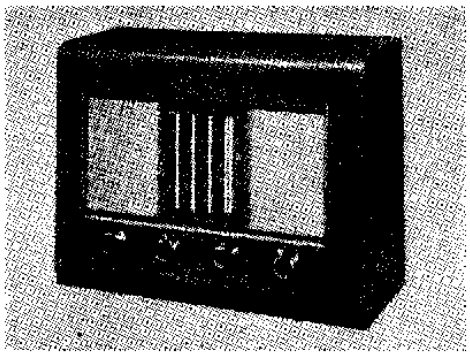
Test Report

BUSH Model BE15

battery radio receiver

R51 **BUSH BE15**



THE table receiver covered in this report is an all-dry battery-operated superhet in which special attention has been given to reception on short waves. The waveband coverage is: S.W.1, 21.25—28 Mc/s; S.W.2, 14.75—21.25 Mc/s; S.W.3, 9.25—14.75 Mc/s; S.W.4, 3.10—9.25 Mc/s; M.W., 525—1604 kc/s (187-570 metres). There is no long waveband. The makers are Bush Radio, Ltd., Power Road, London, W.4.

CIRCUIT DETAILS

This is a conventional type of 5-valve battery receiver using a superheterodyne circuit. The valve sequence is as follows: pentode r.f. amplifier, heptode frequency changer, pentode i.f. amplifier, diode-pentode detector and a.f. amplifier, and l.f. pentode audio output stage feeding an 8-in. permanent magnet moving-coil speaker.

A 3-gang variable capacitor is used to tune the aerial, r.f. and oscillator circuits to all five wavebands. Series capacitors (C1, C8 and C17) are connected in series with the gang sections on the three highest frequency wavebands to provide a suitable degree of band-spreading; these capacitors are shorted in the S.W.4 and M.W. wavebands. All the tuning coils have variable iron dust cores, and are separately switched into circuit for each waveband; during alignment, however, they must be adjusted in the correct order. In order that absorption effects are not troublesome on the short wavebands, all lower frequency coils than the three in use are short-circuited.

Automatic gain control is applied to the r.f., f.c. and i.f. stages, the a.g.c. voltage being obtained from the diode detector load circuit. There is no delay voltage.

Bias for the audio output stage is developed across R18 which is in series with the negative h.t. input.

SERVICE SNAPS OF THE BUSH BE15

Valves: DF91 (r.f.), DK40 (f.c.), DAF91 (det. and a.f.), DL94 (output).
I.F.: 465 kc/s.
Volume Control: 500 kΩ with d.p. switch.
Tone Control: 50 kΩ.
Electrolytics: One 8μF (150 volts), one 50μF (12 volts).
Battery Supply: Separate 90-volt h.t. and 1.5 volt l.t. batteries.

DISMANTLING

Chassis Removal

Turn the tuning capacitor so that the scale pointer and driver are midway between the two pulleys, then lift the driver off the carriage.

Now remove the four control knobs and disconnect the speaker and tone control plug from the chassis, and take out the two screws from the locating brackets; the chassis can then be withdrawn.

When replacing the chassis, see that the locating brackets are fitted with their rubber grommets, and then ensure that the chassis locating pins are correctly positioned in the cabinet.

Replacing the Scale

It is not necessary to remove the chassis. Depress the scale retaining strip (lower front of scale). Gently lever out the scale using a screwdriver inserted beneath junction strips, releasing retaining springs at each side. Fit old junction strips on to new scale. Insert new scale, top foremost, into scale frame clip the retaining springs and scale junction strip, and press the scale into position. Finally lift the lower retaining strip to secure the new scale.

Dismantling Coil Deck

Individual coil and trimmer assemblies can be removed if desired. First remove the switch spindle, making sure that the switch wafer alignment is not disturbed—in particular note position of contacts on removed assemblies. Loosen the screws securing the appropriate mounting plate, and unsolder the leads—there are about five of these in each section—making a note of their destinations; when replacing the assemblies do not overlook the earthing braid from the appropriate tuning capacitor sections to the earth. tag on the mounting plate.

