

**E·M·I SERVICE LTD.**

**"HIS MASTER'S VOICE" 1403**  
**MARCONIPHONE 891**

# **SERVICE MANUAL**

## **4 Valve Dry Battery Portable**

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## TECHNICAL SPECIFICATION

### PHYSICAL.

Height ...	... 11 ins.	} overall.
Width ...	... 14 $\frac{1}{4}$ ins.	
Depth ...	... 7 $\frac{3}{8}$ ins.	
Net Weight ...	... 21 lb. 5 oz. (including batteries).	
Gross Weight ...	... 16 lb. (excluding batteries).	

### BATTERIES.

The standard battery for this model is Marconiphone bat. No. B140, combined 99 volt H.T. and 1.5 volt L.T. Alternatively, a separate 99 volt H.T. battery, Cat. No. B631 or 90 volt battery, Cat. No. B628 and a 1.5 volt bell cell can be fitted if supplies of the standard battery are not available.

**DO NOT use a 2 volt accumulator for L.T. purposes.**

Consumption : L.T. 0.25 amp., H.T. 10.0 mA average.

### WAVE RANGES.

Medium Waves, 200-565 metres ; Long Waves, 800-2,000 metres.

### RATED OUTPUT.

180 milliwatts, maximum.

### VALVES.

Marconi X14 ...	... Frequency Changer.
„ Z14 ...	... I.F. Amplifier.
„ HD14 ...	... Detector, A.V.C. and L.F. Amplifier.
„ N14 ...	... Output.

### LOUDSPEAKER.

**No. 20750A.** A permanent magnet moving-coil loudspeaker with high flux-density magnet.

D.C. resistance of speech coil ...	... 3 ohms.
Impedance at 800 c.p.s. ...	... 3.75 ohms.

### AERIAL AND EARTH.

Sockets are provided for the connexion of an external aerial and earth where interference is prevalent.

## CIRCUIT DESCRIPTION

### FREQUENCY CHANGER.

The first valve is a heptode frequency changer (X14), the grid tuning circuit of which consists of the tuned frame aerial L1. This acts as the tuning inductance for M.W. and is loaded by means of the iron-cored coil L2 for L.W. Oscillations are produced from the tuned grid coils L3 and L5 by coupling coil (L4) in the case of M.W. and by coupling condenser (C5) in the case of L.W.

### I.F. AMPLIFIER.

The first iron-cored I.F. transformer couples the anode of V1 to the I.F. amplifier V2 (Z14). This pentode valve is in turn coupled by a second I.F. transformer to V3. The intermediate frequency is 465 kc/s.

### DETECTOR AND A.V.C.

A single diode triode (HD14) provides demodulation, A.V.C. voltage and L.F. amplification. The signal diode has a load resistance R5, R11 from which is taken the A.V.C. voltage via filter R1, C2 (the frequency-changer and I.F. valves are controlled) and the L.F. voltage via filter R6, C7. The volume control VR1 feeds the grid of the triode portion of V3 which is resistance capacity (R7, C8) coupled to V4.

### OUTPUT STAGE.

The pentode output valve (V4, N14) is coupled to the loudspeaker by the output transformer T1. A tone correcting condenser C12 is fitted across the anode circuit. Bias for this valve is obtained by the voltage drop across R9 in the main H.T. — lead.

## PRELIMINARY TESTS

The following tests, if systematically carried out, will help in locating a fault in the receiver.

**Battery Voltage.**—The combined H.T. and L.T. battery should be replaced if either of the readings on load fall below the following :—

L.T. ...	... 0.9 v.
H.T. ...	... 60.0 v.

**Warning.**—If separate batteries are used it will often be found impractical to replace the H.T. without also replacing the L.T. owing to the special characteristics of the valves.

