LHQ SCHOOL OF ELECTRICAL & MECHANICAL ENGINEERING.

TELECOMMUNICATIONS ENG - WIRELESS SECTION.

LECTURE PRECIS: W/14.

SUBJECT: A.W.A. Receivers Types C6770 and 3C6770. (Part of TELERADIO 3BZ installation).

ASSOCIATED DIAGRAMS: W/14A; W/14B.

GENERAL DESCRIPTION.

This receiver is a five tube superheterodyne which is designed to be conveniently portable and economical in operation. It is constructed in two units, each unit being enclosed in a metal case similar to that in which the associated transmitter is enclosed. The receiver comprises one unit and the loudspeaker the other unit, the speaker itself being a permanent magnet type. The excess space in the loudspeaker case is used for the purpose of carrying spare parts etc.

POWER SUPPLY.

Both above models of this receiver are battery operated and employ either a 6 volt or a 12 volt secondary battery for their primary supply. H.T. is derived from a self-contained vibrator unit which employs "OAK" type 5211 synchronous vibrator and which supplies 150-170 volts H.T. The change from 6volts to 12 volts operation is effected by changing the battery connecting cables, no alteration to the receiver wiring being necessary. On 6 volt operation the battery cabling supplies 6 volts L.T. to the vibrator primary circuit and the tubesheater circuit which are, under these circumstances, connected in parallel. When the change to 12 volt operation is made the appropriate battery connector automatically alters the former parallel circuit of the vibrator primary and tube's heater circuits so that they are supplied separately from the two halves of the 12 volt battery. The vibrator primary circuit is connected from 6 volts positive to ground, 12 volts negative, and the tube's heater circuit from 12 volts positive to 6 volts positive.

N.B. Diagram W/14A illustrates an A.C. version of receiver C6770, the differences apparent in model C6770, battery operated model, being shown in diagram W/14B.

FREQUENCY RANGE: Covered in five bands as follows:- (Model C6770).

BAND	TUNING RANGE	METRES.
A	30.0 - 9 Mc/s	10 - 33
B	11.1 - 3.5 Mc/s	27 - 85
C	4.6 - 1.5 "	65 - 200
D	1.650 - 545 Kc/s	182 - 550
E	515 - 200 "	580 - 1.500

FREQUENCY RANGE. (Model 3C6770). As for model C6770 with the exception that a crystal-locked fixed frequency channel is provided instead of Band A. (30 - 9 Mc/s) This facility provides a single fixed frequency which can be employed for communication between two installations of this type, which have been so constructed as to permit their co-operation in this manner.

INTERMEDIATE FREQUENCY. 535 Kc/s

FACILITIES. Provision is made for the reception of both RT, CW and MCW signals.

MANUAL VOLUME CONTROL. Audio volume control, applied to the 1st Audio Amplifier input, is used in conjunction with the sensitivity control of the R.F. Amplifier, Mixer and I.F. Amplifier stages on all bands.

However, on Bands D & E the minimum bias applied to the tubes whose sensitivity is controlled is increased to equalise the frequency response over the tuning range.

A.V.C. The conditions under which the A.V.C. is applied to the various stages are set out in tabular form below:-

STAGE	FREQUENCY BANDS	SIGNAL MODES.
R.F. Amplifier	A B C D E	R.T. only.
Mixer (Model C6770)	C D E	" "
" (" 3C6770)	A C D E	" "
I.F. Amplifier	A B C D E	" "
1st Audio Amplifier (¼ A.V.C.)	All Bands	All Modes

TUBE TYPES AND FUNCTIONS.

CIRCUIT SYMBOL	TYPE	FUNCTION
V1	6U7G	R.F. Amplifier
V2	6J8G	Frequency Changer
V3	6J8G	I.F. Amplifier B.F.O.
V4	6G8G	Diode Detector AVC 1st Audio
V5	6V6G	Audio Output. (Amplifier.

FUSES. The H.T. vibrator unit is fused in its primary circuit by F1-3 Amps, this fuse being located, in clips, on the left side of the vibrator case.

BATTERY CURRENT FIGURES.

