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"TRADER" SERVICE SHEET

516

MURPHY B24 (& B25)

BATTERY SUPERHET

The appearance of the Murphy model B24.

MANY requests have been received for technical information on the Murphy B25 receiver, and it was considered, therefore, that a "Trader" *Service Sheet* on that model would serve a useful purpose. The makers were approached, but were unable to furnish us with a receiver. They kindly made available, however, a B24 chassis, to which the B25 is similar except for the modifications given at the end of "General Notes."

The Murphy B24 is a 5-valve, 2-band battery superhet using a two-valve frequency changer. The circuit includes a band-pass input filter, automatic overload control and a heterodyne filter. There is provision for a gramophone pick-up and an external speaker.

Release dates: B24, 1934; B25, 1935.

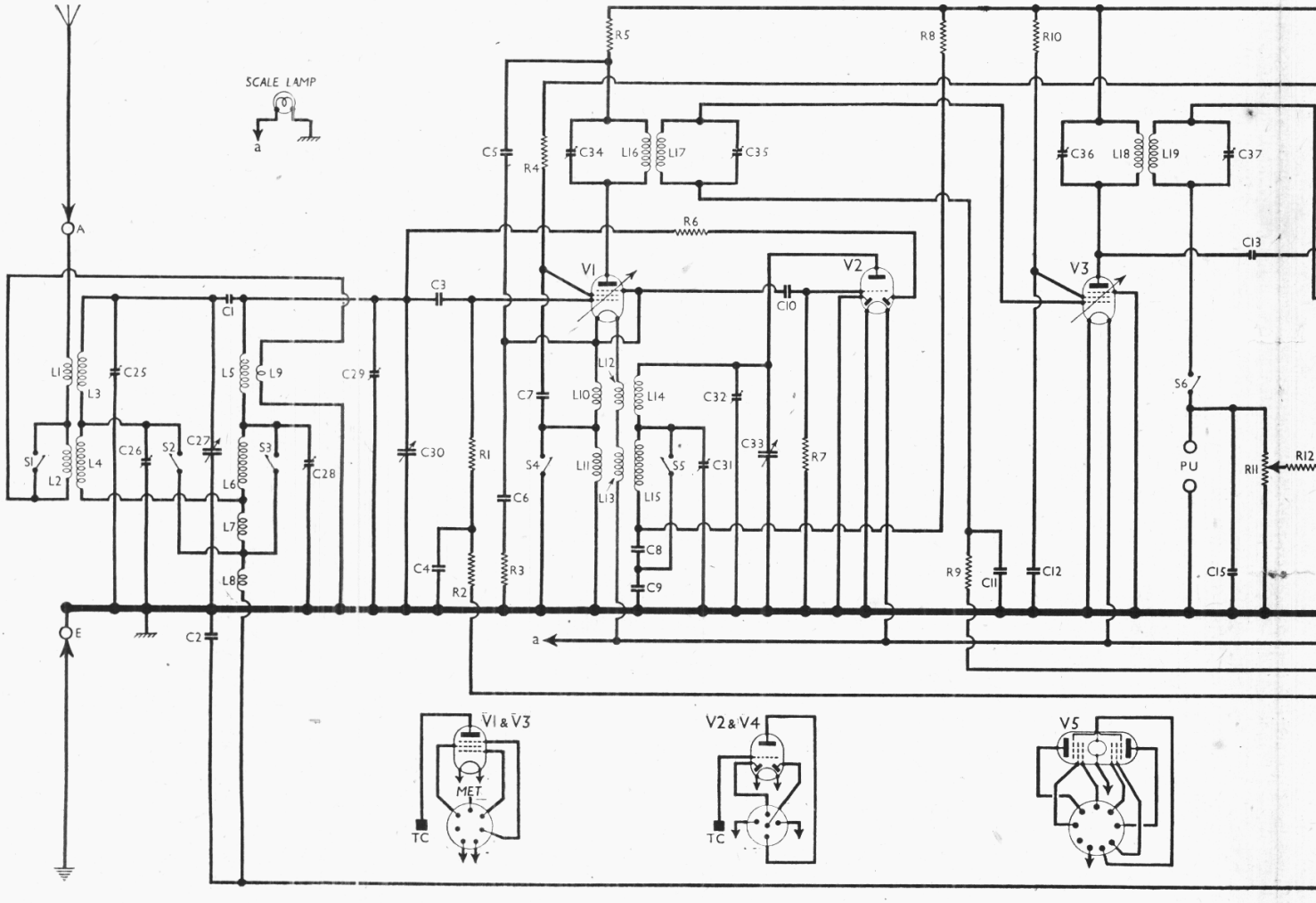
CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (MW) and **L2** (LW) to inductively coupled band-pass filter. Primary coils **L3** (MW) and **L4** (LW) are tuned by **C27**; secondaries **L5** (MW) and **L6** (LW) by **C30.** Coupling by coils **L8** (MW) and **L7** (LW) and **C2.** Image suppression by **C1** and **L9.**

