BUSH RADIO

Service Instructions

MODEL—BA.91

FOR BATTERY OPERATION

Front view of receiver

INDEX

SPECIFICATION

BASIC DESIGN.

A four valve battery operated superheterodyne with six tuned circuits. The frequency changer and I.F. amplifier are followed by a diode detector, A.F. amplifier and a pentode output valve. Negative feedback, taken from the output transformer secondary, is applied to the grid of the first A.F. amplifier and thus maintains the tone response at lower levels of volume.

VALVES.

Mullard -V1 ... KCF.30.
„ V2 ... KF.35.
„ V3 ... KBC.32.
„ V4 ... KL.35.
Filament voltage 2·0 V.
All valves have international octal bases.

BATTERIES.

High tension 120 volts.
Low tension 2 volt accumulator.

BATTERY CONSUMPTION.

H.T. 10·5 mA. at 120 volts.
L.T. 0·47 amps. at 2·0 volts.

INTERMEDIATE FREQUENCY.

465 Kc/s.

WAVERANGES.

Long	850—2,000	metres,	352·9 Kc/s.—150·0 Kc/s.
Medium	170— 560	metres,	1·76 Mc/s.—535·7 Kc/s.
Short	16— 50	metres,	18·75 Mc/s.— 6·0 Mc/s.

CONTROLS.

Front of cabinet :—
Left-hand knob ... On/Off switch and volume.
Right-hand knob ... Waverange switch.
Side of cabinet :—
Tuning.

AERIAL AND EARTH.

Sockets for connecting the aerial and earth are mounted on the left-hand side (back view) of the chassis. The top socket gives maximum sensitivity, and the centre socket maximum selectivity. The bottom socket is for the earth connection.

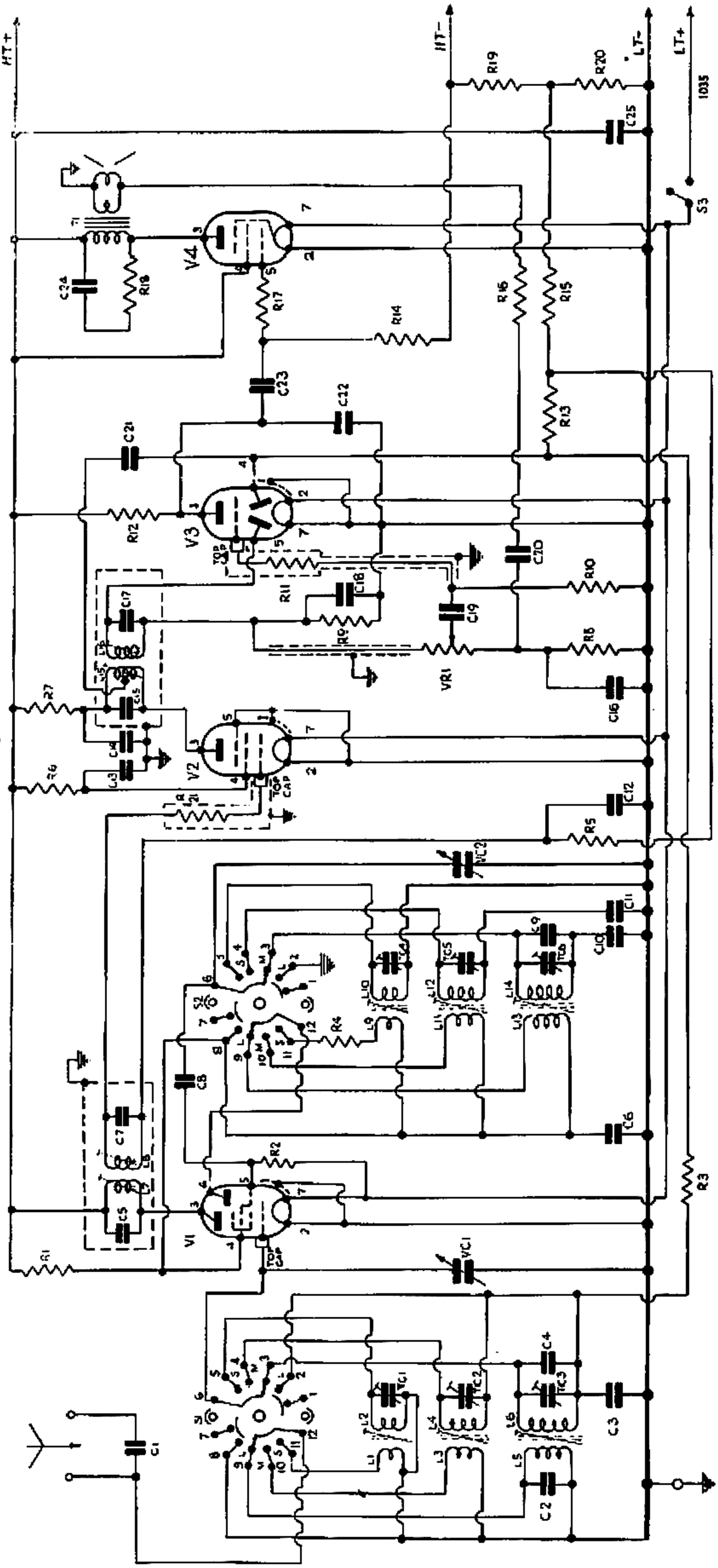
CABINET DIMENSIONS.

