"TRADER" SERVICE SHEET

926

MULLARD MBS147

Three-band Battery Superhet

A SPECIAL system of plugs and sockets permits any combination of standard all-dry type H.T. and 1.5 V L.T. batteries, or the earlier type H.T. battery and accumulator, to be used in the Mullard MBS147, a 6-valve 3-band battery superhet employing all-dry valves with a push-pull output stage.

Other unusual features of the circuit include two I.F. stages and a battery economy switch which disconnects half of the output valve filaments and lowers the H.T. voltage. Three aerial sockets are provided to ensure maximum coupling on weak transmissions and prevent overloading on strong ones.

Release date and original price: July 1948; £18 18s. without batteries, plus purchase tax.

CIRCUIT DESCRIPTION

Aerial input from socket **A1** via series capacitor **C3** and I.F. rejector **L1, C4,** is inductively coupled on S.W. by **L2** and capacitively bottom coupled by **C5** on M.W. and L.W. to single tuned circuits **L3, C41** (S.W.), **L4, C41** (M.W.), and **L5, C41** (L.W.), which precede a heptode valve **(V1, Mullard metallized DK32)** operating as frequency changer with electron coupling. Aerial sockets **A2, A3** provide input attenuation via series capacitors **C1, C2.**

Oscillator grid coils **L7** (S.W.), **L8** (M.W.), and **L9** (L.W.) are tuned by **C42.** Parallel trimming by **C11, C43** (S.W.), **C44** (M.W.) and **C12, C45** (L.W.); series tracking by **C13** (M.W.) and **C13, C14** (L.W.). Inductive reaction coupling is employed on all bands, with additional capacitative coupling on M.W. and L.W. due to the common impedance of **C13** in grid and anode circuits.

Second and third valves **(V2, V3, Mullard metallized DF33's)** are variable-mu R.F. pentodes operating as intermediate frequency amplifiers with tuned transformer input and output couplings **C7, L13, L14, C8** and **C24, L16, L17, C25** in which the tuning capacitors are fixed and adjustments are effected by varying the positions of the iron-dust cores. Parallel-fed tuned anode coupling by **L15, C20, C46** is employed between **V2** and **V3.**