FITTING CORD DRIVE

The length of the drive cord, *after clenching in the anchor*, is 35½in.

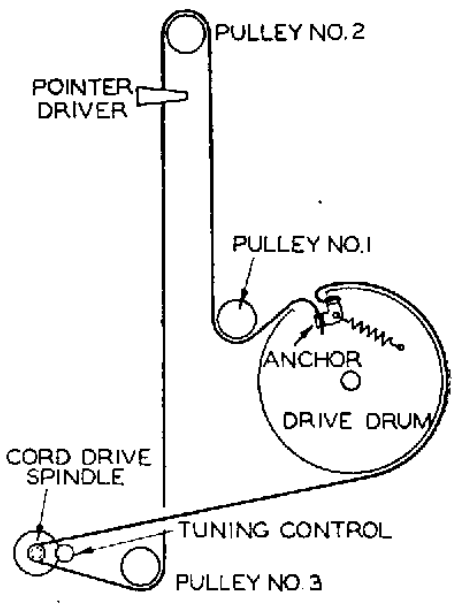
Detach the C-washer from beneath the flywheel, and remove the flywheel, then the tuning spindle while still attached to its cover plate (4 screws), leaving the drive spindle in position. Then remove the tension clip for the drive-cord spindle which is located beneath the chassis.

Set the gang capacitor to minimum, and see that the drive drum is in the position shown in the diagram.

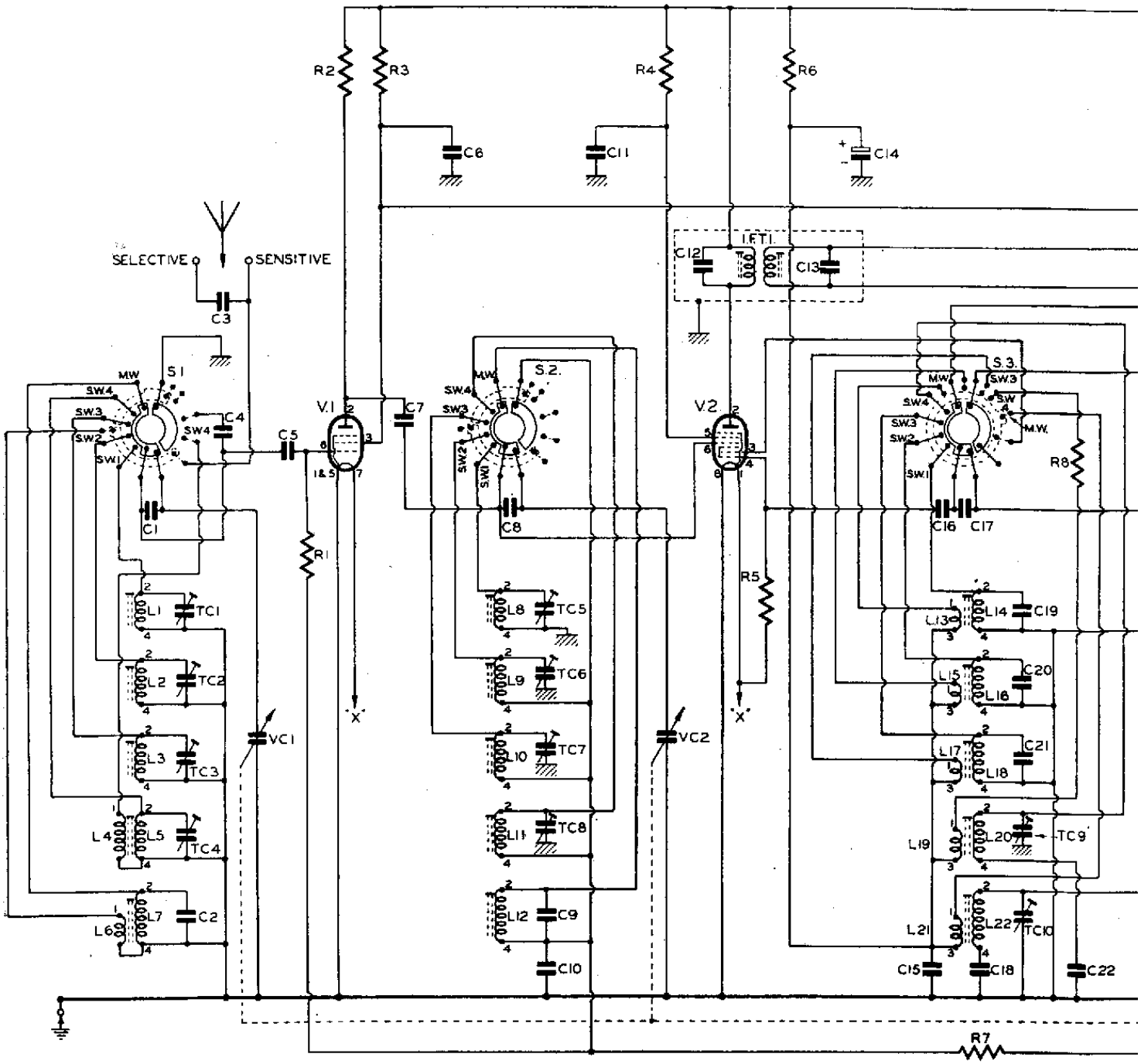
Hook the drive cord spring into the drive drum, attach the anchor and cord, and pass the cord through the slot in the drum. Fit the cord over the pulleys (Nos. 1, 2 and 3) as shown, making 3 turns round the drive spindle, the first being nearest to the chassis. Then replace the tuning spindle (with cover plate), the drive spindle tension clip, the flywheel and finally the C-washer.

