

"TRADER" SERVICE SHEET

892

FERGUSON 219A

Covering also low-voltage Model 219L

THE Ferguson 219A is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 200-250 V, 50-100 c/s. The waveband ranges are 15.6-53 m, 192-590 m and 710-2,100 m.

The 219L is in general similar to the 219A, but is fitted with a mains auto-transformer and is suitable for 100 V mains. The differences are described under "General Notes" overleaf.

Release dates: 219A, October 1948; 219L, shortly. Original price, both models, £18 10s. plus purchase tax.

CIRCUIT DESCRIPTION

Aerial input is via series capacitors **C1**, **C2** (S.W.) or **C1** (M.W. and L.W.) and coupling coils **L1** (S.W.), **L2** (M.W.) and **L3** (L.W.) to single-tuned circuits **L4**, **L5**, **L6**, **L7**, **L8**, **L9**, **L10**, **L11**, **L12**, **L13**, **L14**, **L15**, **L16**, **L17**, **L18**, **L19**, **L20**, **L21**, **L22**, **L23**, **L24**, **L25**, **L26**, **L27**, **L28**, **L29**, **L30**, **L31**, **L32**, **L33**, **L34**, **L35**, **L36**, **L37**, **L38**, **L39**, **L40**, **L41**, **L42**, **L43**, **L44**, **L45**, **L46**, **L47**, **L48**, **L49**, **L50**, **L51**, **L52**, **L53**, **L54**, **L55**, **L56**, **L57**, **L58**, **L59**, **L60**, **L61**, **L62**, **L63**, **L64**, **L65**, **L66**, **L67**, **L68**, **L69**, **L70**, **L71**, **L72**, **L73**, **L74**, **L75**, **L76**, **L77**, **L78**, **L79**, **L80**, **L81**, **L82**, **L83**, **L84**, **L85**, **L86**, **L87**, **L88**, **L89**, **L90**, **L91**, **L92**, **L93**, **L94**, **L95**, **L96**, **L97**, **L98**, **L99**, **L100**.

(L.W.), which precede a triode-hexode valve (**V1**, Mullard metallized **ECH35**) operating as frequency changer with internal coupling.

Triode oscillator anode coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.) are tuned by **C36**, with parallel trimming by **C33** (S.W.), **C34** (M.W.) and **C35** (L.W.) and series tracking by **C8** (S.W.), **C9**, **C31** (M.W.) and **C32** (L.W.). Inductive reaction coupling to grid by coils **L7** (S.W.) and **L8** (M.W.) and capacitive coupling, due to the common impedance of tracker **C32** in grid and anode circuits, on L.W.

Second valve (**V2** Mullard metallized **EF39**) is a variable- μ R.F. pentode operating as intermediate frequency amplifier with tuned-transformer couplings **C37**, **L12**, **L13**, **C38** and **C39**, **L14**, **L15**, **C40**.