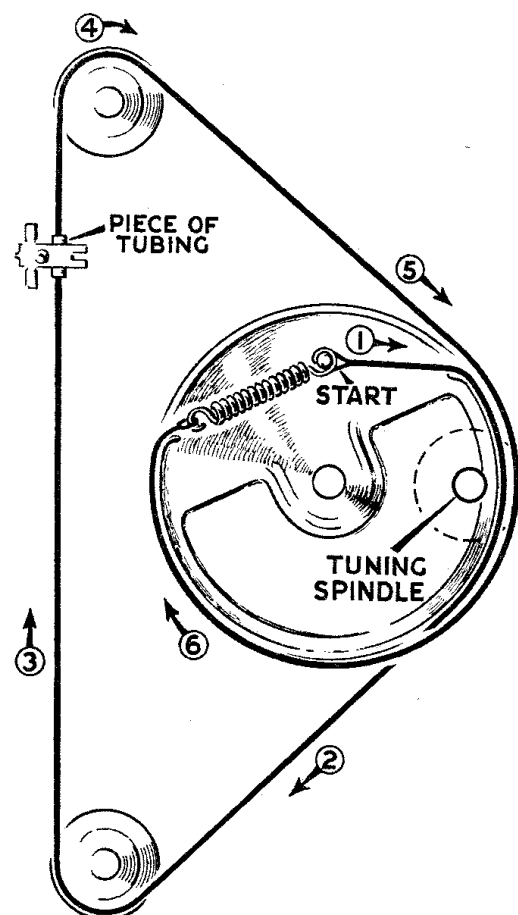
**L.F. Test.**—Touch the top terminal of V3 with wetted finger, a distinct click or whistle should be heard if the L.F. stages (V3 and V4) and loudspeaker are in order. Speech coil continuity can be checked by contacting a small battery (the **L.T. section** of the receiver battery will do) or an ohmmeter across the speech coil.

**H.F. Test.**—To check that the mixer valve V1 (X14) is oscillating connect a voltmeter across R2. If VC2 is now shorted out the voltage should rise if the valve is functioning correctly. If not check oscillator circuit (L3, L4, L5, C5, C11, R3, etc.).

## CONDENSER DRIVE

The special wire drive fitted to these models should not often require renewal, but if it is necessary it is essential to use only the correct wire (Specification S2447, Code No. 390/04001). Approximately 32 inches is required for a drive.

1. Unclamp wire from pointer and remove scale and frame.
2. Form a loop in one end of the wire large enough to pass over the stud on the condenser drive disc, and slip the small piece of tubing which was held in the pointer clamp on to the new wire.
3. Turn gang condenser to maximum, and passing the loop end through the hole in the periphery hook it on to the stud in the condenser drive disc.
4. Pass wire as shown round bottom pulley, over top pulley, and almost once round the drive disc, seeing that the small piece of tubing is between the pulleys.
5. Form a loop in the end of the wire so that when the spring is assembled in position shown the wire will be tensioned.
6. Coat wire with a little grease and replace scale and frame.
7. Clamp pointer on to wire so that it reads on the special max. gang mark on the scale.



## H.F. TESTS AND ADJUSTMENTS

*Do not attempt to make any adjustment to the circuits of this receiver unless you have adequate equipment as outlined below. All necessary oscillators, trimming tools, etc., essential for the correct adjustment of H.F. and I.F. circuits can be obtained from:—*

**E.M.I SERVICE LIMITED.**

## GANGING

Always follow any adjustment to the I.F. trimmers with complete R.F. alignment (M.W. and L.W.).

The E.M.I Service output meter should be connected between the anode of the NI4 (V4) and chassis, but if an A.C. voltmeter (low impedance) is used it must be connected across the speech coil.

Having removed the chassis from the cabinet and the back of the cabinet with frame, *leaving the leather hinges on the back*, the frame, battery and chassis must be reassembled on the bench in *exactly their correct respective positions*. The space between the frame

wire and the battery must be  $\frac{1}{2}$  inch, and the chassis must be disposed correctly relative to both. The battery label should face the frame aerial. The frame leads should be "dressed" to approximately the positions they would occupy in the cabinet.

In carrying out ganging operations the input to the receiver from the oscillator must be kept low, and progressively reduced as the circuits are brought into line so that the output meter reading does not exceed 50 mW or 0.4 V. with the receiver volume control at maximum. This is very important.

## I.F. GANGING.

Since the chassis must be removed for the R.F. ganging which must follow, it is recommended to set up the chassis out of the cabinet as described above, except that the position of the battery is not critical for I.F. alignment. The frame aerial (L1) must be connected.

