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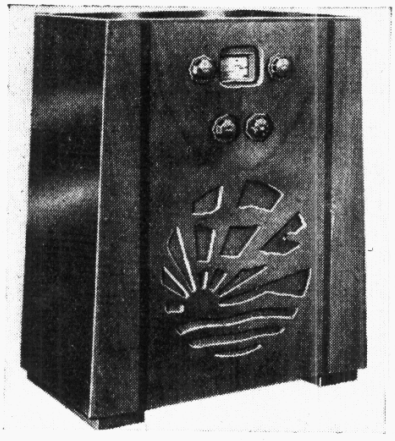
"TRADER" SERVICE SHEET 729

PYE E/B BATTERY SUPERHET



The Pye E/B battery superhet.

A SYSTEM of delayed AVC, using two westectors for detector and delay, is employed in the Pye E/B receiver, a 5-valve 2-band battery superhet with a class B output stage.

Special attention is called to the critical conditions associated with the frequency changing valve explained in col. 4 overleaf.

Release date and original price: 1933; £14 14s. *complete with batteries.*

CIRCUIT DESCRIPTION

Aerial input via switches **S2, S3** and equalising coils **L1, L2** to single-tuned circuit **L3, C16** (MW), plus **L4** (LW), which precedes the first valve **(V1, Mazda metallised S215VM),** a variable-mu RF tetrode operating as signal frequency amplifier.

The equalising coils are tapped into the aerial tuning coils. A local/distant device consisting of resistor **R1** and capacitor **C1** can be switched into circuit by switch **S1** to shunt the aerial circuit and prevent overloading **V1** on very strong signals.

Choke-capacitance RF coupling by **L5, C4** between **V1** and a second RF tetrode valve **(V2, Mazda metallised S215VM)** which operates as first detector frequency changer with filament (cathode) coupling, whose control grid circuit is tuned by **L6, C19** (MW), plus **L7** (LW).

