy rope, 95 feet long, by which the antenna wires are kept stretched out from the mast. The mast is composed of 10 spruce sections, each having a coupling tube to engage the next section. These sections are all alike except the top and bottom sections; the top section is fitted to receive the mast cap; the bottom section carries a heavy insulator on which it rests. The counterpoise system consists of six heavily insulated wires, each 90 feet long, radiating out from a central connecting block. Necessary spare parts and accessories are provided as a part of the antenna equipment.

2. *Erecting the antenna and ground system of the SCR-109-A set.*—The V antenna is used. This antenna can be installed for either of two purposes: (1) General use and (2) directional use. For the former the orientation of the wire is not important, but for the latter the point of the V should be directed toward the other station.

Measure the antenna wires to insure that each leg is 175 feet long and that the lead-in wire is 25 feet long. Correct any departure from this standard length.

Stretch out the antenna wires on the ground with an opening of about 60°. Couple three mast sections together for each mast and lay them on the ground alongside the wire and in the same straight line with it. Attach the antenna wires with their insulators to the tops of the three masts by means of the snap hooks and also attach

two guys to each mast. Drive two ground stakes near each mast about 20 feet beyond the end of the wire, so that the guys will lie at an angle of about 45° with the line of the wire. Attach the lead-in wire to the antenna wires at the front of the V. Having raised the mast at the point of the V, raise the other mast tops gradually by using a light strain on the guys and, keeping the bottom ends of the masts on the ground, move them toward the points where they are to be when the mast is in the vertical position. Pass the guys around the ground stakes and take up the slack with the tent slides. If necessary, straighten up the masts and tighten the guys so that the antenna wires are nearly horizontal. Care should be taken in raising the masts to keep them in the prolongation of the antenna wires, as then there will be little or no stress tending to bend the masts.

For general use the three counterpoise wires should be laid out on the ground under the antenna with the point of the V-like arrangement near the radio transmitter. The counterpoise wires, each of which should be made 175 feet long, are arranged in a V with the third wire bisecting the angle made by the two legs of the V. For directional use the three wires should be laid out in the V-like arrangement with the point near the radio transmitter as before and with the free ends opening out toward the other station. The legs of the counterpoise are connected together electrically at the point of the V. Wherever possible the counterpoise wires should be supported on wood stakes about 1 foot high. This will give greater distance of transmission as well as better telephone communication.

Although ground mats are provided as a part of the antenna equipment, they are seldom used, for it is only under exceptional conditions that they will give as good results as the counterpoise. When used they should be buried under a few inches of earth, which should be well packed down on them. For general use the ground mats may be buried under the antenna wires. For directional use they should extend away from the radio transmitter toward the receiving station.

3. *Erecting the antenna and ground system of the SCR-159-set.*— At least five men are needed to erect the antenna. Three men are at the end of the antenna wires and guy ropes, two men raising the mast and adding the sections. The following directions should be observed:

Select clear space in which the antenna is to be erected. This clear space should be at least 200 feet in diameter. Place the mast

and antenna equipment in the center of the space where the mast is to be erected. Take the top section (the one which has no iron pipe projecting from either end) and place the mast cap in one end of it. (The mast cap has eight sockets, which will hold the metal balls on the end of the antenna wires. It should have the 50-foot antenna lead-in wire permanently fastened to it.) Attach the six antenna wires to the mast cap by means of the ball and sockets provided. Unreel and lay out on the ground the six antenna wires and the guy ropes fastened to them. They should extend out radially from the mast, dividing the circle in equal parts—that is, they should make angles of 60° with each other.

Place a man at every other guy rope at the end of the guy rope. It is the duty of these three men to keep the mast upright as the sections are added. They do this by keeping the correct strain on the guy ropes, walking toward the mast as necessary. Select the eight other sections to be added (all alike) and the bottom section. (This has an insulator screwed on the bottom of it. If it is not screwed on, this should be done before adding the sections to the mast.) The mast will contain, when erected, 10 sections in all, 8 besides the top and bottom sections.

Add the sections, one man raising the mast directly upward and the other man adding the sections. Keep the mast upright, giving any directions that may be necessary to the men at the end of the guy ropes to do this. Having added all the sections, including the bottom one, allow the mast to rest on the ground. The two men at the mast then go out to the end of a guy rope and drive a stake in the ground and by means of the metal tent slide tighten the guy to the proper tension. This is done for each of the six guy ropes. Be careful that the mast is upright and that it is not bent. Make any changes in the strain on the guys necessary to insure this.

