ACE A.C./D.C. RECEIVERS

Covering Model U51 and Ace A.C./D.C. "Minigram" and "Mayfair" Autoradiograms

BASED on the Ace U51 A.C./D.C. table receiver, with which is associated the 535 range of A.C./D.C. autoradiograms, this Service Sheet also covers a number of other models. The model numbers of the receivers and radiograms covered are listed below, and in this list are included all A.C./D.C. models styled "Minigram" and "Mayfair," which differ only in cabinet style. No attempt is made to link a particular arrangement with each model number, but the five different arrangements are explained under "Modifications" overleaf.

The basic table receiver is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. or D.C. mains of 200-250 V. The mains frequency range (in radiograms) would be limited by the kind of motor employed. Where a radiogram is fitted with an A.C. motor, an electronic convertor unit supplies the motor with A.C. power. Waveband ranges are 16.5-50 m, 190-550 m and 800-2,100 m.

The models covered in this service Sheet are, in numerical order:—

33U (table), 33UR, 33RG/DC, U51, MGU535, MGU535/C, MGUS535, MGUS535/C, RGU535, RGU535/C, RGUS535, RGUS535/C, RGU5351. MRGU635 and MRGUS635 are covered except for the omission of their C.R. tuning indicator. Export versions of all models are covered except for their waveband ranges.

Release dates and original prices: 33U (table), November 1950, £15 15s; 33UR, November 1950, £41 18s 6d; 33RG/DC, November 1950, £43 7s 10d; U51, March 1951, £19 0s 6d, increased later to £19 2s 6d; MGU535 or MGU535/C, November 1951, £60 6s 1d; MGUS535 or MGUS535/C, November 1951, £63 19s 7d; RGU535 or RGU535/C, November 1951, £47 16s 1d; RGUS535 or RGUS535/C, December 1951, £51 9s 7d; MRGU635, November 1951, £60 6s 1d; MRGUS635, November 1951, £63 19s 7d.

CIRCUIT DESCRIPTION

Aerial input is inductively coupled on S.W. by **L2** and capacitatively "bottom" coupled on M.W. and L.W. by **C5** to single tuned circuits **L3, C40** (S.W.), **L4, C40** (M.W.) and **L5, C40** (L.W.) which precede triode-hexode valve **(V1, Brimar 6K8GT)** operating as frequency changer with internal coupling. **C1** and **C4** isolate the aerial and earth sockets from the chassis while **R1** provides a D.C. path between the sockets to prevent the build up of static charges on the aerial. **R2** prevents modulation hum.

Oscillator anode coils **L8** (S.W.), **L9** (M.W.) and **L10** (L.W.) are tuned by **C44.** Parallel trimming by **C41** (S.W.), **C42** (M.W.) and **C11, C43** (L.W.); series tracking by **C8** (S.W.), **C9** (M.W.) and **C10** (L.W.). Reaction coupling from grid circuit across the common impedance of the trackers with additional inductive coupling via **L6** (S.W.) and **L7** (M.W.). Stabilization by **R5, R6** and **R7.**

Second valve **(V2, Brimar 6K7GT)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C6, L11, L12, C7** and **C16, L13, L14, C17.**

Intermediate frequency 472 kc/s.

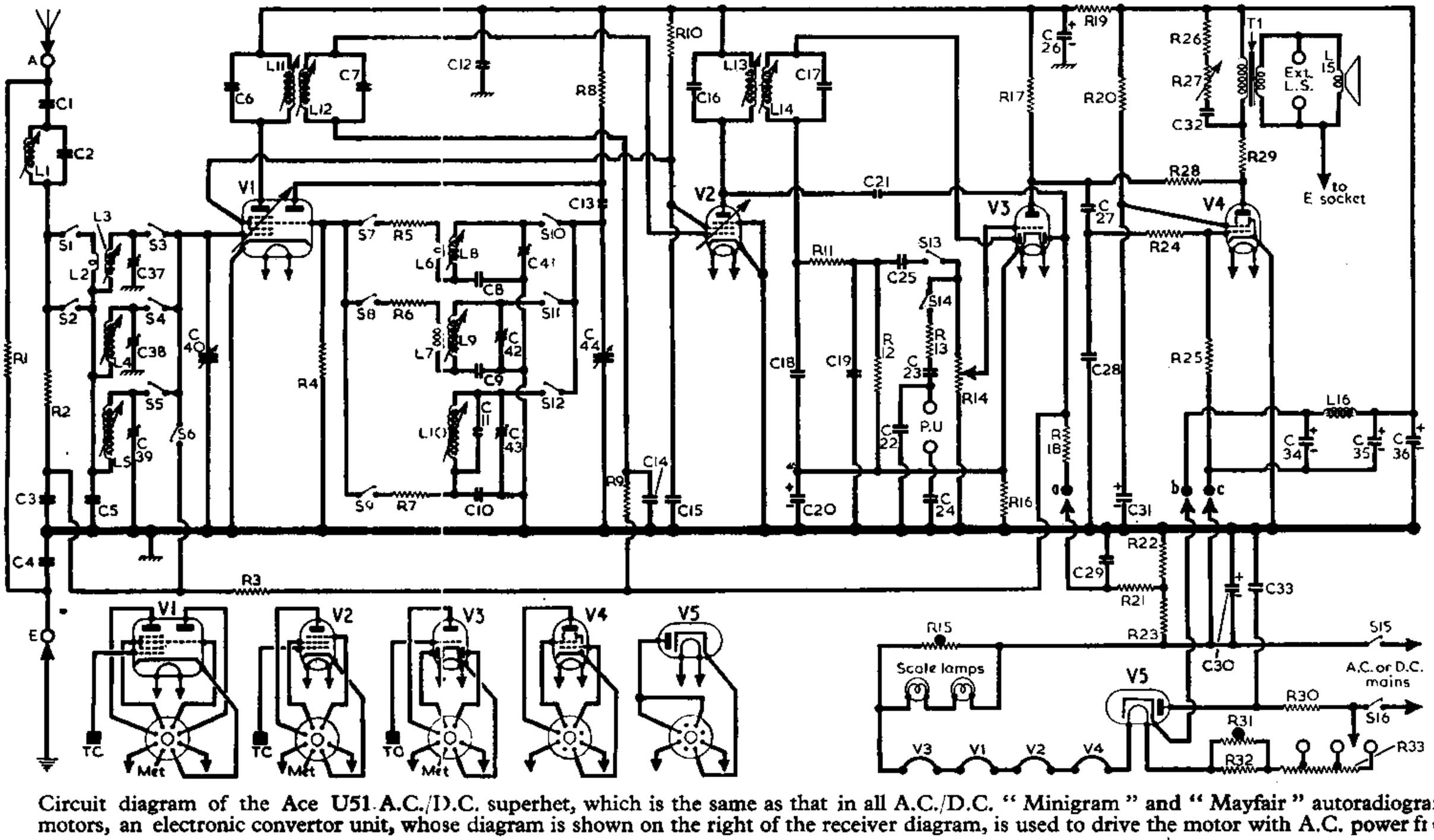
Diode signal detector is part of double diode triode valve **(V3, Brimar 6Q7GT).** Audio frequency component in rectified output is developed across **R12** and passed via **C25** and volume control **R14** to control grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C18, R11** and **C19.**

