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"TRADER" SERVICE SHEET

844

FERGUSON 207

COVERING A.C. and A.C./D.C. VERSIONS

THREE versions are made of the Ferguson 207: the 207A, for A.C. mains only of 200-250 V; the 207L for A.C. mains only of 100-250 V; and the 207U, for A.C. or D.C. mains of 200-250 V. All versions are suitable for mains frequencies of 50-100 c/s.

The difference between the two A.C. versions is confined to the mains transformer primary, but either A.C. version can be converted to an A.C./D.C. version by replacing the power unit and valves and rewiring the heaters. The two power units are shown separately in our circuit diagram, where seven leads on each show clearly how either may be connected to the main chassis. In either case the chassis is "live" to the mains.

The 207 is a 4-valve (plus rectifier) 3-band superhet, with provision for two pre-set M.W. stations in the fourth and fifth positions (PS2 and PS1) of the waveband switch. The ranges are 16-53 m, 197-577.5 m, and 690-2015 m.

Release date, all models, October, 1947. *Original prices:* 207*A*, 207*U*, £24 *plus purchase tax;* 207*L is available only for export.*

CIRCUIT DESCRIPTION

Aerial input is via series capacitor **C1** and coupling coils **L1** (S.W.), **L2** (M.W.) and **L3** (L.W.) to single-tuned circuits **L4, C29** (S.W.), **L5, C29** (M.W.) and **L6, C29** (L.W.). For pre-set tuning in the aerial circuit on M.W., **C34** is replaced by pre-set trimmer type capacitors **C32** and **C33,** selected by switches **S9, S10** at the fourth and fifth positions of the waveband switch.

First valve **(V1, Mullard metallized ECH 35)** is a triode-hexode operating as frequency changer with internal coupling. For manual operation triode oscillator anode coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.) are tuned by **C39.** Parallel trimming by **C38** (S.W.), **C35** (M.W.) and **C36** (L.W.); series tracking by **C9** (S.W.), **C10** (M.W.) and **C11, C37** (L.W.). Reaction coupling to grid circuit is obtained from **C11** on L.W., reaction coil **L8** on M.W., and from **L7** and **C9** on S.W.

For pre-set tuning all the foregoing circuits are disconnected and replaced by one of the iron-dust cored pre-set coils **L14, L15,** which are tuned by **C12** and selected by **S25, S26.** Reaction coupling is then by **L12** or **L13** via **S15, S16.**

