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# Airplane Radio Telegraph Transmitting Sets

Type SCR-65
Type SCR-65-A

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# AIRPLANE RADIO TELEGRAPH TRANSMITTING SETS

## Types SCR–65 and SCR–65–A.

THE GENERAL use for which the radio telegraph transmitting sets, types SCR–65 and SCR–65–A are intended is that of sending messages from airplanes to the ground. The type SCR–65 set is modeled after the Sterling type transmitting set, which is used almost exclusively by the British in artillery fire-control work. The type SCR–65–A set differs from the type SCR–65 only in minor details. Both have proved very efficient and well suited to conditions of actual warfare on account of their simplicity and ruggedness. They are tuned spark-coil transmitting sets, producing damped waves. When used with

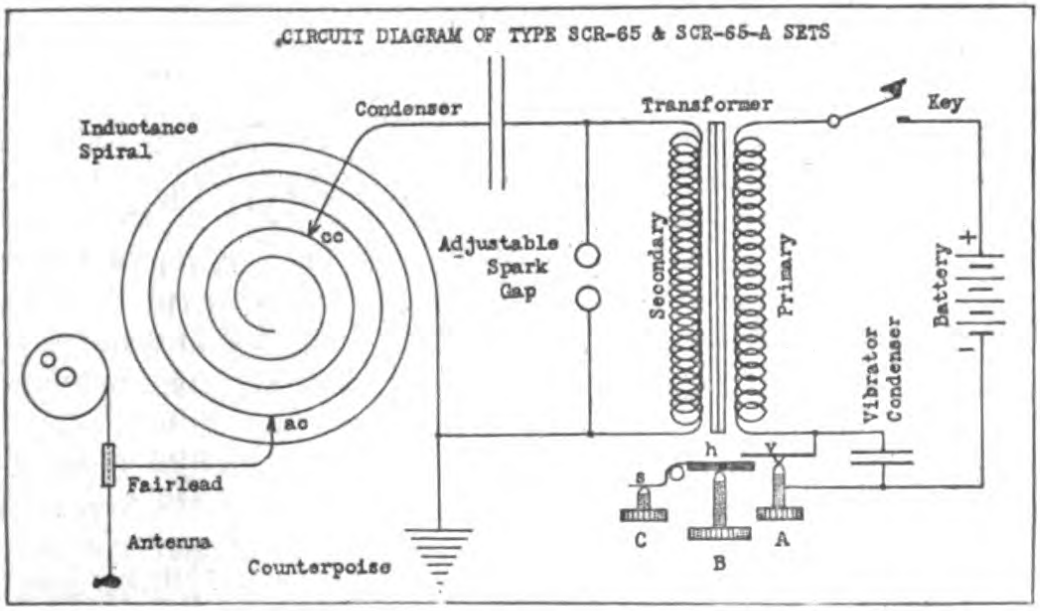


FIG. 1.—Schematic Wiring Diagram of the Type SCR–65 Set.

the usual airplane trailing antenna, 150 to 250 ft. in length, and with the bonded wire stays of the machine as a counterpoise, the wave length is from 100 to 300 meters, depending upon the adjustments.

The essential parts of either set are the spiral tuning inductance, the induction coil, spark gap and sending condenser. The induction (or spark) coil, sending condenser and spark gap are mounted in a box measuring $7\frac{7}{16} \times 6\frac{3}{8} \times 3\frac{1}{4}$ in. over all. The flat spiral of 12 turns of $\frac{1}{4}$-in. brass strip and four binding

posts, marked "Antenna," "Counterpoise," "Key," and "Battery," are mounted on a hard rubber panel set in the top of the set box. Hard rubber markers are placed at a number of different points around the spiral to indicate the position of connection for the condenser clip for various wave lengths of the closed oscillatory circuit.

Fig. 1 shows the diagram of connections for either the type SCR–65 or type SCR–65–A set. It will be noticed that the tuning inductance of the closed oscillatory circuit is the same coil as the tuning inductance of the open oscillatory circuit, thus giving conductive and inductive coupling between the two circuits. Selectivity between sets is obtained by differing the transmitted wave length and also by differing the spark tone according to predetermined schedules. The change in tone is accomplished by the adjustment of the vibrator on the induction coil.