Connect oscillator leads to V2 top grid (via 0.1  $\mu$ F condenser) leaving grid connexion made and chassis.

1. Tune oscillator to 465 kc./s (645.2 metres) and set receiver gang condenser to minimum, and volume control to maximum.

2. Adjust TC8 and TC7 in that order for maximum output.

3. Connect oscillator leads to top grid V1 and chassis, leaving grid connexion made.

4. Adjust TC6 and TC5 in that order for maximum output.

5. Check adjustments in the same order.

## R.F. GANGING.

To inject the ganging signal the screened oscillator earthy lead should be connected to receiver chassis and the "hot" lead (not more than 6 inches long) left free.

**IMPORTANT.** See that chassis, battery and frame aerial are exactly in their correct respective positions, as detailed above.

Do not attempt to align MW circuits only without following up with LW.

1. See that the pointer of the receiver coincides with the special mark on the M.W. calibration when the gang condenser is at maximum.

2. Set receiver (by scale) and oscillator to 200 metres (1,500 kc/s) and adjust TC3 for maximum output.

3. Tune oscillator to 225 metres (1,333 kc/s) and tune in signal on receiver.

Adjust TC1 for maximum output.

4. Tune oscillator to 520 metres (576.9 kc/s), tune in, and adjust core of L3, whilst "rocking" gang, for maximum output.

5. Repeat operations 1 to 4 to check.

6. Set oscillator and receiver to 800 metres (376 kc/s) and adjust TC4 for maximum output.

7. Set oscillator to 1,350 metres (222.2 kc/s), tune in signal on receiver and adjust TC2 for maximum output whilst "rocking" gang condenser.

8. Set oscillator to 1,900 metres (157.9 kc/s), tune in signal and adjust core L5 for maximum output.

9. Now adjust core L2 for maximum output at the same time "rocking" the gang condenser.

10. Repeat operations 8 and 9.

11. Repeat operations 6 and 7 to check settings.

## VALVE TABLE

Values  $\pm 15$  per cent. taken with H.T. battery reading 97 volts (H.T.). 1.4 volts (L.T.) on load. Receiver switched to M.W. and tuned to point of no reception. Resistance readings approximate, taken with batteries disconnected.

		V1 (X14).	V2 (Z14).	V3 (HD14).	V4 (NI4).
ANODE	{	Mxr. 89	Osc. 80	15*	85
	{	0.5	1.0	0.02	4.4
	{	$\infty$	$\infty$	$\infty$	$\infty$
SCREEN	{	50	89	—	89
	{	0.6	0.3	—	0.7
	{	$\infty$	$\infty$	—	$\infty$
BIAS	Volts Measured	Nil	nil.	nil	8.5 HT — and LT —
GRID	Resistance to chassis	1.5M	1.5M	20 ohms to 2M (VRI)	2.3M

Total H.T. current ... .. 8.6 mA.