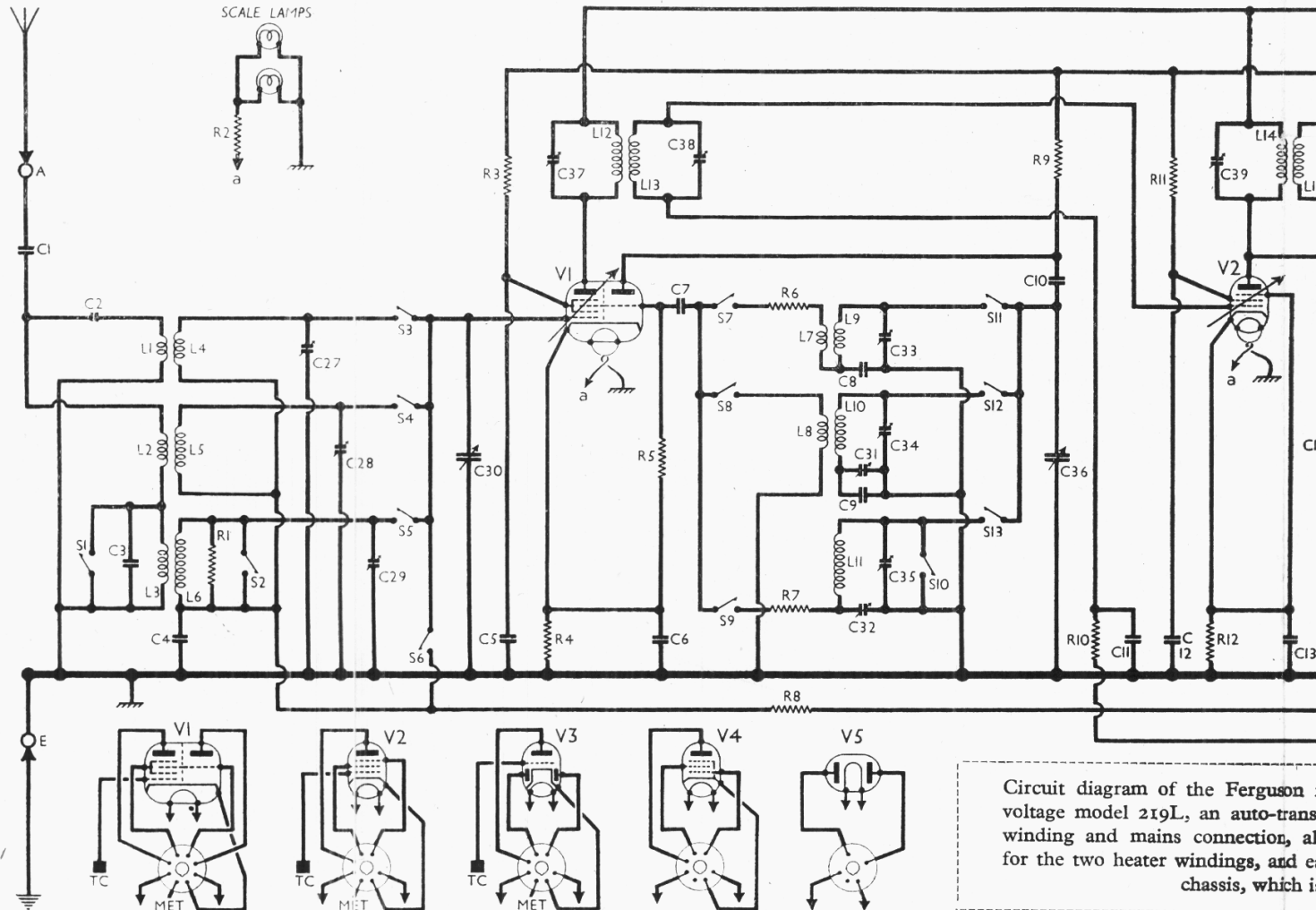
Intermediate frequency 470 kc/s. Diode second detector is part of double diode triode valve (**V3**, Mullard metallized **EBC33**). Audio frequency component in

rectified output is developed across manual volume control **R14**, which is the main load resistor, and passed via A.F. coupling capacitor **C17** and C.G. resistor **R15** to grid of triode section, which operates as A.F. amplifier.

I.F. filtering by **C14**, **R13**, **C15** in diode circuit, and **C20** in triode anode circuit. Provision for the connection of a gramophone pick-up across **R14**, via **S14**.

Second diode of **V3**, fed from **V2** anode via **C19**, provides D.C. potentials which are developed across load resistors **R19**, **R20** in series, tapped off, and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving A.G.C.

Resistance-capacitance coupling by **R18**, **C21** and **R21**, via grid stopper **R22**, between **V3** triode and pentode output valve (**V4**, Mullard **EL33**). Variable tone control by **C22**, **R23** in C.G. circuit, and fixed tone correction by **C24** in anode circuit. Provision is made for the connection of



Circuit diagram of the Ferguson 219L, an auto-transformer winding and mains connection, also for the two heater windings, and connection to chassis, which is earthed.

a low impedance external speaker across T1 secondary winding, and the internal speaker may be disconnected by means of the muting switch S15.

H.T. current is supplied by full-wave rectifying valve (V5, Mullard AZ31). Smoothing by resistor R25 and electrolytic capacitors C25, C26.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6CH35	262 111 Oscillator	1.8 3.6	89	2.5
V2 6BF39	262	7.2	102	—
V3 6BC33	105	2.0	—	—
V4 6BL33	247	40.0	215	4.6
V5 AZ31	333†	—	—	—

† Each anode, A.C.