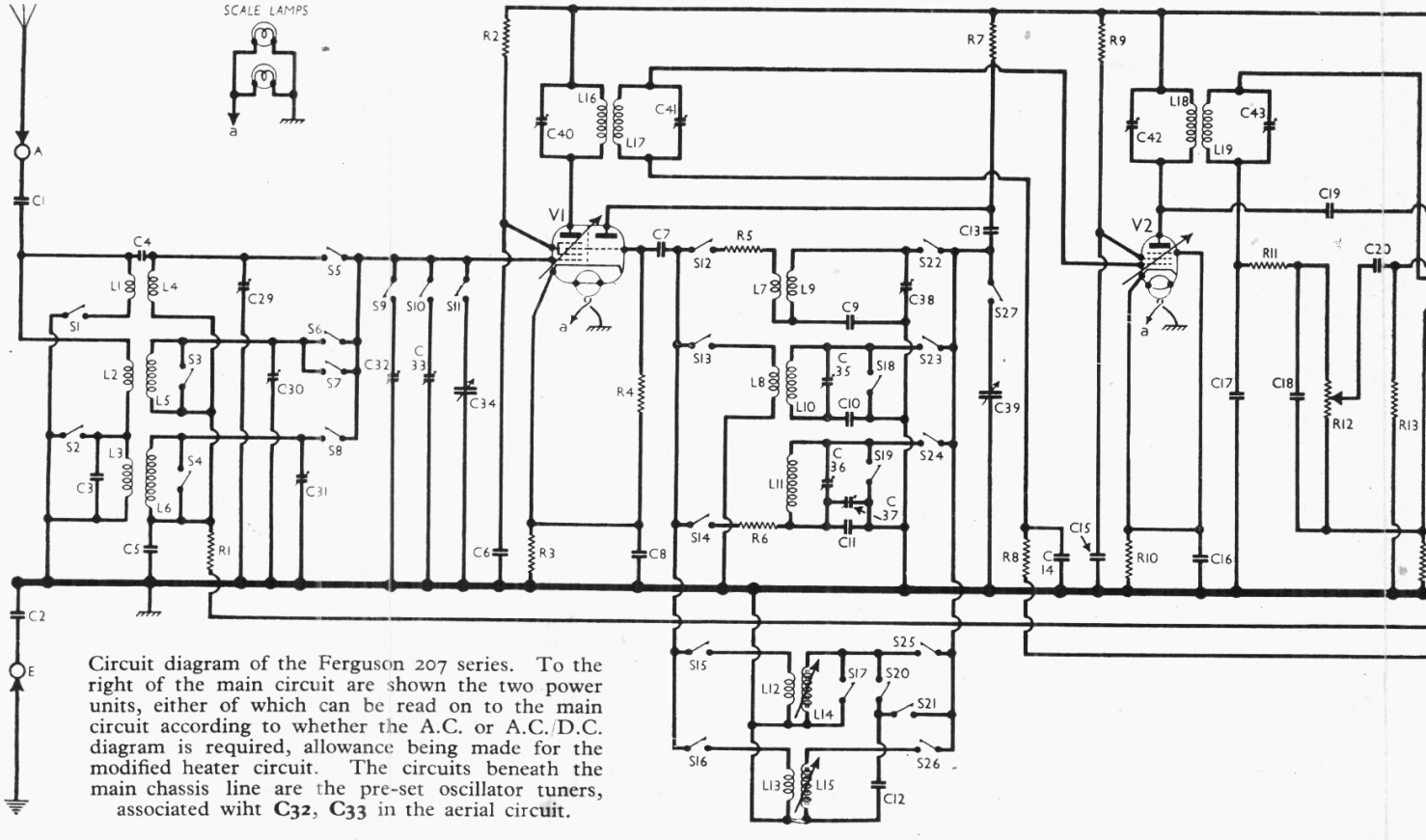
Second valve **(V2, Mullard metallized EF39)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with transformer couplings.

Intermediate frequency 470 kc/s.

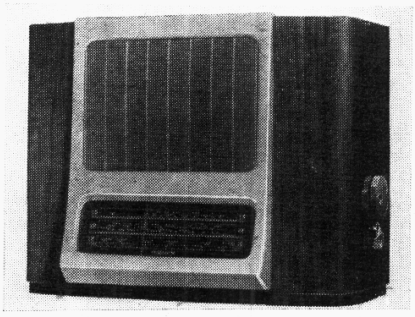
Diode second detector is part of double diode triode valve **(V3, Mullard metallized EBC33).** Audio-frequency component in rectified output is developed across manual volume control **R12,** which is also the diode load resistor, and passed via A.F. coupling capacitor **C20** to C.G. of triode section, which operates as A.F. amplifier. I.F. filtering by **C17, R11** and **C18** in diode circuit, and **C21** in triode anode circuit.

Second diode of **V3,** fed from **V2** anode via **C19,** provides D.C. potentials, which are developed across load resistors **R17, R18** and fed back via decoupling circuits as G.B. to F.C. and I.F. valves, giving A.V.C.

Resistance-capacitance coupling by **R16, C22** and **R19,** via grid stopper **R21,** between triode and pentode output valve **(V4, Mullard EL33).** Variable tone control in C.G. circuit by **C23, R20,** and fixed tone correction by **C24** in anode circuit.



Circuit diagram of the Ferguson 207 series. To the right of the main circuit are shown the two power units, either of which can be read on to the main circuit according to whether the A.C. or A.C./D.C. diagram is required, allowance being made for the modified heater circuit. The circuits beneath the main chassis line are the pre-set oscillator tuners, associated wiht **C32, C33** in the aerial circuit.



The appearance of the Ferguson 207 receivers.