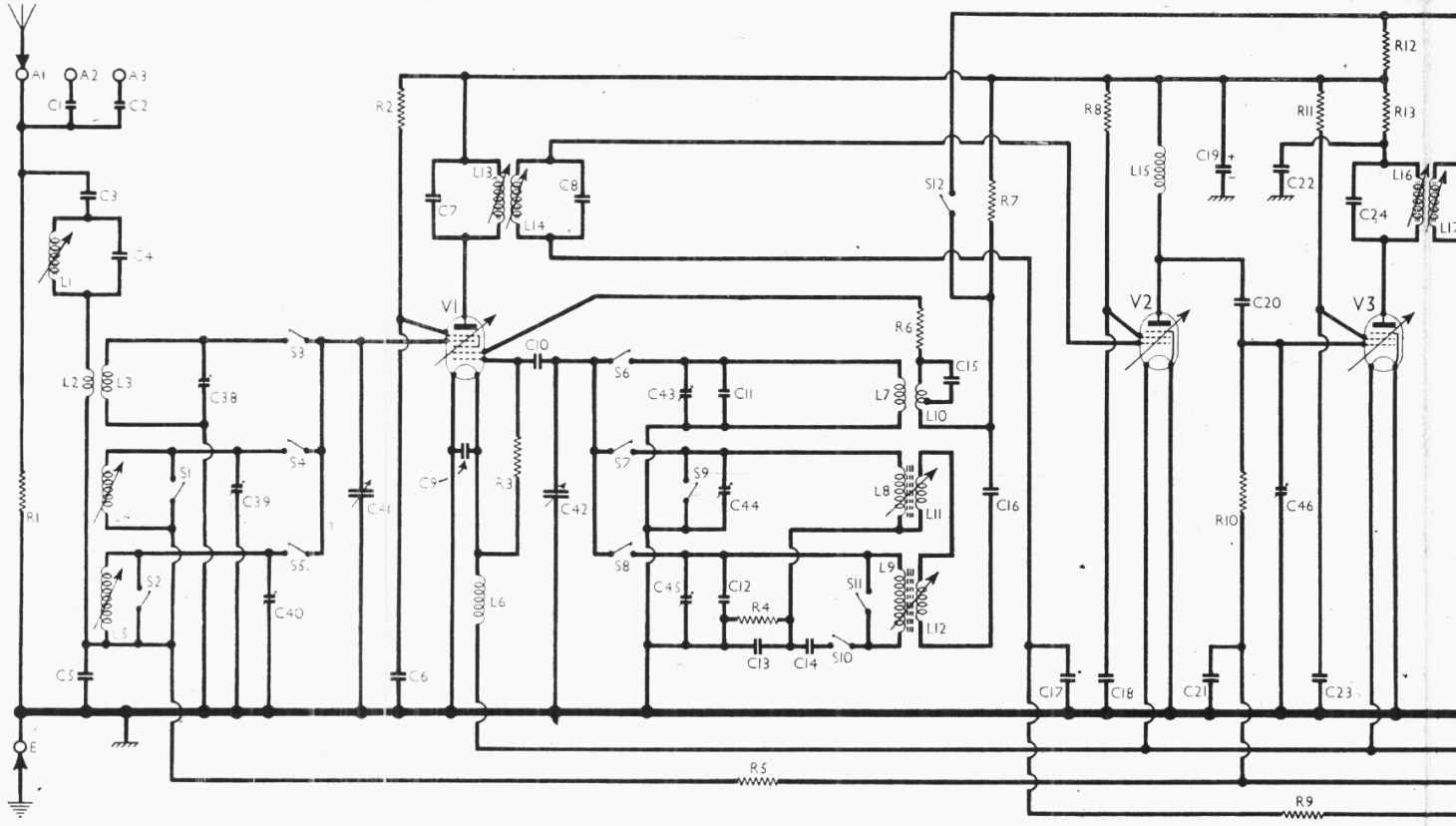
Intermediate frequency 470 kc/s.

Diode second detector is part of single diode triode valve **(V4, Mullard DAC32).** Audio-frequency component in rectified output is developed across volume control **R17,** which is the diode load resistor, and passed via **C28, R18** and C.G. resistor **R19** to grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C26, R14, C29.** Three-position tone control by **C30, C31, S13, S14** in the grid circuit of **V4.**

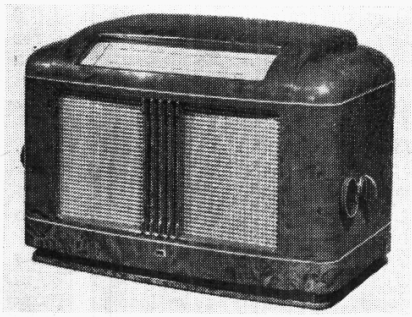
D.C. potential developed across **R17** is tapped off from the potential divider **R15, R16** and fed back via decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic gain control.

Parallel-fed auto-transformer coupling by **R20, C33** and **T1,** via grid stoppers **R22, R23,** between **V4** triode and push-pull output stage comprising two pentode valves **(V5, V6, Mullard DL33's).** Fixed tone correction by **C36, C37** in anode circuits.

G.B. potential for **V5, V6** is obtained from the drop across **R24** in the negative H.T. lead to chassis. With the economy switch **S15, S16** in the normal position **R25** is short circuited and the two halves of each output valve filament are connected in parallel. In the "Economy" position, the H.T. voltage is lowered by the drop along **R25,** and one section of each output valve only is energized.



