"TRADER" SERVICE SHEET

1089

MURPHY 168 Series

TWO versions of the Murphy 168 series are covered here, the A168 and the U168. They are basically similar, but are designed to operate from A.C. mains only of 200-250 V, 50-100 c/s. in the case of the A168, which is provided with a double-wound mains transformer and has a temperature fuse; and from A.C. or D.C. mains of 200-250 V (25-60 c/s in the case of A.C.) in the U168.

The waveband coverage is 16.5-52 m, 185-550 m and 1,000-2,050 m. Provision is made for the connection of a gramophone pick-up and an external speaker, and a rejector can be fitted in the aerial lead to suppress a local transmission.

Two other versions of the 168 series are the A168M and U168M. They are different in many respects from the A168 and U168, and are not covered here. This *Service Sheet* was prepared from an A168, but the differences in the U168 are explained throughout.

Release date and original price both models: June, 1950; £18 16s 5d plus purchase tax.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (S.W.), **L2** (M.W.) and **L3** (L.W.) to single-tuned circuits **L4, C32** (S.W.), **L5, C32** (M.W.) and **L6, C32** (L.W.) which precede triode hexode valve **(V1, 6C9** (A.C. model) or **10C1** (A.C./D.C. model)**).** In the A.C./D.C. model **C37, C38** and **C39** isolate the aerial and earth sockets from chassis, which is "live" to the mains, and **R25** provides a D.C. path between them to leak away static charges.

Provision is made for connecting a Murphy aerial filter in series with the aerial lead, to be tuned to the wavelength of any transmitter which is powerful enough to overload **V1** and produce whistles in the receiver output.

Oscillator anode coils **L9** (S.W.), **L10** (L.W.) and **L11** (M.W.) are tuned by **C36,** coils **L10** and **L11** being connected in series for L.W. operation. Parallel trimming by **C33** (S.W.), **C13, C34** (L.W.) and **C35** (M.W.); series tracking by **C11, C12** (L.W.), **C12** (M.W.). Reaction coupling from grid by **L7** (S.W.) and **L8** (M.W. and L.W.), with additional coupling across the common impedance of **C12** on M.W. and L.W.

Second valve **(V2, 6F16** (A.C. model) or **10F9** (A.C./D.C. model)**)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C5, L12, L13, C6** and **C16, L14, L15, C17.**

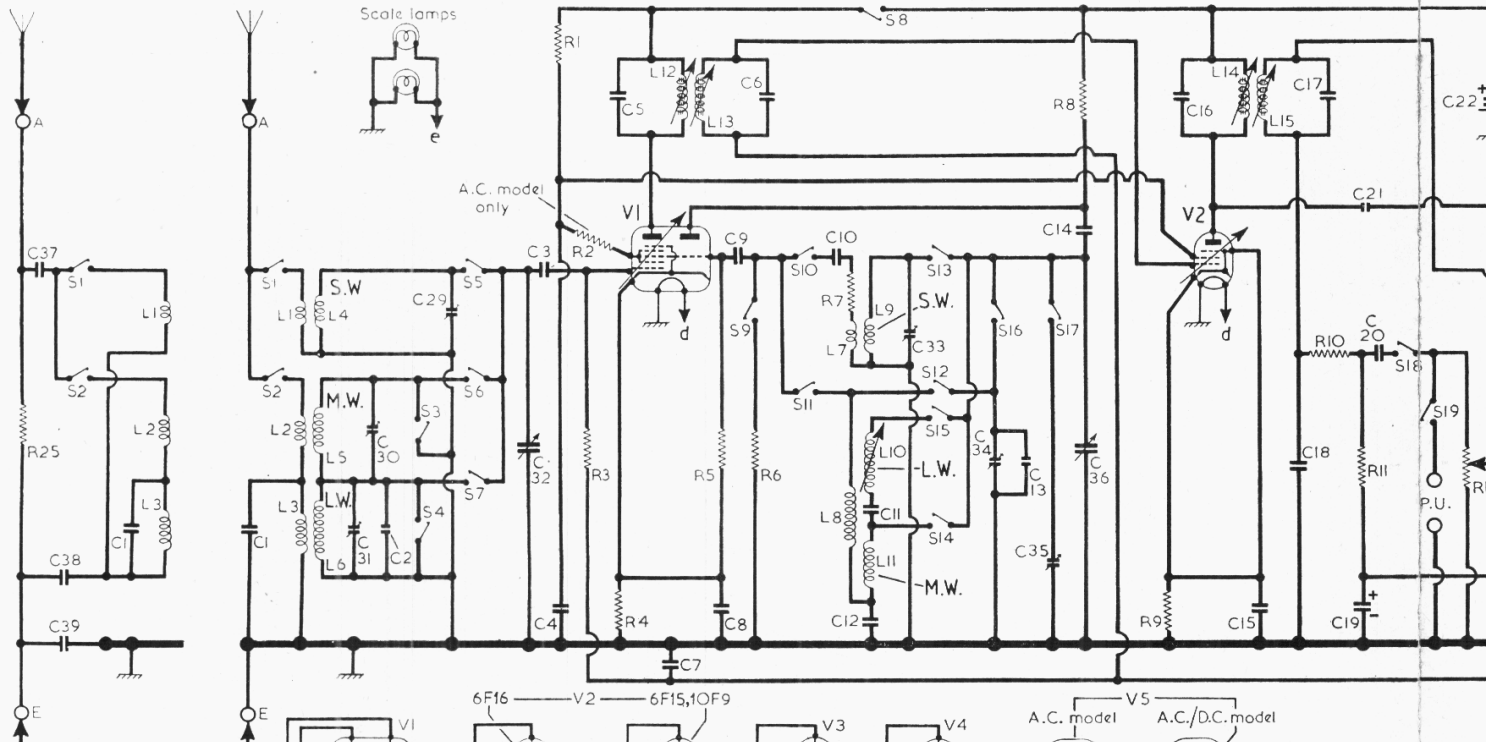
Intermediate frequency 465 kc/s.