6 Volt input	3.3 Amps	20.4 Watts. approx.
12 " "	1.65 "	" " "

WEIGHT AND DIMENSIONS.

		Length	Height	Depth.
Weight.	(Receiver, less valves and vibrator)			38 lbs.
"	(Loudspeaker Unit with cables, microphone and phones)			24 "
Dimensions	(Receiver overall)	16½"	10½"	12¼"
"	(Loudspeaker Unit)	17"	10½"	10¼"

TECHNICAL DESCRIPTION.

Tuning Arrangements. The main tuning control consists of a three gang variable condenser which is used in conjunction with the R.F. input coil secondary, mixer input coil secondary and the oscillator tuning coil secondary of each Band to tune these circuits to resonance at the desired frequency. Note the following points:-

(a) All coils of Bands A & B are air cored whilst those of Bands C, D & E are of the variable iron-cored type.

(b) Individual parallel trimmer condensers are employed with all coils for the alignment at the H.F. end of the frequency Band for which a particular coil is designed. Alignment at the L.F. end of Bands C, D & E is accomplished by use of the iron cores of the coils in use on these Bands. This facility is not provided on Bands A & B. Individual fixed padder condensers are provided with each oscillator coil.

(c) All unused coils, primaries and secondaries both, which are employed on Bands lower in frequency than the Band in use are shorted out in Model C6770. This applies to coil secondaries only in Model 3C6770, the primaries in this instance remaining unshorted.

(d) The R.F. input and Mixer input coils, in Model 3C6770, used in conjunction with the crystal locked frequency are tuned to resonance at the appropriate frequency by preset trimmer condenser.

(e) H.T. is permanently connected to the primaries of all coils used in both the R.F. to Mixer coupling circuit and the Oscillator circuit, the plate of the 6U7G R.F. tube and the Oscillator plate of the 6J8G Frequency Changer being switched to the appropriate primary coil for a given Band.

LOCAL OSCILLATOR CIRCUIT. (Model C6770). This is designed to function at a frequency 535 Kc/s above signal frequency on all Bands, the triode section of the 6J8G triode-heptode Frequency Changer being employed in a simple tuned-grid Meissner circuit.

(Model 3C6770). The LOCAL OSCILLATOR circuit in this receiver is similar to that in the former model on Bands B, C, D & E whilst on Band A (30 - 9 Mc/s), which in this instance is the crystal locked frequency, the circuit is tuned to 535 Kc/s above the fixed signal frequency by the crystal which operates in a conventional "Pierce" circuit.

I.F. CHANNEL. Both I.F. transformers are of the inductively tuned type, one stage only of I.F. amplification being employed. The function of I.F. AMPLIFIER is performed by the heptode section of the second 6J8G. It will be noticed that an amount of neutralisation is provided in this stage by C73 which is connected from the heptode plate to the "cold" end of the 1st I.F. transformer.

B.F.O. CIRCUIT. The triode section of the 6J8G I.F. AMPLIFIER tube performs the function of B.F.O., the circuit employed being of Meissner type and injection into the I.F. channel being accomplished by the mdoulator grid of the heptode section. An important point to note is that the B.F.O. frequency is 178 Kc/s, the 3rd harmonic of this frequency being the frequency utilised to provide the heterodyne note. Adjustment to the correct frequency is performed inductively by the iron core of the B.F.O. coil. H.T. is applied to the B.F.O. on CW only.

DEMODULATOR AND 1st AUDIO AMPLIFIER STAGES. A 6G8G tube is used to perform these functions. One diode of this tube is used in a conventional diode detector arrangement, an I.F. filter network being included in the diode load. The desired amount of audio voltage is derived from the potentiometer, R17 - .5 Mohm, which comprises the didoe load, and is applied to the pentode section grid via C55. The grid return of this pentode section is made to a point on the A.V.C. diode load which applies approx. ¼ A.V.C. voltage to this grid.