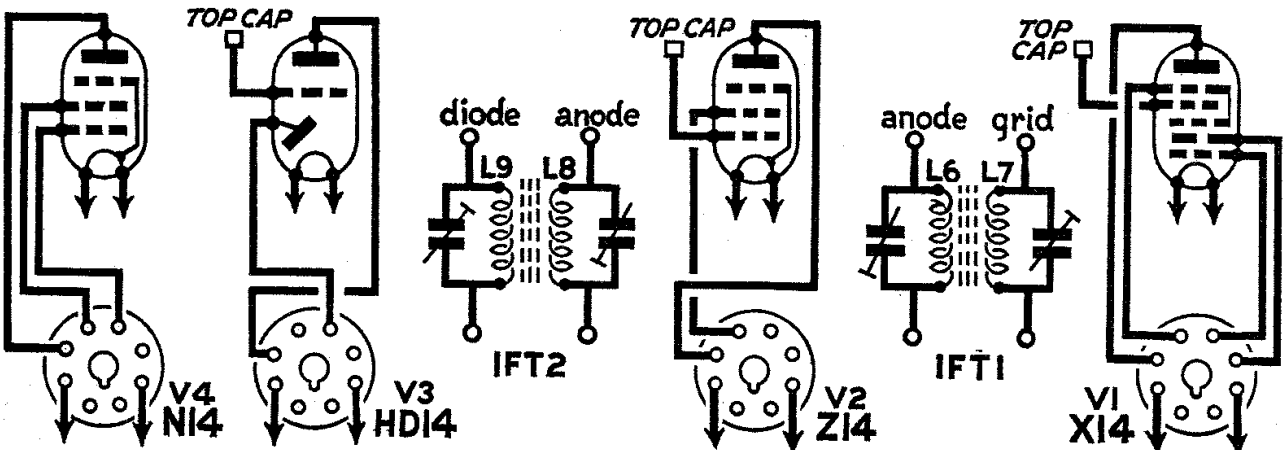
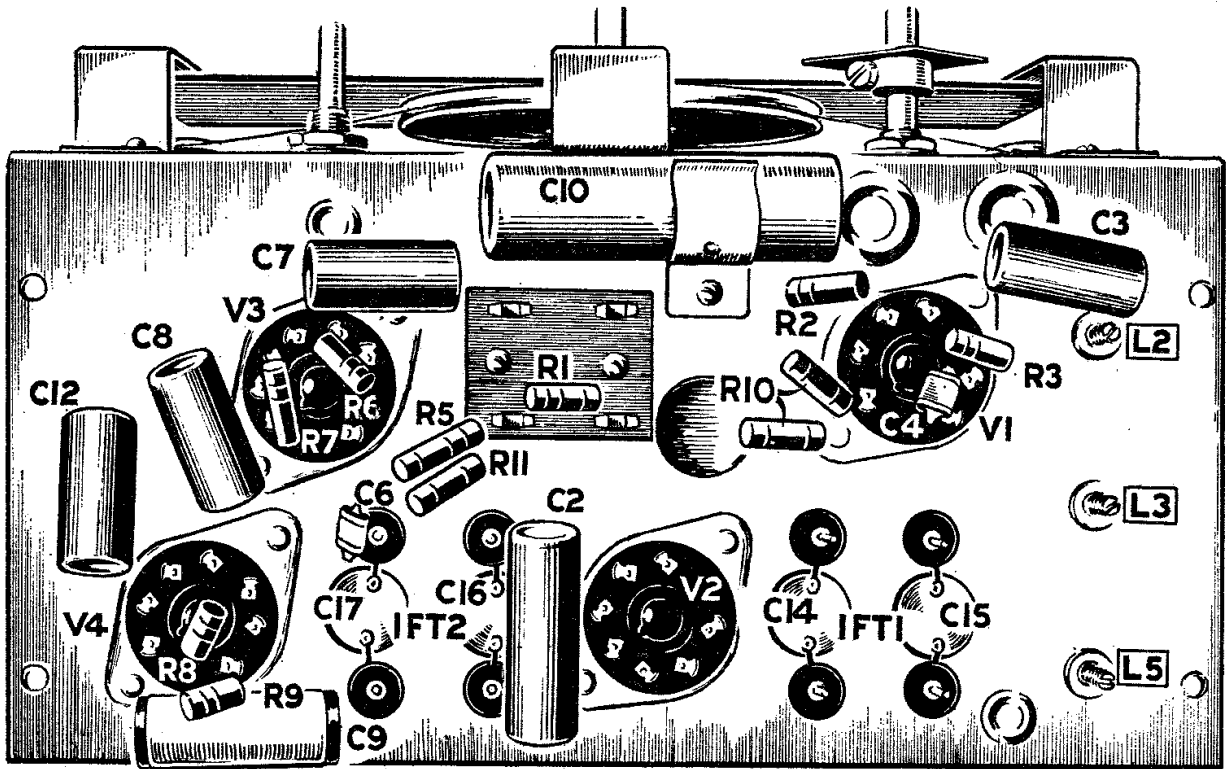