It is to be noted that on each guy rope there is an insulator between it and the antenna wire to which it is fastened. The rope is also divided by insulators. It is absolutely necessary that the antenna wires be well insulated. The antenna wires must not touch an object such as a tree, building, etc. The lead-in wire hangs down beside the mast.

Having erected the antenna, place the counterpoise connecting block on the ground near the mast. (This is fitted with holes in which the ends of the counterpoise wire are plugged.) A short wire leading to the set box is attached to it. Reel out the six counterpoise wires to their full extent—90 feet. Each rests directly under an antenna wire. The counterpoise connecting block should be raised

off the ground to properly insulate it. Wherever possible the counterpoise wires should be supported on wood stakes about 1 foot high. This will give greater distance of transmission as well as better telephone transmission.

4. *Notes on operation.*—For efficient operation, the SCR-109-A and SCR-159 sets require experienced operators who are familiar with the sets. If the operators are not familiar with the sets, it may be expected that at first only poor results will be obtained. The sets should be studied and their adjustments and peculiarities learned. The sets are capable of excellent transmission and reception. If a set fails to operate satisfactorily the following points should be noted:

Carefully go over all connections made when installing the set. Check up as to correct connections, including correct polarity, and as to clean and tight connections.

Test the voltage of all batteries—both storage and dry.

See that the dynamotor is running properly and easily. See that it is properly oiled. The end covers of the dynamotor may be removed for ventilation if conditions are such that dirt, etc., will not get into the dynamotor.

Note that all switches make good contact. Press the double-throw switches firmly in their positions. Clean their contacts frequently.

Inspect the antenna. Check it as to correct length of legs and lead-in wire. See that the antenna wires are properly insulated. Improve the ground system if it admits of improvement.

When using the microphone, speak distinctly and directly into the transmitter. It is well to tap the transmitter smartly with the heel of the hand to make sure that its microphone element is not stuck.

Do not overlook the fact that the tickler adjustment is very critical, especially in receiving undamped wave radio telegraphy.

In transmitting, if any of the three tubes fail to light, it may be due to a bad connection in the socket or a dirty contact pin. Clean the contact pin and replace the tube properly in the socket. If this does not remedy the defect, try a new tube. In exchanging tubes always pull the "Transmit-Receive" switch so that it makes no contact.

In receiving, all three of the tubes will light or none of them will, because their filaments are connected in series. Examine and clean the tube contact pins.

Sometimes a tube is defective. Find the defective one by trial of other tubes known to be in good condition.

Interchange the receiving tube until you have found the combination that works the best. Some tubes are better detectors than others. One of the receiving sockets is connected so that its tube is a detector.

Be careful not to touch any of the metal parts of the transmitter when transmitting, as a shock will result. This applies particularly to the ammeters, the double-throw switches, and the various inductance taps. Even when not transmitting, if the dynamotor is running, a shock is likely to be received. Thus it is well to open the "Transmit-Receive" switch if it is necessary to make any adjustments other than by the control handles.

In transmitting radio telephony, the plate current should continually vary. If it does not, the set is not working properly.

During a thunderstorm or other severe electrical disturbance, disconnect the antenna and ground wires from their binding posts and connect them directly to each other. This should always be done if the set is left installed without an operator being present.

5. *Care of sets.*—*a* The radio equipment must be handled with great care. The various parts are of delicate construction and rough handling will make the set inoperative. The transmitter and receiver boxes contain many parts closely packed together and with a great many connections. These are liable to become dislodged and the connection broken. The set should not be stored in a damp place nor unnecessarily exposed to rain. If the set becomes wet it should be carefully dried out but never exposed to intense heat.

b The storage batteries must receive proper attention and care. The dynamotor panel should be kept clean and the dynamotor properly oiled. Use a good grade of oil and apply one or two drops after two hours' operation. It is important that not too much oil be used. It is much better to oil frequently with a small amount than to oil less frequently using a larger amount of oil.

c The clock needs no attention other than winding and setting. It is wound by a key fastened at the top of the clock, access to which is gained by turning the rim counterclockwise about 45° and pulling outward. The clock is set in the usual manner by pulling the key up until a click is heard.

d Great accuracy has been observed in assembling the telephones and the microphone. There is a right and wrong polarity in connecting the cords of the telephones. If the cords are removed for any reason this must be taken into account in replacing them. The microphone must be carefully handled and packed. It should need no other attention.

