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INSTALLATION AND OPERATING INSTRUCTIONS.

RADIO RECEIVER

SE-143

ENGINEERING DEPARTMENT

RADIOMARINE CORPORATION OF AMERICA

A Radio Corporation of America Service

75 Varick Street, New York, N.Y.

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DESCRIPTION AND DIRECTIONS

FOR USE OF

U. S. NAVY RADIO RECEIVER

TYPE SE 143

RANGE 300 TO 3200 METERS

RADIO TEST SHOP

U.S. NAVY YARD

WASHINGTON, D.C.

DECEMBER, 1918

Approved:

(signed, W.A. Eaton)

Lieutenant, U.S.N.
For Engineer Officer

Description and Directions for the Use of U. S. Navy

Short Wave Radio Receiver

Type SE 143

This receiver consists of a primary circuit tuned with series condenser, inductively coupled with the secondary circuit. The secondary circuit, when the secondary switch is in the ''TUNED'' position, is shunted by a variabel condenser; in the ''UNTUNED'' position, the variable condenser is cut out, and an extra secondary winding, which can be very tightly coupled with the primary, is cut into the secondary circuit. For use with oscillating audion detector, a tickler coil is provided, variably coupled with the secondary winding.

The primary inductance is made in three sections, subdivided into ten taps. By means of an endpoint switch, mechanically connected with the primary inductance switch, sections not in circuit are disconnected, to avoid dead end or ''overhang'' effects. The inductance values corresponding to these ten tap points are:

A	50 microhenries
B	95 ''
C	170 ''
D	260 ''
E	400 ''
F	640 ''
G	1000 ''
H	1600 ''
I	2400 ''
J	3800 ''

The primary condenser is of the variable air type, and has the following capacity values:

0 degrees	0.00008 microfarad
10 ''	0.00018 ''
20 ''	0.00043 ''
30 ''	0.00070 ''
40 ''	0.00097 ''
50 ''	0.00124 ''
60 ''	0.00150 ''
70 ''	0.00176 ''
80 ''	0.00203 ''
90 ''	0.00232 ''
100 ''	0.00260 ''
110 ''	0.00287 ''
120 ''	0.00315 ''
130 ''	0.00343 ''
140 ''	0.00368 ''
150 ''	0.00396 ''
160 ''	0.00423 ''
170 ''	0.00448 ''
180 ''	0.00453 ''

For intermediate values within the range of 20^{o} to 160^{o}, one may interpolate from this table, as the variation of capacity is very closely linear.

Owing to the great variation in the capacity of antennae, it is not practicable to embody a primary wave-length table in these instructions. On an artificial antenna of 0.0008 microfard, the primary circuit measured as follows:

Primary	Primary Condenser Degrees		
Inductance	20 degrees	90 degrees	160 degrees
A	310 Meters	430 Meters	450 Meters
B	380 ’’	535 ’’	567 ’’
C	475 ’’	670 ’’	711 ’’
D	575 ’’	810 ’’	858 ’’
E	707 ’’	997 ’’	1055 ’’
F	887 ’’	1250 ’’	1325 ’’
G	1090 ’’	1535 ’’	1628 ’’
H	1376 ’’	1954 ’’	2075 ’’
I	1700 ’’	2400 ’’	2547 ’’
J	2170 ’’	3060 ’’	3250 ’’

For an antenna of known capacity, it is possible to calculate, at least approximately, the wave-length corresponding to a given setting. If the antenna capacity is Ca, and the primary condenser capacity Cp, the total capacity in the primary circuit is:

$$C = \frac{1}{\frac{1}{Ca} + \frac{1}{Cp}}$$

Multiplying this capacity by the inductance of the primary circuit, including the inductance of the antenna gives the product LC, from which, by use of the attached wave-length table, the wave-length may be found.

Owing to the fact that the capacity and inductance of an actual antenna change with change in wave-length (the capacity, for example, decreases by about 20% when passing from a long wave-length to the natural wave-length or period of the antenna), such calculations are subject to a considerable error, especially at the shorter wave-lengths. Therefore the best way is to calibrate the primary circuit with the station antenna with a wave-meter, marking the calibration in ink on the primary condenser dial, in the sectors corresponding with the inductance steps.

The secondary circuit, at least at loose coupling, is practically independent of the primary circuit and antenna, and is calibrated in wave-lengths on the secondary condenser dial. Details and constants of the secondary circuit are given below, and will be found useful in case it is desired to extend the range by inserting extra loading inductance.