Power Supplies

In the A.C. version, H.T. current is supplied by half-wave rectifier **(V5, Mullard AZ31)** operating with its anodes strapped in parallel, from the extended primary of the heater transformer **T2,** which forms an auto-transformer. Smoothing by resistor **R23** and electrolytic capacitors **C27** and **C26.** The H.T. feed to **V3** triode anode via **R15** is decoupled by **C28.** Fuses **F1, F2** protect the mains input circuit.

In the A.C./D.C. version, the A.C. power unit, shown in our diagram slightly spaced from the main receiver circuit, is replaced by the A.C./D.C. power unit, shown beyond it. The seven leads terminated in arrow-heads replace those of the A.C. unit, and the valve heaters are rewired to form a series chain as shown beneath the circuit.

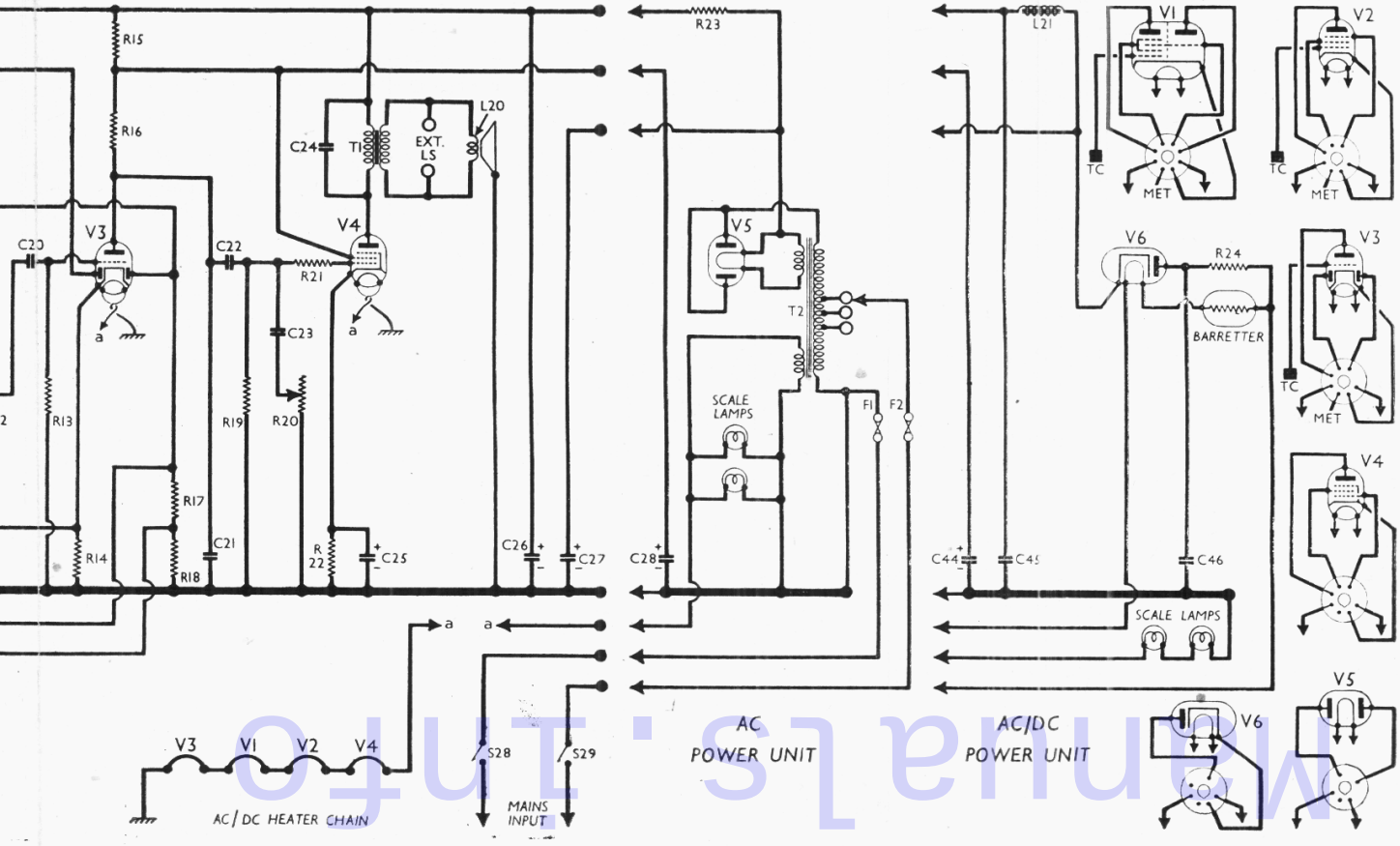
H.T. current is supplied by I.H.C. half-wave rectifying valve **(V6, Mullard CY31)** which, with D.C. mains, behaves as a low resistance. Smoothing by iron-cored choke **L21** and electrolytic capacitors **C27** and **C26.** The H.T. feed to **V3** triode anode via **R15** is decoupled by **C44.** R.F. filtering by **C45** in the H.T. circuit and **C46** in the mains input circuit. The valve heater chain, scale lamps, **V6** heater and the current regulating barretter **(Atlas 150/A4)** in series are connected across the mains input.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)	Location
R1	V1 hex. C.G. decoup.	1,000,000	H7
R2	V1 S.G. feed ...	100,000	J8
R3	V1 fixed G.B. ...	500	K8
R4	V1 osc. C.G. ...	50,000	K8
R5	Osc. S.W. stab. ...	30	J7
R6	Osc. L.W. stab. ...	8,200	I6
R7	Osc. H.T. feed ...	25,000	J8
R8	V2 C.G. decoup. ...	1,000,000	H7
R9	V2 S.G. feed ...	100,000	H7
R10	V2 fixed G.B. ...	500	H8
R11	I.F. stopper ...	100,000	G7
R12	Volume control ...	500,000	D3
R13	V3 C.G. resistor ...	2,000,000	G7
R14	V3 G.B., A.V.C. delay	3,900	G7
R15	H.T. feed resistor...	10,000	F6
R16	V3 triode load ...	250,000	F7
R17	A.V.C. diode load resistors ...	680,000	H7
R18		680,000	H7
R19	V4 C.G. resistor ...	680,000	F7
R20	Tone control ...	100,000	E7
R21	V4 C.G. stopper ...	5,000	F7
R22	V4 G.B. resistor ...	150	F7
R23	H.T. smoothing ...	1,200	C1
R24	V6 surge limiter ...	100	—