AUDIO OUTPUT CIRCUIT. A 6V6G tube is employed under restricted screen voltage conditions to provide an undistorted power output of approx. 850 mW. A system of tone control is provided by condenser C61 and resistor R26 which are connected in series across the primary of the output transformer. A special output transformer having a tapped secondary is employed in the output circuit. Provision is made by this means for driving a 1.5 ohm permanent magnet speaker and for connection to a 600 ohm line. A pair of high resistances headphones can be connected across the 600 ohm line terminals of the output transformer, however, if a speaker is not used under these conditions a 600 ohm resistor should be connected across the speaker terminals to maintain correct loading on the output tube.

A.V.C. NETWORK. The second diode of the 6G8G tube has an amount of I.F. voltage applied to it, via condensor C50 - 200 uuF., from the I.F. AMPLIFIER plate. The diode load is comprised of R18-1.5 Mohm and R30-0-5 Mohm connected in series to ground. This results in a negative delay voltage, equal to the voltage developed across the cathode resistor R19 - 3000 ohms, being applied to the A.V.C. diode. The grid return of the 1st AUDIO AMPLIFIER is made to the junction of R18 and R30. The A.V.C. is removed from all controlled stages excepting the 1st audio tube, by means of a section of the Phone-MCW-CW switch,

when on MCW and CW. A section of the wavechange switch performs the function of removing the A.V.C. from the Mixer stage on Bands A & B in model C6770 and on Band B only in model 3C6770.

STAND-BY CONDITION. This condition is effected when the OFF-TRANS-RECEIVE switch is in the TRANS position. Under these circumstances only the heater circuit is energised, the L.T. input to the vibrator unit being removed. In the A.C. version of this receiver, Diagram W/14A, the STAND-BY condition is effected by removal of the H.T. from the R.F. AMPLIFIER, MIXER, and LOCAL OSCILLATOR stages, this function being performed by switch S4.

ALIGNMENT. Model C6770.

I.F. CHANNEL. This operation to be performed under the following conditions:-

(a) Signal Generator connected from MIXER grid to earth with the MIXER grid clip removed.
(b) Both volume controls turned to maximum.
(c) Output meter shunted by 600 ohm resistor connected across 600 ohm output terminals. If meter internal resistance is sufficiently low 600 ohm resistor need not be used.

(d) Wavechange switch set for Band A and tuning gang condenser fully meshed.

Proceed as follows:-
With Signal Generator set to 535 Kc/s peak all I.F. transformers for maximum reading on output meter. Do not use any greater input than is necessary. This will avoid the effect of the A.V.C. being brought into action with consequent apparent broadening of the tuning.

N.B. If it is found necessary to push aside the condenser connected to the AUDIO VOLUME CONTROL to gain access to the primary adjustment of the 1st I.F. transformer, then this condenser must be returned to its original position or an audio howl may result. The I.F. sensitivity is approx. 200 uV input for 6mW into 600 ohms output.

B.F.O. ADJUSTMENT. This adjustment is most conveniently carried out immediately following the I.F. alignment. The procedure is as follows:-

(a) Remove the modulation of the Signal Generator leaving it set to 535 Kc/s.
(b) Turn PHONE-MCW-CW switch to CW and adjust B.F.O. coil, T18, iron core for zero-beat, then turn adjusting screw in either direction until the beat note heard is approx. 1,000 c.p.s.

R.F. CIRCUITS ALIGNMENT. On Bands A, B & E these circuits are aligned at their H.F. end by means of plunger type trimmer condensers mounted on the chassis. Compression type trimmers are employed for this purpose on Bands C and D, these components being located on the wavechange switch shields close to their respective coils.

N.B. Before commencing R.F circuits alignment ensure that when the gang condenser is fully meshed the hairline on the tuning dial pointer coincides with the line through the letter "S" engraved directly above the letter "C" on the dial scale, and that the Signal Generator is connected from Aerial to earth using the dummy aerial provided.

Band "E" Alignment.

(a) With both Signal Generator and receiver dials set to 210 Kc/s adjust the oscillator, R.F. and aerial coil, T15, 10, 5 respectively, iron cores for maximum output.

(b) Set both receiver and Signal Generator dials to 500 Kc/s and adjust Oscillator trimmer C35 for maximum output. Next adjust R.F. and Aerial trimmers, C23 and C8 respectively, for maximum output. Whilst performing this latter operation rock the tuning gang to prevent pulling of the Oscillator frequency.