The secondary inductance, like the primary, is divided into three sections, with a total of six taps. An endpoint switch, similar to that on the primary, serves to disconnect sections not in use. The inductance corresponding to the six tap points is:

1	19 microhenries
2	72 ’’
3	340 ’’
4	1350 ’’
5	2330 ’’
6	3670 ’’

The capacity of the secondary condenser is:

0 degrees	0.00010 microfarad
10 ’’	0.00012 ’’
20 ’’	0.00025 ’’
30 ’’	0.00044 ’’
40 ’’	0.00062 ’’
50 ’’	0.00082 ’’
60 ’’	0.00098 ’’
70 ’’	0.00117 ’’
80 ’’	0.00136 ’’
90 ’’	0.00153 ’’
100 ’’	0.00171 ’’
110 ’’	0.00190 ’’
120 ’’	0.00208 ’’
130 ’’	0.00226 ’’
140 ’’	0.00244 ’’
150 ’’	0.00264 ’’
160 ’’	0.00283 ’’
170 ’’	0.00302 ’’
180 ’’	0.00314 ’’

To connect the receiver for operation, the antenna lead must be run to the binding post marked ‘‘ANT’’, and the ground lead to the post marked ‘‘GR’’. The antenna lead to the receiver must be well insulated, and not bunched with other leads, or run for any distance in close proximity to a steel bulkhead or other metal mass. A single cell of dry battery must be connected to the posts marked ‘‘BUZ. BAT’’.

To the posts marked ‘‘DETECTOR’’ a crystal detector may be connected, and used for spark reception only. Leads from the ‘‘RA’’, ‘‘RE’’, ‘‘TICKLER’’, and ‘‘AUD. TEL’’ are then run to the corresponding posts on the Audion Control Panel, and, finally, the telephone receivers are connected to the posts marked ‘‘TELEPHONE’’. The leads from ‘‘RA’’, ‘‘RE’’, and ‘‘TICKLER’’ to the Audion Control Panel should be as short as possible, and must not be bunched. Especially should the ‘‘RA’’ lead be kept well separated from the others.

IF it is desired to receive spark signals on the crystal detector, the detector switch must be set on ‘‘CRYSTAL’’. With the secondary switch in the ‘‘UNTUNED’’ position, and the Inductive Coupler set at ‘‘MAX’’, the detector is first adjusted to a sensitive condition on signals from the receiver buzzer.

If the wave-length of the desired station is known, the primary and secondary circuits may be at once set to this wave-length, the secondary switch thrown to the ‘‘TUNED’’ position, and the coupling varied until the best signal is heard in the phones. Slight re-tuning of both primary and secondary circuits, by means of the primary and secondary condensers will generally be found necessary for best signal, owing to the effect of the coupling, and the possible slight inaccuracy of the distant stations wave-length setting. Finally, the stopping condenser should also be adjusted until the clearest and loudest signal is obtained.

Spark signals may also be received on the audion, by simply throwing over the detector switch from ‘‘CRYSTAL’’ to ‘‘AUDION’’.

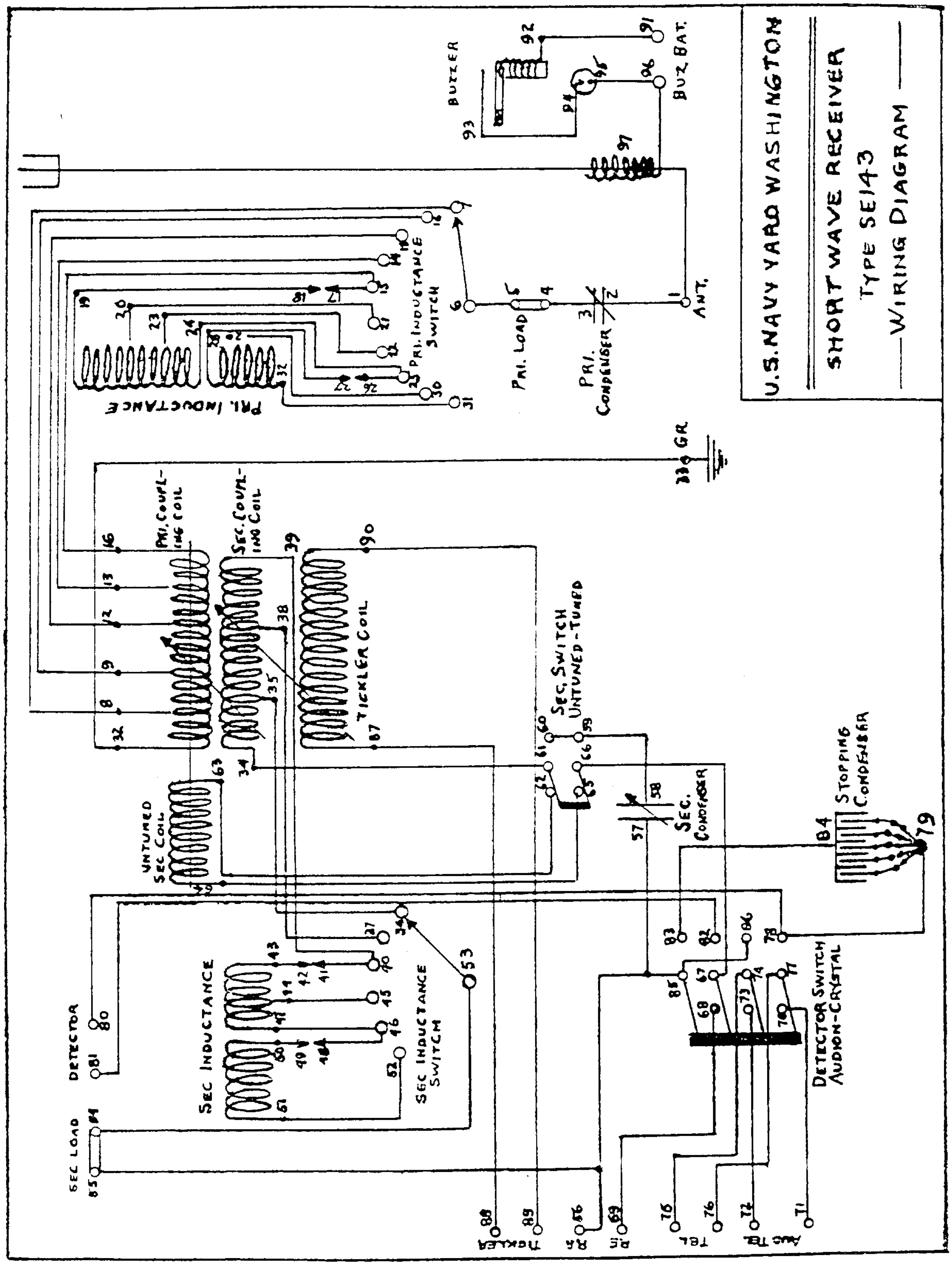
If the desired station is of unknown wave-length, it will be easiest picked up by leaving the secondary switch in the ‘‘UNTUNED’’ position, the Inductive Coupler in the ‘‘MAX’’ position, moving the primary inductance switch from point to point, and at each point rotating the primary condenser through 180^{o}. In this way all tunes within the range of the receiver will be quickly passed over. As soon as the station is heard, decrease the coupling as far as possible without losing the signal, re-tune the primary by variation of the primary condenser, and then throw the secondary switch over to the ‘‘TUNED’’ position. Next carefully tune the secondary circuit first approximately by setting it on the same wave-length marking as indicated by the primary, and then more closely by slow movement of the secondary condenser. Finally, readjust coupling for maximum strength of signal. It is usually necessary to slightly readjust both primary and secondary circuits after any considerable change of coupling.