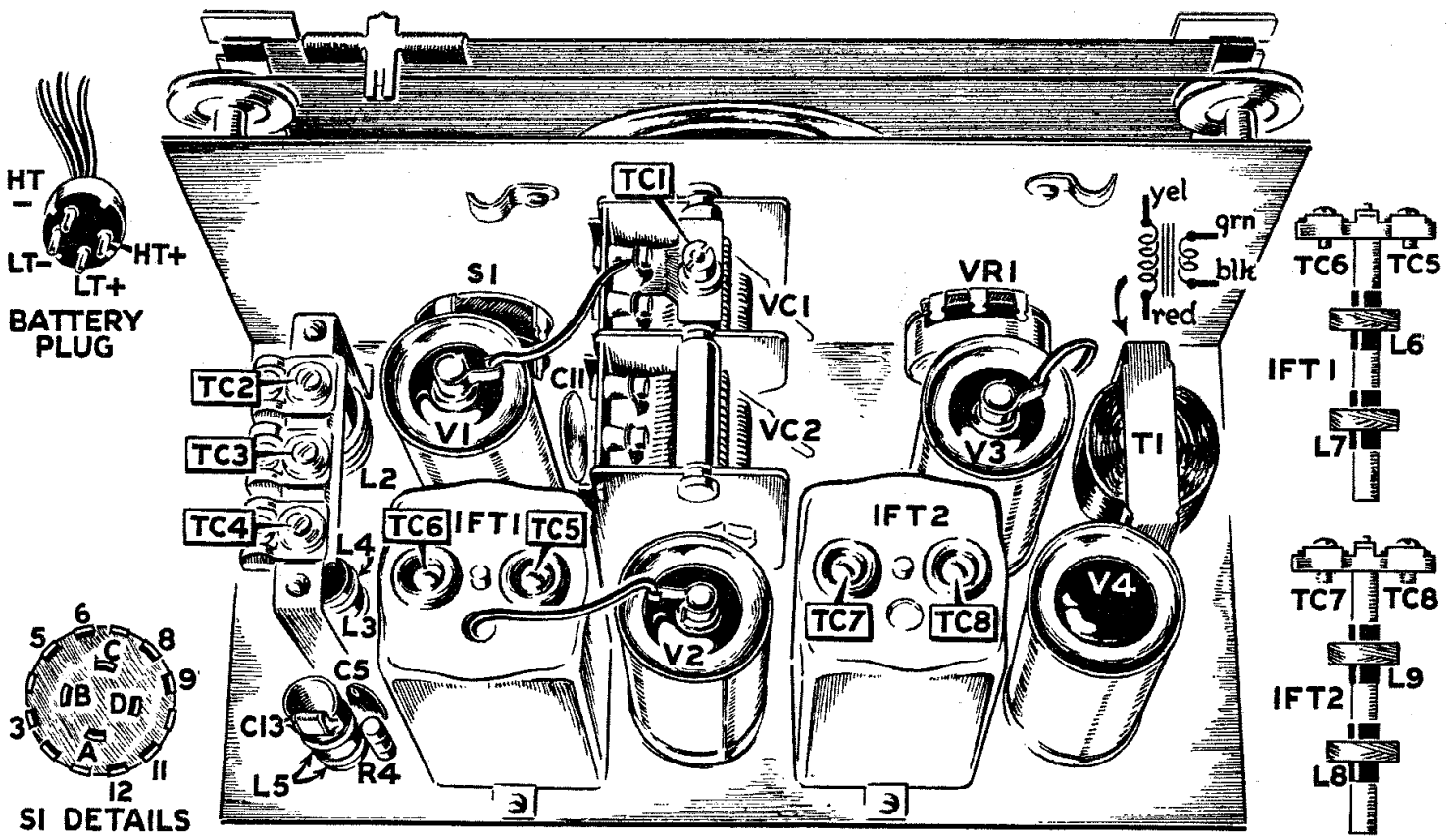
Total L.T. current ... .. 0.25 A.