Circuit diagram of the Mullard MBS147, with the three battery plug diagrams inset on the right as seen from the free ends of their pins. Their



COMPONENTS AND VALUES

	RESISTORS	Value (ohms)	Locations
R1	Aerial shunt ...	10,000	K4
R2	V1 S.G. H.T. feed	47,000	H4
R3	V1 osc. C.G. ...	100,000	H4
R4	Osc. stabilizer ...	27,000	H3
R5	V1 A.G.C. decoup.	1,000,000	H4
R6	Osc. stabilizer ...	47	H4
R7	Osc. anode load ...	47,000	H4
R8	V2 S.G. H.T. feed	180,000	G4
R9	V2 A.G.C. decoup.	2,200,000	G4
R10	V3 C.G. resistor ...	68,000	G4
R11	V3 S.G. H.T. feed ...	180,000	F4
R12	H.T. decoupling ...	3,300	E4
R13	V3 anode decoup. ...	1,200	F4
R14	I.F. stopper ...	47,000	F3
R15	A.G.C. potential	3,300,000	G4
R16	divider	1,800,000	G4
R17	Volume control ...	1,000,000	D3
R18	V4 grid stopper ...	82,000	D3
R19	V4 C.G. resistor ...	3,300,000	E3
R20	V4 triode load ...	1,000,000	E3
R21	G.B. decoupling ...	270,000	E4
R22	V5 grid stopper ...	82,000	E4
R23	V6 grid stopper ...	82,000	E4
R24	V5, V6 G.B. res. ...	1,000	E4
R25	H.T. economy res.	8,200	E4
R26	Filament ballast ...	1·7	F4

	CAPACITORS	Values (μF)	Locations
C1	Aerial series ...	0·000027	K4
C2	Aerial series ...	0·0000033	K4
C3	Aerial series ...	0·00022	K4
C4	I.F. rejector tune ...	0·00056	K4
C5	Aerial coup. ...	0·0033	J4
C6	V1 S.G. decoup ...	0·047	H4
C7	1st I.F. transformer	0·00015	B1
C8	tuning	0·00015	B2
C9	V1 fil. by-pass ...	0·1	H4
C10	V1 osc. C.G. ...	0·0001	J4
C11	Osc. S.W. trim ...	0·000012	H3
C12	Osc. L.W. trim. ...	0·000022	H3
C13	Osc. M.W. tracker	0·00036	J3
C14	Osc. L.W. tracker ...	0·00015	J4
C15	S.W. react. shunt ...	0·0001	H4
C16	Osc. coupling ...	0·00027	H4
C17	V2 C.G. decoup. ...	0·022	H4
C18	V2 S.G. decoup. ...	0·047	G4
C19*	H.T. decoupling ...	8·0	E4
C20	I.F. coupling ...	0·00056	G4
C21	V3 A.G.C. decoup.	0·01	H4
C22	V3 anode decoup. ...	0·047	F3
C23	V3 S.G. decoup. ...	0·047	F4
C24	2nd I.F. transformer	0·00015	C1
C25	tuning	0·00015	C1
C26	I.F. by-pass ...	0·00018	F3
C27	Top boost	0·00015	E3
C28	A.F. coupling ...	0·01	D3
C29	I.F. by-pass ...	0·000082	D4
C30	Tone control capacitors	0·0022	D4
C31		0·001	D4
C32	I.F. by-pass ...	0·000056	E3
C33	A.F. coupling ...	0·1	E3
C34	G.B. decoupling ...	0·22	D4
C35*	H.T. decoupling ...	8·0	D3
C36	Tone correctors ...	0·0022	C1
C37		0·0022	C1
C38‡	Aerial S.W. trim. ...	0·00003	J3
C39‡	Aerial M.W. trim. ...	0·00003	K3
C40‡	Aerial L.W. trim. ...	0·00003	K3
C41†	Aerial tuning ...	0·000492	A1
C42†	Oscillator tuning ...	0·000492	A2
C43‡	Osc. S.W. trim. ...	0·000012	H3
C44‡	Osc. M.W. trim. ...	0·00003	H3
C45‡	Osc. L.W. trim. ...	0·00003	H3
C46‡	V2 anode tuning ...	0·0002	G4