First valve **(V1, Mazda metallised VP215)** is a variable-mu RF pentode operating as mixer in conjunction with separate triode oscillator which is part of double diode triode valve **(V2, Mazda metallised HL21DD).**

V2 triode anode coils **L14** (MW) and **L15** (LW) are tuned by **C33.** Parallel trimming by **C32** (MW) and **C31** (LW); series tracking by **C9** (MW) and **C8** (LW). Cathode injection by **V2** grid reaction coils **L10** (MW) and **L11** (LW) in **V1** negative filament lead. Coils **L12, L13** are included in the positive filament lead to raise the RF potential of the filament above chassis, as otherwise the filament circuit would short-circuit **L10, L11.**

One diode of **V2** is connected to filament and is not used. The second diode is connected via **R6** to the band-pass secondary circuit to form an automatic local/distant control, designed to prevent **V1** from being overloaded on the arrival of a strong signal. The diode is biased negatively via **L8, L7, L6, L5,** and until a sufficiently strong signal arrives, the diode is inoperative. When the signal



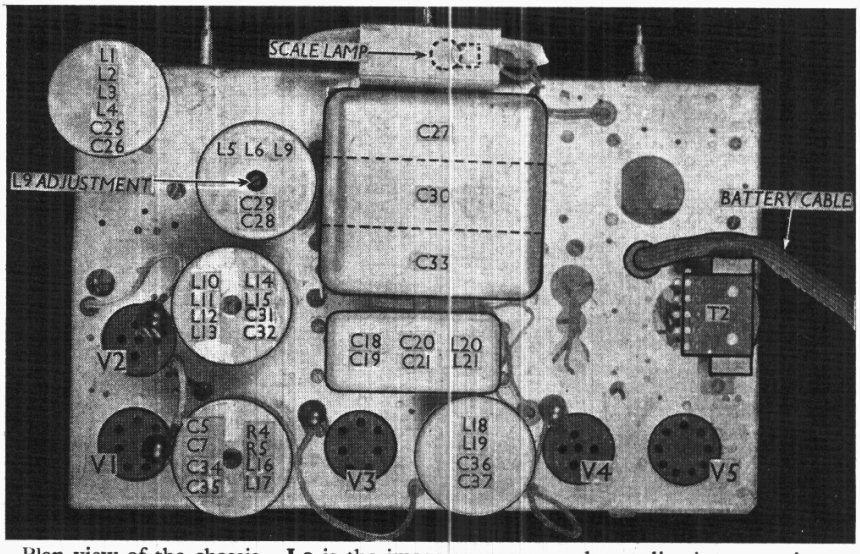
carrier is large enough to overcome the delay bias, however, current flows in the diode circuit, and damps the band-pass secondary circuit, across which it is connected. **R6** limits the shunting effect.

Third valve **(V3, Mazda metallised VP215)** is a second variable-mu RF pentode, operating this time as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C34, L16, L17, C35** and **C36, L18, L19, C37.**

Intermediate frequency 117 KC/S.

Diode second detector is part of a second double diode triode valve **(V4, Mazda metallised L21DD).** Audio frequency component in rectified output is developed across manual volume control **R11,** which also operates as load resistance, and passed via IF stopper **R12,** AF coupling condenser **C14** and CG resistance **R13** to CG of triode section, which operates as AF amplifier. IF filtering by **C15, R12** and **C16.** Provision by switched jack for connection of gramophone pick-up across **R11.** When the plug is inserted, **S6** opens to mute radio.