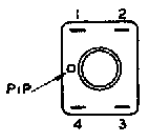
Complete the fitting of the drive cord round the drive drum. Spin the flywheel, and see that the drive is satisfactory, then set the gang capacitor to midway, and temporarily attach the pointer driver to the centre of the drive cord.

(continued on page 3)

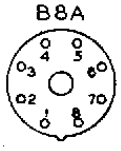


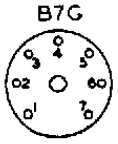
Circuit of the Bush BE15 battery radi





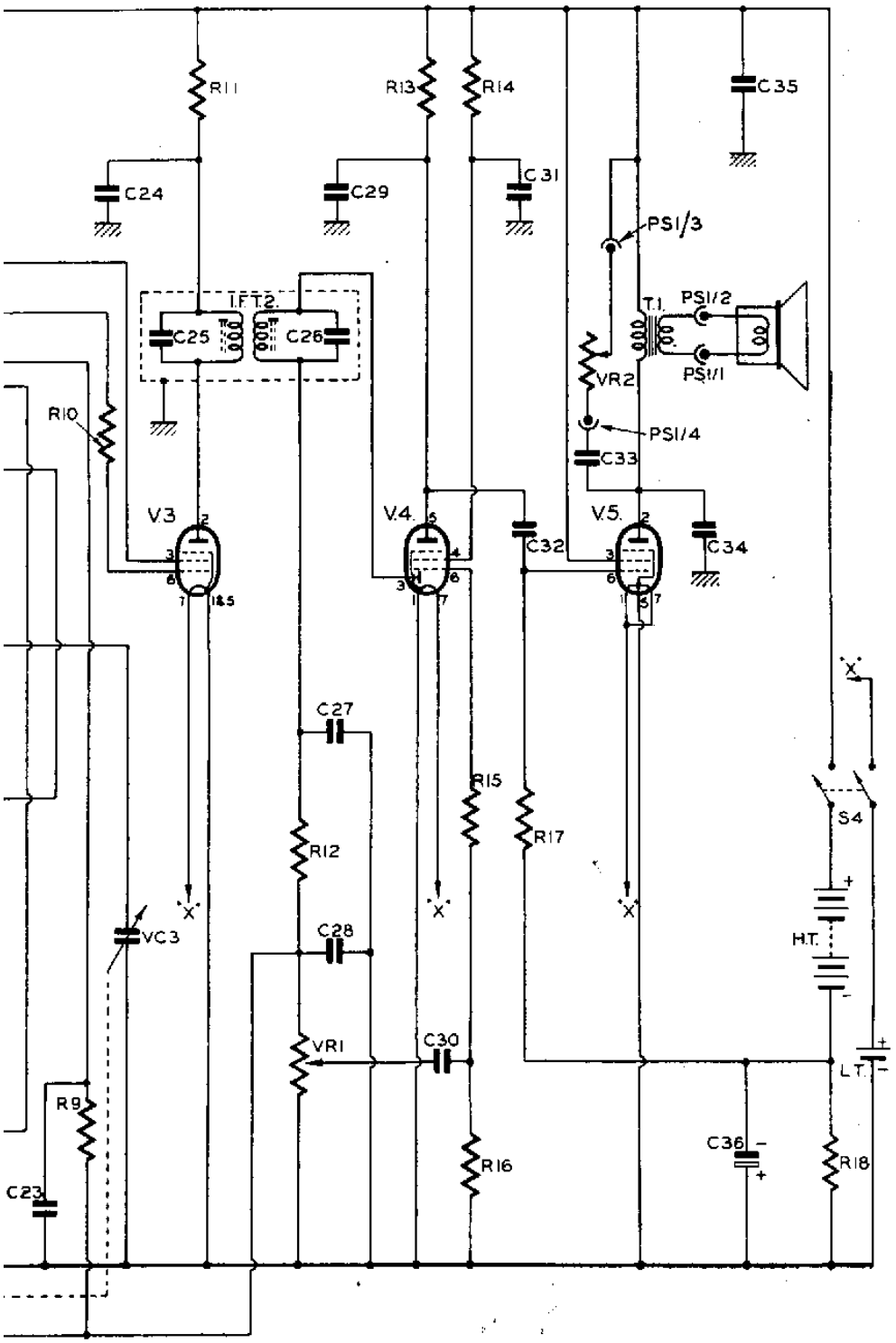
COIL FORMER SHOWING PIN NUMBERS

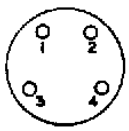




KEY TO VALVE BASES VIEWED FROM UNDERSIDE

o receiver





4 PIN PLUG & SOCKET
VIEWED FROM UNDERSIDE.

CORD DRIVE—*continued*

Fit the chassis into its cabinet, and insert the pointer driver into its carriage. Set gang capacitor to maximum, and align pointer with datum spot on the top of the tuning scale; then clench pointer driver clip tightly to the drive cord.

BATTERIES

Separate h.t. and l.t. batteries are required. Any type of h.t. battery can be used providing that the voltage applied to the receiver does not exceed 90 volts. Any type of 1.5 volts l.t. battery can be used providing that it is fitted with a suitable 2-pin connecting socket.

All h.t. and l.t. leads are clearly marked enabling the h.t. plugs or l.t. 2-pin plug to be removed in order that non-standard batteries can be used if necessary.

AUXILIARY POINTER

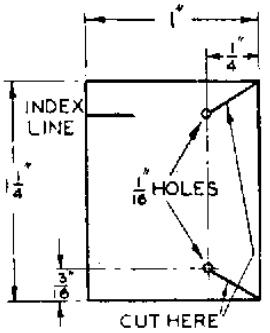


Diagram shows dimensions for auxiliary pointer for use in re-aligning receiver (see *Alignment Procedure* on Page 4). The pointer can be cut from cardboard, and is used in conjunction with the calibration marks on the chassis pulley support.