The vibrator, as shown in Fig. 1, consists of a hammer *h*, which is held against the screw B by the tension of the spring *s*. This iron hammer is mounted opposite one end of the transformer core and at a distance from it which may be varied by means of the screw B. The vibrator spring blade *v* projects out into the gap between the hammer *h* and the core and normally rests against the contact point of the screw A. The principle of operation of this vibrator is as follows:

As the telegraph sending key is closed, the current from the battery flows in the primary circuit, comprising the screw A, spring blade *v*, and primary coil of the transformer. A magnetic field builds up in the latter, increasing until it is strong enough to overcome the tension of the hammer spring *s*, at which time the hammer *h* is attracted toward the core. After leaving the screw B on which it was resting, the hammer strikes the end of blade *v*, which, upon being lifted off the tip of screw A, breaks the primary circuit, thus stopping the current flow in it, and the hammer falls back, due to the tension of spring *s*. This, however, permits the blade *v* to reestablish contact with A, closing the primary circuit, and the operation repeats itself.

It will be seen from the above discussion that the strength of the magnetic field, and therefore the intensity of the primary

current, required to lift the hammer from its position, depends on the spring tension adjustment (screw C) and on the hammer stroke adjustment (screw B). Also, as the hammer is moved by means of the screw B, it is necessary to adjust the vibrator contact screw A in order to keep the blade *v* in proper position. The method of making these adjustments is explained in a later paragraph.

In order to reduce the sparking at the vibrator and make the break quicker a 0.6 mfd. condenser is shunted across the contact points.

FIG. 2.—Inductance Spiral on Set Box Type BC–15 of the Type SCR–65 Set.

The spark gap consists of two zinc electrodes, one of which is mounted on a finely threaded brass screw with a knurled hard rubber handle by means of which the length of the gap may be readily adjusted. The stems of the two electrodes are provided with cooling flanges which cool the electrodes by increasing the area of contact with the surrounding air. This, together with the metal of the electrode sparking surface, results in a fairly good quenching action of the gap.

The sending condenser is made up of 15 sheets of brass placed alternately between 16 sheets of mica and inclosed in a fiber case. The capacity is approximately 0.009 mfd.

## Method of Operation.

The set is adjusted on the ground before being installed in the airplane. A phantom antenna is used for this purpose, having the same inductance, capacitance, and resistance as the particular airplane antenna to be used in the flight. The 10-volt storage battery and a telegraph sending key (or a switch) are connected to the "Battery" and "Key" terminals of the set box, while