Second diode of **V3** is fed from **V2** anode via **C21,** and the resulting D.C. potential developed across its load resistor **R18** is fed back as bias to **V1** and **V2** giving automatic gain control. Provision is made for the connection of a gramophone pick-up across **R14** via **S14** which closes in the gram position of the waveband switch. **S6** closes and **S13** opens on Gram to prevent radio break-through.

On the table model the P.U. sockets are isolated from chassis by **C23** and **C24,** and shunted by **C22.** On the radiogram model a transformer isolates the P.U. sockets, one side of its primary being connected to the earth socket, and one side of its secondary to chassis.

Resistance-capacitance coupling via **R17, C27** and **R25** between **V3** triode and beam tetrode output valve **(V4, Brimar 25L6GT).** Variable tone control by **R26, R27** and **C32** in **V4** anode circuit. Fixed tone correction by negative feedback between the anodes of **V4** and **V3** via **R28.** Bias for **V4** is obtained from the voltage drop across **R22** and **R23** in the H.T. negative lead to chassis. A proportion of this voltage, that dropped across **R22,** is fed via decoupling circuit **R21, C29** to the A.G.C. line to act as delay voltage to the A.G.C. diode and to provide bias for **V1** and **V2.** Provision is made for the connection of a low impedance external speaker across **T1** secondary.

H.T. current is supplied by I.H.C. half-wave rectifying valve **(V5, Brimar 25Z4GT).** Smooth-



Circuit diagram of the Ace U51 A.C./D.C. superhet, which is the same as that in all A.C./D.C. "Minigram" and "Mayfair" autoradiograms whi motors, an electronic convertor unit, whose diagram is shown on the right of the receiver diagram, is used to drive the motor with A.C. power fr om D.

ing by **R19**, choke **L16** and electrolytic capacitors **C26, C34, C35** and **C36.**

Valve heaters together with scale lamps, ballast and voltage adjustment resistors **R32, R33** and thermistors **R15, R31** are connected in series across the mains input. **R15** shunts the scale lamps, and **R31** protects the valve heaters from current surges.

In the radiogram models a D.C. to A.C. electronic convertor is fitted to supply the gram motor with A.C. from D.C. mains. When the receiver is operated from A.C. mains the convertor switch is set to A.C., opening **S17, S18** and closing **S19** which connects one side of the motor to the convertor chassis. Starting the motor by closing motor switch **S20** connects the mains input across the motor coils via ballast resistor **R46.**

When the receiver is operated from D.C. mains, the convertor switch is set to D.C., opening **S19** and closing **S17, S18** which connect the motor coils directly across the output winding of **T2.** When the motor switch is now closed, the electronic convertor is switched on by having its H.T. line connected via **S17,** motor switch **S20** and ballast resistor **R46** to the D.C. mains input.

The convertor consists of a two valve 50 c/s multivibrator **(V6a, V6b, Brimar 12AU7)** whose frequency is governed by the time-constant of **C46, R35** and **C47, R34. The output from V6a** and **b** is developed across anode load circuit **L17, C48,** which is tuned to 50 c/s, and passed via **C49** and **C50** to the control grids of the push-pull connected beam pentode output valves **(V7, V8, Emitron or Cossor 185BT's).** Output from **V7, V8** is coupled via push-pull output transformer **T2** and a four-way plug and socket **5, 6, 7, 8** to the gram motor (pin 7 is blank).