Valve voltages and currents given in the table above are those measured in our receiver when it was operating on mains of 230 V, using the 230 V tapping on the mains transformer. The receiver was

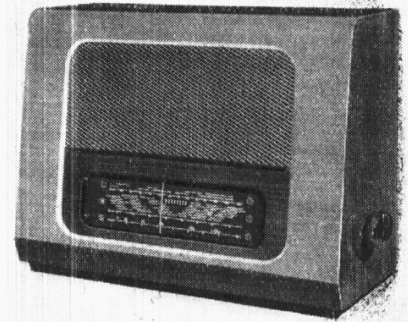
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COMPONENTS AND VALUES

CAPACITORS		Values (μF)	Locations
C1	Aerial series ...	0.0001	K4
C2	Aerial S.W. series...	0.00003	K4
C3	Aerial L.W. shunt...	0.0001	J4
C4	V1 A.G.C. decoup.	0.05	K4
C5	V1 S.G. decoupling	0.1	J4
C6	V1 cath. by-pass ...	0.1	J4
C7	V1 osc. C.G. ...	0.0001	J5
C8	Osc. S.W. tracker...	0.005	G3
C9	Osc. M.W. tracker	0.00025	H4
C10	Osc. anode coup. ...	0.0001	J5
C11	V2 A.G.C. decoup.	0.05	G5
C12	V2 S.G. decoupling	0.1	G4
C13	V2 cath. by-pass ...	0.1	H5
C14	I.F. by-pass capaci- tors ...	0.0001	F4
C15		0.0001	F4
C16*	V3 cath. by-pass ...	25.0	F4
C17	A.F. coupling ...	0.02	E5
C18*	H.T. feed decoupling ...	8.0	B1
C19	A.G.C. coupling ...	0.0001	F5
C20	I.F. by-pass ...	0.0001	E5
C21	A.F. coupling ...	0.02	E5

* Continued next col.

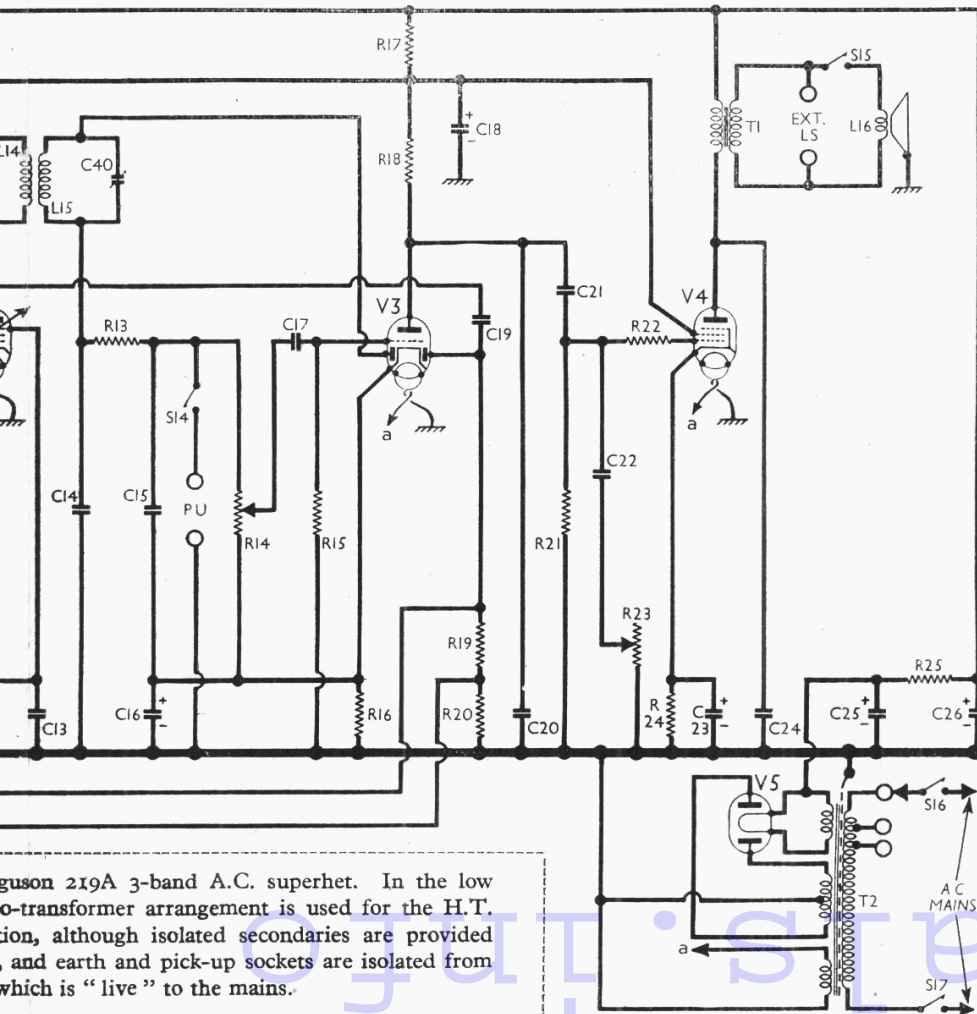
* Electrolytic.