Diode signal detector is part of double diode triode valve **(V3, 6LD20** (A.C. model) or **10LD11** (A.C./D.C. model)**).** Audio frequency component in rectified output is developed across diode load resistors **R10, R11,** and that across **R11** is passed via **C20** and manual volume control **R12** to grid of triode section, which operates as A.F. amplifier.

Provision is made for the connection of a gramophone pick-up across **R12** via **S19,** which closes in the gram position of the waveband control. **S8** (in the H.T. circuit) and **S18** open on gram to prevent radio break-through. In the A.C./D.C. model **R26, R27, C41** and **R28** provide pick-up tone correction, and **C42** isolates the pick-up from the chassis. Socket **C** connects the screening of the pick-up lead via **C40** to chassis, and socket **E** takes the gramophone motor board, etc., directly to the earth socket.

Second diode of **V3,** fed from **V2** anode

(Continued column 1 overleaf)



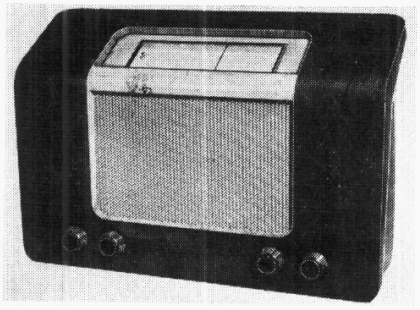
Circuit diagram of 168A A.C. receiver the modified aerial and AF, output circuits (right) as t 168U A.C./D.C. r latter model also, I

COMPONENTS AND VALUES

	RESISTORS	Values	Locations
R1	S.G. H.T. feed ...	‡12kΩ	F4
R2	V1 S.G. stopper ...	22Ω	F3
R3	V1 C.G.	470kΩ	F3
R4	V1 G.B.	§270Ω	F3
R5	V1 osc. C.G. ...	47kΩ	F3
R6	M.W. osc. shunt ...	3·9kΩ	G3
R7	S.W. osc. stabilizer	82Ω	G3
R8	Osc. anode feed ...	¶33kΩ	F3
R9	V2 G.B.	††270Ω	F4
R10	Signal diode load ...	330kΩ	E3
R11		180kΩ	E3
R12	Volume control ...	1MΩ	E3
R13	H.T. decoupling ...	47kΩ	E3
R14	V3 anode load ...	100kΩ	E4
R15	V3 G.B.	3.3kΩ	E4
R16	A.G.C. diode load ...	1MΩ	E4
R17	A.G.C. decoupling	1MΩ	F3
R18	V4 C.G.	470kΩ	E3
R19	V4 C.G. stopper ...	47kΩ	E3
R20	H.T. smoothing ...	1·8kΩ	F3
R21	Parts tone control	3·9kΩ	D3
R22		22kΩ	D3
R23	V4 G.B.	150Ω	E3
R24	H.T. smoothing ...	*500Ω	F3
R25	Anti-static leak ...	1MΩ	—
R26	P.U. tone correctors	1MΩ	—
R27		6·8MΩ	—
R28		220kΩ	—
R29	V3 G.B.	1·5kΩ	—
R30		1kΩ	—
R31	V3 anode load ...	47kΩ	—
R32	Parts tone control	4·7kΩ	—
R33		33kΩ	—
R34	V4 G.B.	180Ω	—
R35	V5 surge limiter ...	47Ω	—
R36	Heater ballast ...	†1·030Ω	—