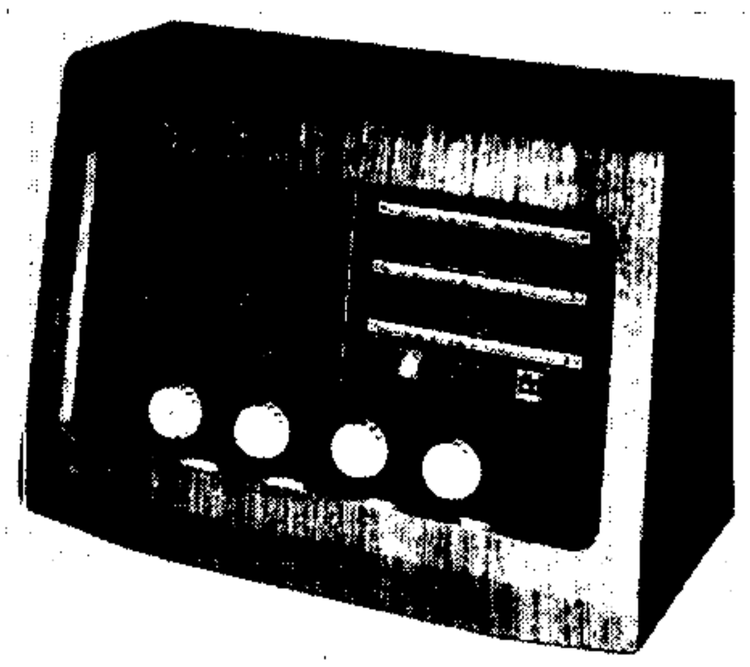
The heater ballast resistor **R52** and associated components **R50, R51, R53** are mounted on the convertor chassis in the radiogram models, and are connected by a four-way plug and socket **1, 2, 3, 4.** The heaters of **V6** are connected in parallel for 0.3 amp operation and together with the heaters of **V7, V8** are wired in series with the heaters in the radio chassis. Extra current is passed through **V7, V8** heaters by ballast and voltage adjustment resistors **R47, R48** and **R49** to bring their total current, including the H.T. current from the receiver, up to 0.45 amp.

COMPONENTS AND VALUES

	RESISTORS	Values	Locations
R1	Aerial shunts ...	2·2kΩ	G4
R2	Aerial shunts ...	10kΩ	F4
R3	A.G.C. decoupling	1MΩ	F4
R4	V1 osc. C.G. ...	47kΩ	G4
R5	Oscillator stabilizers	22Ω	F3
R6	Oscillator stabilizers	2·2kΩ	F3
R7	Oscillator stabilizers	5·6kΩ	F3
R8	Osc. anode load ...	22kΩ	G4
R9	A.G.C. decoupling	1MΩ	F4
R10	S.G. feed	10kΩ	F4
R11	I.F. stopper ...	47kΩ	F4
R12	Diode load ...	470kΩ	F4
R13	Tone correction ...	22kΩ	F4
R14	Volume control ...	1MΩ	E3
R15	Thermistor CZ2 ...	—	D3
R16	V3 G.B.	2·2kΩ	F4
R17	V3 anode load ...	220kΩ	F4
R18	A.G.C. diode load ...	1MΩ	F4
R19	H.T. smoothing ...	1kΩ	D3
R20	V4 S.G. feed ...	15kΩ	E4
R21	A.G.C. decoupling	1MΩ	D3
R22	G.B. resistors ...	68Ω	D3
R23	G.B. resistors ...	22Ω	D3
R24	V4 grid stopper ...	100kΩ	E4
R25	V4 C.G.	470kΩ	E4
R26	Part tone control ...	680Ω	D3
R27	Tone control ...	50kΩ	D3
R28	Neg. feed-back ...	1MΩ	F4
R29	V4 anode stopper ...	47Ω	E4
R30	Surge limiter ...	68Ω	E4
R31	Thermistor CZ2 ...	—	C2
R32	Heater ballast ...	140Ω	C2
R33	Heater ballast ...	*530Ω	C2
R34	V6a, V6b, C.G. ...	47kΩ	K6
R35	V6a, V6b, C.G. ...	47kΩ	K7
R36	H.T. smoothing ...	†20kΩ	K6
R37	V7, V8 C.G. ...	100kΩ	L6
R38	V7, V8 C.G. ...	100kΩ	L7
R39	V7, V8 C.G. stoppers	1kΩ	L6
R40	V7, V8 C.G. stoppers	1kΩ	L7

Continued next column

* Tapped at 410Ω+60Ω+60Ω from R32.
† Two 10kΩ resistors in series.



The appearance of the Ace U51 table receiver.

	RESISTORS (*continued*)	Values	Locations
R41	V7, V8 G.B. ...	‡34Ω	M6
R42	V7 anode stopper ...	68Ω	H5
R43	V7, V8 S.G. stoppers	1·1kΩ	L6
R44	V7, V8 S.G. stoppers	1·1kΩ	L7
R45	V8 anode stopper ...	68Ω	H5
R46	Motor voltage adj.	§120Ω	J5
R47	V7, V8 heater current boost ...	1·49kΩ	J5
R48	V7, V8 heater current boost ...	500Ω	L7
R49	V7, V8 heater current boost ...	500Ω	L7
R50	Thermistor CZ2 ...	—	J5
R51	Heater ballast resistors	410Ω	J5
R52	Heater ballast resistors	§120Ω	J5
R53	Heater ballast resistors	550Ω	J5
R54	Heater ballast resistors	140Ω	J5

‡ Two 68Ω resistors in parallel.
§ Tapped at 60Ω+60Ω.