	CAPACITORS	Values (μF)	Location
C1	Aerial series ...	0·00025	K6
C2	Earth isolator ...	0·005	L7
C3	Aerial L.W. shunt...	0·0001	K6
C4	Aerial S.W. coup....	0·000005	K6
C5	V1 hex. C.G. decoup.	0·05	K6
C6	V1 S.G. decoupling	0·1	J7
C7	V1 osc. C.G. ...	0·0001	J7
C8	V1 cath. by-pass ...	0·1	K7
C9	Osc. S.W. tracker...	0·005	J6
C10	Osc. M.W. tracker	0·000515	I6
C11	Osc. L.W. tracker...	0·0001	I5
C12	Osc. P.S. tuning ...	0·00025	J7
C13	Osc. anode coup. ...	0·0001	J7
C14	V2 C.G. decoup. ...	0·05	H7
C15	V2 S.G. decoup. ...	0·1	H7
C16	V2 cath. by-pass ...	0·1	I8
C17	I.F. by-pass capacitors ...	0·0001	G7
C18		0·0001	G7
C19	A.V.C. coupling ...	0·0001	G8
C20	A.F. coupling ...	0·02	F7
C21	I.F. by-pass ...	0·0001	F8
C22	A.F. coupling ...	0·02	F7
C23	Tone control ...	0·005	F8
C24	Tone corrector ...	0·002	—
C25*	V4 cath. by-pass ...	25·0	F6
C26*	H.T. smoothing capacitors ...	16·0	F5
C27*		16·0	F5
C28*	H.T. feed decoup....	4·0	G6
C29‡	Aerial S.W. trim....	0·00005	K5
C30‡	Aerial M.W. trim....	0·00005	K5
C31‡	Aerial L.W. trim....	0·00005	J5
C32‡	Aerial P.S.2 tune...	0·00015	K8
C33‡	Aerial P.S.1 tune...	0·0004	K8
C34†	Aerial tuning ...	0·000483§	A3
C35‡	Osc. M.W. trim. ...	0·00005	J5
C36‡	Osc. L.W. trim. ...	0·00005	I5
C37‡	Osc. L.W. track ...	0·00003	B2
C38‡	Osc. S.W. trim. ...	0·00005	J5
C39†	Oscillator tuning ...	0·000483§	A3
C40‡	1st I.F. transformer tuning ...	0·00018	C4
C41‡		0·00018	C4
C42‡	2nd I.F. transformer tuning ...	0·00018	C4
C43‡		0·00018	D4
C44*	H.T. feed decoup....	4·0	—
C45	H.T. R.F. by-pass	0·1	—
C46	Mains R.F. by-pass	0·01	—