Height 9⅛ ins. Width 12⅝ ins. Depth 7⅞ ins.

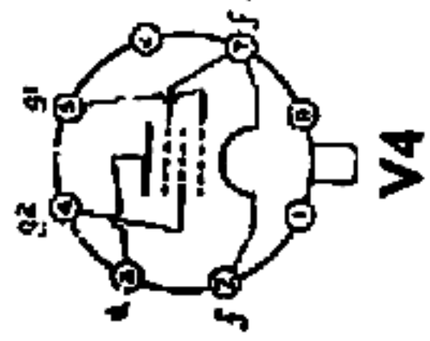
WEIGHT.

Approximately 11 lbs.

CIRCUIT DIAGRAM



VALVE BASE DIAGRAMS



The pin connections are shown as they would appear when the base or its holder is viewed from the underside of the chassis.

CAPACITORS

Ref.	Value mfd.	Value mmfd.	Tolerance ± %	Type	Working Voltage D.C.	Part No.	Description
C 1	—	50	20	Silver Mica	350	AP15067	Series aerial capacity.
C 2	—	800	20	Mica	350	P 3776	L.W. aerial shunt.
C 3	·05	—	20	Paper tubular	350	P 3770	V1 A.V.C. decoupling.
C 4	—	30	10	Silver Mica	350	AP15698	L.W. fixed trimmer.
C 5	—	110	2	,, ,,	350	AP13286	1st I.F.T. primary capacity.
C 6	·05	—	20	Paper tubular	350	P 3770	V1 screen and oscillator anode decoupling.
C 7		110	2	Silver Mica	350	AP13286	1st I.F.T. secondary capacity.
C 8	—	100	20	Mica	350	P 3775	V1 oscillator grid capacity.
C 9	—	180	2	Silver Mica	350	AP15734	L.W. oscillator fixed trimmer.
C10	—	390	1	,, ,,	350	AP15735	L.W. fixed padder.
C11	—	556	1	,, ,,	350	AP15731	M.W. fixed padder.
C12	·05	—	20	Paper tubular	350	P 3770	V2 A.V.C. decoupling.
C13	·05	—	20	,, ,,	350	P 3770	V2 screen decoupling.
C14	·05	—	20	,, ,,	350	P 3770	V2 anode decoupling.
C15	—	110	2	Silver Mica	350	AP13286	2nd I.F.T. primary capacity.
C16	0·1		20	Paper tubular	350	P 3771	Part of feedback circuit.
C17	—	110	2	Silver Mica	350	AP13286	2nd I.F.T. secondary capacity.
C18		100	20	Mica	350	P 3775	I.F. filter.
C19	·03	—	20	Paper tubular	350	P 8986	Coupling to V3 grid.
C20	·05	—	20	,, ,,	350	P 3770	Part of feedback circuit.
C21	—	50	20	Mica	350	P 3774	Coupling to A.V.C. diode V3.
C22	·002	—	25	Paper tubular	350	P 8931	I.F. by-pass.
C23	·03	—	20	,, ,,	350	P 8986	Coupling to V4 grid.
C24	·005	—	25	,, ,,	350	P 3767	Fixed tone corrector.
C25	2·0	—	25	,, ,,	250	P 3727	H.T. decoupling.

RESISTORS

Ref.	Value in Ohms	Rating in Watts	Part No.	Tolerance ± %	Description
R 1	22,000	½	P6695	20	V1 oscillator and anode decoupling.
R 2	47,000	½	P6779	20	V1 oscillator grid/filament return.
R 3	1 meg.	½	P7115	20	V1 A.V.C. decoupling.
R 4	68	½	P6065	20	Oscillator voltage reduction on S.W.
R 5	1 meg.	½	P7115	20	V2 A.V.C. decoupling.
R 6	220,000	½	P6947	20	V2 screen decoupling.
R 7	4,700	½	P6527	20	V2 anode decoupling.
R 8	15,000	½	P6659	10	Part of feedback circuit.
R 9	470,000	½	P7031	20	I.F. filter.
R10	4·7 meg.	½	P7283	20	V3 grid/earth return.
R11	100,000	½	P6863	20	V3 grid stabiliser.
R12	100,000	½	P6863	20	V3 anode load.
R13	1 meg.	½	P7115	20	Part of A.V.C. diode load V3.
R14	470,000	½	P7031	20	V4 grid/earth return.
R15	1 meg.	½	P7115	20	Part of A.V.C. diode load V3.
R16	2,200	½	P6443	20	Part of feedback circuit.
R17	100,000	½	P6863	20	V4 grid stabiliser.
R18	15,000	½	P6653	20	Fixed tone corrector.
R19	270	½	P6221	5	Part of bias resistor with R20.
R20	82	½	P6095	5	Part of bias resistor with R19.
R21	220	½	P6191	20	V2 grid stabiliser.
VR1	2 meg.	—	CP15017	—	Volume control with S3 ganged.