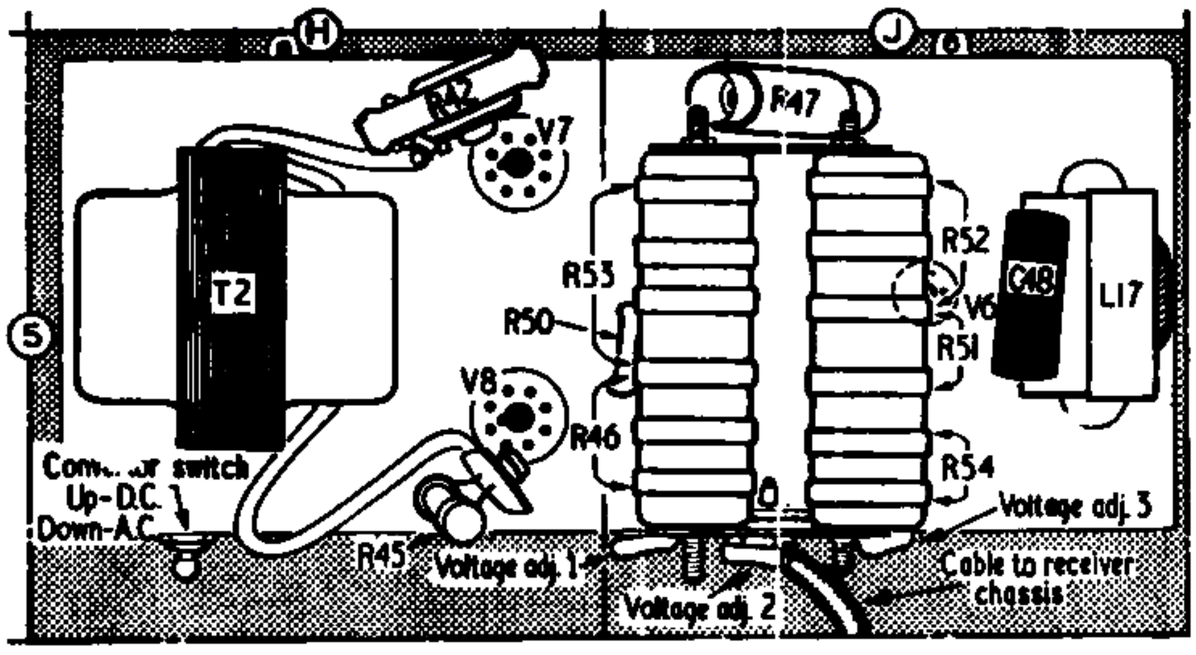
	CAPACITORS	Values	Locations
C1	Aerial isolator ...	500pF	G4
C2¶	I.F. rejector tune ...	800pF	G4
C3	A.G.C decoupling	0·01μF	F3
C4	Chassis isolator ...	0·05μF	G4
C5‖	Aerial coupling ...	0·0032μF	G3
C6	1st I.F. trans. tuning	100pF	A2
C7	1st I.F. trans. tuning	100pF	A2
C8	S.W. osc. tracker ...	0·0022μF	F3
C9	M.W. osc. tracker ...	380pF	F3
C10	L.W. osc. tracker ...	150pF	F3
C11	L.W. osc. trim. ...	25pF	F3
C12	R.F. by-pass ...	0·1μF	F4
C13	Osc. anode coup.	50pF	G3
C14	A.G.C. decoupling	0·01μF	G4
C15	S.G. decoupling ...	0·1μF	F4
C16	2nd I.F. trans. tuning	100pF	A2
C17	2nd I.F. trans. tuning	100pF	A2
C18	I.F. by-passes ...	120pF	F4
C19	I.F. by-passes ...	120pF	F3
C20*	V3 cath. by-pass ...	50μF	E4
C21	A.G.C. coupling ...	23pF	F4
C22	P.U. shunt ...	250pF	F4

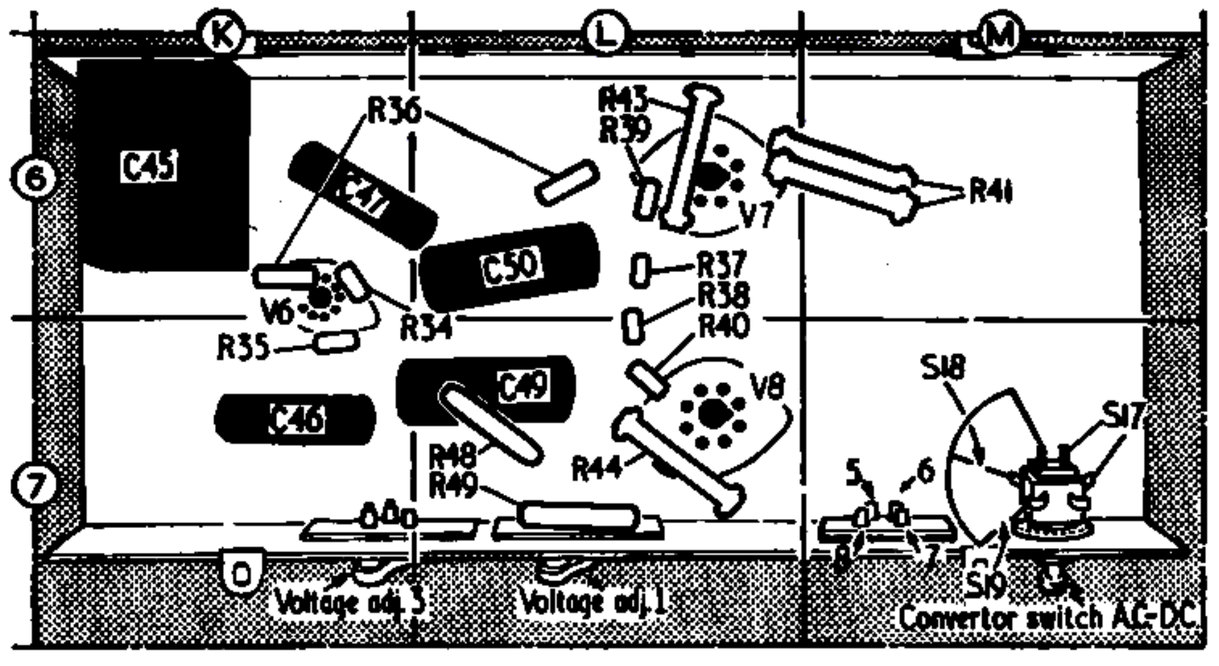
Contd. col. 1 overleaf

¶ Two capacitors, 300pF + 500pF, in parallel.
‖ Two capacitors, 0·0014μF + 0·0018μF in parallel.
* Electrolytic.

If the component numbers given in the accompanying tables are used when ordering replacement parts, dealers are advised to mention the fact on the order, as these numbers may differ from those used in the manufacturers' diagram.

which are fitted with A.C./D.C. gramophone motors. When the A.C./D.C. autoradiograms are fitted with A.C. D.C. mains. Switching arranges matters so that on A.C. mains the motor is connected directly across the mains.