The appearance of the Ferguson 219A and 219L superhets. The control knobs are at the sides of the cabinet.

CAPACITORS (continued)		Values (μF)	Locations
C22	Part. tone control...	0.01	C5
C23*	V4 cath. by-pass ...	25.0	D4
C24	Tone corrector ...	0.005	D4
C25*	H.T. smoothing ca- pacitors ...	16.0	B1
C26*		24.0	B1
C27†	Aerial S.W. trim...	0.00005	K3
C28†	Aerial M.W. trim...	0.00005	J3
C29†	Aerial L.W. trim ...	0.00005	J3
C30†	Aerial tuning ...	0.000483‡	A1
C31†	Osc. M.W. tracker	0.0003	G3
C32†	Osc. L.W. tracker...	0.0003	F3
C33†	Osc. S.W. trimmer	0.00005	H4
C34†	Osc. M.W. trimmer	0.00005	H4
C35†	Osc. L.W. trimmer	0.00005	H3
C36†	Oscillator tuning ...	0.000483‡	A1
C37†	1st I.F. transformer tuning ...	0.00018	A2
C38†		0.00018	A2
C39†	2nd I.F. transformer tuning ...	0.00018	B2
C40†		0.00018	B2

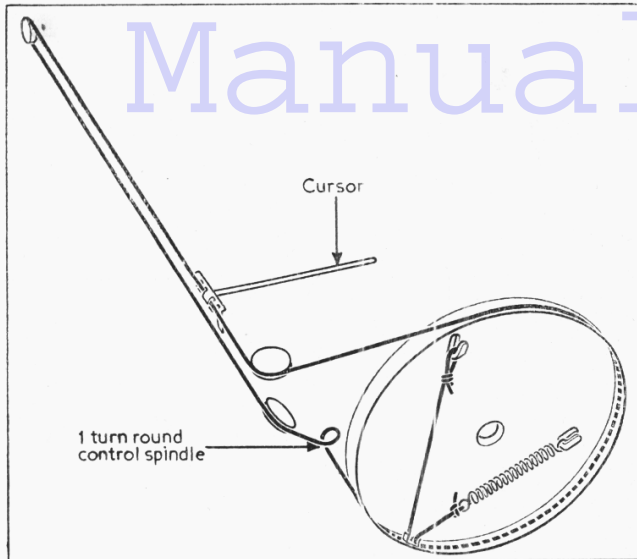
* Electrolytic. † Variable. ‡ Pre-set.
‡ "Swing" value, min. to max.



Ferguson 219A 3-band A.C. superhet. In the low-voltage transformer arrangement is used for the H.T. section, although isolated secondaries are provided for the speaker and earth and pick-up sockets are isolated from the mains which is "live" to the mains.

RESISTORS		Values (ohms)	Locations
R1	Aerial L.W. shunt...	47,000	J3
R2	Scale lamp series ...	2	D5
R3	V1 S.G. feed ...	47,000	F5
R4	V1 fixed G.B. ...	220	K5
R5	V1 osc. C.G. ...	47,000	K5
R6	Oscillator stabiliz- ing resistors ...	47	G4
R7		10,000	H5
R8	V1 A.G.C. decoup.	1,000,000	E5
R9	Osc. anode load ...	22,000	G5
R10	V2 A.G.C. decoup.	1,000,000	B4
R11	V2 S.G. feed ...	47,000	G5
R12	V2 fixed G.B. ...	330	H5
R13	I.F. stopper ...	100,000	F4
R14	Volume control ...	500,000	C4
R15	V3 C.G. resistor ...	2,200,000	F5
R16	V3 G.B., A.G.C. delay ...	1,000	F4
R17		3,000	G5
R18	H.T. feed resistor...	3,000	G5
R19	V3 triode load ...	47,000	E5
R20	A.G.C. diode load resistors ...	680,000	E5
R21		680,000	E4
R22	V4 C.G. resistor ...	680,000	D5
R23	V4 grid stopper ...	4,700	D5
R24	Tone control ...	100,000	C5
R25	V4 G.B. resistor ...	100	D4
R26	H.T. smoothing ...	1,200	B1