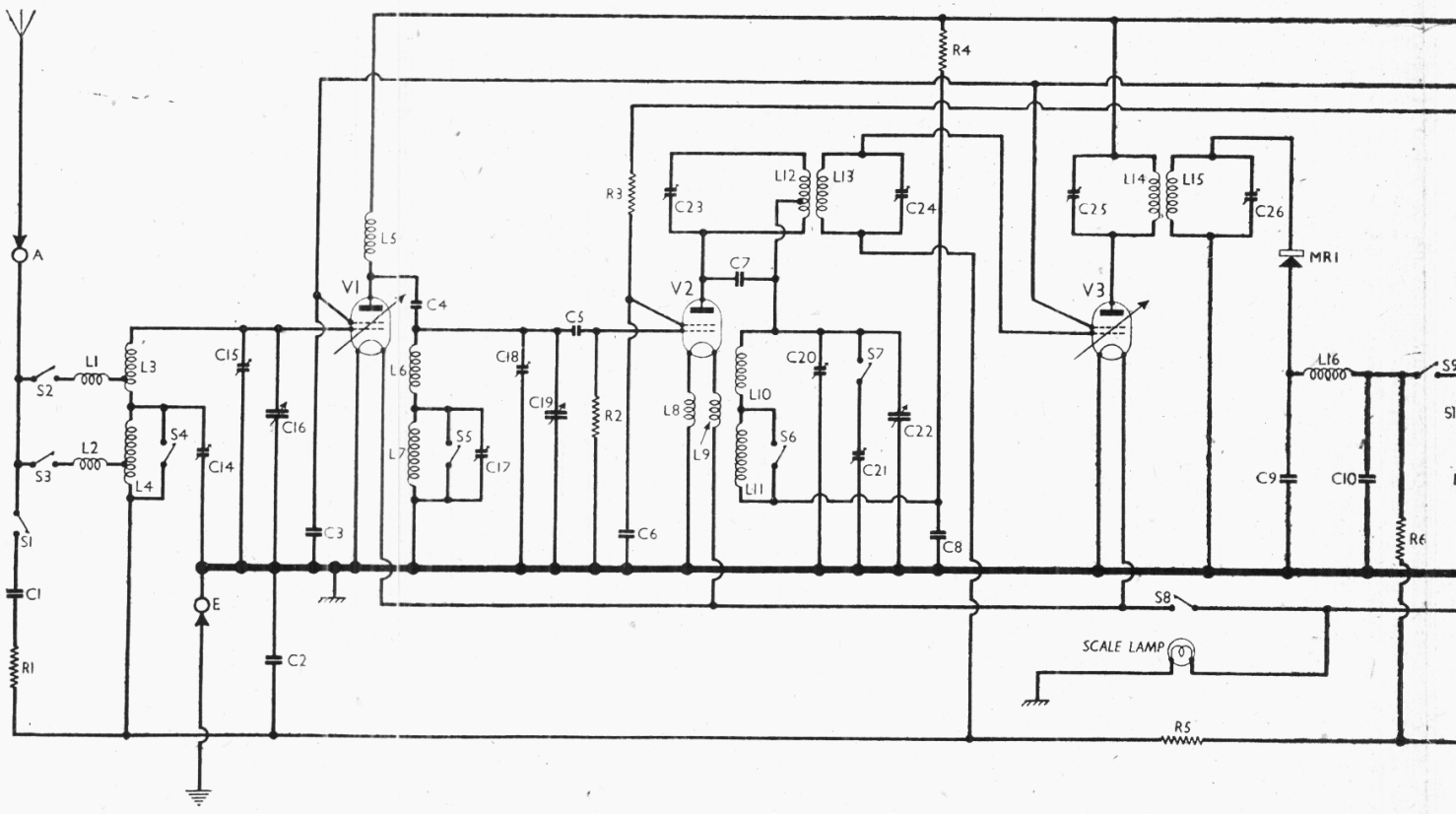
Oscillator tuning coils **L10** (MW) and **L11** (LW) are tuned by **C22.** Parallel trimming by **C20** (MW) and **C21,** via switch **S7,** (LW). Tracking is effected by specially shaped vanes of **C22.** Coupling from anode is via **C7** and a few turns of **L12;** coupling from filament is via coils **L8, L9** in filament leads to the valve.

Third valve **(V3, Mazda metallised S215VM)** is another variable-mu RF tetrode, operating this time as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C23, L12, L13, C24** and **C25, L14, L15, C26.**

Intermediate frequency 114 kc/s.

Diode second detector **(MR1, Westinghouse W6)** is a Westector RF metal rectifier. Audio-frequency component in rectified output is developed across the manual volume control **R7,** which also operates as load resistor, and passed via AF coupling capacitor **C11** and AF transformer **T1** to a triode valve **(V4, Mazda L2).**

IF filtering by **C9, C10** and choke **L16.** Provision for connection of gramophone pick-up, via switch **S10,** across **R7.** When the waveband control is switched to gram, **S10** closes, and **S8, S9** open to



Circuit diagram of the Pye E/B battery superhet. Owing to the method used for oscillator mixer coupling, the filament of **V2** is at RF p **MR2** is another Westector, operating in a special AVC delay system. **C27** is the variable tone control. On gram, S

mute radio. **S8** open-circuits the LT supply to **V1, V2** and **V3,** achieving economy in accumulator current. The scale lamp, which is run from the positive accumulator lead on the supply side of **S8,** thus remains alight in all three positions of the waveband switch control.

V4 operates as driver valve to double triode class B output valve **(V5, Mazda PD220),** to which it is coupled by a second intervalve transformer **T2.** Fixed tone correction between **V5** anodes by filter circuit **R8, C12.** Variable tone control by **C27** across secondary winding of **T1.**

The internal speaker is connected by means of plugs to the secondary of the output transformer **T3,** and sockets in the plugs permit an external low-impedance speaker to be connected at the same time. The internal speaker may be muted by withdrawing one of its plugs, and the associated external speaker plug then replaces it.