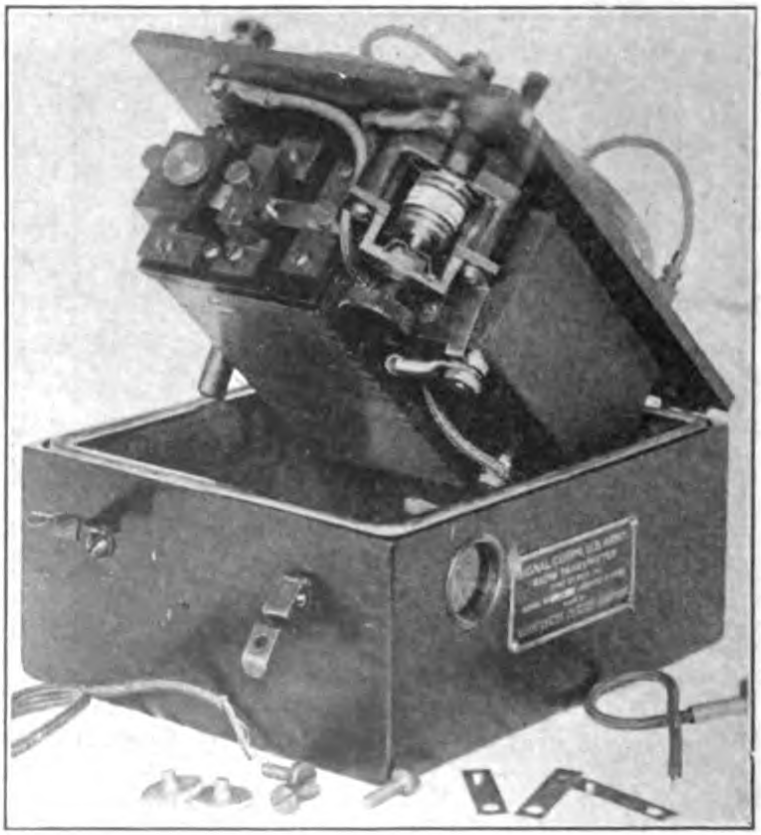

FIG. 3.—Induction Coil, Spark Gap, and Condenser Mounting in Type BC–15 Set Box of the SCR–65 Set.

the phantom antenna is connected to the "Counterpoise" and "Antenna" terminals. A hot wire ammeter should be included in the phantom antenna circuit. The method of adjusting the set is then as follows:

1. Place the closed circuit clip, *cc* (the clip coming out of the center of the panel) on the spiral inductance next to the marker corresponding to the wave length at which it is desired to transmit. This will make the constants of the closed oscillatory cir-

cuit of such values as to give it the natural wave length marked on the spiral inductance. As may be seen on the circuit diagram, Fig. 1, the closed oscillatory circuit comprises the spark gap, the fixed sending condenser, and that part of the inductance spiral connected in the circuit by the closed circuit clip *cc*.

2. Open the box by lifting the operating panel and loosen the spark gap clamping screw.

3. Turning the movable spark gap electrode, bring the two electrodes together so they will just touch, and note the position of the movable electrode adjusting screw knob. Then open the spark gap by turning this screw back three-quarters turn to one turn, and tighten the clamping screw.

4. Place the antenna clip *ac* (the clip coming from the "Antenna" binding post) on the inductance spiral one turn away from the closed circuit clip. This will couple the antenna circuit to the closed oscillatory circuit.

5. Adjust the vibrator, proceeding as follows:

(*a*) Loosen the vibrator clamping screws just enough to allow adjusting.

(*b*) Loosen the hammer stroke adjusting screw B, and tighten the hammer spring adjusting screw C so that the hammer stands well away from the vibrator spring *v*.

(*c*) Make sure that the vibrator contact points A are clean, and directly in line, one above the other.

(*d*) Adjust the vibrator contact screw A until it just makes contact with the vibrator spring, and then tighten it up another one-quarter or one-half turn.

(*e*) Tighten screw B until the hammer almost touches the contact spring.

(*f*) Loosen screw C until contact with the hammer tension spring is barely made. This will decrease the current in the primary winding.

(*g*) Close the telegraph key, and if required make such slight readjustments of A, B and C (in the order mentioned) as will produce a clear tone with minimum sparking at the vibrator. Adjustments of B and C should always be made in opposite directions, so that the tension of the hammer spring will remain about the same. Also make a slight adjustment of the spark gap, so that white sparks will occur, these taking place between various points on the electrode surface.

(*h*) Set all clamping screws.

6. Close the set box.

7. Tune the antenna circuit by moving the antenna clip *ac*, along the inductance spiral while the telegraph key is closed, until a point is found giving maximum current on the antenna hot wire ammeter. At this point, the clip is securely fastened.

8. The vibrator should now be readjusted slightly so that the set will produce fairly good radiation with the least sparking at the vibrator contact points.

9. Disconnect the phantom antenna and install the set on the airplane.

## Installation of the Set.

The method of installing the set on an airplane varies with the type of machine. The fittings required are furnished by the Bureau of Aircraft Production. The principles underlying the installation of the type SCR–65 or SCR–65–A sets are the following:

The set box and storage battery should be mounted near each other, so that the connecting leads may be as short as possible, in order to reduce to a minimum the energy losses in those wires. Also, the set box should be of easy access, as it is almost always necessary to remove it from the plane for tuning and inspection. In fact, a frequent practice is to have a number of sets all ready and tuned on the ground, so that when an airplane comes down to the ground with a defective set, another may be substituted immediately. To effect this, a sliding wooden tray is often used, on which the set box is mounted together with its battery. It is then simply necessary to make the connections to the "Counterpoise" and "Key" binding posts of the set box.