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx Values (ohms)	Locations
L1	I.F. rejector coil ...	4·0	K4
L2	Aerial S.W. coup.	1·5	J3
L3	Aerial tuning coils	Very low	J3
L4		2·0	K4
L5		18·0	A1
L6	Fil. R.F. choke ...	Very low	H4
L7	Oscillator tuning coils	Very low	H4
L8		3·0	H4
L9		11·0	A1
L10	Oscillator coupling coils	2·0	H4
L11		1·0	H4
L12		3·5	A1
L13	1st I.F. Pri. ...	7·0	B2
L14	trans. Sec. ...	7·0	B2
L15	V2 anode load ...	10·0	F4
L16	2nd I.F. Pri. ...	7·0	B1
L17	trans. Sec. ...	7·0	B1
L18	Speech coil ...	3·5	—
T1	Intervalve trans-former a, b ...	1,500·0	
	b, c ...	4,000·0	E4
	c, d ...	3,750·0	
T2	Output trans. Pri. total	1,060·0	C1
	Sec. ...	0·5	
S1-S12	W/band switches ...	—	J4
S13,	Tone switches ...	—	D4
S14			
S15,	Economy switches	—	E4
S16			
S17	Battery switches		
S18	g'd R17	—	D3

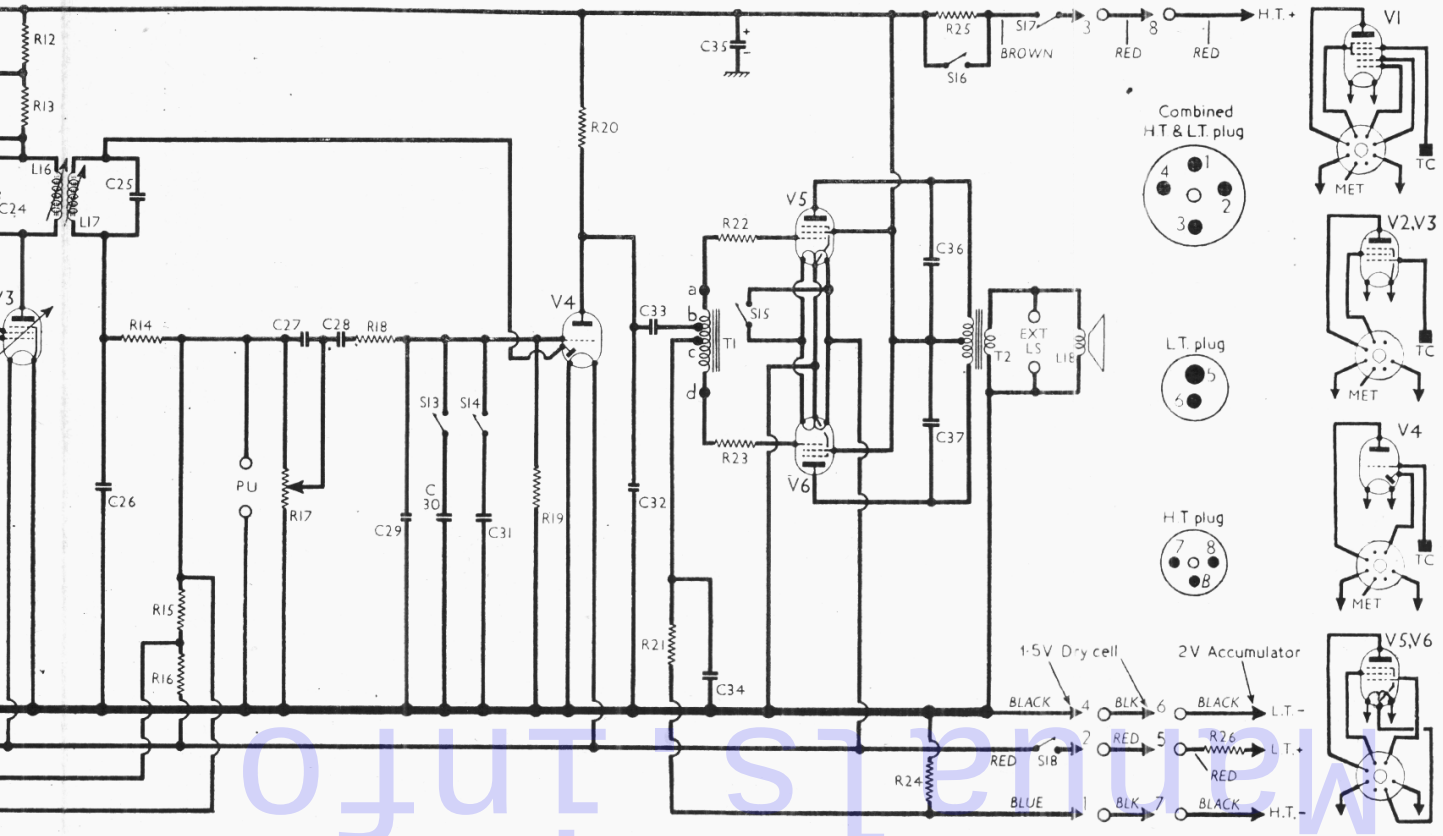
DISMANTLING THE SET

Removing Chassis.—Pull off the four control knobs, unplug "L.T.," "H.T." and "Combined H.T. and L.T." battery plugs from the back cover, and remove four self-tapping screws (with one washer each), retaining the back cover;

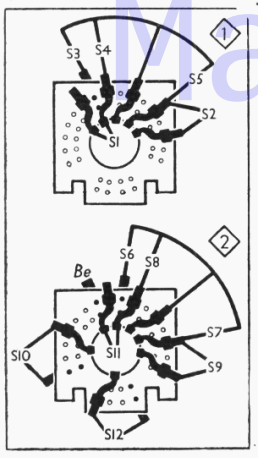
remove the two large cheese-head screws (with one lock-washer each), one located to the left of the tuning gang and the other adjacent to the output transformer;

slide the chassis out of the cabinet for approx. 1in and then lower it, making sure that

(Continued col. 1 overleaf)



Their pin numbers correspond with those in the successive battery terminations in the circuit diagram. An L.T. accumulator may also be used.



Diagrams of the waveband wsitch units, as seen in the direction of the arrows in our under-chassis view. **Be** indicates a bearer tag. On the right is the associated switch table.

Switch	S.W.	M.W.	L.W.
S1	C	—	—
S2	C	C	—
S3	C	—	—
S4	—	C	—
S5	—	—	C
S6	C	—	—
S7	—	C	—
S8	—	—	C
S9	C	—	—
S10	—	—	C
S11	C	C	—
S12	C	—	—

Dismantling the Set—*continued*

the output transformer clears the right-hand cabinet bracket;

withdraw the chassis to the extent of speaker leads and remove the four screws (with plain washers), holding the bottom cover in position.

To free chassis entirely, unsolder the speaker leads at the speech coil tags.