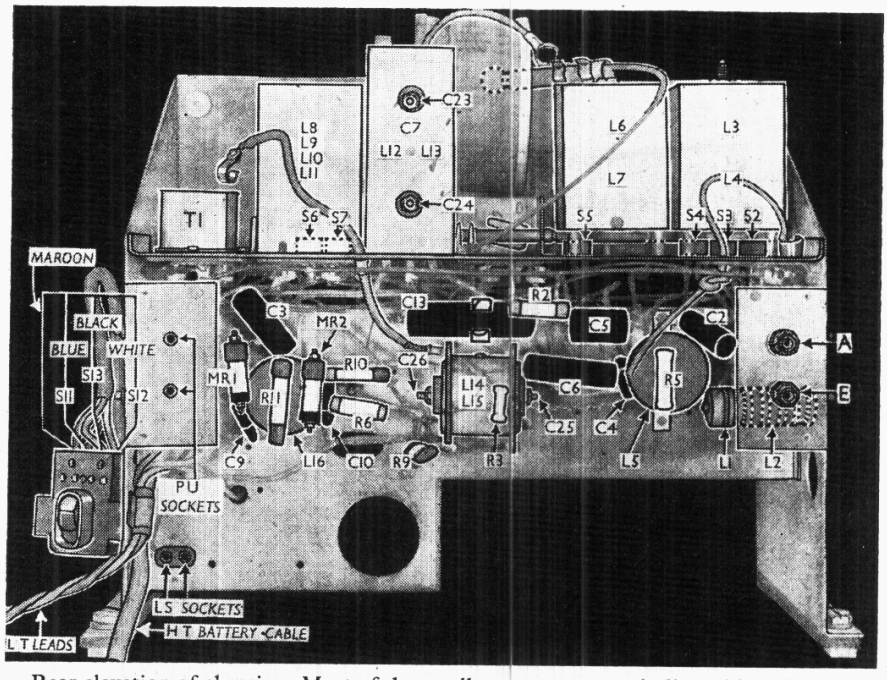
Fixed GB potentials for all valves except **V2** are obtained from a potential divider comprising resistors **R9, R10** and **R11** connected in series across the GB section of the HT battery.

The DC potential developed across **R7** is tapped off at the junction of **L16** and **S9** and fed back through **R6** and further decoupling filter **R5, C2** to control grids of the RF and IF amplifying valves, giving automatic volume control.