Manual



Sketch showing the tuning drive system, drawn as seen from the front right-hand bottom corner of the chassis, which has been tipped up to stand on its rear member. The drum is shown in the position it assumes when the gang is at maximum capacitance.

couple of inches when hooked to its anchor.

Finally, slip the cord into the claws of the pointer cord grip, and adjust the pointer as explained under "General Notes."

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator, via an $0.1 \mu\text{F}$ isolating capacitor in each lead, to control grid (top cap) of **V1** and the **E** socket, after removing the existing top cap connector and connecting a $500,000 \Omega$ resistor between the top cap of the valve and chassis. Switch set to M.W., tune to 200 m on scale, turn the volume control to maximum, feed in a 470 kc/s (638.3 m) signal, and adjust **C37**, **C38**, **C39** and **C40** (location references **A2**, **B2**) for maximum output. Finally, remove the $500,000 \Omega$ resistor and replace the original top cap connector.

R.F. and Oscillator Stages.—With the gang at maximum capacitance the cursor should be coincident with the high wavelength ends of the three scales. Transfer "live" signal generator lead to **A** socket, via a suitable dummy aerial.

S.W.—Switch set to S.W., tune to 20 m on scale, feed in a 20 m (15 Mc/s) signal, and adjust **C33** (**H4**) and **C27** (**K3**) for maximum output. Tune to 50 m on scale, feed in a 50 m (6 Mc/s) signal, and adjust the position of the end turn on **L9** (**G4**) to correct any calibration error which may be present. Repeat these operations until no improvement results.

M.W.—Switch set to M.W., tune to 210 m on scale, feed in a 210 m (1,429 kc/s) signal, and adjust **C34** (**H4**) and **C28** (**J3**) for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust **C31** (**G3**) for maximum output. Repeat these operations until no improvement results.

L.W.—Switch set to L.W., tune to 850 m on scale, feed in an 850 m (352.9 kc/s) signal, and adjust **C35** (**H3**) and **C29** (**J3**) for maximum output. Tune to 1,875 m on scale, feed in a 1,875 m (160 kc/s) signal, and adjust **C32** (**F3**) for maximum output. Repeat these operations until no improvement results.

impedance (2-3 Ω) external speaker. The internal speaker muting switch **S15** is operated by turning the external speaker plug a few degrees; an anti-clockwise movement mutes the internal speaker.

Scale Lamps.—These are two Osram M.E.S. type lamps, with small clear spherical bulbs, rated at 6.5 V, 0.3 A, although 6.2 V types are also suitable. As the valve heater winding is 6.2 V, a series resistor **R2** is inserted in the lead to the scale lamps.

Resistor R25.—This is a wire-wound cement coated unit rated at 1,200 Ω , 5 W.

Capacitors C18, C25, C26.—These are three electrolytics in a single metal tubular container mounted on the chassis deck. The unit is rated at 450 V D.C. working. The red tag is the positive connection of **C25** (16 μF), the yellow tag is that of **C26** (24 μF), and the plain tag is that of **C18** (8 μF), while the can forms the common negative connection.

Chassis Divergencies.—**R15**, which was 2,200,000 Ω in our chassis, may be 1,000,000 Ω in some cases. **R2**, which is usually 2 Ω , may sometimes be 1.5 Ω or even 1 Ω , according to the availability of components. **R7** may be 8,200 Ω or 10,000 Ω .

Model 219L.—This is in general like the 219A, but a special transformer is fitted to permit working from low-voltage mains. The ranges covered are 110-115 V, 120-130 V, 200-220 V and 230-250 V.