In service, the vibrator contacts soon become pitted due to sparking, and then give a ragged spark and greatly lower the efficiency of the set. The contacts must therefore be watched closely and kept smooth by the use of a very fine, flat file or replaced with the spare contacts provided. The antenna, counterpoise, battery and key leads should be attached securely to their respective binding posts so that the vibration of the airplane will not loosen them and make the set inoperative at possibly a critical moment. It should be noted that the key is not

mounted on the box containing the set. The keys used are of a special airplane type (type J-7), and are mounted on small battens located at the sides of the cockpits, Fig. 4, one on either side of the pilot's cockpit and one on the right of the observer. These are all connected in parallel.

The zinc spark electrodes should be removed at regular intervals and cleaned and trued up. When the electrodes are in place, the faces should be exactly opposite and parallel. A zinc oxide deposit is formed around them and should be removed frequently. It is very essential that this set be thoroughly inspected before being used in the air.

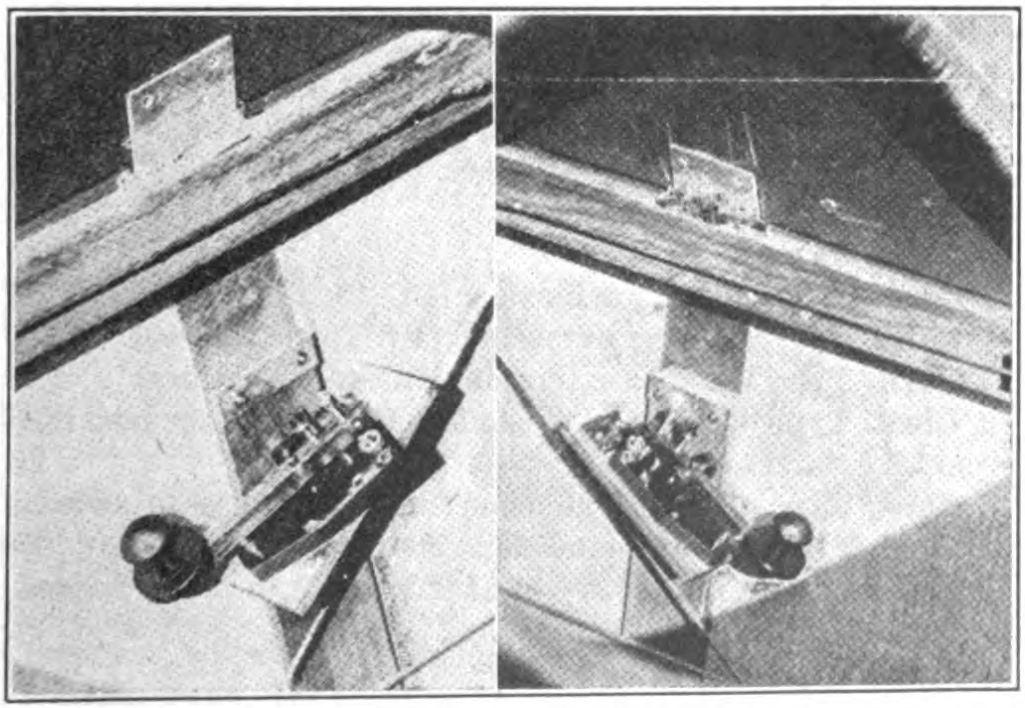

FIG. 4.—Mounting of Sending Keys on Either Side of Pilot.

## PARTS LISTS.

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, Airplane Radio Telegraph Transmitting, Type SCR-65." 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 RT-1."

These sets are not complete unless they include all of the items listed below under the respective set names.

## SET, AIRPLANE RADIO TELEGRAPH TRANSMITTING, TYPE SCR–65.

EQUIPMENT, TYPE PE-21; Power.

**2 Batteries, Type BB–11;** lead storage; Liberty; 8 volts; discharge rate 3 amp. for 3 hours; 1 in use, 1 spare.

EQUIPMENT, TYPE RT-1; Transmitting.

