*Supplement to The Wireless & Electrical Trader, January 8, 1949*



# 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, C30** (S.W.), **L5, C30** (M.W.) and **L6, C30** (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 capacitative 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-mu 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 diode 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
voltage model 219L, an auto-trans
winding and mains connection, a
for the two heater windings, and e
chassis, which i

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 ECH35 | 262 | 1·8 | 89 | 2·5 |
| | Oscillator | | | |
| | 111 | 3·6 | | |
| V2 EF39 | 262 | 7·2 | 102 | — |
| V3 EBC33 | 105 | 2·0 | — | — |
| V4 EL33 | 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

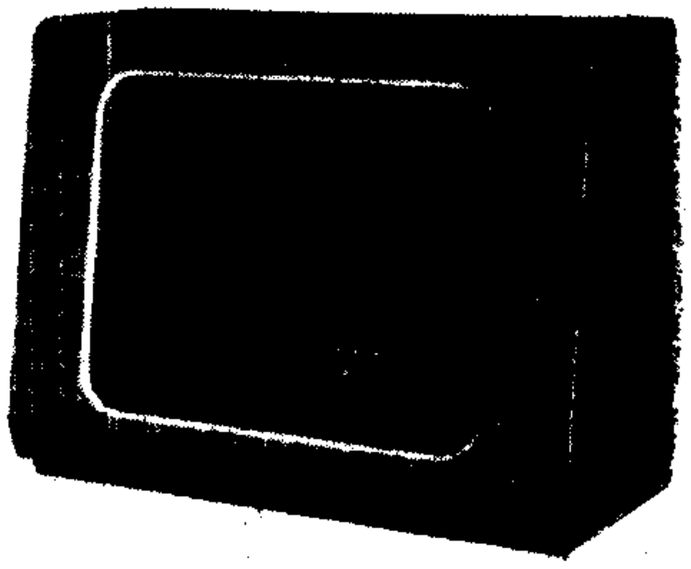
*(Continued col. 1 overleaf)*

## 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 capacitors ... ... | 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.