The transformer has double-wound low-voltage secondary windings for the receiver and rectifier valve heaters, but it uses an auto-transformer arrangement for the H.T. winding, and the rectifier works on the half-wave system. The valve used is a Mullard AZ31 with its anodes strapped.

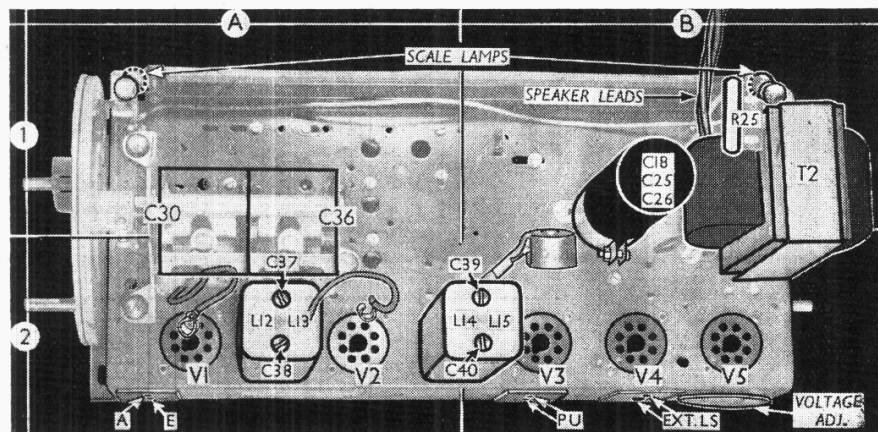
As the chassis is thus "live" to the mains, an isolating capacitor of 0.005 μF is inserted in the lead to the **E** socket, while a 0.1 μF capacitor isolates the "earthy" P.U. socket.

DRIVE CORD REPLACEMENT

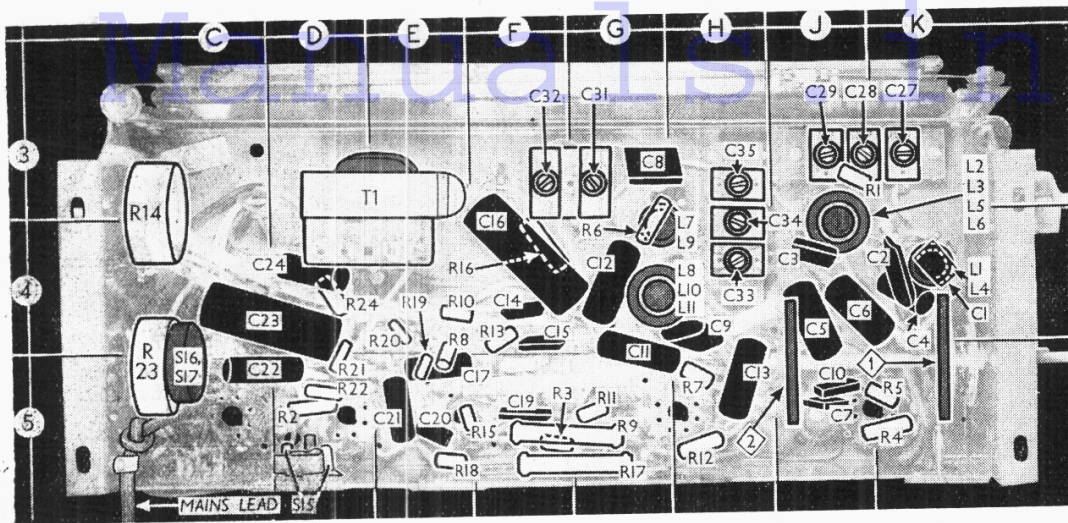
About five feet of flax fishing line is required for the tuning drive cord, this length allowing sufficient for tying off. To set the drum correctly, slacken the two fixing screws in the drum boss, turn the gang to maximum, then, with the receiver standing on its rear member, and the scale facing upwards, turn the drum to the position shown in our sketch above, and tighten up the screws.

The idea of drawing the sketch as seen with the receiver lying on its back was that this is the best position in which to carry out the operation of fitting a new cord.

Tie a loop in one end of the cord, hook it over the anchor as shown, thread the rest of the cord outwards through the groove slot, and run clockwise a short way round the drum, down to the control spindle and the inclined pulley, and follow the course indicated in our sketch, tying off the end to the tension spring, which should be expanded to about a



Plan view of the chassis. **R25** is the H.T. smoothing resistor, wire-wound and cement coated. In this position the air can circulate freely round it.