Second diode of **V4,** fed from **V3** anode via **C13,** provides DC potentials which are developed across load resistances **R16, R17** and fed back through decoupling circuits as GB to mixer and IF valves, giving automatic volume control.



Plan view of the chassis. **L9** is the image suppressor, whose adjusting screw is inside the **L5, L6, L9** can. The heterodyne filter is enclosed in the container behind the tuning gang.

Heterodyne filter circuit comprising coils **L20, L21** and condensers **C18, C19, C20** and **C21** is included in **V4** triode anode circuit. It cuts off sharply at about 5,000 C/S.

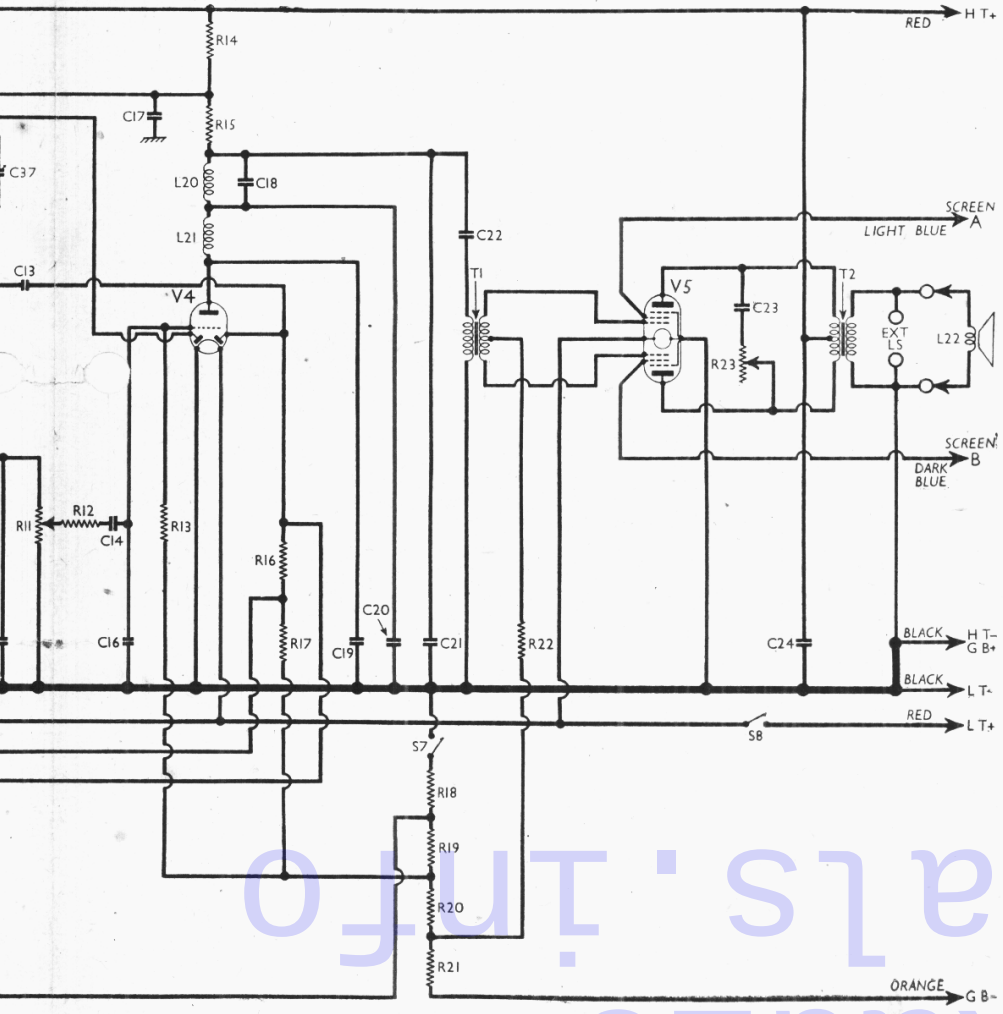
Parallel-fed transformer coupling by **R15, C22** and **T1** between **V4** triode and double-pentode quiescent push-pull output valve **(V5, Mazda QP240).** Variable tone control by **C23, R23.** Provision for connection of low impedance external speaker across secondary of output transformer **T2** by sockets similar to those used for internal speaker connection.