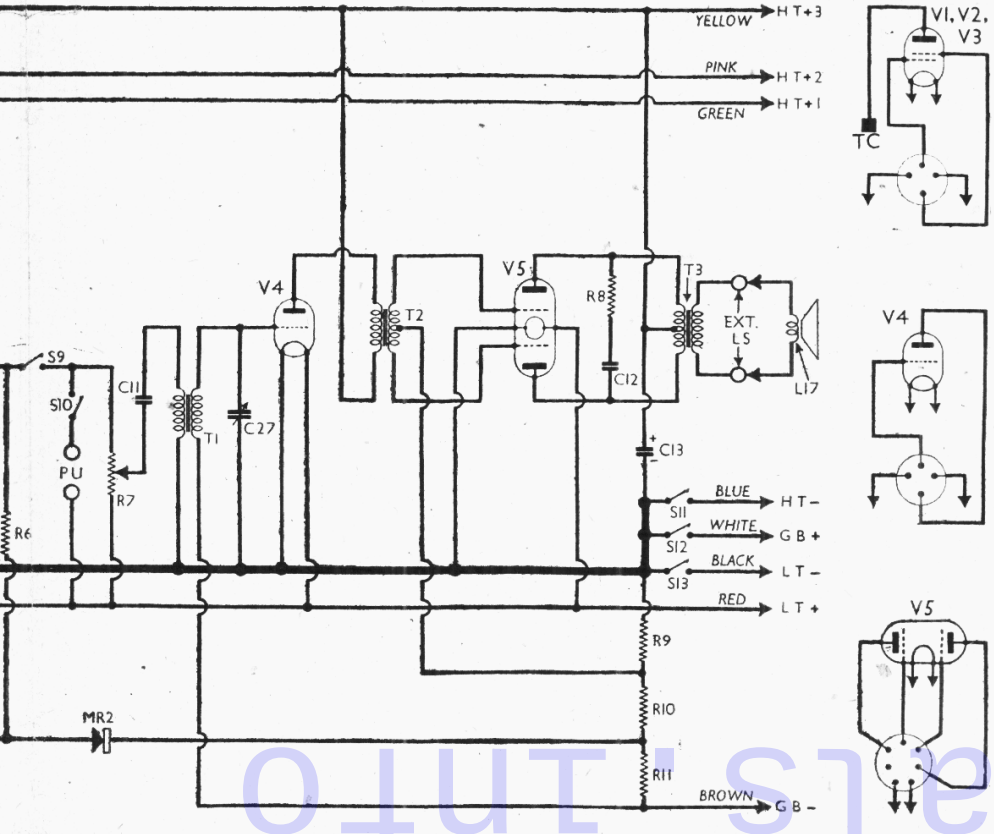
AVC action, however, is delayed by the introduction of a second Westector **(MR2, Westinghouse W2).** The positive side of **MR2** is connected to the junction of **R10** and **R11,** where it receives a negative bias of about 3 V with respect to chassis. Its negative side goes via **R6** and **S9** to **R7,** which is returned to the LT positive line, so that the no-signal potential across **MR2** is about 5 V.

Under these conditions **MR2** is conductive, using **R7** as its load resistor and producing a voltage drop across it with the negative potential at the **S9** end. Upon the arrival of a signal, current flowing from **MR1** also passes through **R7** in the same direction, and as the signal becomes stronger the negative potential at the 'top' of **R7** becomes greater, until it exceeds the potential at the junction of **R10** and **R11,** when **MR2** ceases to conduct.

Up to this point the AVC line potential has remained constant, but when this point is passed the AVC line follows the rising negative potential at the top of **R7.**



Rear elevation of chassis. Most of the small components are indicated here beneath the deck. Some of the switches are indicated above the deck.



RF potential above chassis. **MR1** is a Westector operating as second or AF detector; am, **S8** opens to break the LT supply to **V1, V2** and **V3** filaments.

COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	Local/distant capacitor ...	0·005
C2	AVC line decoupling ...	0·1
C3	V1, V3 SG's decoupling ...	0·1
C4	V1-V2 RF coupling ...	0·00005
C5	V2 CG capacitor	0·00002
C6	V2 SG decoupling ...	0·1
C7	Oscillator coupling ...	0·0003
C8	V2 anode decoupling ...	0·1
C9, C10	IF by-pass capacitors ...	0·0001, 0·002
C11	AF coupling to T1 ...	0·25
C12	Part tone corrector ...	0·0025
C13*	HT circuit reservoir ...	8·0
C14‡	Aerial circ. LW trimmer...	—
C15‡	Aerial circ. MW trimmer...	—
C16†	Aerial circuit tuning ...	—
C17‡	V2 CG LW trimmer ...	—
C18‡	V2 CG MW trimmer ...	—
C19†	V2 CG circuit tuning ...	—
C20‡	Osc. circ. MW trimmer ...	—
C21‡	Osc. circ. LW trimmer ...	—
C22†	Oscillator circuit tuning...	—
C23‡	1st IF trans. pri. tuning...	—
C24‡	1st IF trans. sec. tuning...	—
C25‡	2nd IF trans. pri. tuning...	—
C26‡	2nd IF trans. sec. tuning...	—
C27†	Variable tone control ...	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	Local/distant resistor ...	7.5
R2	V2 CG resistor	250,000
R3	V2 SG HT feed	65,000
R4	V2 anode HT feed ...	2,000
R5	AVC line decoupling ...	20,000
R6	AVC line decoupling ...	100,000
R7	Manual volume control; MR1 load resistor ...	40,000
R8	Part tone corrector ...	5,000
R9	GB and AVC delay potential divider resistors ...	84
R10	GB and AVC delay potential divider resistors ...	63
R11	GB and AVC delay potential divider resistors ...	63