Owing to supply difficulties it may be found that the colour coding of some resistors does not correspond with the value shown in the above table. The measured value of the component fitted, however, will come within the tolerance of the specified resistance.

VARIABLE CAPACITORS

Ref.	Value mmfd.	Type	Part No.	Description
V.C.1	533	Ganged	P12422	Aerial circuit tuning.
V.C.2	533	Ganged	P12422	Oscillator circuit tuning.
T.C.1	3–40	" Postage Stamp "	P2937A	S.W. Aerial coil trimmer.
T.C.2	3–40	,,	,,	M.W. Aerial coil trimmer.
T.C.3	3–40	,,	,,	L.W. Aerial coil trimmer.
T.C.4	3–40	,,	,,	S.W. Oscillator coil trimmer.
T.C.5	3–40	,,	,,	M.W. Oscillator coil trimmer.
T.C.6	3–40	,,	,,	L.W. Oscillator coil trimmer.

DISMANTLING

Remove the tuning knob, the grub-screw of which is accessible from the inside of the cabinet.

Lay the receiver on its back and remove the waverange and volume control knobs by inserting a screwdriver through the large holes in the bottom of the cabinet and loosening the grub-screws.

Take out the two bolts which pass through the securing lugs at the extreme bottom corners of the chassis.

Withdraw the chassis from the cabinet.

NOTE.—When replacing the chassis ensure that the locating pins, projecting from the front of the chassis, are correctly positioned in the recessed cups in the cabinet and that each pin is fitted with its rubber pad.

The tuning scale can be taken out by unscrewing the two bolts holding the retaining clips. Note that rubber channels are fitted along the edges of the scale and also that there is a left and a right-hand retaining clip.

CIRCUIT ALIGNMENT

The use of a reputable signal generator with variable and modulated output is essential for accurate alignment of the R.F. and I.F. circuits.

A suitable dummy aerial should be connected in series with the output lead and the signal generator for each waverange. The dummy aerial may consist of a 400 ohm non-inductive resistor for the short waverange and a fixed capacitor of 200 mmfd. for the medium and long waveranges.

A sensitive output meter should be used as a visual indicator. To obtain the most accurate adjustment of the tuned circuits always use the lowest possible input to the receiver from the signal generator, with the volume control at maximum.

Check the position of the tuning pointer in relation to the ganged condenser ; when the plates are fully meshed the centre of the pointer should coincide with the two points at the extreme right-hand side of the pulley mounting plate next to the waverange indicator.

INTERMEDIATE FREQUENCY CIRCUITS 465Kc/s.

Set the receiver to the medium waverange, with the tuning control at approximately 300 metres. Do not connect an aerial to the receiver.

Set the signal generator to 465 Kc/s. and connect it to V2 control grid (top cap). Adjust L16 and L15 in that order. Transfer the signal to V1 control grid (top cap) and adjust L8 and L7. With the signal still applied to V1 control grid make a finer adjustment of L16, L15, L8 and L7, and repeat in the reverse order for a final adjustment.

RADIO FREQUENCY CIRCUITS.

Short Waverange. 16 to 50 metres (18·75 6 Mc/s.)

1.—Set the generator to 25m. (12 Mc/s.) and connect via the dummy aerial to the sensitive aerial socket of the receiver.

2. Tune the receiver to 25m., or set the right-hand edge of the pointer against the 25m. mark on the calibration scale.

3.—Adjust TC4 (oscillator) and TC1 (aerial) for maximum output.

4.—Check calibration on 50m. (6 Mc/s.)

Medium Waverange. 170 560 m. (1·76 Mc/s.- 535·7 Kc/s.)

1.—Set the signal generator to 200 m. (1500 Kc/s.) and connect via the dummy aerial to the sensitive aerial socket.

2.—Tune receiver to 200 m., or set the right-hand edge of the pointer against the 200 m. mark on the calibration scale.

3.—Adjust TC5 (oscillator) for maximum output.

4.—Re-tune signal generator and receiver to 300 m. (1000 Kc/s.) and adjust TC2 (aerial) for maximum output.

5.—Check calibration on 500 m. (600 Kc/s.)

Long Waverange. 850–2,000 metres (352·9- 150·0 Kc/s).

1.—Set signal generator to 1000 m. (300 Kc/s.) and connect via the dummy aerial to the sensitive aerial socket.

2.—Tune receiver to 1000 m. (300 Kc/s.), or set the right-hand edge of the pointer against the 1000 m. mark on the calibration scale.

3.—Adjust TC6 (oscillator) and TC3 (aerial) for maximum output.

4. Check calibration on 2000 m. (150 Kc/s)

SERVICING NOTES

Before proceeding to locate a fault in the receiver it is important to ensure all valves are up to standard and are making good contact in their holders.

Voltage readings should be checked on all valves. The windings of the output transformer and speaker speech coil should be checked for continuity, short-circuit, etc.

If these preliminary tests give satisfactory results apply an A.F. signal to the control grid of V3 to check stages V3 to V4. If there is little or no output check all the components from the anode resistor V3 to the grid of V4, including the cathode circuits of both valves.