Plan view (left) and underside (right) illustrations of the electronic convertor unit. The three voltage adjustment panels are grouped in a triangle at the rear. The A.C./D.C. change-over switch unit S17-S19 is replaced by a plug-and-socket device in later models. The 4-pin socket numbered 5, 6, 7, 8 accepts the motor plug.

CAPACITORS (*Continued*)		Values	Location
C23	P.U. isolators	0·1μF	F4
C24		0·1μF	F4
C25	A.F. coupling	0·1μF	F3
C26*	H.T. smoothing	8μF	E3
C27	A.F. coupling	0·01μF	F4
C28	I.F. by-pass	250pF	E4
C29	A.G.C. decoupling	0·01μF	F4
C30*	G.B. by-pass	50μF	E3
C31*	V4 S.G. decoup.	8μF	E3
C32	Part tone control	0·05μF	D3
C33	Mains R.F. filter	0·05μF	E4
C34*	H.T. smoothing	16μF	C1
C35*		16μF	C1
C36*		12μF	D3
C37‡	S.W. aerial trim.	—	G3
C38‡	M.W. aerial trim.	—	G3
C39‡	L.W. aerial trim.	—	G3
C40†	Aerial tuning	—	A1
C41‡	S.W. osc. trim.	—	F3
C42‡	M.W. osc. trim.	—	F3
C43‡	L.W. osc. trim.	—	F3
C44†	Oscillator tuning	—	A1
C45§	H.T. decoupling	4μF	K6
C46	Multi-vibrator reaction coup.	0·1μF	K7
C47		0·1μF	K6
C48	Osc. anode tune	0·2μF	J5
C49	Osc. coupling	0·5μF	L7
C50		0·5μF	L6

*Electrolytic. †Variable. ‡Pre-set. §Paper type, not electrolytic.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	I.F. filter	1·8	G4
L2	S.W. aerial coup.	—	G3
L3	Aerial tuning coils	—	G3
L4		1·7	G3
L5		40·0	G3
L6	Reaction coupling	0·4	F3
L7		1·0	F3
L8	Oscillator tuning	—	F3
L9		5·5	F3
L10		17·5	F3
L11	1st I.F. trans. Pri.	9·0	A2
L12	1st I.F. trans. Sec.	9·0	A2
L13	2nd I.F. trans. Pri.	6·0	A2
L14	2nd I.F. trans. Sec.	6·0	A2
L15	Speech coil	2·5	—
L16	Smoothing choke	140·0	C1
L17	Converter osc. coil	650·0	J5
L18	Gram. motor coils	230·0	—
L19		230·0	—
T1	O.P. trans. Pri.	500·0	E3
	O.P. trans. Sec.	0·5	
T2	Converter O.P. trans Pri., total	50·0	H5
	Converter O.P. trans Sec.	65·0	
S1-S14	Waveband switches	—	G3
S15, S16	Mains sw., g'd R14	—	E3
S17-S19	Converter switches	—	M7
S20	Gram. motor sw.	—	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receivers. The figures for **V1-V5** were measured in a table model when it was operating from 230 V A.C. mains and tuned to the highest wavelength end of M.W. There was no signal input. The figures for **V6-V8** were measured in the convertor unit of a radiogram model when it was switched to D.C., and operating from 230 V D.C. mains with the gram motor running.

Voltage readings were measured with an Avo Electronic TestMeter, and as this instrument draws no appreciable current, allowance must be made for the current drawn by other types of meter. The A.C. voltage measured across the gram motor input with the converter operating from 230 V D.C. mains was 230 V. The receiver chassis was the negative connection for voltage readings from **V1-V5** and the converter chassis for readings from **V6-V8.**

Valve	Anode V	Anode mA	Screen V	Screen mA	Cath. V
V1 6K8GT	192	2·6	110	5·4	—
	Oscillator				
	105	4·0			
V2 6K7GT	195	4·7	110	2·4	—
V3 6Q7GT	95	0·4	—	—	1·2
V4 25L6GT	175	66·0	135	4·5	—
V5 25Z4GT	220†	—	—	—	230·0
V6 12AT7 a	68	3·0	—	—	—
V6 12AT7 b	68	3·0	—	—	—
V7 185BT	175	115·0	165	16·0	9·5
V8 185BT	175	115·0	165	16·0	9·5

† A.C. reading.

DISMANTLING

Removing Chassis.—Remove control knobs (pull-off) and felt washers;
unsolder leads from speech coil tags on speaker;
remove four 2BA bolts with washers securing chassis to cabinet and withdraw chassis.

The foregoing applies to the table models only; the fixing is different in the radiograms.

GENERAL NOTES

Switches.—S1-S12 are the waveband switches, and **S13, S14** are the radio-gram change-over switches, ganged in a single rotary unit beneath the chassis. The unit is indicated in our under-chassis illustration and shown in detail in the diagram in col. 4, where it is drawn as seen from the rear of an inverted chassis.

The table below it 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, S16 are the Q.M.B. mains switches, in a double-pole unit ganged with the volume control **R14.**

Scale Lamps.—These are two M.E.S. lamps, with small clear spherical bulbs rated at 6.5 V, 0.3 A. They are shunted by a Brimistor CZ2, **R15.**

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (about 3-4 Ω) speaker.