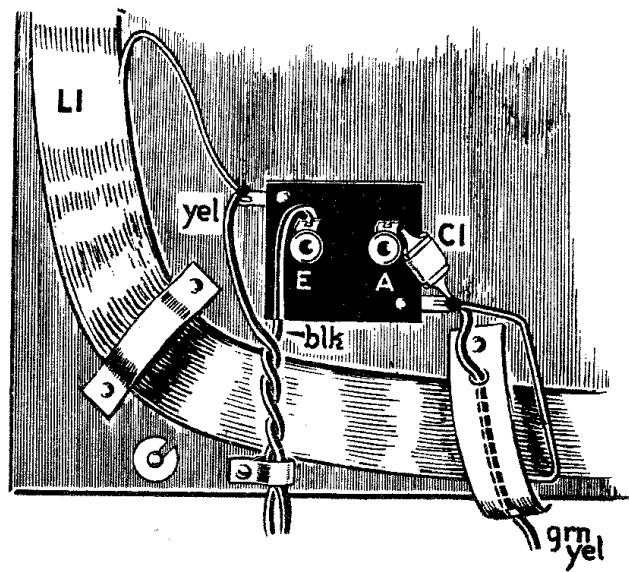
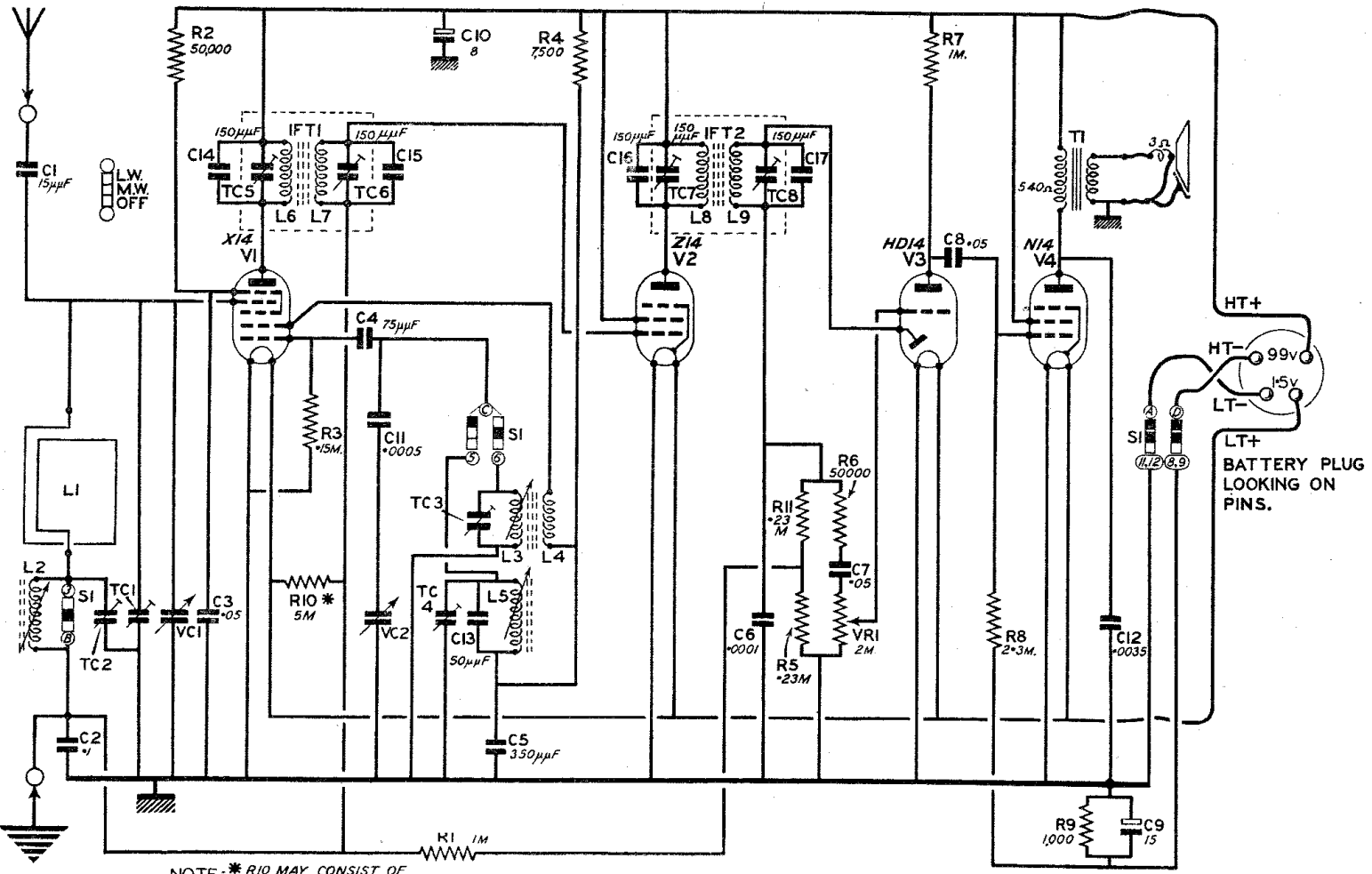
\* Owing to the high value of the anode resistance true readings are difficult to obtain on this valve.