Component List

	CONDENSERS		RESISTORS (Value in ohms)	
C1	120pF 350V	C30	1000pF 350V	
C2	12pF 350V	C31	0.05μF 350V	
C3	50pF 350V	C32	0.005μF 350V	
C4	5.6pF 350V	C33	0.05μF 350V	
C5	100pF 350V	C34	0.002μF 350V	
C6	0.05μF 350V	C35	0.5μF 350V	
C7	50pF 350V	C36	50μF 12V	
C8	120pF 350V			
C9	8.2pF 350V	R1	470,000 ¼W	
C10	0.05μF 350V	R2	10,000 ¼W	
C11	0.05μF 350V	R3	22,000 ¼W	
C12	110pF 350V	R4	100,000 ¼W	
C13	110pF 350V	R5	33,000 ¼W	
C14	8μF 150V	R6	8,200 ¼W	
C15	0.005μF 350V	R7	1 Meg. ¼W	
C16	50pF 350V	R8	150 ¼W	
C17	120pF 350V	R9	2.2 Meg. ¼W	
C18	515pF 350V	R10	220 ¼W	
C19	65pF 350V	R11	10,000 ¼W	
C20	33pF 350V	R12	47,000 ¼W	
C21	15pF 350V	R13	470,000 ¼W	
C22	3600pF 350V	R14	2.2 Meg. ¼W	
C23	0.05μF 350V	R15	100,000 ¼W	
C24	0,05μF 350V	R16	4.7 Meg. ¼W	
C25	110pF 350V	R17	2..2 Meg. ¼W	
C26	110pF 350V	R18	510 ¼W.	
C27	100pF 350V	VR1	500,000	
C28	100pF 350V	VR2	50,000	

Alignment Procedure

Circuit alignment should only be carried out if the following equipment is available: an accurately calibrated signal generator with modulated and variable output, dummy aerial and a sensitive output meter, 3 ohms impedance.

As the tuning scale is fitted in the cabinet it is advisable to attach an auxiliary pointer to the drive cord since the chassis must be removed for alignment. This auxiliary pointer should line up with the upper datum mark on the pulley support (see page 3) when the ganged capacitor is at maximum. The other two calibration marks ("B" and "C") on the support are for alignment purposes, and correspond with the frequencies given below. Use lowest possible output from signal generator and set receiver volume control at maximum.

I.F. Alignment

Set the receiver to m.w., tuned to 1,500 kc/s (C). Unscrew all i.f. cores. Tune signal generator to 465 kc/s, and connect to V3 control grid (pin 6). Adjust I.F.T.2 sec and pri. (in that order) for maximum output. Connect signal generator to grid V2 (pin 6) and adjust I.F.T.1 sec. and pri. Do not readjust.

R.F. Alignment

(*Tune receiver in following order*): **M.W.:** Connect the signal generator, tuned to 600 kc/s, to the aerial (sensitivity) socket via 200pF, tune receiver to "B," adjust L22, L12 and L7 for maximum output. Tune the signal generator and receiver to 1,500 kc/s (C) and adjust TC10 (osc.). Now repeat at 600 kc/s (B) and 1,500 (kc/s (C)) and check calibration.

All S.W. Bands: Connect the signal generator to the aerial (sensitivity) socket via 400 ohms. Tune the signal generator to the stated low frequency, and receiver to calibration mark (B), and adjust osc., r.f. and aerial coils; then tune signal generator and receiver to the stated high frequency and the calibration mark (C), and adjust trimmer capacitors, rocking the gang capacitor, until no further improvement is obtainable.

Repeat adjustments to coils at low frequency and to trimmers at stated high frequency for optimum performance, then check calibration. Adjust in the following order:—

S.W.4: Tune to 3.5 Mc/s (B). Adjust L20, L11 and L5. Tune to 8.4 Mc/s (C). Adjust TC9, TC8 and TC4.

S.W.3: Tune to 9.3 Mc/s (B). Adjust L18, L10 and L3. Tune to 13.5 Mc/s (C). Adjust TC7 and TC3.

S.W.2: Tune to 14.9 Mc/s (B). Adjust L16, L9 and L2. Tune to 20 Mc/s (C). Adjust TC6 and TC2.

S.W.1: Tune to 21.5 Mc/s (B). Adjust L14, L8 and L1. Tune to 27 Mc/s (C). Adjust TC5 and TC1.

Note that two aerial and r.f. trimming positions can be obtained; the correct setting is with trimmers at *maximum* capacitance.