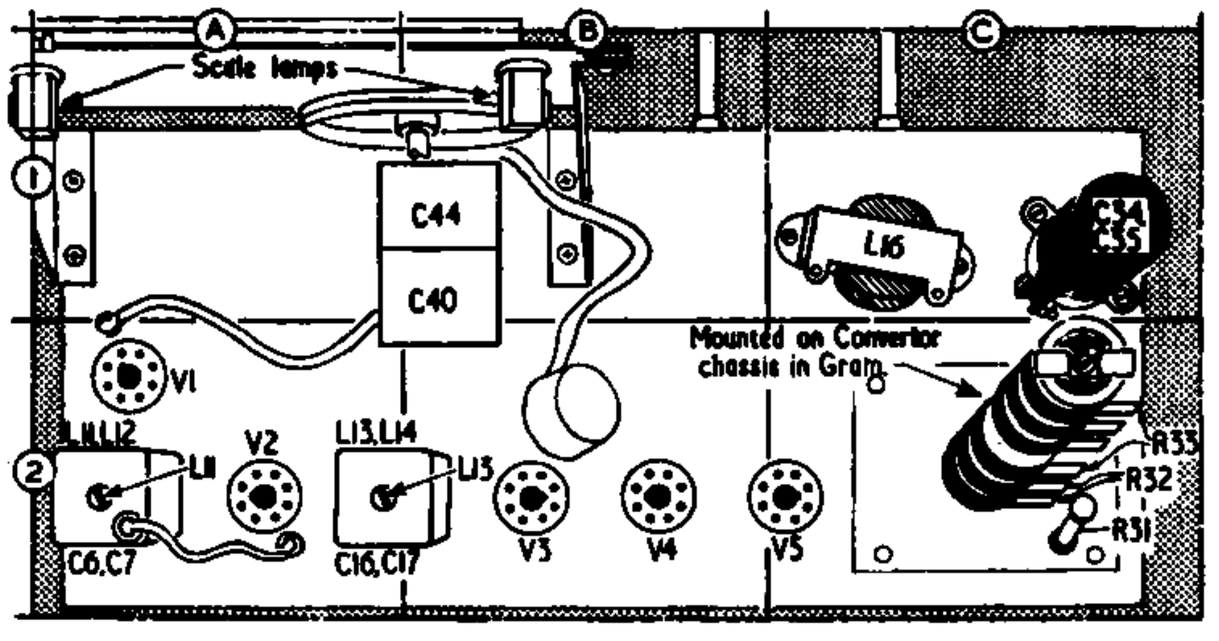
Drive Cord Replacement.—About 50 inches of high-grade flax fishing line is required for a new drive cord, which should be run as shown in the sketch in col. 6 where it is drawn as seen from the rear of the chassis, neglecting obstructions, when the gang is at maximum capacitance.

Capacitor C4.—This is a 4μF paper type capacitor decoupling the H.T. feed to the convertor oscillator. An electrolytic should not be used as a replacement because if the mains plug is inserted with reversed polarity, this will be applied to the capacitor as soon as the motor is switched on. The motor, of course, will not run under these conditions as the H.T. supply to the anodes of the convertor is reversed.

Resistors R30, R42, R45.—These are 68 Ω resistors in the anode circuits of heavy-duty valves, and they are rated at 2 W dissipation.

MODIFICATIONS

Export models.—There are two versions of the U51 A.C./D.C. receiver for export, one with S.M.L. wavebands, as in the home version, and one with S.S.M. wavebands. The differences between the circuit of the home model and that of the export versions are that the latter are equipped with a cathode ray tuning indicator (Brimar 6U5G) and that the aerial circuit switching is omitted.



Plan view of the receiver chassis as it is in the normal models. In those radiograms which use a convertor, the heater ballast resistor R32, R33 is in the convertor unit.

Where we show **S1** in the home model, there is a short-circuit, and **S2** is omitted, as are **S6** and **S13** also. The switch unit is a simple rotary type with twelve contacts, the tags of two being nipped off, and it has four settings.

Autoradiograms.—There are several series of A.C./D.C. radiograms, with varying type numbers which need not be detailed here, but they divide up electrically into four kinds: (i) uses an unmodified U51 chassis with a single-speed A.C./D.C. record changer; (ii) is like (i) but has a 3-speed A.C./D.C. record changer; (iii) uses a modified U51 chassis with a single-speed A.C. record changer whose motor is run on D.C. mains from an electronic D.C. to A.C. convertor; (iv) is like (iii) but has a 3-speed A.C. record changer whose motor is run from an electronic D.C. to A.C. convertor. The model numbers covered are explained in the introduction and the title of this *Service Sheet*. Models designed for A.C. mains only are not covered at all.

Universal Motors.—Where the radiogram is fitted with an A.C., D.C. record-changer and the electronic convertor is not needed, a standard U51 chassis is employed, as used in the table receiver, but in some models **R13, C22, C23** and **C24** are omitted and the pick-up is fed in via a matching transformer. One end of the primary goes to the **E** socket, and one end of the secondary goes to chassis.

A.C. Motors.—Where the radiogram is fitted with an A.C. record changer, an electronic convertor is used on D.C. mains to supply A.C. to the motor, and the use of this involves physical changes in the chassis as compared with that in the U51 table model, although the circuit is not very different electrically. The same modification with regard to the pick-up input obtains as was described for universal motors.

Convertor Models.—The physical differences involved in the models using the convertor are associated with the power supply components, of which the heater ballast resistor is removed from the radio chassis and is included in the convertor.

In order to make this quite clear, the affected part of the receiver circuit is redrawn, in our main diagram overleaf, beneath the convertor circuit as it is in the convertor models, although all the circuit shown below the chassis line of