Fixed GB potential for **V1** and **V3,** GB for **V4** and **V5,** AVC delay potential and local/distant diode delay are all obtained from drop along resistances **R18, R19, R20** and **R21** which form a potential divider across the GB section of the HT battery.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs from the front of the cabinet.

Unthread the HT leads from the hole in the cross-bar by passing each lead separately through the slot at the rear. The HT and LT leads can then be drawn through the hole on the right-hand side of the cross-bar. Now withdraw the speaker plugs from their sockets at the rear of the chassis, and remove the three hexagon screws holding the chassis.



Circuit diagram of the Murphy B24 battery superhet. One diode of **V2** operates as local/distant control, and its triode section as the oscillator, whose grid reaction coils are in **V1** filament circuit. A fixed 100,000 Ω resistance may be connected in parallel with **R23.** The differences in model B25 are described under "Model B25 Modifications."

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Part image suppressor ...	0·000002
C2	Part band-pass coupling...	0·1
C3	V1 CG condenser... ...	0·005
C4	V1 CG decoupling ...	0·01
C5	V1 anode decoupling ...	0·002
C6	Mixer coupling shunt ...	0·00025
C7	Part LW mixer coupling...	0·001373
C8	Osc. circuit LW tracker ...	0·001373
C9	Osc. circuit MW tracker...	0·002
C10	V2 CG condenser... ...	0·0003
C11	V3 CG decoupling ...	0·025
C12	V3 SG decoupling ...	0·1
C13	Coupling to V4 AVC diode	0·00005
C14	AF coupling to V4 triode	0·001
C15, C16	IF by-pass condensers ...	0·00005, 0·00005
C17	V1 SG and V4 triode anode decoupling	1·0
C18	Heterodyne filter condensers	0·001373
C19		0·002
C20		0·003
C21		0·001
C22	AF coupling to T1 ...	0·2
C23	Part variable tone control	0·01
C24	HT circuit reservoir ...	1·0
C25‡	Band-pass pri. MW trimmer	0·00007
C26‡	Band-pass pri. LW trimmer	0·00007
C27†	Band-pass pri. tuning ...	0·0005
C28‡	Band-pass sec. LW trimmer	0·00007
C29‡	Band-pass sec. MW trimmer	0·00007
C30†	Band-pass sec. tuning ...	0·0005
C31‡	Osc. circuit LW trimmer	0·00007
C32‡	Osc. circuit MW trimmer	0·00007
C33†	Oscillator circuit tuning...	0·0005
C34‡	1st IF trans. pri. tuning ...	0·00014
C35‡	1st IF trans. sec. tuning ...	0·00014
C36‡	2nd IF trans. pri. tuning...	0·00014
C37‡	2nd IF trans. sec. tuning...	0·00014

† Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 CG resistance... ...	2,000,000
R2	V1 CG decoupling ...	2,000,000
R3	Mixer coupling shunt ...	100
R4	V1 SG HT feed	25,000
R5	V1 anode HT feed ...	10,000
R6	V1 CG damping limiter ...	1,000
R7	V2 CG resistance... ...	50,000
R8	V2 anode HT feed ...	100,000
R9	V3 CG decoupling ...	2,000,000
R10	V3 SG HT feed	150,000
R11	Manual volume control; V4 signal diode load ...	1,000,000
R12	IF stopper	250,000
R13	V4 triode CG resistance ...	2,000,000
R14	HT feed resistance ...	50,000
R15	V4 triode anode load ...	25,000
R16, R17	V4 AVC diode load resistances	490,000, 2,000,000
R18	Local/distant delay; AVC delay; and GB potential divider	100
R19		100
R20		800
R21		25
R22	V5 CG's decoupling ...	150,000
R23	Variable tone control ...	100,000