PARTS LISTS OF SETS FOR FIELD OPERATION.

6. *Equipments in the SCR-109-A set.*—The SCR-109-A set comprises the following equipments:

- One power equipment, type PE-36.
- One radio equipment, type RE-19-A.
- One antenna equipment, type A-9-B.

7. *Equipments in the SCR-159 set.*—The SCR-159 set comprises the following equipments:

- One power equipment, type PE-36.
- One radio equipment, type RE-19-A.
- One antenna equipment, type A-14.

8. *Parts lists of above equipment.*—These equipments are made up of parts as noted below:

Power equipment, type PE-36:

- Battery, type BB-28; 12, 6 in use, 6 spare.
- Dynamotor, type DM-13; 1.

Radio Equipment, type RE-19-A:

- Battery, type BA-2; 8, 4 in use, 4 spare.
- Chest, carrying, type BE-49; 1, for radio transmitter and receiver.
- Chest, carrying, type BE-50; 1, for spare parts and accessories including dynamotor.
- Cord, type CD-15; 1, transmitter to high-voltage side of dynamotor.
- Cord, type CD-38; 8, for storage-battery connections.
- Cord, type CD-47; 1, transmitter to low-voltage side of dynamotor.
- Cord, type CD-48; 1, transmitter to storage batteries.
- Cord, type CD-49; 1, transmitter to key.
- Head sets, type P-11; 2.
- Key, type J-12 or J-2; 1, telegraph sending.
- Pliers, side cutting, 6-inch; 1 pair.
- Radio receiver, type BC-98-A; 1.
- Radio transmitter, type BC-86-A; 1.
- Screw driver, electrician's 3-inch blade; 1.
- Tape, friction, $\frac{3}{4}$ -inch; 1 pound.
- Transmitter, type T-3; 1, microphone.
- Tube, type VT-1; 6, 3 in use, 3 spare.
- Tube, type VT-2; 2, 1 in use, 1 spare.
- Tube, type VT-4; 4, 2 in use, 2 spare.
- Wire, type W-7; 2 pounds.

9. ANTENNA EQUIPMENT, TYPE A-9-B (V ANTENNA) :

Antenna, type AN-8-A ; 2, on 2 reels, 1 in use, 1 spare.
Bag, type BG-12; 2, carrying.
Cord, type RP-3; sash No. 5, olive drab, 300 feet.
Guy, type GY-4; 8, complete on 4 reels, 6 in use, 2 spare.
Hammer, 2-pound crosspein; 1.
Insulator, type IN-10; 4 spare.
Mast section, type MS-14; 12, 9 in use, 3 spare.
Mat, type M-5; 3, ground.
Pliers, combination, 6-inch; 1 pair.
Reel, type RL-3; 10 hand, 4 for counterpoise, 4 for guys,
2 for antenna E.
Roll, type M-15; 1, carrying.
Stake, type GP-8; 12 ground, 6 in use, 6 spare.
Tape, friction; 1 roll.
Wire, type W-4; 50 feet, lead-in.
Wire, type W-24; 750 feet on a spool, antenna.
Wire, type W-30; 600 feet, on 4 reels, counterpoise.

10. ANTENNA EQUIPMENT, TYPE A-14, 40-FOOT UMBRELLA :

Antenna, type AN-12; 1, six 50-foot wires with insulators
and cords attached.
Bag, type BG-6; 2, carrying.
Bag, type BG-7; 1, carrying.
Connector, type M-6; 2 spares for antenna wires.
Cord, type CD-94; 1, to counterpoise. Insulator block
BL-2 on one end.
Counterpoise, type CP-3; 1, six 90-foot wires.
Hammer, 2-pound crosspein; 2.
Insulator, type IN-4; 1, for bottom of mast.
Mast cap, type MP-4; 1, with 50 feet lead-in wire.
Mast section, type MS-1; 1, top.
Mast section, type MS-2; 8, intermediate.
Mast section, type MS-3; 1, bottom.
Reels, type RL-3; 13, 6 for antenna, 6 for counterpoise, 1 for
lead-in.
Stakes, type GP-2; 6, ground.
Straps, type ST-5; 6, for bundling mast sections.