## CONTINUITY CHECKS

Values  $\pm 15$  per cent.

Component.	Measured.	Switch.	Resistance.
L1 ... ..	Across ends ... ..	—	0.6 ohms.
L2 ... ..	One side of frame (L1) and earth socket ...	L.W.	8.7 ohms.
L3, L4, L5 ... ..	Across ends ... ..	—	L3—2.6 ohms. L4—2.2 ohms. L5—7.3 ohms.
L6 ... ..	Anode socket V1 (X14) and H.T.+ pin of battery plug	—	4.0 ohms.
L7, L9, R1 ... ..	Top grid V2 (Z14) and diode socket V3 (HD14)	—	1 megohm. (L7—4.0 ohms.) (L9—4.0 ohms.)
L8 ... ..	Anode socket V2 (Z14) and H.T.+ pin of battery plug.	—	4.0 ohms.
For transformers, and other valve socket to chassis resistances	See circuit diagram and Valve Table.		





## SPARE PARTS LIST

### INDUCTANCES.

Part No.	Description of Part.
31501B	L1—Frame aerial.
31407A	L2—L.W. aerial coil.
31407B	L3—M.W. oscillator coil.
31407G	L4—M.W. oscillator coil.
26330CK	L5—L.W. oscillator coil.
26330CL	IFT1—including L6, L7, TC5 and TC6.
19255S	IFT2—including L8, L9, TC7 and TC8.
	TI—Output transformer.

### CONDENSERS.

—	TC1—See VCI and 2.
31486A	TC2—L.W. coil trimmer.
	TC3—M.W. osc. coil trimmer.
	TC4—L.W. osc. coil trimmer.
	VCI.
20735B	VC2.
22164D	C1—15 mmfd.
24900AA	C2—0.1 mfd.
24900W	C3—0.05 mfd.
22164K	C4—75 mmfd.
28444P	C5—350 mmfd. $\pm 2$ per cent. (NA).
22164L	C6—100 mmfd.
24900W	C7—0.05 mfd.
24900W	C8—0.05 mfd.
17250R	C9—15 mfd. 9 v. electrolytic.

Part No.	Description of Part.
17250K	C10—8 mfd. 125 v. electrolytic.
28444H	C11—500 mmfd. $\pm 2$ per cent.
24900G	C12—0.0035 mfd.
22164J	C13—50 mmfd.
28444C	C14—150 mmfd.
28444C	C15—150 mmfd.
28444C	C16—150 mmfd.
28444C	C17—150 mmfd.

### RESISTANCES.

24150P	R1—1 megohm, $\frac{1}{4}$ w.
24150J	R2—50,000 ohms., $\frac{1}{4}$ w.
24150AJ	R3—0.15 megohm, $\frac{1}{4}$ w.
24150S	R4—7,500 ohms, $\frac{1}{4}$ w.
19202M	R5—0.23 megohm.
24150J	R6—50,000 ohms.
24150P	R7—1 megohm, $\frac{1}{4}$ w.
24150AM	R8—2.3 megohms, $\frac{1}{4}$ w.
24150BA	R9—1,000 ohms $\pm 5$ per cent., $\frac{1}{4}$ w.
19202CK	R10—5.0 megohms.
19202M	R11—0.23 megohm.
27655EU	VRI—2 megohms.

### SWITCHES, ETC.

20736B	SI—Wave change/On-Off switch.
20750A	LSI—Loudspeaker.