When replacing, ensure that the prongs on the chassis supporting brackets in the cabinet coincide with the centres of the grommets on the chassis front member.

Removing Speaker.—First remove the chassis as previously described, then slacken the screws of the two lower speaker retaining clamps and swivel the clamps aside;

remove the two upper screws (with one lock-washer and clamp each), and lift out speaker.

When replacing, the connecting tags must be at the top. The black lead should be re-soldered to the two left-hand connecting tags, and the yellow lead to the right-hand tag.

Transit Bolts.—During transit the front pair of scale supports should be held firmly to the sub-baffle, and they are so fixed when dispatched from the works, but the supports should be freed before the set is put into operation.

The fixing may consist of two wood-screws through the supports, or of a pair of "D"-shaped discs which are screwed to the sub-baffle and can be swivelled into and out of position when the screws are slackened.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W., turn the gang to minimum, the volume control to maximum, and the tone control to the "brilliant" position. Connect signal generator via an 0.032 μF capacitor in the "live" lead to the control grid (top cap) of **V1** and chassis (the control grid connection may be made at the top tag on the front section of the gang, **C41**). Feed in a 470 kc/s (638.3 m) signal, and adjust the cores of **L16** and **L17** (location reference B1); then adjust **C46** (G4) by unwinding its wire; and finally adjust the cores of **L13** and **L14** (B2); all for maximum output. Repeat these operations (except **C46**) until no improvement can be obtained.

When adjusting the primary of a transformer, a 0.0001 μF damping capacitor must be connected across the secondary; and conversely, when adjusting the secondary, the capacitor must be shunted across the primary. Adjustment of **C46** may be made only by unwinding turns from it until the peak is reached, when the end should be secured with wax; turns must not be added. If more turns are required, the capacitor must be replaced by a new one.