(c) Check calibration at 350 Kc/s.

Band "D" Alignment.

As for Band "E", the L.F. alignment point being 600 Kc/s and the H.F. point, 1,550 Kc/s. The check point is 1,050 Kc/s. The Aerial, R.F. and Oscillator coils are T4,9 and 14 respectively and the corresponding trimmers C7, C22 and C34.

Band "C" Alignment.

As for Bands "E" and "D", the L.F. adjustment point being 1.6 Mc/s and the H.F. point 4.2 Mc/s. The check point is 2.9 Mc/s. The Aerial, R.F. and Oscillator coils are T3, 8 and 13 respectively and the corresponding trimmers C6, 21 and 33.

Band "B" Alignment.

This differs from that of Bands C, D & E and is performed as follows:- Adjustment is performed at the H.F. end of the Band only, the alignment point being 10.5 Mc/s.

(a) Adjust Oscillator plunger type trimmer condenser C32, starting at minimum capacity, for maximum output with both receiver and Signal Generator dials set to 10,5 Mc/s. As two tuning points are usually found on adjusting C32 note that the correct setting is that nearest the minimum capacity end of this trimmer.

(b) Check that the correct Oscillator trimmer condenser setting has been obtained by turning the receiver dial to 9.43 Mc/s when the image signal should be heard. It may be necessary to increase the Signal Generator output to hear the image signal.

(c) When the correct Oscillator trimmer adjustment has been found return both receiver and Signal Generator dials to 10.5 Mc/s and complete the alignment of this Band by adjusting the R.F. and Aerial trimmers, C20 and C5 respectively, for maximum output. The tuning gang must be rocked during operation (C).

(d) Check alignment at 7.0 and 3.8 Mc/s.

Band "A" Alignment.

This performed in similar manner to that on Band "B". The alignment point is 27 Mc/s and the image point 25.9 Mc/s. The check points are 18.5 and 10 Mc/s. The Aerial, R.F. and Oscillator trimmers are C4, 19 and 31 respectively.

ALIGNMENT. (Model 3C6770). In this receiver the I.F. channel must be aligned first to a signal, corresponding in frequency to that of the distant co-operating transmitter, applied to the receiver input circuit. This may be obtained from a Signal Generator; but in this case the adjustment must be immediately checked on a signal from the distant transmitter. The adjustment merely consists of adjusting the I.F. channel and the R.F. circuits for maximum output, on Band "A", at the fixed operating frequency. Once this has been accomplished the remainder of the alignment is conducted in similar manner to Model C6770.