* Electrolytic. † Variable. ‡ Pre-set. § "Swing" value, minimum to maximum.



OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial coupling coils	2·2	K6
L2		17·5	K6
L3		26·5	K6
L4	Aerial tuning coils	Very low	K6
L5		3·5	K6
L6		22·0	K6
L7	Oscillator reaction coils	0·1	J6
L8		1·5	J6
L9	Oscillator tuning coils	Very low	J6
L10		2·0	J6
L11		6·0	J6
L12	P.S.2 react. coil	2·0	J8
L13	P.S.1 react. coil	1·4	J7
L14	P.S.2 tuning coil	1·8	J8
L15	P.S.1 tuning coil	1·4	J7
L16	1st I.F. trans. Pri.	8·0	C4
L17	1st I.F. trans. Sec.	8·0	C4
L18	2nd I.F. trans. Pri.	8·0	D4
L19	2nd I.F. trans. Sec.	8·0	D4
L20	Speech coil	2·0	—
L21	H.T. choke	130·0	—
T1	Speaker trans. Pri.	245·0	—
	Speaker trans. Sec.	0·3	—
T2	Mains trans. Pri., total	85·0	C2
	Mains trans. Htr. sec.	0·15	C2
	Mains trans. Rect. heat. sec.	0·1	C2
S1-S27	W/band switches	—	K7
S28, S29	Mains switches, ganged R20	—	F7
F1, F2	Mains fuses, 1·0 A.	—	D2

VALVE ANALYSIS

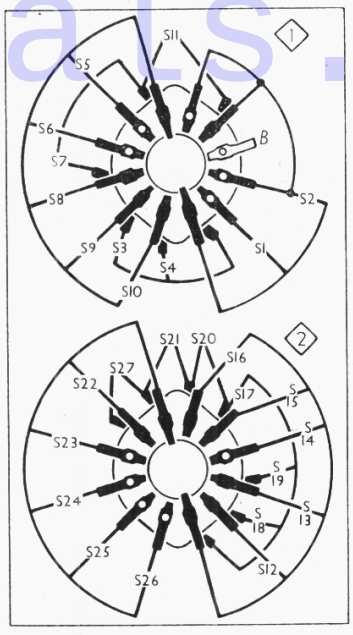
Valve voltages and currents given in the table below are those measured in our receivers when they were operating from A.C. mains of 232 V, using the 220-230 V tapping on the mains transformer in the case of the A.C. model. The receivers were tuned to the lowest wavelength on the M.W. band, with volume controls at maximum and tone controls in the "deep" position, but there was no signal input.

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

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
	A.C. Model			
V1 ECH35	283	2·6	150	1·4
	Oscillator			
	82	5·3		
V2 EF39	283	5·9	92	1·6
V3 EBC33	57	0·7	—	—
V4 EL33	268	34·0	230	3·6
V5 AZ31	320*	—	—	—
	A.C./D.C. Model			
V1 CCH35	210	1·0	62	1·3
	Oscillator			
	104	3·9		
V2 EF39	210	4·0	62	1·2
V3 EBC33	36	0·4	—	—
V4 CL33	200	36·0	160	3·5
V6 CY31†	—	—	—	—

* Anode, A.C.
† Cathode to chassis 223 V, D.C.