	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial series chokes ...		3·6
L2	Aerial series chokes ...		23·0
L3	Aerial tuning coils ...		4·0
L4	Aerial tuning coils ...		33·0
L5	V1 anode RF choke ...		230·0
L6	V2 CG tuning coils ...		4·0
L7	V2 CG tuning coils ...		33·0
L8	V2 filament oscillator coupling coils		0·38
L9	V2 filament oscillator coupling coils		0·38
L10	Osc. MW tuning coil ...		2·25
L11	Osc. LW tuning coil ...		9·0
L12	1st IF trans.	Pri., total	114·0
L13	1st IF trans.	Sec. ...	122·0
L14	2nd IF trans.	Pri. ...	122·0
L15	2nd IF trans.	Sec. ...	122.0
L16	IF filter choke		230·0
L17	Speaker speech coil ...		1·23
T1	1st inter-valve trans.	Pri. ...	720·0
	1st inter-valve trans.	Sec. ...	4,200·0
T2	2nd inter-valve trans.	Pri. ...	990·0
	2nd inter-valve trans.	Sec., total	310·0
T3	Output trans.	Pri., total	570·0
	Output trans.	Sec. ...	0·23
S1	Local/distant switch ...		—
S2-S7	Waveband switches ...		—
S8,S9	Radio muting switches ...		—
S10	Pick-up switch		—
S11	HT circuit switch ...		—
S12	GB circuit switch ...		—
S13	LT circuit switch... ...		—

VALVE ANALYSIS

Valve voltages and currents in the table (next col.) are those quoted in the makers' manual. They represent conditions to be expected in an average chassis when it is operating from a new HT battery reading 130 V on load and the battery plugs are inserted in the sockets specified in col. 5.

The receiver should be operating with no signal input. Voltages should be measured with a high resistance meter whose negative lead is connected to chassis.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 S215VM	129	0·9	66	0·1
V2 S215VM	127	1·4	†	0·3
V3 S215VM	130	0·9	66	0·1
V4 L2	129	1·5	—	—
V5 PD220	129*	0·5*	—	—

† Voltage depends on position of HT + 1 plug.
* Each anode, quiescent.

DISMANTLING THE SET

If the fibre panel covering the PU and aerial/earth socket panels is removed (four 6 BA screws) access may be gained to all the components in the rear under-chassis compartment without removing the chassis.

Removing Chassis.—Remove the four control knobs (pull-off) from the front of the cabinet;

turn the set face down on the bench, protecting the cabinet from scratches with a soft cloth;

withdraw the speaker plugs from their sockets at the base of the chassis;

remove two 1in. round-head wood screws holding the top corners of the chassis to the corner battens at the front of the chassis, taking care not to lose the rubber grommets and metal liners through which they pass;

remove the four cheese-head screws (with washers) holding the chassis to wooden blocks on the sides of the cabinet. The screwdriver may be inserted through holes provided in the bottom of the cabinet.

remove the battery switch from the side of the cabinet (two ½in. wood screws).

If the cabinet is now stood on its base again, the chassis may be withdrawn, but before the under-chassis compartment can be seen as in our rear view of the chassis, a fibre panel covering the back must be removed. It is held by four 6 BA screws, one at each corner of the **A, E** and **PU** socket panels.

Removing Speaker.—The speaker is mounted on the accumulator platform by two bolts, nuts and washers, a steel plate forming a clamp over the speaker magnet, through which the bolts pass. When the chassis is removed, therefore, the speaker comes away with the platform, which is held between the chassis feet and the mounting blocks.