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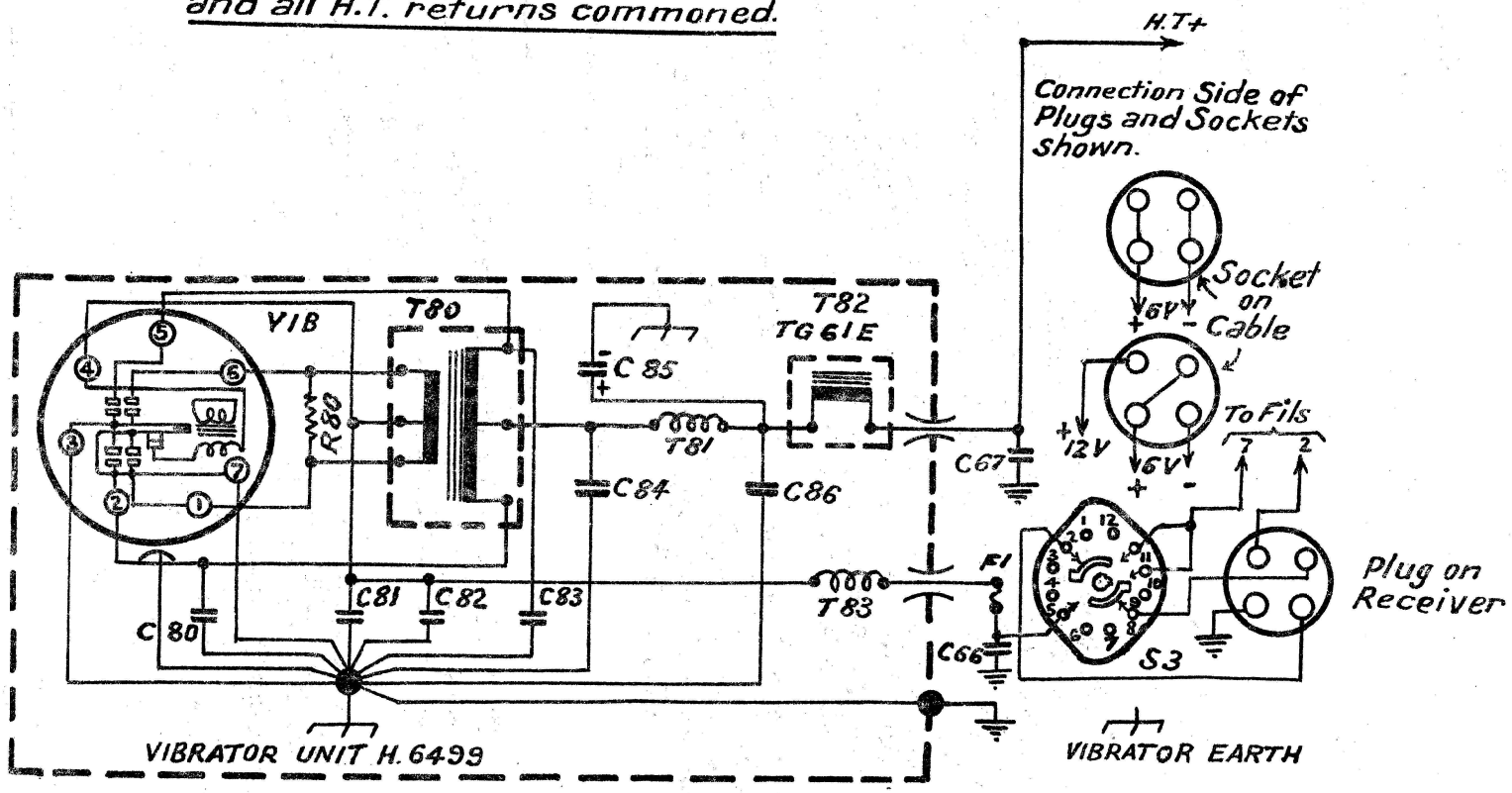
L.HQ. E. & M.E. SCHOOL. TELECOM WING