Waveband Switch Unit Diagrams and Table



Diagrams of the two waveband switch units, drawn as seen when viewed from the power unit end of an inverted chassis. ***B*** indicates a blank tag. The associated table is on the right of the diagrams.

Switch	S.W.	M.W.	L.W.	P.S.2	P.S.1
S1	C	—	—	—	—
S2	—	C	—	C	C
S3	C	—	—	—	—
S4	C	C	—	—	—
S5	C	—	—	—	—
S6	—	C	—	—	—
S7	—	—	—	C	C
S8	—	—	C	—	—
S9	—	—	—	C	—
S10	—	—	—	—	C
S11	C	C	C	—	—
S12	C	—	—	—	—
S13	—	C	—	—	—
S14	—	—	C	—	—
S15	—	—	—	C	—
S16	—	—	—	—	C
S17	—	—	C	—	—
S18	C	—	—	—	—
S19	C	C	—	—	—
S20	—	—	—	C	—
S21	—	—	—	—	C
S22	C	—	—	—	—
S23	—	C	—	—	—
S24	—	—	C	—	—
S25	—	—	—	C	—
S26	—	—	—	—	C
S27	C	C	C	—	—

DISMANTLING THE SET

Almost unimpeded access to the under-side of the chassis may be obtained upon removal of the bottom cover (six round-head wood screws with washers).

Removing Chassis.—Remove two control knobs (two recessed grub screws each inside cabinet) at either side of the cabinet, and unclip the scale lamp holders;
from the underside of the cabinet remove the fibre covers over the heads of the chassis retaining screws, extract the four screws (with metal washers), and slide out the chassis to the extent of the speaker leads.

To free the chassis entirely, unsolder the black lead from a tag beneath the upper right-hand speaker fixing nut, and the two leads from the connecting panel on the speaker input transformer.

When replacing, reconnect the red lead and black/brown lead to tags on the speaker input transformer, and the black lead to the earthing tag on the speaker chassis. Do not omit the replacement of the insulating covers over the heads of the chassis retaining screws.

Removing Speaker.—Remove chassis as previously described, and extract the two round-head wood screws securing the extension speaker socket panel to the cabinet;
loosen the nuts of the four speaker retaining clamps and lift out speaker.

When replacing, the connecting panel on the input transformer should point to the top left-hand corner of the cabinet.

GENERAL NOTES

Switches.—**S1-S27** are the waveband and pre-set station switches, ganged in two rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams in col. 2, where they are drawn as seen when viewed from the mains input end of an inverted chassis.

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

S28, S29 are the Q.M.B. mains switches, ganged with the tone control **R20.**

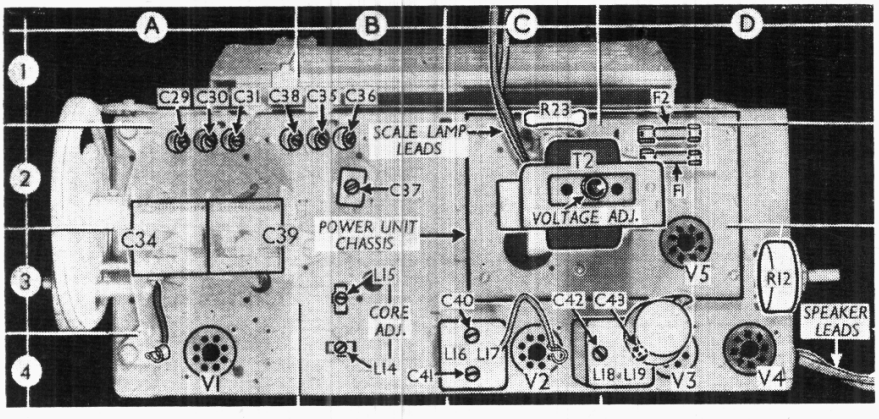
Scale Lamps.—These are two Osram lamps with clear spherical bulbs and M.E.S. bases. They are rated at 6.5 V (or 6.2 V), 0.3 A for any of the three versions of chassis.