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial MW coupling ...	1·0
L2	Aerial LW coupling ...	7·0
L3	Band-pass primary coils...	5·0
L4		12·0
L5	Band-pass secondary coils	5·0
L6		12·0
L7	Band-pass coupling coils...	2·75
L8		0·75
L9	Image suppressor coil ...	0·25
L10	V1 filament coupling coils	0·2
L11		0·3
L12		(0·6 total)
L13		
L14	Osc. circ. MW tuning coils	4·0
L15	Osc. circ. LW tuning coils	8·5
L16	1st IF trans. Pri. ...	40·0
L17	Sec. ...	40·0
L18	2nd IF trans. Pri. ...	40·0
L19	Sec. ...	40·0
L20	Heterodyne filter coils ...	370·0
L21		450·0
L22	Speaker speech coil ...	—
T1	Intervalve trans. Pri. ...	1,020·0
	Sec., total ...	4,500·0
T2	Output trans. Pri., total ...	270·0
	Sec. ...	0·21
S1-S5	Waveband switches ...	—
S6	PU jack switch ...	—
S7	GB circuit switch ...	—
S8	LT circuit switch...	—

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 VP215	115	1·25	55	0·4
V2 HL21DD	50	0·5	—	—
V3 VP215	135	1·4	60	0·4
V4 L21DD	51	1·0	—	—
V5 QP240	135†	1·3†	*	0·3†

* According to code letter. † Each half of valve.

Valve voltages and currents given in the table above are approximately correct for a receiver operating with a new battery reading 146V overall.

The volume control should be at maximum, but it is important that no signal should be permitted to enter the receiver, because, apart from AVC action, **V5** anode current will vary according to the strength of the signal. The values given in the table are for quiescent conditions.

The meter used had a resistance of 1,000 O per volt, chassis being negative.

GENERAL NOTES

Switches.—S1-S5 are the waveband switches in a leaf-spring unit fitted beneath the chassis. All five switches close on MW, and open on LW.

S7, S8 are in a double-pole QMB unit, mounted beneath the chassis, near the control end of the **S1-S5** unit. They are operated by the **S1-S5** control spindle, which has three positions, and they open in the fully anti-clockwise (off) position of the control.

S6 is the radio muting switch, which forms part of the gramophone pick-up jack, and opens automatically when the plug is inserted.

Coils.—L1-L4; L5, L6, L9; and **L10-L15** are in three screened units on the chassis deck. Their trimmers are in the same containers, but are reached from beneath the chassis.

L7, L8 are wound on a small flat bakelite bobbin which is bolted to the front chassis member. **L7** is the large winding, in four banks wound round the middle of the bobbin; **L8** is the small winding at the end near the chassis deck.

The IF transformers **L16, L17** and **L18, L19** are in two further screened units on the chassis deck with their associated trimmers, which also are reached from beneath the chassis.

L20, L21, in conjunction with condensers **C18-C21,** form a heterodyne filter in **V4** triode anode circuit. The filter cuts off sharply above 5,000 C/S. All the components are contained in a metal can mounted on the chassis deck.

Scale Lamp.—This is a low-consumption Ediswan MES type, with a semi-mushroom type bulb. It is rated at 2.5 V, 0.2 A.

External Speaker.—Four sockets are provided at the rear of the chassis. Two of these are for the internal speaker, and the other two for a low impedance (about 2-4 O) external speaker. The two pairs of sockets are connected in parallel.

Gramophone Pick-up.—A jack-type socket is fitted at the rear of the chassis for a gramophone pick-up. Switch **S6** is associated with the jack, and this opens automatically, muting radio, when the plug is inserted.

Component Assemblies.—Most of the small components are mounted in four assemblies beneath the chassis. Three of the assemblies are formed by mounting components on the two sides of vertical bakelite panels. The fourth assembly is encased in a metal container, in which are housed eight resistances and six condensers. The unit is indicated in the centre of our under-chassis view, with the components listed on it. The diagram in cols. 1 and 2 shows the connections between the internal components and the external connecting tags, which are lettered **A-H** and **J-M** to correspond with the markings on the connecting panel. The casing is earthed. The diagram is drawn as seen when viewed from the left-hand end of the chassis, as seen in our under-chassis view.

R23.—This is the variable tone control, mounted on the front member beneath the chassis. In some chassis a 100,000 O resistance may be connected between the upper end of **R23** in the diagram and the slider.