GENERAL NOTES

Switches. — S1 is the local/distant switch, operated by a push-pull action of the volume control spindle. It is fitted on the back of the control, and although it cannot be seen in our chassis illustrations, its approximate position and its connecting tags are indicated in our front view of the chassis.

S2-S7 are the waveband switches, and **S8-S10** the radio/gram change-over switches, ganged and operated by a spindle which runs nearly the whole length of the chassis, above the deck and at a right-angle to the control spindle. **S2-S7** are located inside or just beneath their respective coil assemblies, while **S8-S10** occupy a position beneath the rear of the scale drum.

The positions of the switches are indicated in our plan and rear chassis views, although some of them cannot be seen. Their action is indicated in the table below for the three control settings, starting from the fully anti-clockwise (MW) position of the control. A dash indicates open, and **C**, closed.

S11, S12 and **S13** are the QMB battery circuit switches, contained in a single plastic moulding fitted to the side of the cabinet and attached to the chassis by a four-way cable.

This unit is indicated in our rear chassis view, where the lead colours are marked in association with the switch numbers.

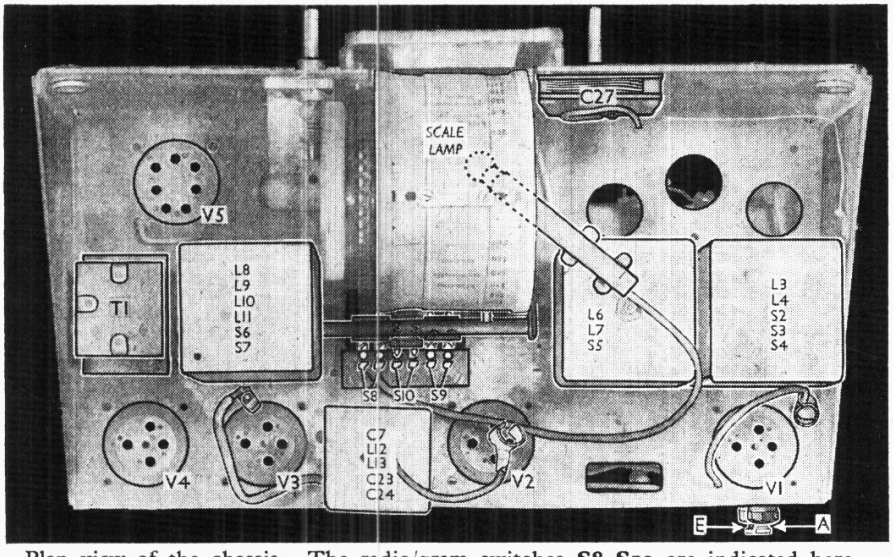
Switch Table

Switch	MW	Gram	LW
S2	C	—	—
S3	—	—	C
S4	C	—	—
S5	C	—	—
S6	C	—	—
S7	—	C	C
S8	C	—	C
S9	C	—	C
S10	—	C	—

Coils.—The RF and oscillator coils **L3, L4; L6, L7** and **L8-L11** are in three screened units on the chassis deck along the line of the switch spindle. The aerial series coils **L1, L2** are wound on an unscreened wooden bobbin fixed to one of the upright members, just behind the **A** and **E** sockets in our rear chassis view.

The first IF transformer **L12, L13,** is in a fourth screening can on the chassis deck, with its tuning capacitors and **C7,** while the second IF transformer **L14, L15** is in a screened unit beneath the deck, attached to the vertical screen which divides the front and rear compartments. Its tuning capacitors are fitted on opposite external faces of the unit.

The two RF chokes **L5** and **L16** are in two unscreened units, also fitted to the dividing screen. Each is fitted with four soldering tags, two of which are used in each unit for the connections to the coil;



Plan view of the chassis. The radio/gram switches **S8–S10** are indicated here. The positions of the waveband switches are indicated in the rear view overleaf.

the others are all used to anchor other components.