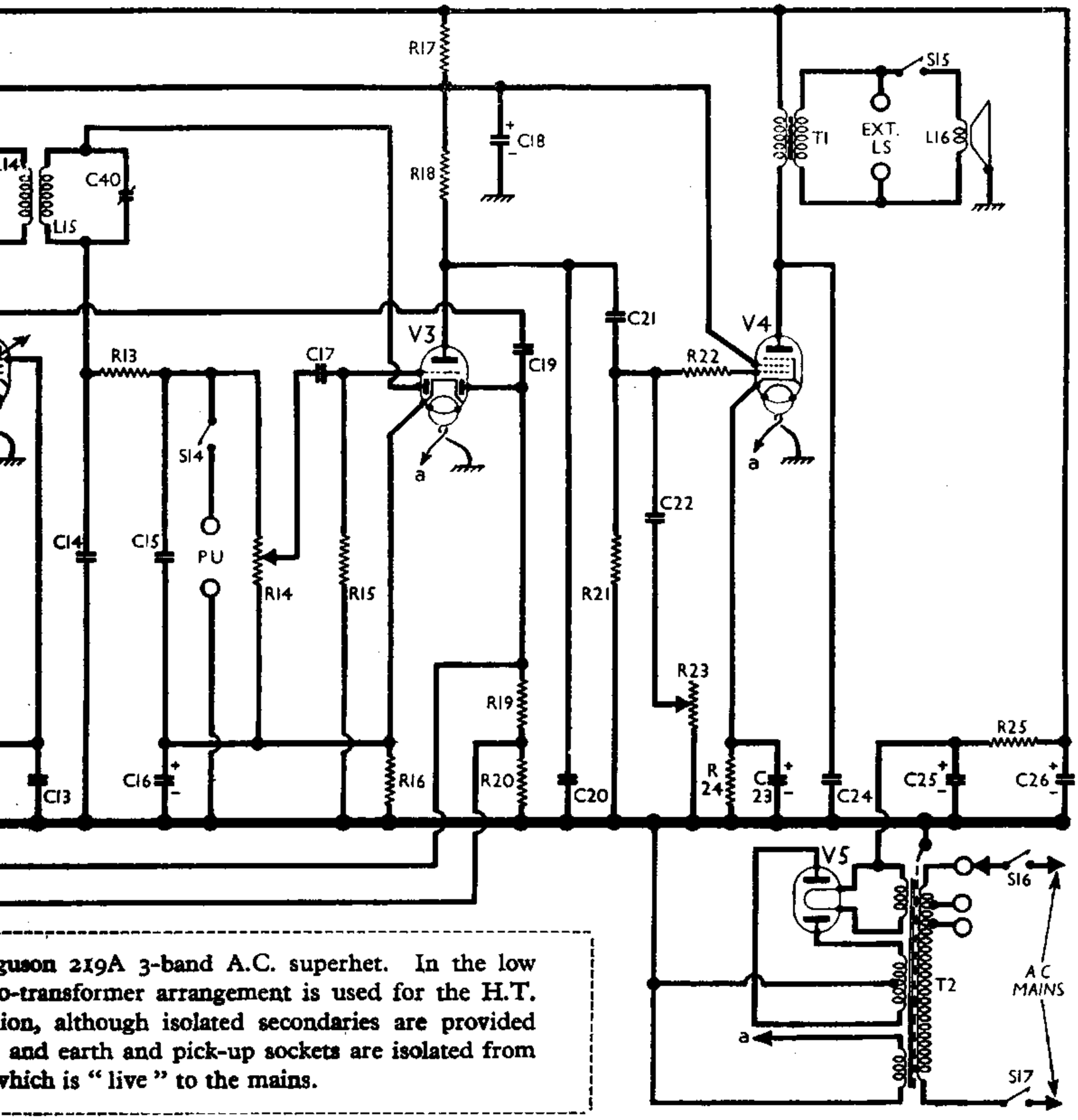


The appearance of the Ferguson 219A and 219L superhets. The control knobs are at the sides of the cabinet.

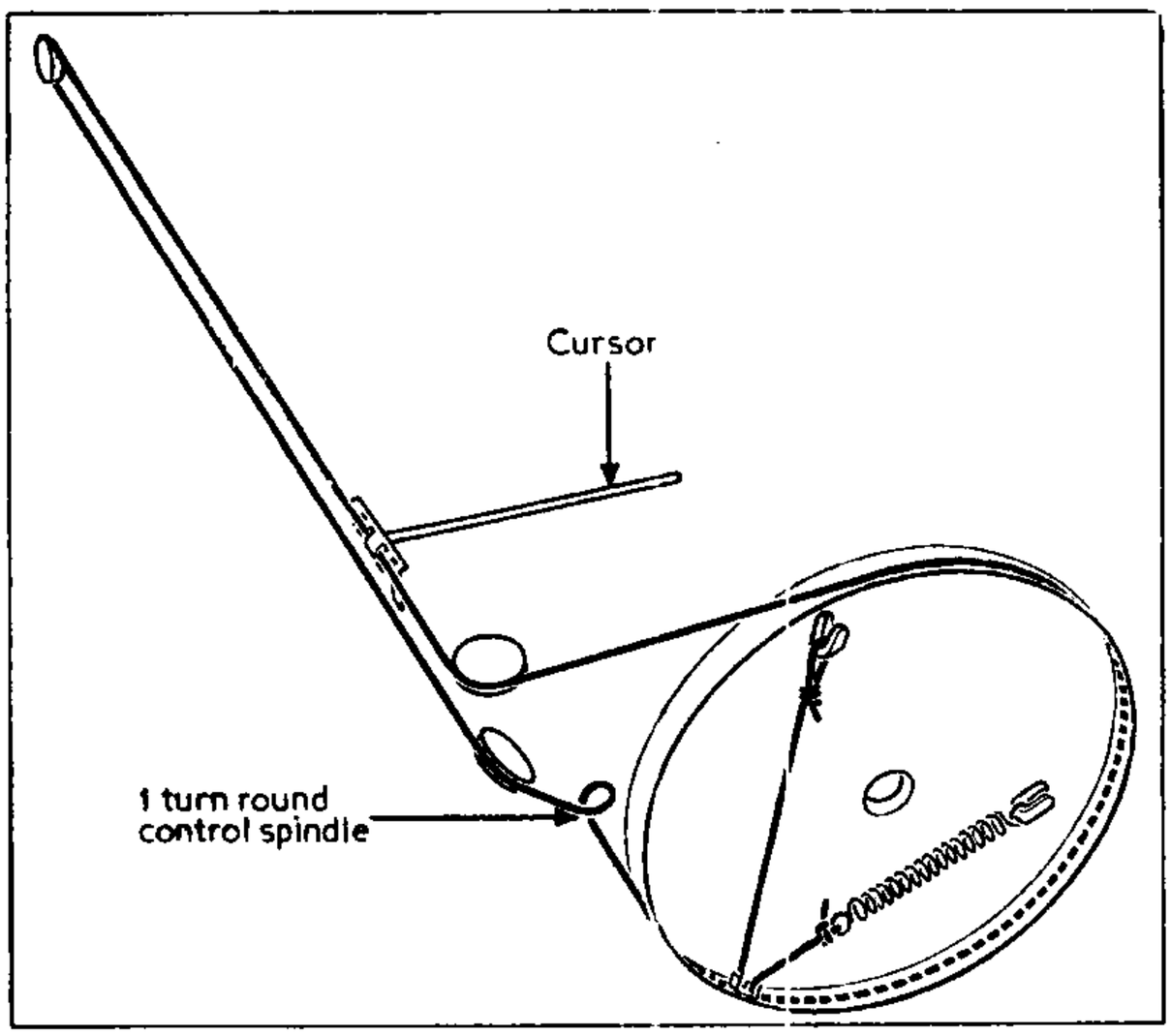
| | CAPACITORS (*continued*) | Values (μF) | Locations |
|---|---|---|---|
| C22 | Part. tone control... | 0·01 | C5 |
| C23* | V4 cath. by-pass ... | 25·0 | D4 |
| C24 | Tone corrector ... | 0·005 | D4 |
| C25* | H.T. smoothing capacitors ... ... | 16·0 | B1 |
| C26* | | 24·0 | B1 |
| C27‡ | Aerial 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.