Batteries.—A combined HT and GB battery of 133 V plus 10.5 V, and a 2V accumulator are required. Separate HT and GB batteries could be used, as a wartime measure, if a GB positive lead, joined to chassis, were fitted, but the receiver should not be operated without the HT negative plug inserted in the combined type of battery. If separate batteries are used, however, it is important that they are renewed together, as it is neces-

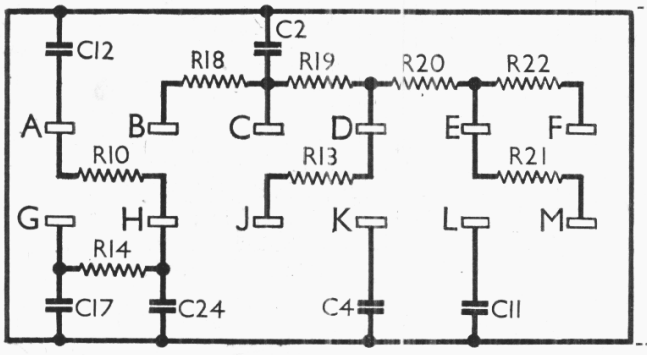
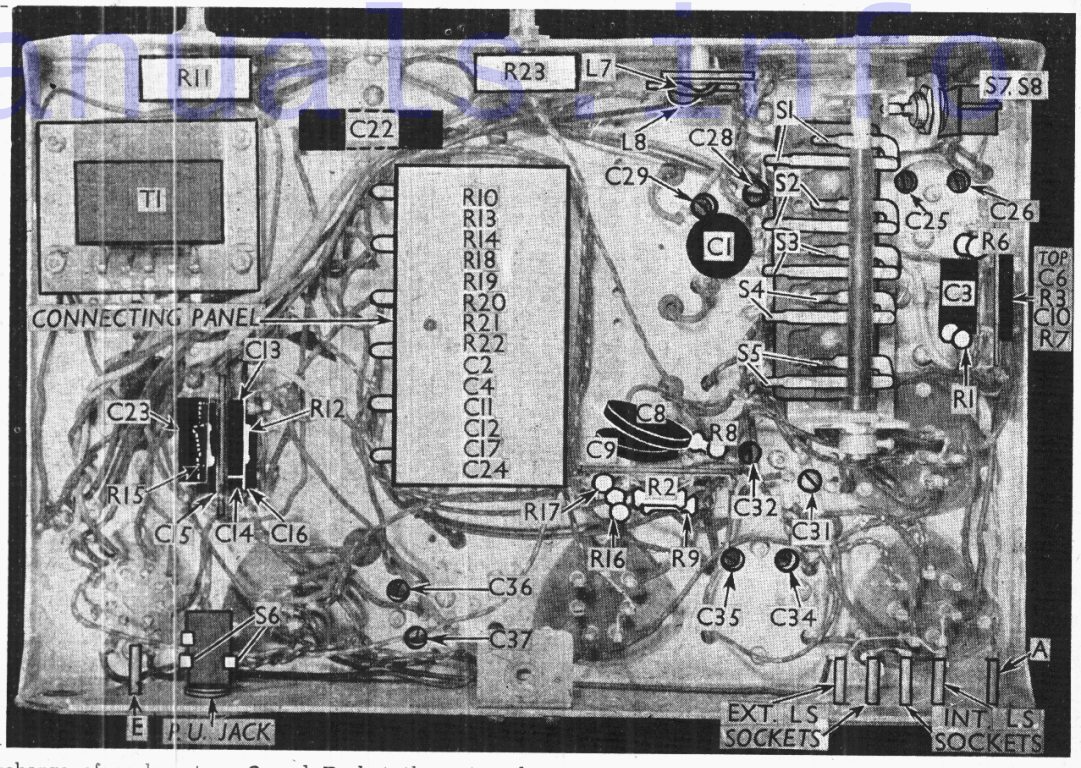


Diagram of the connections of the enclosed assembly, showing the internal components. The connecting panel, showing the tags, is drawn as seen when viewed in the direction of the arrow in our under-chassis view.



Under-chassis view. Most of the components are mounted in four assemblies, one of which, seen in the centre of the chassis, is shown diagrammatically in cols. 1 and 2 opposite. The components in the other three assemblies are indicated individually here. All the RF, oscillator and IF trimmers are reached through holes in the chassis, and are indicated here.

sary that the rate of discharge of each should run them down in approximately the same proportion.