Valve Voltage and Current Readings

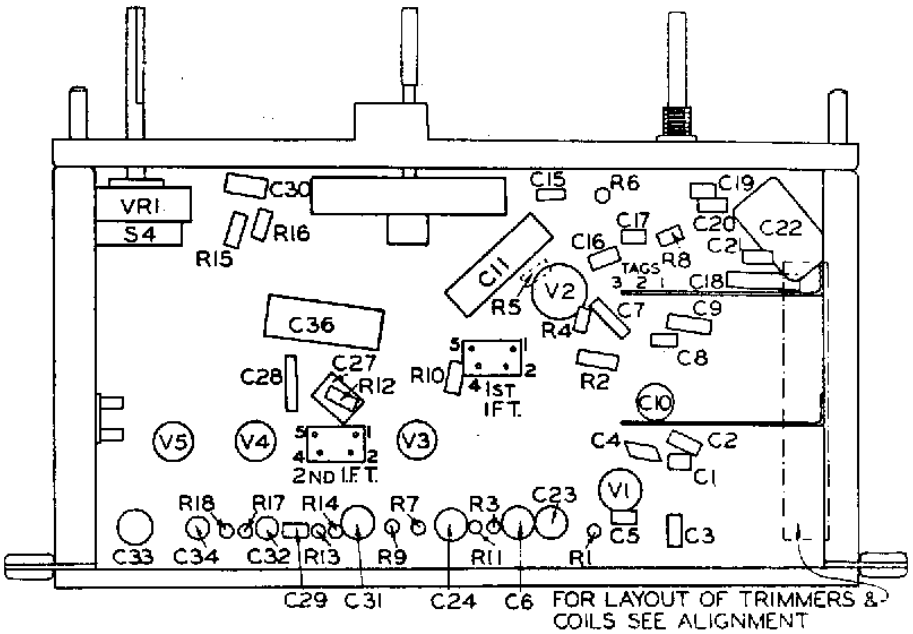
Valve Type	Anode Voltage	Anode Current mA	Screen Voltage	Screen Current mA	Osc. Anode Voltage	Osc. Anode Current mA
V1 DF91	65	1.8	45	0.7	—	—
V2 DK40	84	0.8	70	0.15	65	2.1
V3 DF91	60	1.8	45	0.8	—	—
V4 DAF91	10	0.12	5	0.02	—	—
V5 DL94	82	3.0	84	0.8	—	—

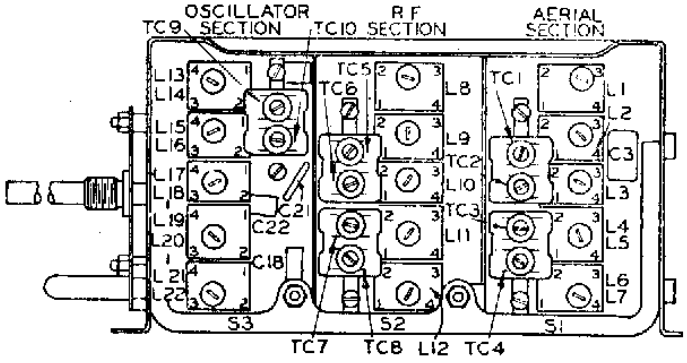
All measurements were taken with an Avometer Model 7, 1,000 and 10-volt ranges being used. Battery voltages were 90 and 1.5; 6 volts approximately are developed across R18.

Coil and Transformer Resistance Readings

Coil	L4	L6	L7	L12	L21	L22	All i.f. coils	T1 Pri
Resistance (ohms)	2.5	1.5	6.5	6.5	1.0	4.5	12.5	525

All other windings have a resistance of less than one ohm, and with the exception of the secondary of T1, are very much less. The primary/secondary ratio of T1 is 57.4:1; the primary inductance (at 400 c/s, 5mA d.c., and with no secondary load) is 20 Henrys.





ABOVE: Layout of underside of receiver chassis, showing location of major components.

LEFT: Layout of trimmers and coils at side of chassis. See Alignment Procedure.