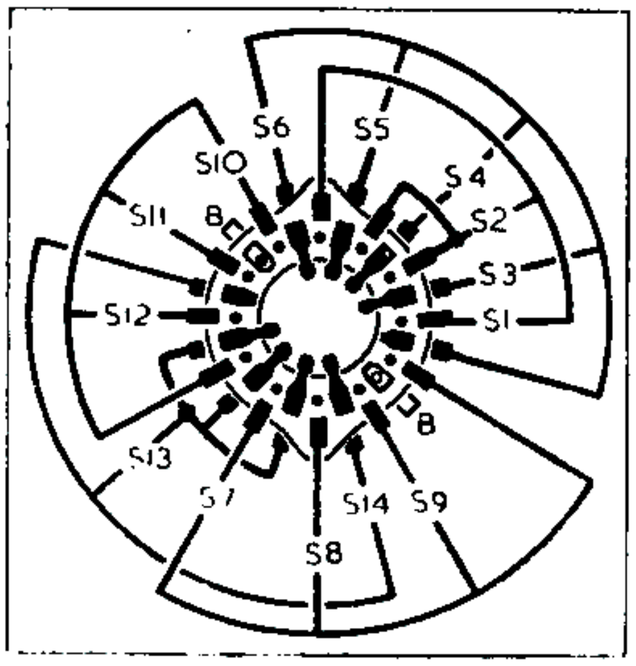
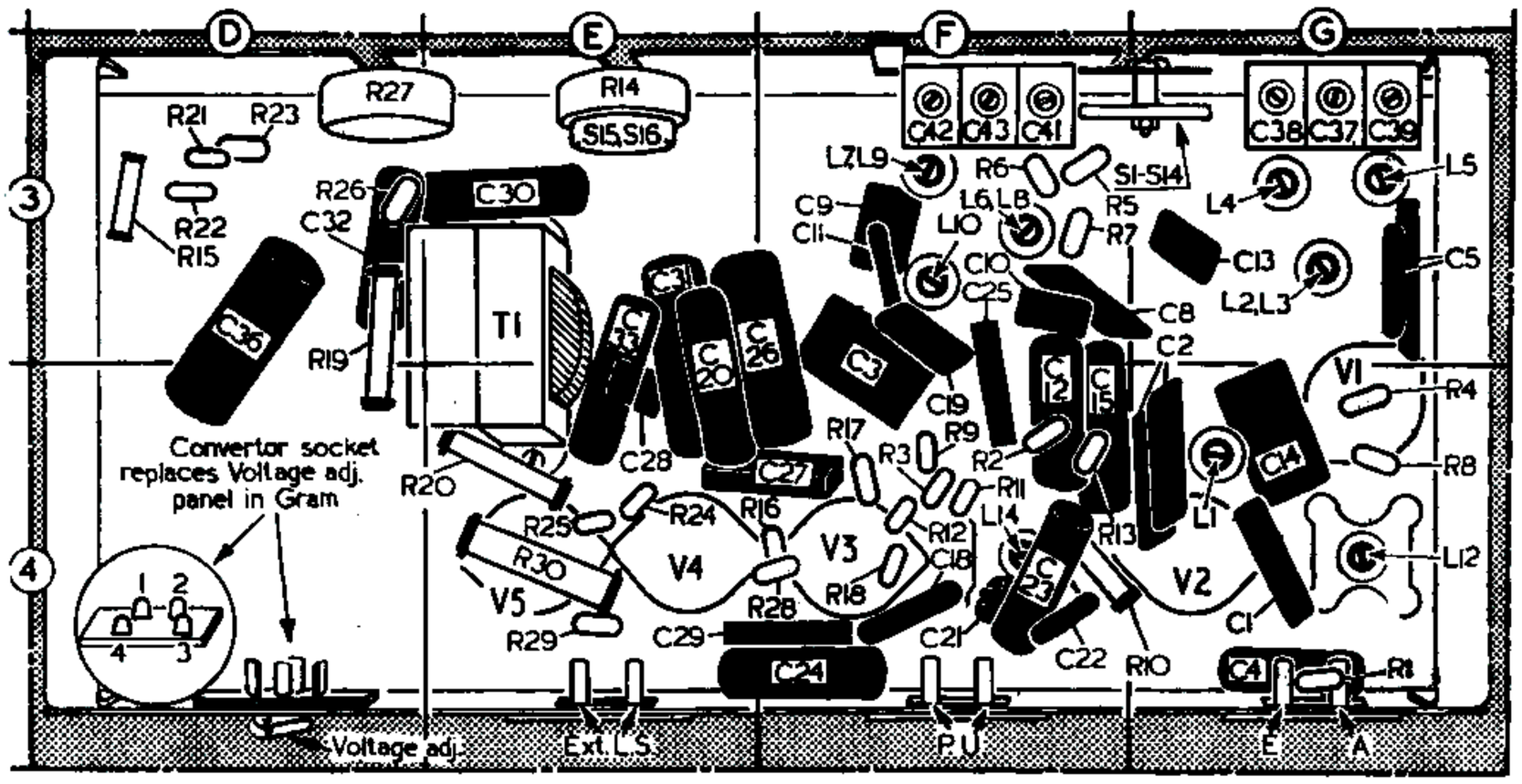


Diagram of the waveband switch unit, drawn as seen from the rear of an inverted chassis. Below is the associated switch table.

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

the convertor unit is actually in the receiver chassis. Points **a, b** and **c** show where the affected part of the circuit joins the rest of the receiver.

It will be seen that the ballast circuit is a little different from that in the U51, and that



Underside drawing of the radio receiver chassis, with inset at the lower left-hand corner a diagram of the convertor socket which takes the place of the voltage adjustment panel in the convertor-type radiograms.

the heaters of the convertor valves are included in the series heater chain. The two halves of the **V6** heater are connected in parallel to match the 0.3 A heater circuit, but the heaters of **V7** and **V8**, which are rated at 0.45 A, are at the "earthy" end of the chain and have a separate ballast resistor **R47, R48, R49** which passes 0.15 A, shunting the original heater circuit and bringing the total current for **V7, V8** up to the rated value.

Convertor Unit.—The convertor consists of a multi-vibrator type of 50 c/s oscillator driving a push-pull output stage of large-output valves whose output is transformer coupled to the A.C. motor of the gramophone, and it is required, of course, only when the A.C./D.C. receiver is operating from D.C. mains.