I.F. Rejector.—With set still switched to M.W., transfer signal generator "live" lead to **A1** socket via a suitable dummy aerial, feed in a 470 kc/s signal and adjust core of **L1** (location A2) for minimum output.

R.F. and Oscillator Stages.—With the gang at minimum capacitance the pointer should be perpendicular and coincident with zero on the S.W. logging scale; at maximum capacitance the pointer should coincide with the "180" on the same section of the scale. Note that the local oscillator frequency in this receiver is higher than the signal frequency on all bands. In order to adjust the trimmer capacitors the yellow wax may be broken with tweezers.

M.W.—With set still switched to M.W., tune to 500 m on scale, feed in a 500 m (600 kc/s) signal and adjust the core of **L8** (H4) for maximum output; tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal and adjust **C44** (H3) for maximum output. Retune to 500 m on scale, feed in a 500 m signal, and adjust core of **L4** (K4) for maximum output; retune to 200 m, feed in a 200 m signal, and adjust **C39** (K3) for maximum output. Repeat these operations until no improvement results.

L.W.—Switch set to L.W., tune to 1,700 m on scale, feed in a 1,700 m (176.5 kc/s) signal, and adjust the core of **L9** (A1) for maximum output; tune to 850 m on scale, feed in an 850 m (353 kc/s) signal, and adjust **C45** (H3) for maximum output. Retune to 1,700 m on scale, feed in a 1,700 m signal, and adjust the core of **L5** (A1) for maximum output; retune to 850 m on scale, feed in an 850 m signal, and adjust **C40** (K3) for maximum output. Repeat until no improvement results.

S.W.—Switch set to S.W., tune to 20 m on scale, feed in a 20 m (15 Mc/s) signal, adjust **C38** and **C43** (J3 and H3) for maximum output.

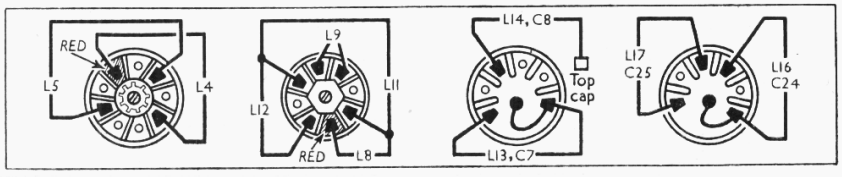
GENERAL NOTES

Switches.—**S1-S12** are the waveband switches, ganged in two rotary units beneath the chassis. These units are indicated in our under-chassis view, where they are identified by the figures **1** and **2** in diamonds and arrows which show the direction in which they are viewed in the diagrams in col. 1.

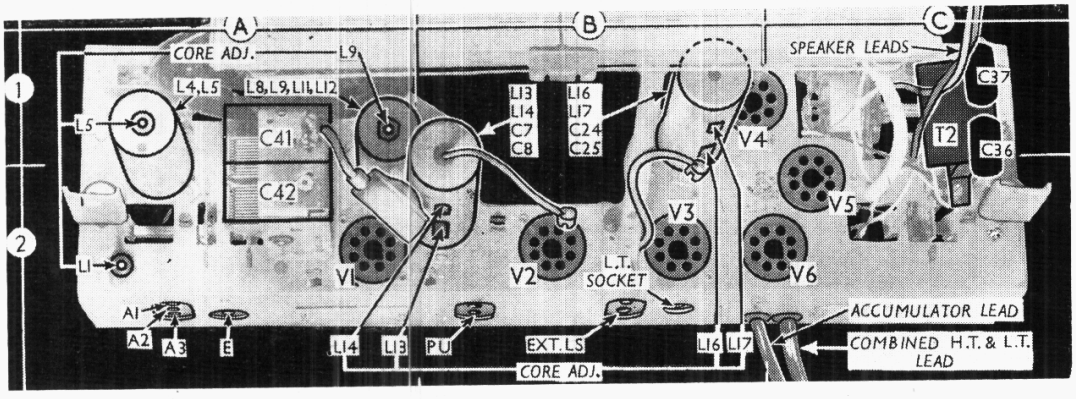
The table (col. 2) gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

S13, S14 are the tone control switches, ganged in a 3-position rotary unit. The unit indicated in our under-chassis illustration, where an arrow indicates the direction in which it is viewed in the diagram in col. 6, where it is shown in detail. In the fully anti-clockwise position of the control knob, both switches are open (brilliant); in the central (normal) position, **S14** is closed; in the fully clockwise position (deep), **S13** is closed, and **S14** is open.