| | 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 stabilizing 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 | E4 |
| 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 | H.T. feed resistor... | 3,000 | G5 |
| R18 | V3 triode load ... | 47,000 | E5 |
| R19 | A.G.C. diode load resistors ... | 680,000 | E5 |
| R20 | | 680,000 | E4 |
| R21 | V4 C.G. resistor ... | 680,000 | D5 |
| R22 | V4 grid stopper ... | 4,700 | D5 |
| R23 | Tone control ... | 100,000 | C5 |
| R24 | V4 G.B. resistor ... | 100 | D4 |
| R25 | H.T. smoothing ... | 1,200 | B1 |




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




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.

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 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

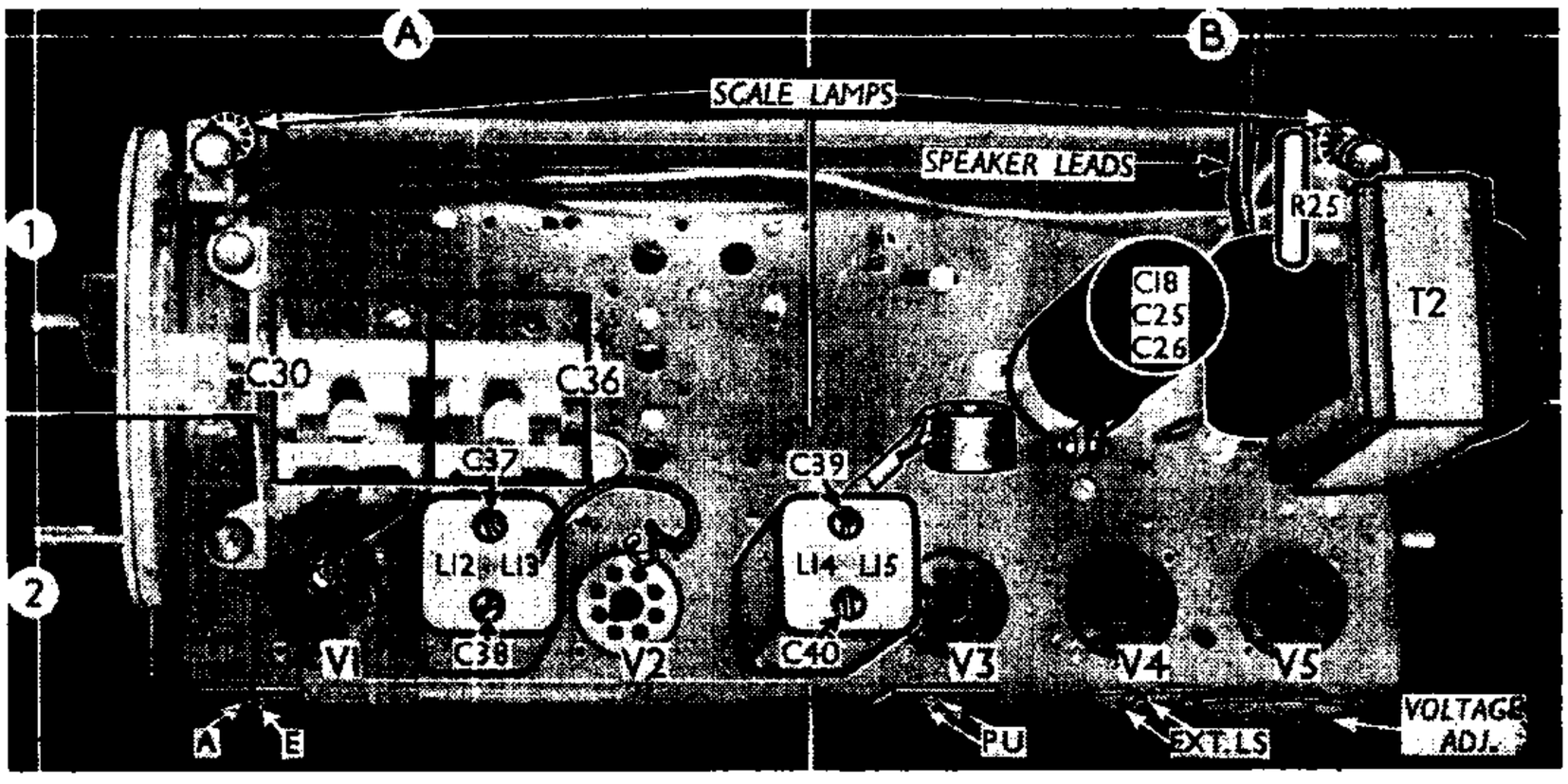
**I.F. Stages.**—Connect signal generator, via an 0.1 μF isolating capacitor in each lead, to control grid (top cap) of **V1** and the **E** socket, after removing the existing top cap connector and connecting a 500,000 Ω resistor between the top cap of the valve and chassis. Switch set to M.W., tune 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 Ω 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.