Battery Leads and Voltages.—Black rubber lead, spade tag, LT negative; red rubber lead, spade tag, LT positive 2 V. Black lead and plug, HT negative; red lead and plug, HT positive 133 V; light blue lead and plug, screen A of **V5**; dark blue lead and plug, screen B of **V5**. Orange lead and plug, GB negative 10.5 V.

The screen plugs A and B should be inserted in the HT battery sockets which correspond with the following values for the code letters marked on the side of the valve envelope: P, 103.5; Q, 111; R, 118.5; S, 126; T, 133.5. These values are correct only if the HT positive (red) plug is in the 133 V socket. Otherwise, the two halves of the valves can be balanced by so adjusting the two screen tappings that the quiescent anode current in the two halves is equal.

The table below gives the valve makers' recommendations for three values of anode voltage, under quiescent conditions.

Anode Volts (V)	GB Volts (V)	Screen volts for code letters					Anode to anode load (ohms)	Approx. total anode current (mA)
		P	Q	R	S	T		
150	—11·5	112·5	121·5	130·5	139·5	148·5	15,000	4·0
135	—10·5	103·5	111·0	118·5	126·0	133·5	16,000	3·3
120	—9·0	91·5	97·5	103·5	109·5	115·5	17,000	3·0

Model B25 Modifications.

Although the design of the model B25 is essentially the same as that of the B24, there are differences in detail.

R19 becomes 200 O instead of 100 O, and is connected between tags **B** and **D** of the metal-cased assembly instead of tags **C** and **D**, but the external connections to the tags remain the same as they are in the B24. When **S7** is closed, therefore, tag **C** will be at chassis potential, so that the delay voltage to **V2** diode will be lowered. The potentials at **B, D, E** and **M** will remain the same, since the total resistance of the circuit is unaltered. **R18** remains the same as in the B24, but in the B25 its function is simply to provide a DC path across **C2**, which forms part of the band-pass coupling.

The tone control **R23** becomes 50,000 O, and should be logarithmic, while switches **S7** and **S8** are ganged with the volume control **R11.**

This necessitates a further modification, because the extra space required by the switches leaves insufficient room for **T1.** Therefore **T1** and **T2** are transposed in the B25.

Also, in order to extend the waveband coverage downwards below 200 m, **C25, C29** and **C32** are changed to 0.00005 μF, and, consequently, in order to compensate for the reduced capacity, the LW trimmers **C26, C28** and **C31** are increased to 0.00008 μF.

C6 is changed in B25 models bearing a serial number higher than 3,800, when it becomes 0.00035 μF; otherwise it remains the same as in the B24.

It should be noted that the lead connecting the tone control directly to one of **V5** anodes must be taken by such a route as to avoid proximity with the volume control leads, and should be kept as close to the chassis as possible.

CIRCUIT ALIGNMENT

IF stages.—Switch set to MW, and connect the junction of **C6** and **V1** filament to chassis. Connect signal generator to control grid (pin 1) of **V3** via a dummy aerial. Feed in a 117 KC/S (2564.2 m) signal, and adjust **C37** and **C36** in turn for maximum output. Transfer signal generator leads to control grid (pin 1) of **V1,** and adjust **C35** and **C34** for maximum output. Remove short-circuit.

RF and Oscillator Stages.—Transfer signal generator leads to **A** and **E** sockets via a suitable dummy aerial. With the gang at maximum, the pointer should cover the line crossing the two scales at the high-wavelength ends of the scales.

MW.—Switch set to MW, tune to 220 m on scale, feed in a 220 m (1362 KC/S) signal, tune it in, and adjust **C32** for maximum output. Now adjust **C25,** then **C29,** for maximum output, repeating these latter adjustments until no improvement can be obtained.

LW.—Switch set to LW, tune to 1100 m on scale, feed in a 1100 m (273 KC/S) signal, and adjust **C31** for maximum output. Now adjust **C26,** then **C28,** for maximum output, repeating these two latter adjustments until no further improvement can be obtained.

Image Suppressor.—Tune receiver to 450 m on scale. Feed in a strong 333 m (900 KC/S) signal, and adjust **L9** (screw in top of **L5, L6, L9** can) for *minimum* output. The makers recommend using the speaker as an indicator for this adjustment, instead of an output meter, as an aural indication is more satisfactory than a visual one.

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