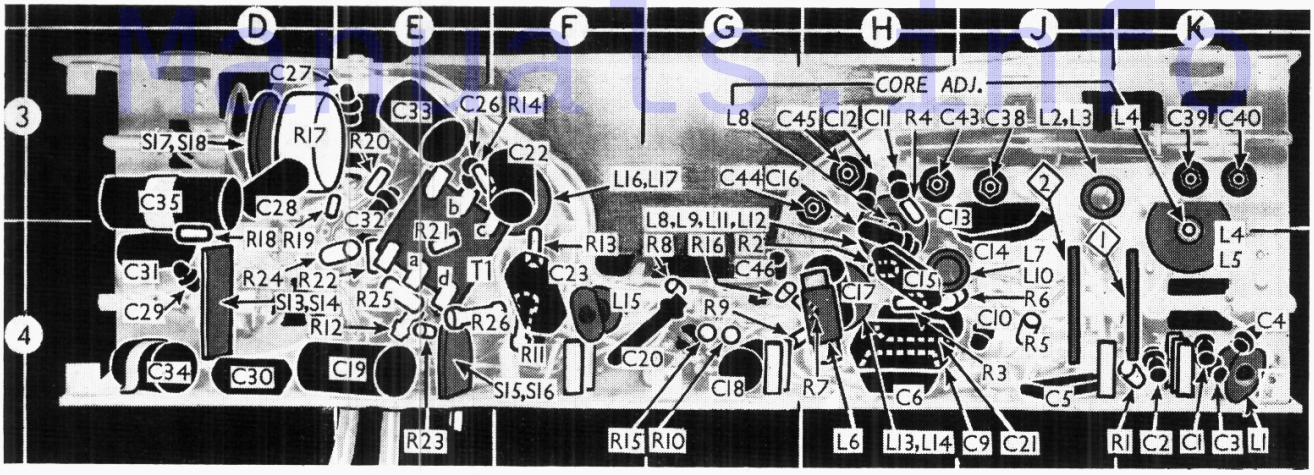
S15, S16 are the "economy" switches, in a small lever-operated unit mounted on the rear member of the chassis. In the



Underside view of the coil units, as seen from the rear, in which the tags are identified.



Plan view of the chassis, in which several of the core adjustments are indicated.



Under-chassis view. Diagrams given elsewhere show the four switch units in detail and the base connections of the four coil units.

"Normal" position (lever down) both switches are closed; in the "Economy" position, both switches open, inserting **R25** in series with the H.T. feed to the receiver and open-circuiting the L.T. supply to one of the twin filament sections in each output valve.

The position of the unit is indicated in our under-chassis view, and it is shown in detail in the diagram in col. 6, where it is drawn as seen in the direction of the arrow in the chassis illustration.

S17, S18 are the H.T. and L.T. Q.M.B. switches, ganged with the manual volume control **R17.**

Coils.—All the R.F., oscillator and I.F. coils, excepting the S.W. coils **L2, L3** and **L7, L10,** are in four screened units mounted on the chassis deck. Their bases, carrying the soldering tags, appear beneath the deck, and are indicated in our under-chassis view. Diagrams in cols. 2 and 3 identify these tags and indicate the internal connections.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (about 5-7 Ω) external speaker.

Batteries and Leads.—No one type of battery is specified by the makers for this receiver, but a system of plugs and sockets is provided which permits the use of the standard all-dry combined H.T. and L.T. unit (such as the Ever Ready All-dry No. 3), which are fitted with a 4-pin valve-base type of plug; or separate all-dry units (such as the Batrymax 90V B107 H.T. unit with 3-pin plug and "All-dry 1" 1.5. V L.T. unit with 2-pin plug); or the ordinary H.T. battery of 90-120 V with wander plugs and a 2 V accumulator.