To check the R.F. section of the receiver commence with the I.F. stage V2. Inject a 465 Kc/s. signal (modulated) into the control grid of V2 (top cap) and if the output of the receiver is low check the 2nd. I.F. transformer, the decoupling components of V2, the A.V.C. components, and the detector and input circuits of V3.

To check the 1st. I.F. transformer transfer the 465 Kc/s. signal to the hexode anode of V1. No greater output should be expected than from the previous test. If it is greatly reduced check the 1st. I.F. transformer and the input circuit to V2.

Apply an R.F. (modulated) signal, within the limits of the particular waverange, to the grid of V1. If the signal can be tuned the oscillator circuits are correct, and the aerial circuits should be checked. If the circuit cannot be tuned inject into the oscillator grid of V1 an unmodulated signal which is 465 Kc/s. higher than the frequency of a station known to be transmitting. If this station can be tuned at its correct position on the tuning scale the oscillator circuits would appear to be at fault.

COMPONENTS AFFECTING CALIBRATION :—

Short Waverange —TC4, L9, L10.
Medium Waverange—TC5, L11, L12, C11.
Long Waverange —TC6, L13, L14, C9, C10.

DECOUPLING AND BIAS COMPONENTS:

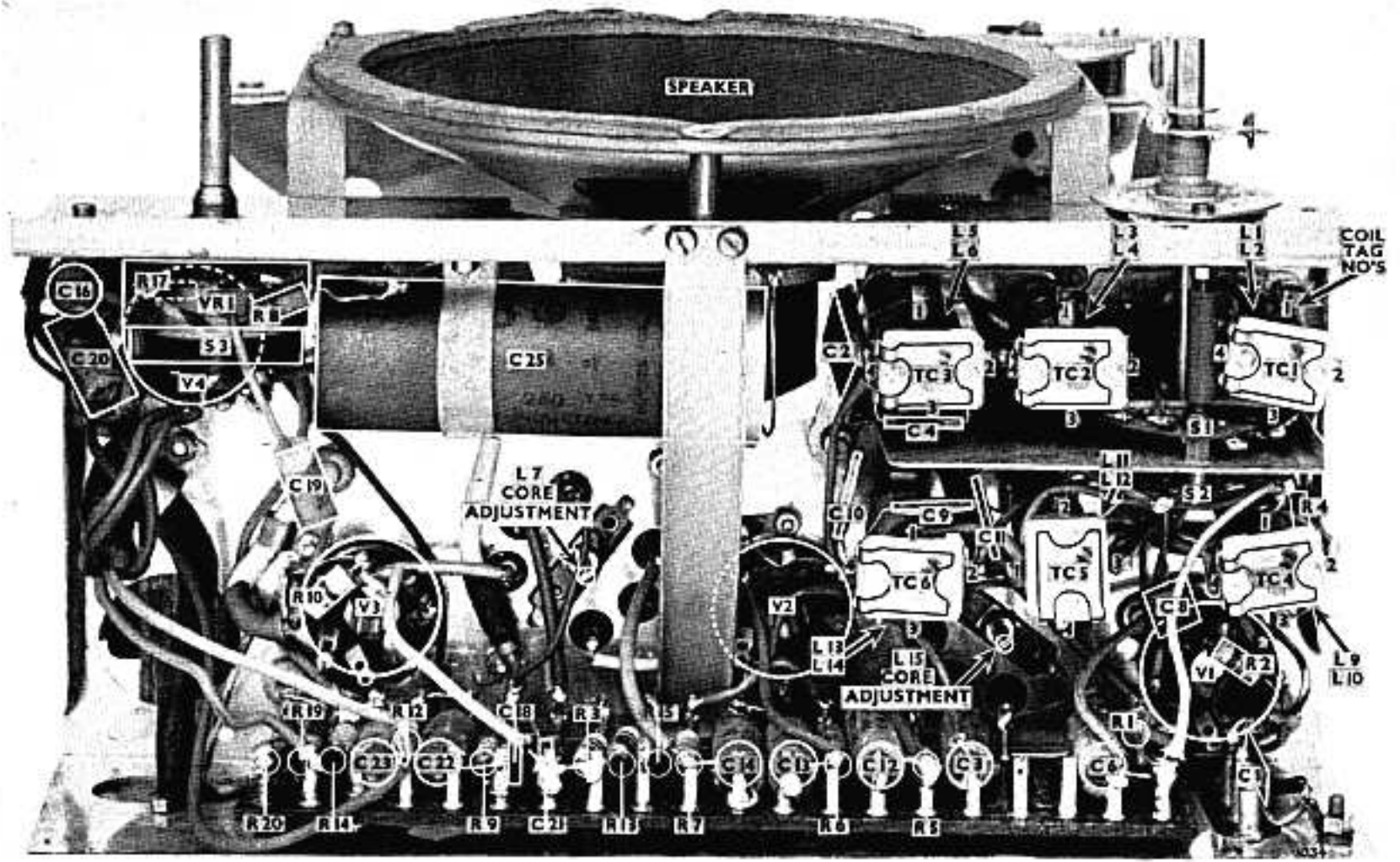
V1. Screen and Oscillator Anode— R1, C6.