* Two 1kΩ resistors in parallel. † Tapped at 700Ω + 200Ω + 80Ω + 50Ω from V5 heater. ‡ 8.2kΩ in U168. § 180Ω in U168. ¶ 22kΩ in U168. †† 330Ω in U168.

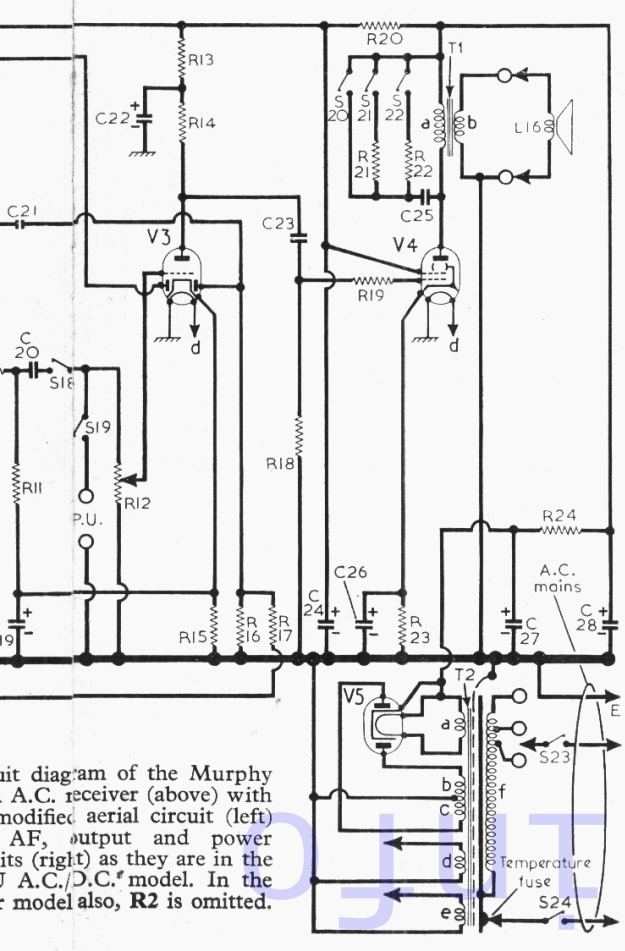
	CAPACITORS	Values	Locations
C1	L.W. aerial shunt ...	470pF	G3
C2	L.W. aerial trim. ...	27pF	G3
C3	V1 C.G.	470pF	F3
C4	S.G. decoupling ...	0·05μF	F3
C5	1st I.F. trans. tuning	150pF	B2
C6		150pF	B2
C7	A.G.C. decoupling	0·05μF	F4
C8	V1 cath. by-pass ...	0·05μF	F3
C9	V1 osc. C.G. ...	220pF	F3
C10	Oscillator coupling	100pF	G3
C11	Osc. trackers	180pF	G3
C12		620pF	F4
C13	L.W. osc. trim. ...	82pF	F4
C14	Osc. anode coup. ...	100pF	F3
C15	V2 cath. by-pass ...	0·05μF	F4
C16	2nd I.F. trans. tuning	150pF	B2
C17		150pF	B2
C18	I.F. by-pass ...	220pF	E4
C19*	V3 cath. by-pass	50μF	E4
C20	A.F. coupling ...	0·005μF	E4
C21	A.G.C. coupling ...	33pF	F4
C22*	H.T. decoupling ...	4μF	D3
C23	A.F. coupling ...	0·01μF	E4
C24*	H.T. smoothing ...	16μF	D3
C25	Part tone control ...	0·05μF	D3
C26*	V4 cath. by-pass ...	50μF	E4
C27*	H.T. smoothing ...	16μF	C2
C28*		32μF	C2
C29‡	S.W. aerial trim. ...	35pF	G3
C30‡	M.W. aerial trim. ...	35pF	G3
C31‡	L.W. aerial trim. ...	35pF	G3
C32†	Aerial tuning ...	546pF	A1
C33‡	S.W. osc. trim. ...	35pF	G4
C34‡	L.W. osc. trim. ...	35pF	F4
C35‡	M.W. osc. trim. ...	35pF	G4
C36†	Oscillator tuning ...	546pF	A1
C37	Aerial and earth isolators ...	470pF	—
C38		0·0018μF	—
C39		0·01μF	—
C40	P.U. isolators ...	0·01μF	—
C41		0·001μF	—
C42		0·005μF	—
C43	Part tone control	0·05μF	—
C44	Tone corrector ...	0·005μF	—
C45	R.F. by-pass ...	0·05μF	—