**1 Set Box, Type BC–15;** airplane radio telegraph transmitting.

**1 Stone, Type TL–3;** carborundum, No. 53 medium India.

**1 Screwdriver, Type TL–4;** steel wire; 5 in. long.

**3 Contacts, Type CN–3;** upper; vibrator; spare.

**3 Contacts, Type CN–4;** lower; vibrator; spare.

**2 Electrodes, Type CN–5;** spark gap, spare.

**1 Switch, Type SW–9;** battery.

**2 Keys, Type J–7.**

**1 Cord, Type CD–27;** extension; BC–15 to ground.

**1 Cord, Type CD–28;** extension; BC–15 to fairlead.

**1 Cord, Type CD–29;** extension; BC–15 to battery.

**1 Cord, Type CD–30;** extension; battery and set box to observer's key and switch.

**1 Cord, Type CD–31;** extension; observer's key to switch.

**1 Cord, Type CD–32;** extension; observer's key to pilot's key.

**6 Lamps, Type LM–3;** for blinker keys; 2 in use, 4 spares.

EQUIPMENT, TYPE A-21; Antenna.

**1 Reel, Type RL–2;** antenna.

**2 Drums, Type DR–2;** antenna reel.

**3,000 ft. Wire, Type W–5;** probable maximum length of antenna, 300 ft.

**10 Weights, Type WT–1;** antenna; 1 in use, 9 spares.

**2 Fairleads, Type F–1;** type F–2 when type F–1 is not available; 1 in use, 1 spare.

**20 ft. Cord, Type RP–6;** approximately 2 ft. in use.

## SET, AIRPLANE RADIO TELEGRAPH TRANSMITTING. TYPE SCR–65–A.

**EQUIPMENT, TYPE PE-21**; Power.

**2 Batteries, Type BB–11**; lead storage; Liberty; 8 volts; discharge rate, 3 amp. for 3 hours; 1 in use, 1 spare.

**EQUIPMENT, TYPE RT-1-A**; Transmitting.

**1 Set Box, Type BC–15–A**; airplane radio telegraph transmitting; weight, 6 lb. 12 oz.

**1 Stone, Type TL–3**; carborundum; medium India; No. 53.

**1 Screwdriver, Type TL–4**; steel wire; 5 in. long.

**1 Screwdriver, Type TL–22**; for spark coil clamping screws; similar to Stanley No. 55; 1½-in. blade, $\frac{5}{32}$ in. diameter; $\frac{1}{8}$-in. tip; 4 in. over all.

**3 Contacts, Type CN–3**; assemblies; spare.

**3 Contacts, Type CN–4**; assemblies; spare.

**2 Electrodes, Type CN–5**; spark gap; spare.

**1 Switch, Type SW–14**; battery.

**2 Keys, Type J–7**; with winker light sockets.

**6 Lamps, Type LM–3**; for keys; 2 in use, 4 spares.

**30 ft. Cord, Type W–8**; lamp; No. 16 B. & S. gauge, special braid, N. E. C.; wound on 8-in. coil; total weight, 1 lb. 6 oz.

**15 ft. Cable, Type W–9**; high tension; Packard; No. 30 B. & S. gauge, 40-strand; outside diameter of cable, $\frac{3}{64}$ in.; wound on 8-in. coil; total weight, 3 lb.

**1 Lead, Type CD–2**; spiral inductance; 11⅛ in. long; spare.

**1 Lead, Type CD–3**; spiral inductance; 6⅝ in. long; spare.

**EQUIPMENT, TYPE A-21**; Antenna.

**1 Reel, Type RL–2**; antenna.

**2 Drums, Type DR–2**; antenna reel.

**3,000 ft. Wire, Type W–5**; Antenna; probable length of antenna, 300 ft.

**10 Weights, Type WT–1**; antenna; 1 in use, 9 spare.

**2 Fairleads, Type F–1**; type F–2 when type F–1 is not available; 1 in use, 1 spare.

**20 ft. Cord, Type RP–6**; approximately 2 ft. in use.