For arc and other undamped wave signals, it is necessary to use the oscillating audion. Even with spark signals, a large increase in receiving sensitiveness may be had by using the oscillating audion, although in general the distinctive musical note of the spark will be lost, and replaced by a hissing sound. The detector switch must be set on ‘‘AUDION’’ and the secondary switch on ‘‘TUNED’’.

After tuning the primary and secondary circuits approximately to the desired wave-length, and leaving the inductive coupler at about 50^{o}, vary the tickler coupler until good oscillations are obtained in the secondary circuit. The presence of oscillations may be readily discovered by either short-circuiting the ‘‘TICKLER’’ posts or touching the ‘‘RA’’ terminal, a click being heard if the circuit is oscillating properly. When the station is heard, readjust the coupling of the primary and secondary circuits for best signal, similarly to the adjustment for spark signals. The tickler coupler should also be readjusted until the best result is obtained.

An arc station of unknown wave-length may be picked up by a similar process to that employed for unknown spark signals. But in this case it will be found necessary to change the tune of the primary circuit very slowly, swinging the secondary condenser through resonance at each slight change in the primary. When the secondary circuit is oscillating, passage through the resonance point is marked by a slight click, and the best not of the station will be heard at a setting above or below the resonance point.

WIRELESS SPECIALTY APPARATUS CO.


U.S. NAVY YARD WASHINGTON
SHORT WAVE RECEIVER
TYPE SE143
WIRING DIAGRAM

NOTES BY NA4G

1. You can obtain additional SE 143 information from the following sources:
   a) George Sterling's Radio Manual, 1st edition, 1928, pages 469-471.
   b) Robison's Manual of Radiotelegraphy and Radiotelephony, 5th edition, 1919.
2. This receiver represents the earliest satisfactory U.S. Navy radio receiver. Prior to the introduction of this receiver, all other Navy receivers had been marginally acceptable, at best. This receiver began a long developmental line of receivers, among which were the SE 143, SE 1220, SE 1420, SE 1440, IP-501, IP-501-A, and BC-131. A few other variants are also known to exist.
3. This receiver is essentially identical to the slightly later SE 1220 medium wave radio receiver. The only differences appear to be in the overall tuning ranges of either type. The SE 143 was known as the short wave receiver and the SE 1220 as the medium wave receiver. The range of the SE 143 was 300 to 3300 meters, while the SE 1220 was 300 to 6800 meters. Additional long wave loading coils could be used interchangeably with either type to extend the range up to approximately 8000 to 10000 meters.
4. In both the SE 143 and SE 1220 receivers, external detectors were used. An external crystal detector or an external audion detector were commonly used, with several types of audion control box arrangements. With the use of the audion, the receiver became a single tube regenerative receiver for the reception of spark (damped) or arc (continuous) waves, depending upon whether the detector was non-oscillating or oscillating, respectively. Additional external outboard audion audio amplifiers were sometimes used to give additional amplification. Later, the additional tubes were incorporated into the main tuner box, typified by the SE 1440 or the IP-501-A radio receivers.

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