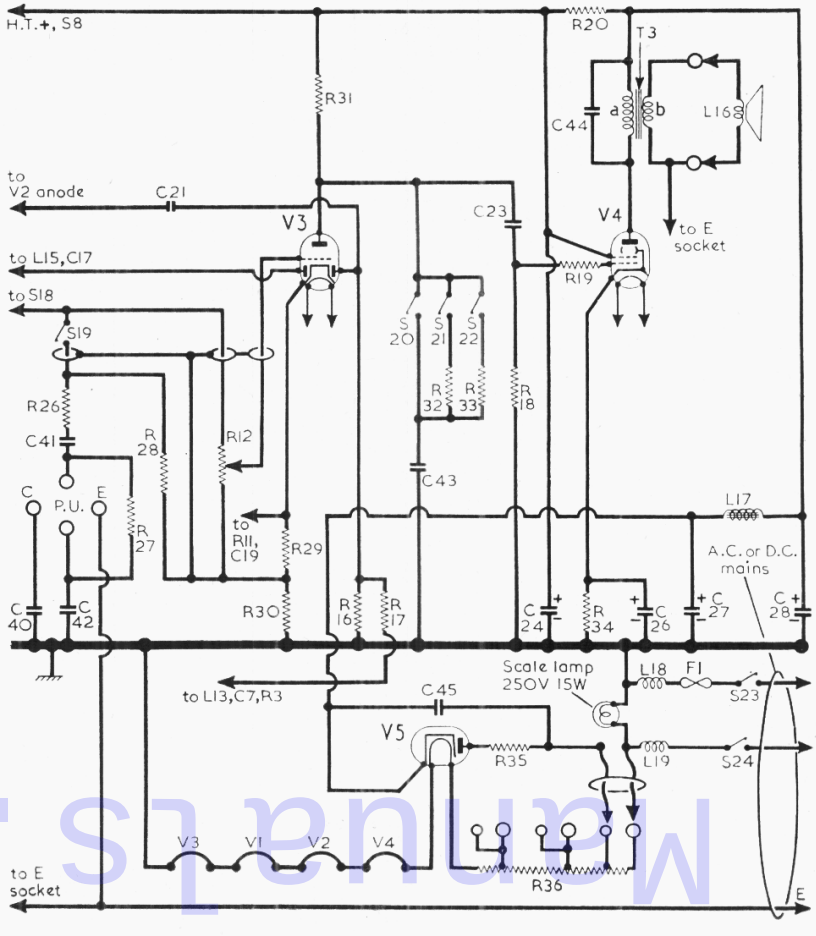


	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	Aerial coupling coils	—	A1
L2		1·0	A1
L3		20·0	A1
L4	Aerial tuning coils	—	A1
L5		3·5	A1
L6		21·0	A1
L7	Oscillator reaction coils	—	G3
L8		—	F3
L9	Oscillator tuning coils	—	G3
L10		5·2	F3
L11		2·0	F3
L12	1st I.F. trans. Pri.	6·5	B2
L13	1st I.F. trans. Sec.	6·5	B2
L14	2nd I.F. trans. Pri.	6·5	B2
L15	2nd I.F. trans. Sec.	6·5	B2
L16	Speech coil ...	2·5	—
L17	H.T. smoothing choke	270·0	—