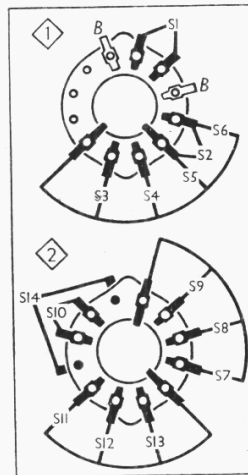


Under-chassis view. The wave-band switch units are indicated here by the numbers 1 and 2 in diamonds, with arrows to show the direction in which they are viewed in the diagrams in col. 2 below.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial coupling coils	5-0	K4
L2		4-0	J4
L3		50-0	J4
L4	Aerial tuning coils	Very low	K4
L5		3-2	J4
L6		31-0	J4
L7	Oscillator reaction coils	0-1	G4
L8		2-6	G4
L9	Oscillator tuning coils	Very low	G4
L10		2-2	G4
L11		5-5	G4
L12	1st I.F. trans.	Pri. ... 7-0	A2
L13		Sec. ... 7-0	A2
L14	2nd I.F. trans.	Pri. ... 8-0	B2
L15		Sec. ... 8-0	B2
L16	Speech coil	1-25	—
T1	Output trans.	Pri. ... 390-0	E3
		Sec. ... 0-1	E3
T2	Mains Rect. trans.	Pri., total 30-0	B2
		Heat. sec. Very low	B2
		sec. ... Very low	B2
	H.T. sec., total ...	720-0	B2
S1-S14	W/band switches	—	—
S15	Int. spkr. switch ...	—	D5
S16, S17	Mains sw., g'd R23	—	C5

cheese-head screws (with metal washers) securing the chassis side members to the base of the cabinet;

Switch Diagrams and Table



Diagrams of the waveband switch units, drawn as seen when viewed in the direction of the arrows in our under-chassis view above. Below is the associated switch table.

Switch	S.W.	M.W.	L.W.	Gram.
S1	—	C	—	—
S2	—	C	—	—
S3	C	—	—	—
S4	—	C	—	—
S5	—	—	C	—
S6	—	—	—	C
S7	C	—	—	—
S8	—	C	—	—
S9	—	—	C	—
S10	—	C	—	—
S11	C	—	—	—
S12	—	C	—	—
S13	—	—	C	—
S14	—	—	—	C

the chassis may now be slid from the cabinet to the extent of the speaker leads, which is sufficient for most purposes. To free the chassis entirely, unsolder the three speaker leads at tags on the speaker chassis.

When replacing, ensure that the heads of the chassis retaining screws are covered by discs of insulating material. The two red speaker leads should be re-connected to the speech coil tags on the speaker chassis, and the black earthing lead goes to a soldering tag beneath the upper right-hand speaker fixing nut.

Removing Speaker.—Remove the chassis as previously described, loosen the nuts of the four speaker retaining clamps, swivel the clamps aside, and lift out the speaker.

When replacing, the connecting panel should be at the top, and if the leads have been disconnected they should be resoldered as previously described.

GENERAL NOTES

Switches.—S1-S14 are the waveband and gramophone pick-up switches, ganged in two rotary units beneath the chassis. These units are indicated in our under-chassis view, where they are identified by numbers 1 and 2 in diamonds, with arrows to show the direction in which they are viewed in the diagrams in col. 2, where they are shown in detail.

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

S15 is the internal speaker switch, associated with the external speaker sockets and operated by a radial movement of the external speaker plug. It is closed when the external speaker plug is in the vertical position. If the plug is turned a few degrees anti-clockwise, S15 opens to mute the internal speaker.

S16, S17 are the mains input circuit switches, ganged with the variable tone control R23.

External Speaker.—Two sockets and a special plug are provided at the rear of the chassis for the connection of a low

Valve Analysis—continued

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 400 V scale of a model 7 Avometer, chassis being the negative connection.

DISMANTLING THE SET

Almost unimpeded access to the underside of the chassis may be obtained upon sliding out the detachable bottom cover which is held by two swivel clips inside the cabinet.

Removing Chassis.—Remove the four control knobs (two recessed grub screws each, inside cabinet) and the four 2BA