External Speaker.—Two sockets are provided on a panel at the rear of the cabinet for the connection of a low impedance (about 2 Ω) external speaker.

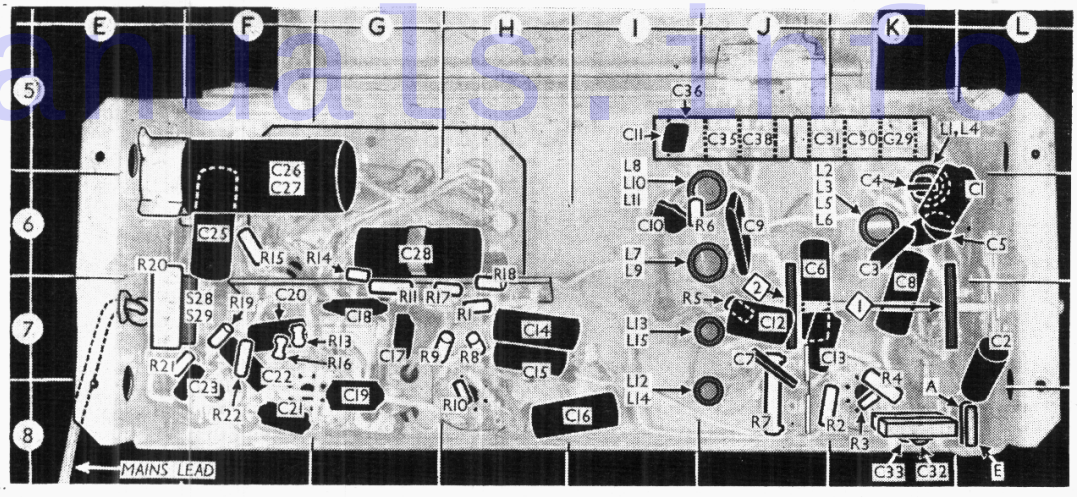
Capacitors C26, C27.—These are two dry electrolytics in a tubular cardboard container mounted in a clip beneath the chassis.

Both are rated at 16 μF, 450 V D.C. working, but the red tag is the positive of the reservoir section **(C27)** and the yellow one that of the other **(C26).** The black tag is the common negative connection.

Chassis Divergencies.—**R5,** which is quoted in our component tables as 30Ω, may be anything between 20 Ω and 40 Ω.



Plan view of the A.C. chassis. If the power unit is replaced, it applies equally to the A.C. D.C. version. The two pre-set station oscillator adjustments **L14, L15** are indicated on the chassis deck. The aerial circuit adjustments **C32, C33** are shown in the under-chassis view.



Under-chassis view. **C28** is mounted on the power unit chassis, but the **C26, C27** unit is mounted on the side of the main chassis. The waveband switch units (marked **1** and **2** in diamonds) are indicated on the right, but they are viewed from the left in the diagrams in col. 2, as indicated by the arrows here.

C17, which was returned to chassis in our sample, may be returned to **V3** cathode. If wired as in our diagram, it should be altered to the latter arrangement if signals are distorted when the volume control is near to minimum. A 51,000 Ω resistor may be found in parallel with **L6.**

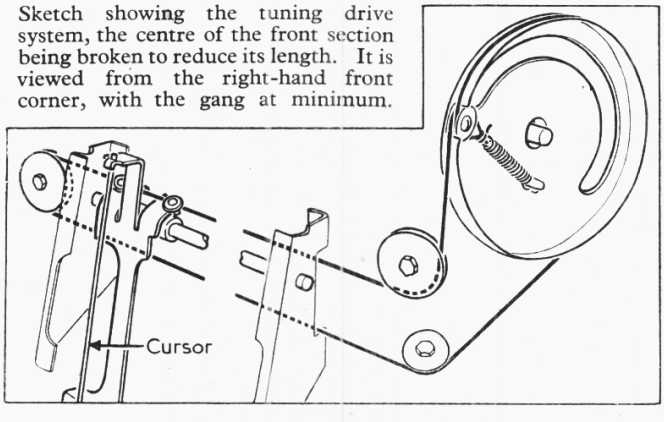
In most A.C. versions, a 0.1 μF tubular capacitor is connected between the H.T. positive line (at the output end of **R23**) and chassis, like **C45** in the A.C./D.C. version, and this should be added if not already there. **R24** and **C46** may be omitted from early A.C./D.C. versions.