(*Continued column 1 overleaf*)

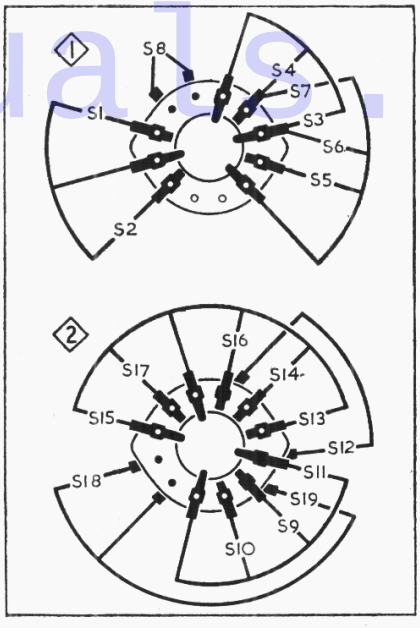
* Electrolytic. † Variable. ‡ Preset.





...uit diagram of the Murphy ... A.C. receiver (above) with ...modified aerial circuit (left) ... AF, output and power ...its (right) as they are in the ...U A.C./D.C. model. In the ...r model also, **R2** is omitted.

OTHER COMPONENTS (*continued*)		Approx. Values (ohms.)	Locations
L18, L19	Mains R.F. chokes	7·0 7·0	— —
T1	O.P. trans. (A168) a b	290·0 —	E3
T2	Mains trans. a ... b ... c ... d ... e ... f, total	183·0 173·0 — — 42·5	C1
T3	O.P. trans. (U168) a b	300·0 —	—
S1-S19	Waveband switches	—	G3
S20-S22	Tone control switches	—	D3
S23, S24	Mains sw., g'd R12	—	E3
F1	500 mA. fuse ...	—	—



Diagrams of the waveband switch units, drawn as seen from the rear of an inverted chassis. In the next column (on the right) is the associated switch table.

Switches	S.W.	M.W.	L.W.	Gram
S1	C	—	—	—
S2	C	C	C	—
S3	C	—	—	C
S4	—	C	—	—
S5	C	—	—	—
S6	—	C	—	—
S7	—	—	C	—
S8	C	C	C	—
S9	—	C	—	—
S10	C	—	—	—
S11	—	C	C	—
S12	C	—	—	—
S13	C	—	—	—
S14	—	C	—	—
S15	—	C	C	C
S16	—	—	C	—
S17	—	C	—	—
S18	C	C	C	—
S19	—	—	—	C

Circuit Description—*continued*

via **C21,** provides D.C. potential, which developed across load resistor **R16,** is fed back as bias to **V1** and **V2,** giving automatic gain control.

Resistance-capacitance coupling by **R14, C23** and **R18** between **V3** and beam tetrode output valve **(V4, 6P25** (A.C. model) or **10P14** (A.C./D.C. model)**).** Three-position tone control is provided by **R21, R22, C25** and switches **S20, S21, S22** in **V4** anode circuit (A.C. model) or **R32, R33, C43** in **V3** anode circuit (A.C./D.C. model). Provision is made for the connection of a low impedance external speaker by sockets in the internal speaker plugs.

In the A.C. model, H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, UU9).** Smoothing by **R20 R24** and electrolytic capacitors **C24, C27, C28.** The valve heaters are parallel-fed from windings **a** and **d** on mains transformer **T2.** Scale lamps are fed from a separate winding **e.**

The temperature fuse consists of a spring contact which is held by a low melting-point alloy to a copper bar embedded in the mains transformer near the primary winding. One side of the mains is connected to the transformer primary through the temperature fuse, and if the transformer becomes overheated owing to a component break-down, the copper bar conducts the heat to the fusible alloy and melts it, releasing the spring contact and breaking the input circuit.

In the A.C./D.C. model H.T. current is supplied by I.H.C. half-wave rectifying valve **(V5, U404).** Smoothing by **L17, R20** and electrolytic capacitors **C24, C27, C28.** Valve heaters, together with ballast resistor **R36,** are connected in series across the mains input, but the scale lamp is connected directly across the mains input. R.F. filtering by **C45** and chokes **L18, L19. R35** protects **V5** from current surges, and **F1** protects the mains input circuit from overloads resulting from component breakdown.