V2 Anode—R7, C14. Screen— R6, C13.

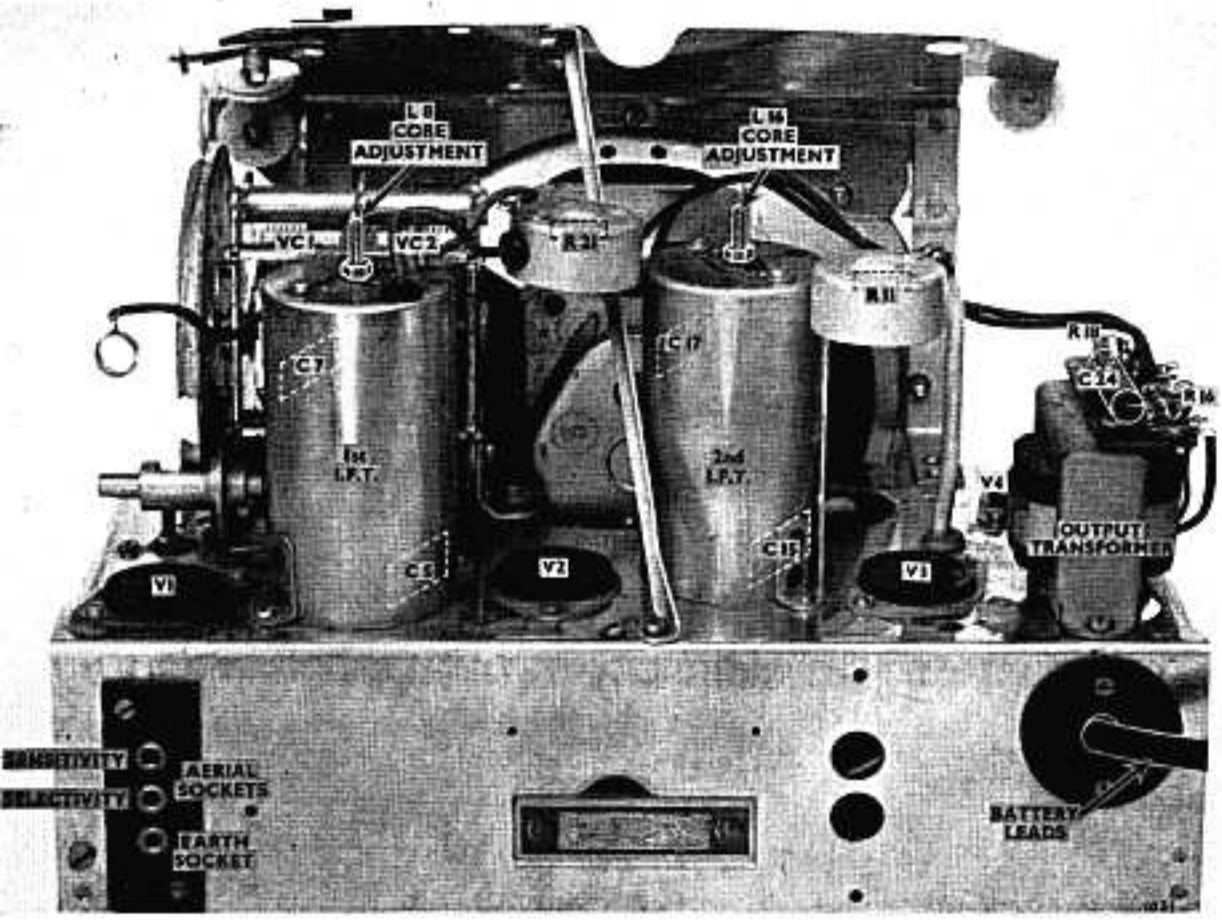
V4 Bias—R19, R20. (R20 also provides bias for V1, and V2).

A.V.C. LINE COMPONENTS :—

C3, C12, C21, R3, R5, R13, R15.



Under chassis view of receiver



← TOP VIEW OF BA.91 RECEIVER.

OUTPUT TRANSFORMER

Part No. CS.16071.

D.C. resistance:— Primary 525 ohms.
Secondary 0·37 ohms.