Scale Lamp.—This is an Osram MES type lamp, rated at 3.5 V, 0.15 A, with a spherical bulb. It is fitted in a long tubular holder which is mounted in two spring clips on top of the **L6, L7** coil unit and projects into the centre of the scale drum.

The centre-contact of the holder is connected by a flexible lead to the LT positive line to **V4** and **V5,** and the tube is connected via its mounting clips to chassis. The flexible lead is sufficiently long to permit convenient handling for replacement purposes after the tube has been eased from its clips.

External Speaker.—Two sockets are provided at the bottom left-hand corner of the dividing screen beneath the chassis, facing the rear, for the speaker connections. These are connected to either end of the output transformer **T3** secondary winding, and provide connections for the internal speech coil **L17** or a low-impedance (3-5 Ω) external speaker.

The internal speaker connecting plugs carry sockets in the tops for the connection of a second speaker when both internal and external speakers are required to operate together.

Valve V2.—The operating conditions of this valve are rather critical, and although a standard valve may be satisfactory, a specially selected one is usually employed.

Generally speaking, a valve which will operate with the HT+1 plug (screen tapping) in a lower voltage socket in the HT battery before instability occurs is a more suitable valve. Sometimes improved performance can be obtained by substituting one of the other two SG 215 VM valves in the set for the existing one.

The HT+1 plug should be left in the lowest HT battery socket at which stable operation can be obtained over the whole of the waveband employed, particular care being taken to ensure that the oscillator still functions at the longest wavelength.

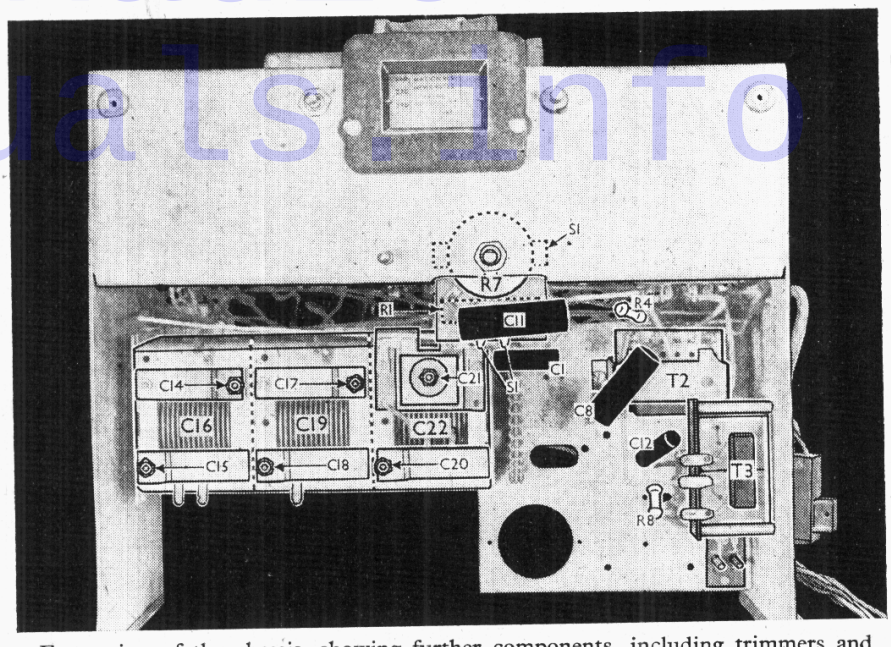
Another important feature of this valve is that its filament is at RF potential with respect to chassis, so that its metallised coating must be prevented from contacting any screening near it. A simple method of ensuring this is to fit a rubber band round the bulb.

V2 valveholder is fitted with a fifth (centre) socket. This is not required for the valve itself, but is used as a bearer for the positive LT line wiring. In our sample chassis, the lower end of **R2** was soldered to it.