A.C. to A.C./D.C. Conversion.—The components shown in the two power unit diagrams, separated from the main circuit and to the right of it in our circuit diagram overleaf, can be removed as a complete assembly if the seven leads are unsoldered at the points indicated and the four fixing bolts, holding the power unit to the main chassis deck, are removed.

Thus to convert an A.C. mains version to an A.C./D.C. version, the power units can be exchanged. In addition, however, a different range of valves must be used and their heaters must be wired in series. The scale lamps are wired differently also, but this is automatically corrected in replacing the power unit.

Replacing the valves involves only changing **V1, V4** and the rectifier, as **V2** and **V3** are the same types in either version. The complete ranges of valves for the two versions are given in the table in "Valve Analysis" in col. 1.

Sketch showing the tuning drive system, the centre of the front section being broken to reduce its length. It is viewed from the right-hand front corner, with the gang at minimum.



DRIVE CORD REPLACEMENT

Five feet of cord is sufficient to replace the drive cord and leave ample length for tieing off. To set drive drum correctly, slacken fixing screws in the boss, turn the gang to minimum, and turn the drum anti-clockwise (viewed from its open side) to its stop, and tighten up fixing screws. It will then be in the position shown in our sketch (above), where the scale has been removed.

Tie one end of the cord to the free end of the spring, run it over the small pulley, out through the gap in the drum, round the other three pulleys as shown in the sketch, round the drum, and return through the gap round the other side of the small pulley, tieing off finally again on the free end of the spring, whose tension should be sufficient to prevent any slackness in the cord.

The cursor should be adjusted so that it covers the high wavelength ends of the scales when the gang is at maximum. If the two clamping screws on the carrier are slackened, it can be slid along the cord as required.

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator, via an 0.1 μF capacitor in each lead, to control grid (top cap) of **V1** and chassis, removing the original top cap connector, but connecting a 500,000 Ω resistor between the top cap of the valve and chassis.

Switch set to M.W., turn the volume control to maximum, and tune to 197 m on scale. Feed in a 470 kc/s (638.3 m) signal, and adjust **C40, C41, C42** and **C43** (chassis locations **C4, D4)** for maximum output, keeping the input small to avoid A.V.C. action. Finally, remove the 500,000 Ω resistor and replace top cap.

R.F. and Oscillator Stages.—With the gang at maximum capacitance check that the cursor is vertical and that it coincides with the high wavelength ends of the three scales. If any error exists, slacken the two screws clamping the cursor carriage to the drive cord, adjust the carriage, and tighten the clamping screws.

S.W.—Switch set to S.W., tune to 18 Mc/s on scale, feed in an 18 Mc/s (16.67 m) signal, and adjust **C38** (B2) and **C29** (A2) for maximum output. If two peaks are found for **C38,** choose the one involving the lesser capacitance.

M.W.—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C35** (B2) and **C30** (A2) for maximum output. Check calibration at 500 m.

L.W.—Switch set to L.W., tune to 750 m on scale, feed in a 750 m (450 kc/s) signal, and adjust **C36** (B2) and **C31** (A2) for maximum output. Tune to 1,875 m on scale, feed in an 1,875 m (160 kc/s) signal, and adjust **C37** (B2) for maximum output. Repeat these adjustments until no improvement can be obtained.

PRE-SET STATION SETTING

The average wavelength coverage of each pre-set circuit is : P.S.1, 200-325 m; P.S.2, 325-545 m. To set either circuit, switch to the appropriate position on the waveband switch and adjust the core of **L15** (B3) (P.S.1) or **L14** (B4) (P.S.2), and **C33** (K8) (P.S.1) or **C32** (K.8) (P.S.2) for maximum output on the desired transmission. Bear in mind that the chassis may be "live" to earth.

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