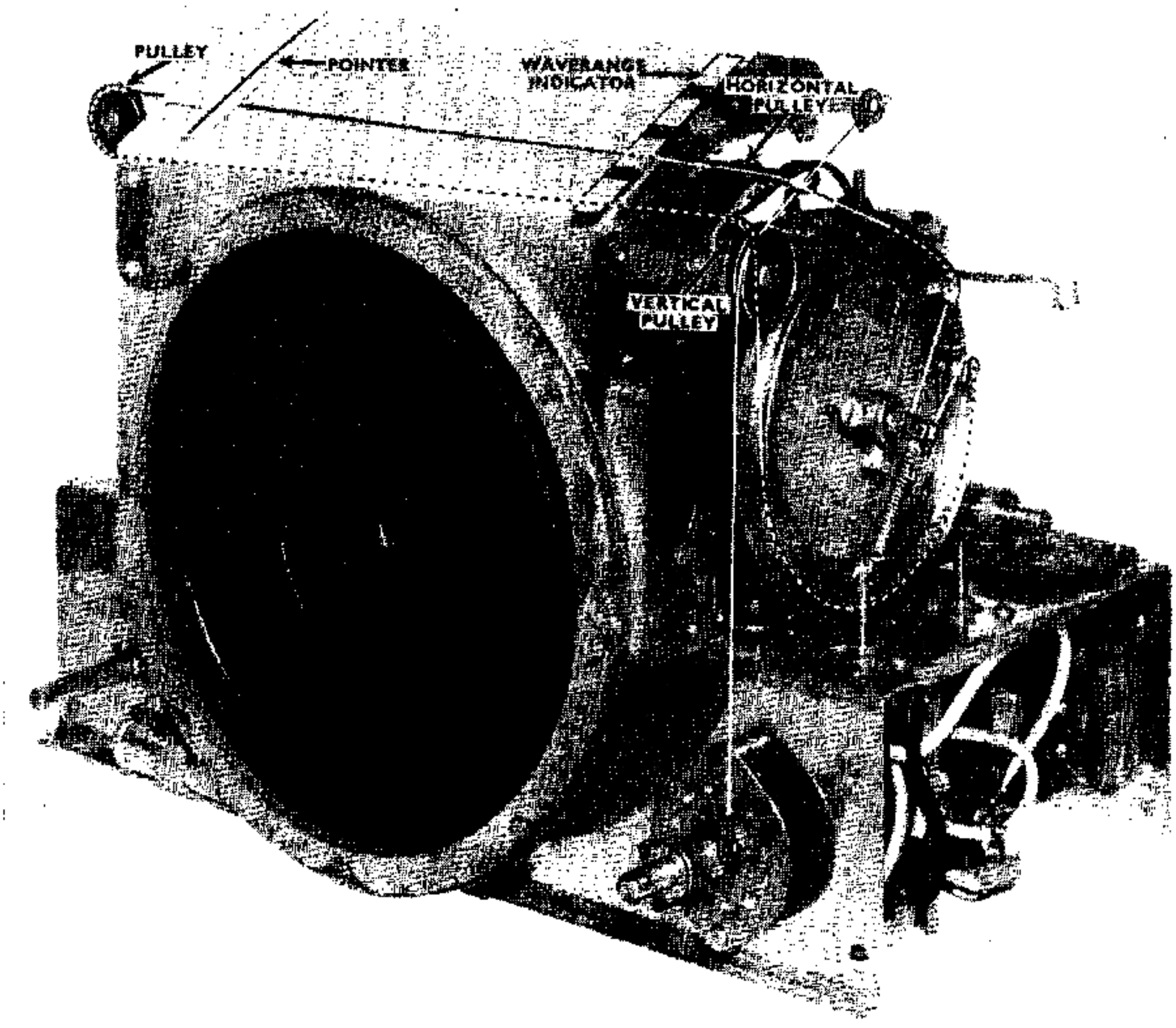
Ratio : 86-1.

Inductance : Primary 20 henrys at 400 cycles 10 volts with 5 mA. D.C. flowing.

SPEAKER

Part No. PI2498.

Speech coil D.C. resistance 2·5 ohms.



View showing wire drives

FITTING WIRE DRIVES

Part Numbers :—

Wire and anchor for tuning drive	S12717
Drive pressure spring	P8240
Wire and eyelets for waverange indicator ...	S12721

The wire drive for tuning is 32 ins. long, and after clenching in the anchor 30⅝ ins.

When replacing a wire drive remove the screw holding the rear scale frame support.

Detach the pointer from the old drive by easing over the two small clips on the back of the pointer.

Turn the variable condenser until the plates are fully open. With the anchor of the new wire attached to the spring pass the wire round the drive wheel clockwise, bringing it over the vertically mounted pulley at the back of the scale assembly on the right-hand side. Bring the wire behind the scale to the pulley at the left-hand side and back across the top of the scale to the horizontally mounted pulley. From there pass the wire over the top of the drive wheel. Turn the drive wheel once or twice to ensure that the wire is travelling properly.

With the plates of the variable condenser fully meshed, place the pointer on the scale so that the centre line coincides with the two points at the extreme right-hand side of the calibration scale next to the waverange indicator.

Tighten the clips of the pointer on the wire.

The wire drive for the waverange indicator is 7¼ ins. measured between the centres of the eyelets.