When using an accumulator, the surplus 0.6 V is dropped along **R26,** which is automatically brought into circuit when the spade terminals are used. A special platform measuring $3\frac{1}{8}$ by $3\frac{1}{8}$in is provided as a stand.

When using the combined H.T./L.T. battery, the 4-pin plug attached to the chassis goes straight to the battery socket. This plug is represented in our circuit diagram by the arrowheads numbered **1, 2, 3, 4,** as indicated by the 4-pin plug diagram inset in the circuit.

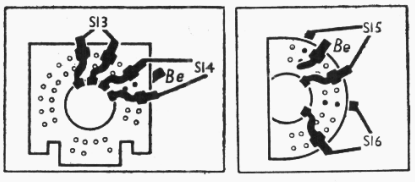
When it is desired to use the separate H.T. and L.T. all-dry units, the 4-pin plug is inserted into the appropriate socket on the back cover of the receiver, to which are connected leads from the 3-pin H.T. and 2-pin L.T. plugs. These plugs (represented by arrowheads **5, 6, 7, 8** in our circuit diagram, and again with plug diagrams inset) are then inserted in their respective batteries.

To use an ordinary H.T. battery and accumulator, the 3-pin H.T. plug (pins **7** and **8**) is inserted in the "H.T. only" socket on the back cover, and the 2-pin L.T. plug is inserted in the "L.T." socket on the rear member of the chassis. The 4-pin plug remains in its socket. The only free leads now are the pair with wander plugs for the H.T. battery, coming from the back cover, and the accumulator lead which emerges from the rear of the chassis.

DRIVE CORD REPLACEMENT

Two drive cords are used in this receiver: one for the gang drive and one for the cursor drive. The courses taken by the two cords are shown in the sketches at the foot of cols. 4 and 5, in which the gang drive is drawn as seen from the front of the receiver, and the cursor drive as seen from the rear, in which positions they should be viewed when fitting. In both cases the gang is at minimum capacitance.

The gang drive requires about 2ft of cord, and the cursor drive about 4ft. For convenience, it is advisable to start the run for the cursor drive in a clockwise direction round the gang drum, and the gang drive in an anti-clockwise direction, so that as the gang is at minimum, it can be pulled against its stop to maintain tension on the cord.



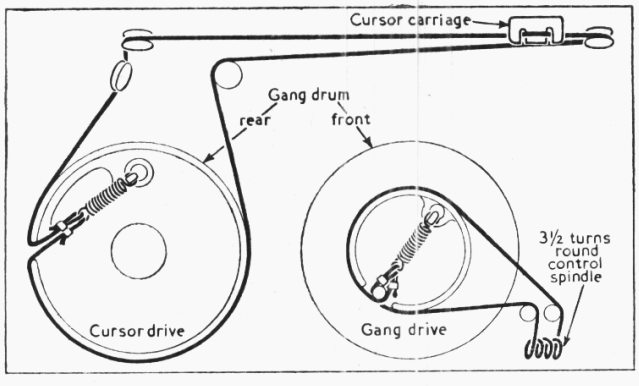
Diagrams of the tone control (*left*) and economy (*right*) switch units, viewed in the direction of the arrows in our under-chassis view.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from a new 120V H.T. battery and 2V accumulator. The economy switch was in the "normal" position, the receiver was tuned to the lowest wavelength on the M.W. band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400V range of a model 7 Avometer, chassis being the negative connection. The grid bias voltage measured across **R24** was 10.5V.

Valve		Anode		Screen	
		V	mA	V	mA
V1	DK32	93 (Oscillator 45)	0·7 (0·98)	42	1.1
V2	DF33	93	0·68	45	0·15
V3	DF33	93	0·4	43	0·15
V4	DAC32	17	0·05	—	—
V5	DL33	106	2·5	107	0·25
V6	DL33	106	2·5	107	0·25



Rear view (*left*) of the cursor drive system, and front view (*right*) of the gang drive system, in the Mullard MBS147. In each case the gang is at minimum capacitance.

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