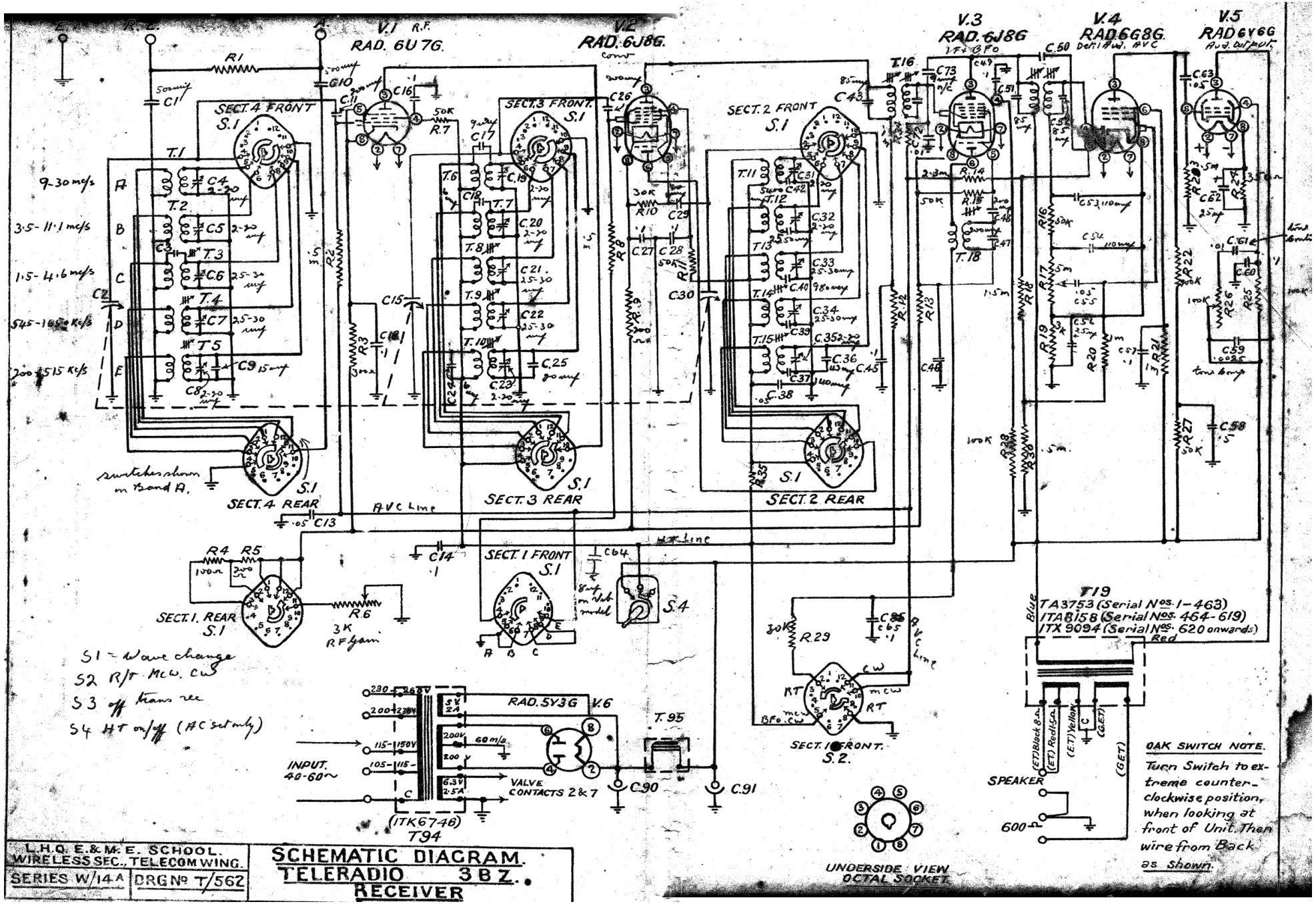
SERIES W/14 B | DRG. No T/600

TELERADIO 3 BZ. RECEIVER VIBRATOR POWER SUPPLY.

Note:

In Battery Receiver switch S4, (see diagram W/144.) is removed and all H.T. returns commoned.




V.1 R.F.
RAD. 6U7G.
V.2
RAD. 6J8G.
V.3
RAD. 6J8G
V.4
RAD. 6G8G.
V.5
RAD. 6V6G
SECT. 4 FRONT
SECT. 3 FRONT
SECT. 2 FRONT
SECT. 4 REAR
SECT. 3 REAR
SECT. 2 REAR
SECT. 1 FRONT
SECT. 1 REAR
S.1
S.2
S.4
T.1
T.2
T.3
T.4
T.5
T.6
T.7
T.8
T.9
T.10
T.11
T.12
T.13
T.14
T.15
T.16
T.18
T19
TA3753 (Serial Nos. 1-463)
ITA8158 (Serial Nos. 464-619)
ITX 9094 (Serial Nos. 620 onwards)
9-30 mc/s
3.5-11.1 mc/s
1.5-4.6 mc/s
545-1650 K/s
200-515 K/s
AVC Line
H.T. Line
RAD. 5Y3G
V.6
T.95
T.90
T.91
INPUT 40-60~
VALVE CONTACTS 2 & 7
(ITK6746)
T94
SPEAKER
600Ω
S1 - Wave change
S2 R/T MCW. CW
S3 off trans rec
S4 HT on/off (AC set only)
3K RF gain
switches shown on Band A.
OAK SWITCH NOTE.
Turn Switch to extreme counter-clockwise position, when looking at front of Unit. Then wire from Back as shown.
UNDERSIDE VIEW OCTAL SOCKET
L.H.Q. E.& M.E. SCHOOL. WIRELESS SEC., TELECOM WING.
SERIES W/14A
DRG No T/562
SCHEMATIC DIAGRAM.
TELERADIO 3BZ.
RECEIVER