Chassis Divergencies.—The makers explain in their technical information that the GB potential divider resistors **R9, R10, R11** had different values in early models from those given in our tables. The former values were **R9,** 77 Ω; **R10,** 150 Ω; **R11,** 150 Ω.

In our sample chassis there were two differences as compared with the makers' diagram. The first concerns **R1, C1,** which were transposed. In the makers' diagram **R1** is joined to **S1,** and **C1** is joined to **C2,** but the matter is relatively unimportant.

The second difference was in the connection of **R2,** whose low potential end in our chassis was returned to LT positive. We show it in our circuit diagram as the makers show it in theirs, but if difficulty is experienced in getting **V2** to operate properly it is a point worth investigating. Our sample may, of course, have been altered since it left the factory.



Front view of the chassis, showing further components, including trimmers and gang, beneath the deck. **S1** is behind the volume control **R7.**

Batteries.—The original HT battery supplied with the receiver was a Pye type P/B135, comprising a 130 V HT section and an isolated 4.5 V GB section. Any other 130 V HT battery and separate GB battery could be used. The accumulator was a Pye unspillable celluloid free-acid type.

Battery Leads and Voltages.—Black lead, spade tag, LT negative; red lead, spade tag, LT positive 2 V. Blue lead, black plug, HT negative; green lead and plug, HT+1 (see "**Valve V2**" under "General Notes"); pink lead, red plug, HT+2, HT positive 66 V; yellow lead, red plug, HT+3, 130 V HT positive.

White lead, red plug, GB positive; brown lead, black or brown plug, GB negative 4.5 V.

The makers point out that when the HT battery voltage falls, the sensitivity of the receiver may be restored by moving the HT+2 plug to a higher voltage socket on the battery. They say also that with a well-run-down battery, poor quality, or possibly complete cessation of signals, may be remedied by moving the HT+1 plug to a slightly higher voltage, perhaps 6-12 V higher. If it is raised too far, sensitivity will be impaired.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator leads via a 0.002 μF non-inductive capacitor to control grid of **V2** and chassis, and short-circuit **L8** by connecting rearmost pin of **V2** holder to chassis to mute the oscillator.

Feed in a 114 kc/s (2,631.5 m) signal, and adjust **C23, C24, C25** and **C26** for maximum output, reducing input to avoid AVC action as the circuits come into line. Now remove the short-circuit from **L8.**

RF and Oscillator Stages.—Transfer signal generator leads to **A** and **E** sockets via a dummy aerial.

To set scale drum accurately, turn gang to maximum, slacken the chain wheel fixing screw on the gang spindle, and turn tuning control until drum reaches its stop at minimum wavelength end. Now slacken escutcheon moulding (two screws) and adjust it so that the two pointers cover the red calibration line on the scale, then tighten screws.

Turn gang to maximum, then back a little; with the flat end of a metal bar pressed against the stator vanes, adjust rotors until it can be felt that they are level with stators and, while holding gang steady, adjust drum so that pointers are level with 560 m mark and black dot on LW scale. Then tighten up chain wheel screw. A slot in the boss permits quite a wide adjustment.

MW.—Switch set to MW, slacken off **C15** to minimum and screw up **C18** to maximum. Turn scale to minimum wavelength (red line), feed in a 196 m (1,530 kc/s) signal, and adjust **C20** for maximum output. If two peaks are found, select that involving the lesser trimmer capacitance. Then adjust **C15** and **C18** for maximum output. Finally, readjust **C20** for maximum output.

LW.—Switch set to LW, leaving tuning scale at red line. Set **C14** to minimum, and screw up **C17** nearly to maximum. Feed in a 775 m (387.1 kc/s) signal, and adjust **C21** for maximum output; but if two peaks are found, that involving the *greater* trimmer capacitance must be used. Then adjust **C14** and **C17** for maximum output. Now feed in a strong 775 m signal and readjust **C21** for maximum output, without disturbing **C14** and **C17.**

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