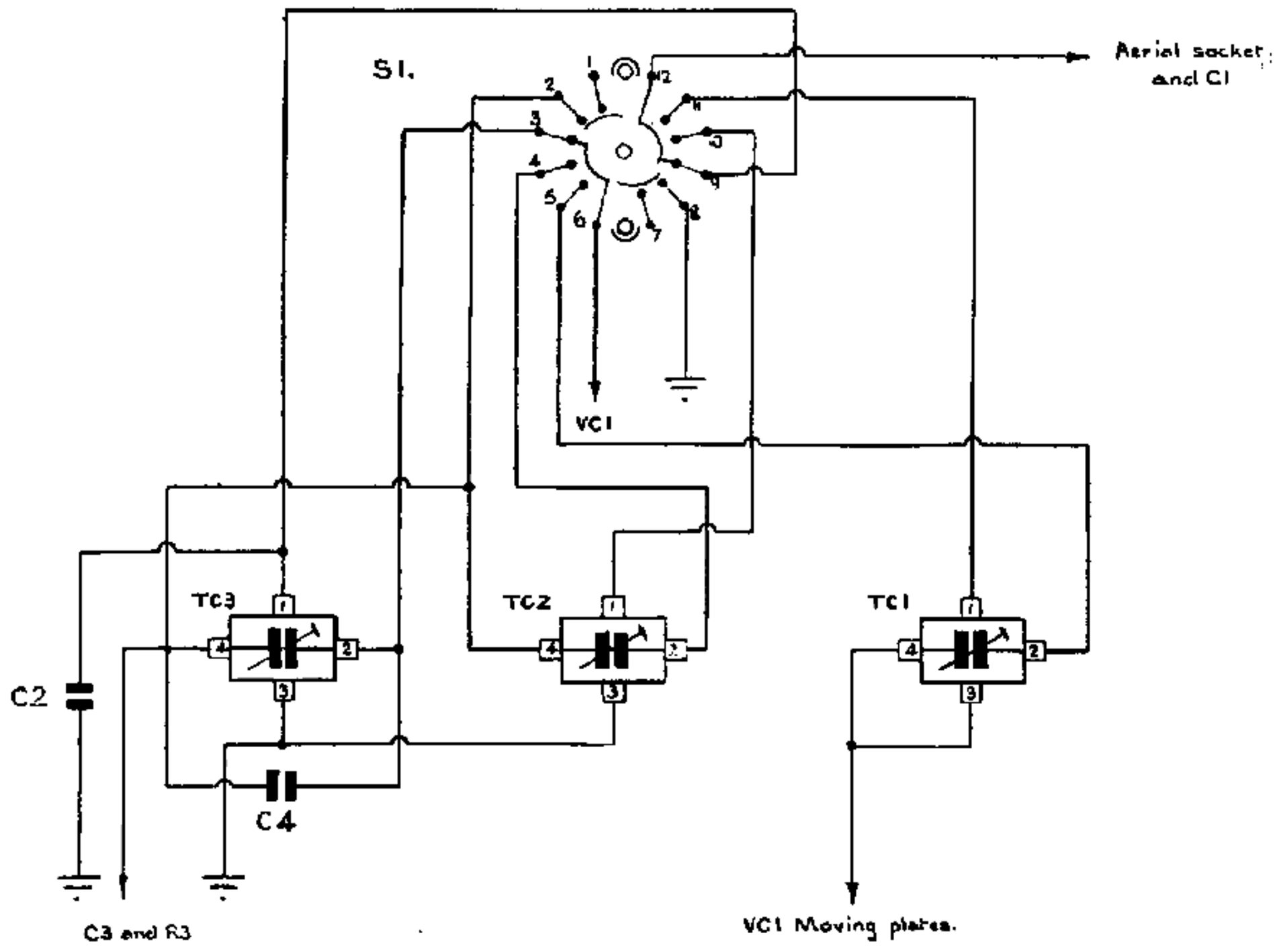
Turn waverange switch fully anti-clockwise, hook the wire on to the indicator lever and adjust the arm on the switch spindle until the wire is taut without pulling the indicator.