**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.**

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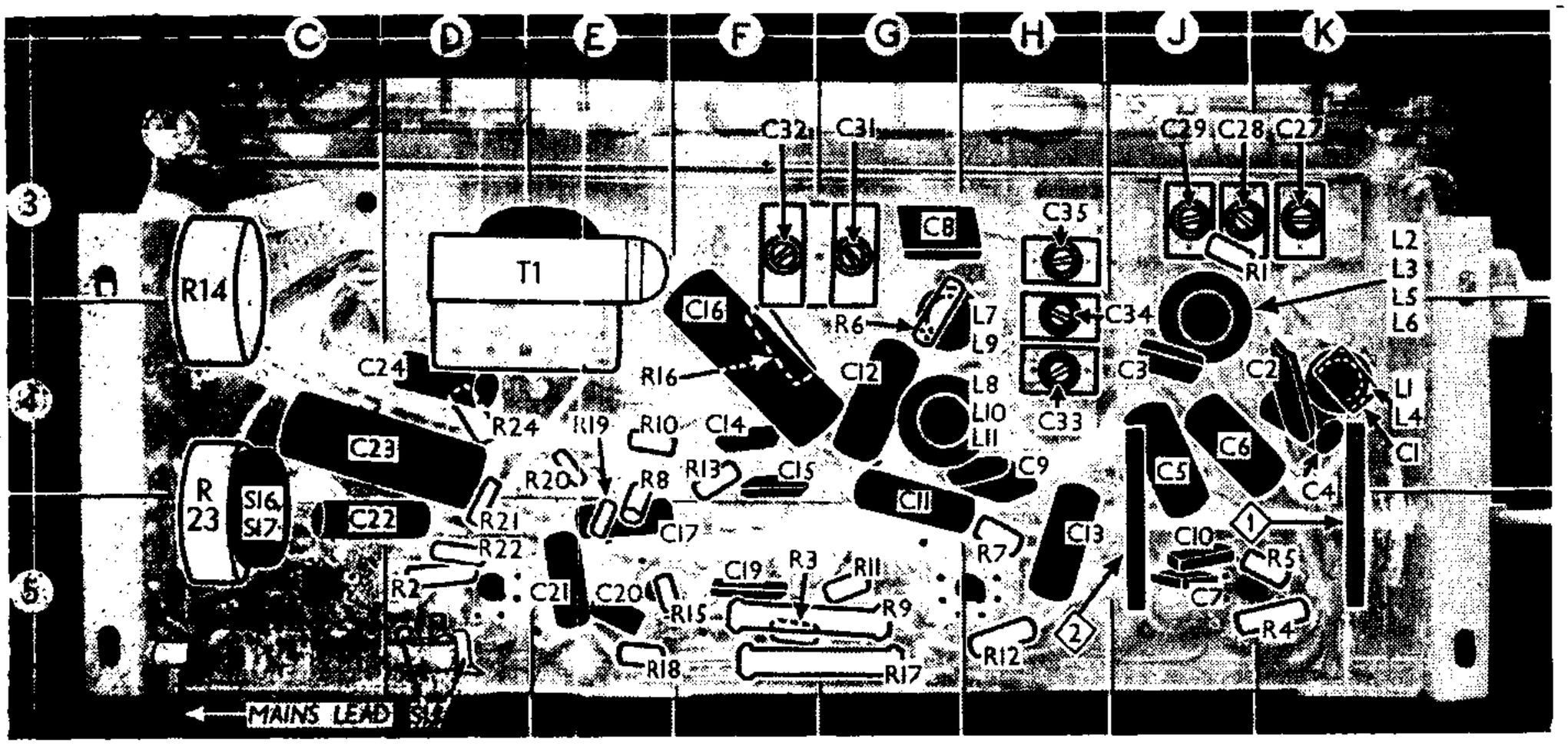



Under-chassis view. The waveband switch units are indicated here by the numbers 1 and 2 in diamonds, with arrows to show the direction in which they are viewed in the diagrams in col. 2 below.

| | OTHER COMPONENTS | | Approx. Values (ohms) | Locations |
|---|---|---|---|---|
| L1 | Aerial coupling coils | | 5·0 | K4 |
| L2 | | | 4·0 | J4 |
| L3 | | | 56·0 | 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 | | | 3·2 | 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 trans. | Pri., total | 30·0 | B2 |
| | | Heat. sec. | Very low | B2 |
| | | Rect. heat 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 |

**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.

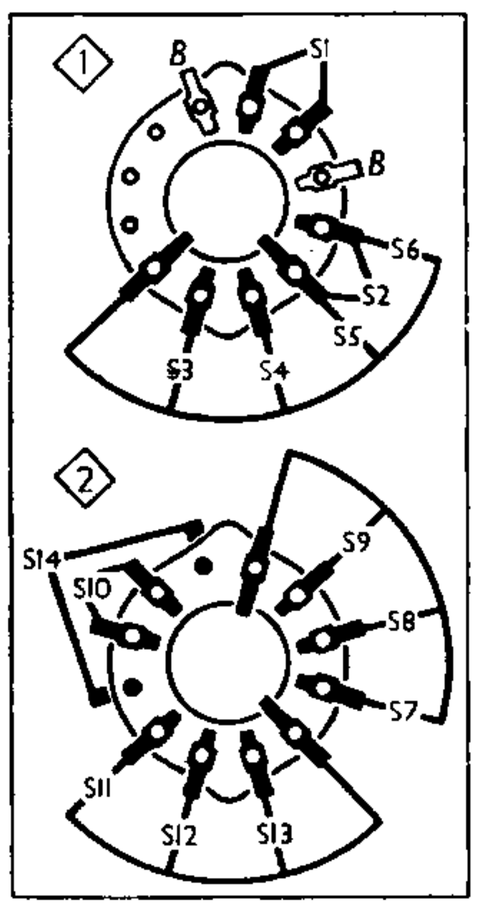
Voltages were measured on the 400 V scale of a model 7 Avometer, chassis being the negative connection.

## 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 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 reconnected 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