Change-over from A.C. to D.C. and vice versa is effected either by a double-pole 2-way switch or a plug-and-socket device. In either case the change-over is represented by switches **S17, S18, S19**, as explained in "Circuit Description." When a switch is used, its toggle is up for D.C., and down for A.C.; when a plug-and-socket arrangement is used, the plug goes to the upper sockets for D.C., and to the lower ones for A.C.

The gramophone motor is connected to the convertor unit by means of plug and socket **5, 6, 7, 8**, the socket being mounted on the rear member of the convertor, and pin 7 being unused. The convertor is connected to the receiver by a similar plug, whose socket is mounted on the rear member of the receiver chassis (it takes the place occupied in normal U51 receivers by the voltage adjustment panel). The mains input to the convertor is via the receiver and then via pins 1 and 3 of the plug, and the heaters are connected in the series via pins 2 and 4. The chassis of the convertor is at a different potential from that of the receiver.

For D.C. operation the gramophone motor is connected directly across the convertor output transformer secondary, and the motor switch **S20** controls the H.T. supply to the convertor valves. For A.C. mains **S20** controls the mains supply to the motor. If the convertor model is connected to D.C. mains, therefore, while adjusted for A.C. the motor will burn out.

Voltage adjustment in the convertor models requires attention at three points, all located on the convertor unit. In our diagram they are numbered 1, 2 and 3. Unfortunately, in our sample at least, all the adjustment panels are not mounted at the same angle, so that although they have been grouped fairly close together it is not a simple matter to see that they are adjusted for the same settings, and the lettering on the panels must be read. In our specimen, adjustment No. 2 was mounted at right-angles to the other two.

H.T. current from the radio receiver, besides heater current from the receiver and the additional ballasting current from the voltage adjustment No. 1 ballast circuit, flows through the convertor output valve heaters **V7** and **V8**, and the total current through them should be 0.45 A. The current through the oscillator valve heater **V6** is 0.3 A through the two halves connected in parallel. The rated current for each half is **0.15 A.**

CIRCUIT ALIGNMENT

It is necessary before carrying out the following alignment procedure to remove the chassis from its cabinet in order to make all the core and trimmer adjustments accessible.

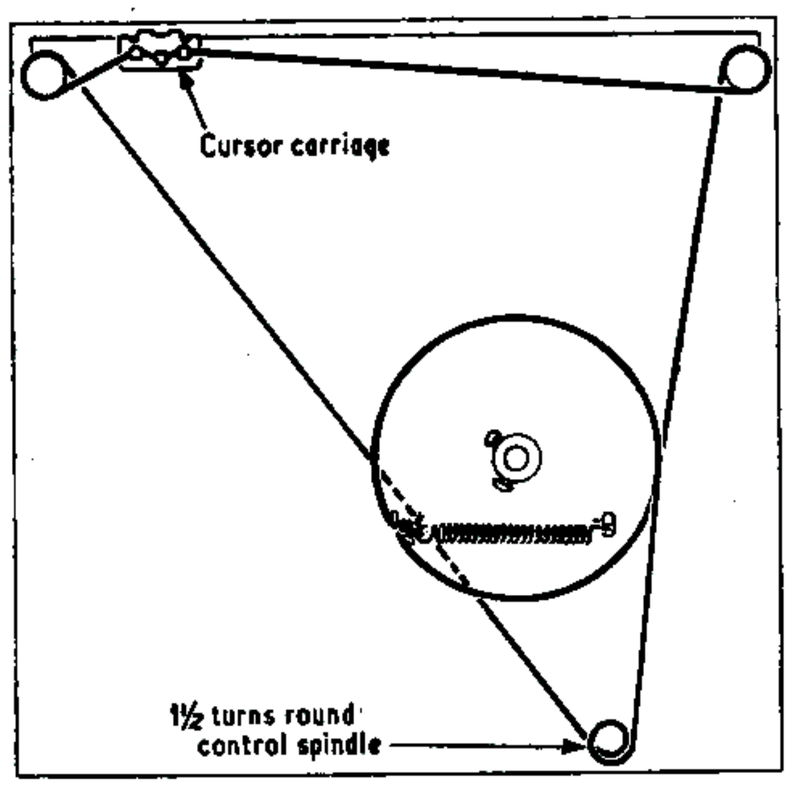
I.F. Stages.—Switch receiver to M.W. and turn gang to maximum capacitance. Connect output of signal generator, via 0.1 μF capacitor in each lead, to control grid (top cap) of **V1** and chassis. Feed in a 472 kc/s (635.6 m) signal and adjust the cores of **L14** (location reference F4), **L13** (A2), **L12** (G4) and **L11** (A2) for maximum output. Repeat those adjustments.

R.F. and Oscillator Stages.—Transfer signal generator leads, via a suitable dummy aerial, to **A** and **E** sockets.

L.W.—Switch receiver to L.W., tune to 2,000 m, feed in a 2,000 m (150 kc/s) signal and adjust the cores of **L10** (F3) and **L5** (G3) for maximum output. Tune receiver to 1,000 m, feed in a 1,000 m (300 kc/s) signal and adjust **C43** (F3) and **C39** (G3) for maximum output. Repeat these adjustments.

M.W.—Switch receiver to M.W., tune to 500 m, feed in a 500 m (600 kc/s) signal and adjust the cores of **L9** (F3) and **L4** (G3) for maximum output. Tune receiver to 200 m, feed in a 200 m (1,500 kc/s) signal and adjust **C42** (F3) and **C38** (G3) for maximum output. Repeat these adjustments.

S.W.—Switch receiver to S.W., tune to 50 m, feed in a 50 m (6 Mc/s) signal and adjust the cores of **L8** (F3) and **L3** (G3) for maximum output. Tune receiver to 20 m, feed in a 20 m (15 Mc/s) signal and adjust **C41** (F3) and **C37** (G3) for maximum output. Repeat these adjustments.



Sketch of the drive cord system, drawn as seen from the rear of the chassis, neglecting obstructions.

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