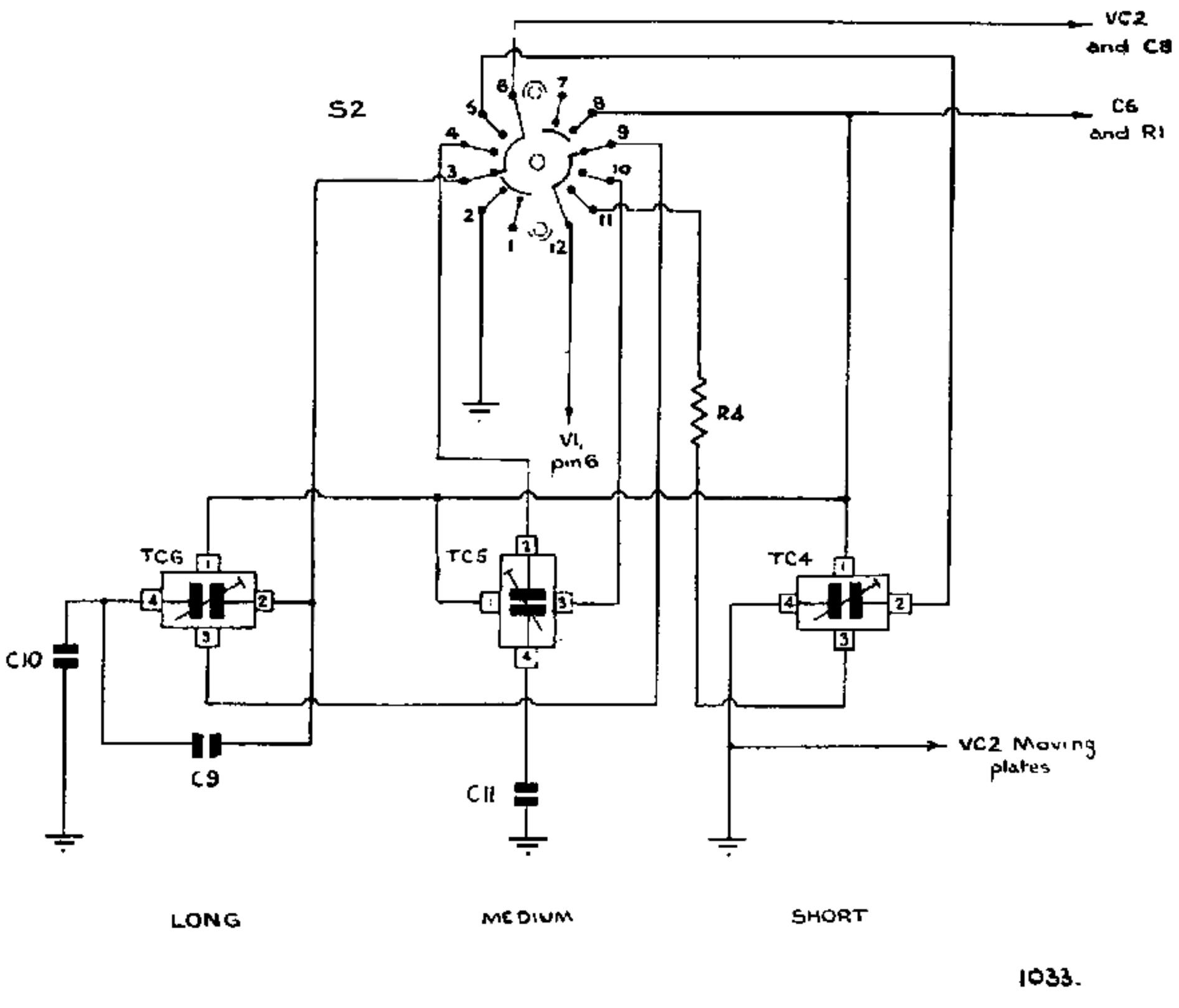
VALVE DATA

H.T. 120 volt battery.
L.T. 2 volt accumulator.
All measurements taken on an Avometer Model 7, 400 volt range with *chassis negative*.

Valve	Electrode	Pin No.	Voltage
V1	Hexode Anode	3	115
	Screen	4	50
	Oscillator Anode	6	50
V2	Anode	3	108
	Screen	4	35
V3	Anode	3	60
V4	Anode	3	113
	Screen	4	116

Bias voltage across R19 and R20 (Chassis *positive*) 3·8 volts.
H.T. consumption 10·5 mA.
L.T. consumption 0·47 A.





Wiring diagram of coil deck

COIL CONNECTIONS

Coil Tag Numbering.--Looking at the trimmer end of the coil with the hinge of the moving plate on the left tag No. 1 is at the top and tags Nos. 2, 3 and 4 follow in a clockwise direction.

Switch Tag Numbering.—Switch tags are numbered in an anti-clockwise direction when viewed from the front of the chassis, tag No. 1 being on the right-hand side of the mounting screw near the base of the coil deck.

COIL DATA

Ref.	Approx. D.C. Resistance	Part No.	Description
L. 1	Under ½ ohm.	S12733	S.W. Aerial coupling.
L. 2	" " "		S.W. Aerial tuning.
L. 3	0·6	S12737	M.W. Aerial coupling.
L. 4	4·0		M.W. Aerial tuning.
L. 5	32·0	S12739	L.W. Aerial coupling.
L. 6	16·0		L.W. Aerial tuning.
L. 7	5·0	S12680	1st I.F.T. primary.
L. 8	5·0		1st I.F.T. secondary.
L. 9	Under ½ ohm.	S12733	S.W. Oscillator coupling.
L.10	" " "		S.W. Oscillator tuning.
L.11	0·6	S12738	M.W. Oscillator coupling.
L.12	3·2		M.W. Oscillator tuning.
L.13	1·5	S12740	L.W. Oscillator coupling.
L.14	4·0		L.W. Oscillator tuning.
L.15	5·0	S12683	2nd I.F.T. primary.
L.16	5·0		2nd I.F.T. secondary.

LIST OF PART NUMBERS

The following part numbers are not shown elsewhere in this manual.

When ordering replacements or spare components please quote :—

(a) Type and serial number of receiver.
(b) Part number and description of item.
(c) Quantity required.

Battery lead	CS16072
Cabinet	AP15087
Cabinet back	DP16077
Grid Cap V2	S9116D
Grid Cap V3	S9389A
Knob, large	P12814
Knob, small	P12993
Pointer	S12714
Scale clip, left-hand	P12482
Scale clip, right-hand	P12483
Tuning scale	P12778

ERRATUM : MODEL BA.91

Resistors, page 3. The description of R3 should read : "Screen and oscillator anode decoupling."