Order spare parts from :—

E.M.I SERVICE LTD.,

SHERATON WORKS,

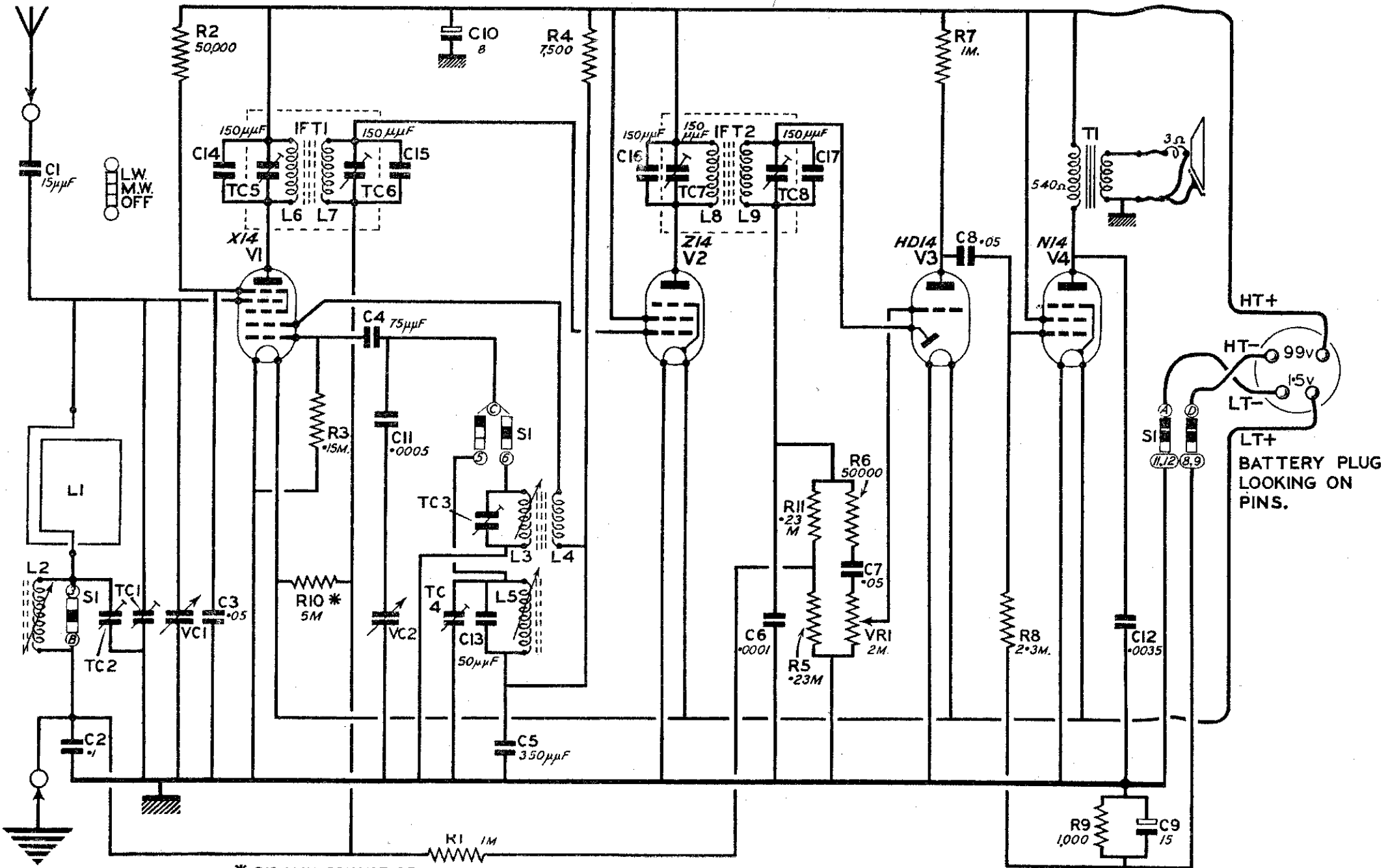
HAYES, MIDDLESEX.

Telephone : Southall 2468.

Telegraphic Address : Service, Hayes, Middlesex.

*The right is reserved to make any modification without notice.*





NOTE: \*R10 MAY CONSIST OF TWO 2.3 RESISTANCES IN SERIES

HT+  
 HT- 99v  
 LT- 1.5v  
 LT+  
 BATTERY PLUG  
 LOOKING ON  
 PINS.