GENERAL NOTES

Switches.—**S1-S17** are the waveband switches, and **S18, S19** are the radio/gram change-over switches, ganged in two rotary units beneath the chassis. **S8** is a radio muting switch. The units are indicated in our underside view of the chassis by the numbers **1** and **2** in diamond surrounds, and they are shown in detail in the diagrams above, where they are drawn as seen from the rear of an inverted chassis.

The table beside the diagrams 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.

S20-S22 are the tone control switches, ganged in a single rotary unit beneath the chassis. This is indicated in our underside view of the chassis, and shown in the diagram in col. 3, where it is drawn as seen from the rear of an inverted chassis. **S20** closes for deepest tone, and **S22** for maximum high-note response.

S23, S24 are the Q.M.B. mains switches, ganged with the volume control **R12.**

Scale Lamps.—In the A.C. model, there are two of these, rated at 6.2 V, 0.3 A. They have large clear spherical bulbs and M.E.S. bases. In the A.C./D.C. model, a "Pygmy" or sign-type of lamp is used. It has a standard bayonet cap base and is rated at 250 V, 15 W.

External Speaker.—The connecting plugs by which the internal speaker is connected are themselves provided with sockets for the connection of a low impedance (3-7 Ω) external speaker.

Temperature Fuse.—As shown in the circuit diagram overleaf, the mains transformer in the A.C. model is fitted with a temperature fuse. This is connected in series with the primary winding and open-circuits if the transformer overheats.

To re-set the fuse, the springy strip should be held down in position while a hot iron is applied to the solder at the point of contact. The iron must be clean, and no ordinary solder must be mixed with the special solder already there. If additional solder is required, it must be fusible alloy 0075/1, which can be obtained from the makers' service department.

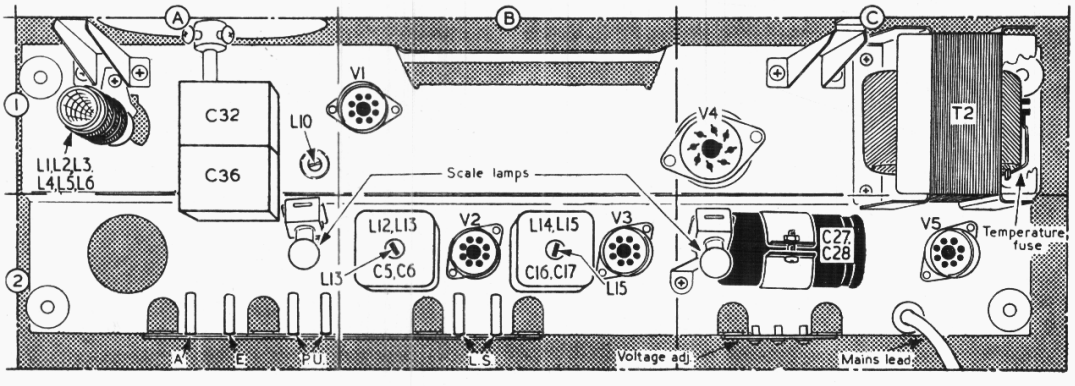
Valve V2.—Originally **V2** was a 6F15, and pins 3 and 4 (shield and suppressor) were connected to the spigot tube and chassis. When a 6F16 is used the wiring must be altered, however, because in the latter the suppressor is connected internally to the cathode, although it has its own pin (No 3). Pin 4 is not used.

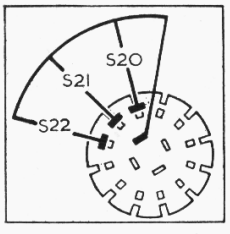
To accommodate the 6F15, pins 3 and 4 must be disconnected from the spigot and taken instead to pin 7 (cathode). When this is done, either valve may be plugged in, and later chassis are all wired this way.

Valve V3.—In some A.C./D.C. chassis a Mullard UBC41 valve may be used as **V3** instead of the Mazda 10LD11 specified, but although these valves are not equivalent types, no wiring changes are necessary when substituting one for the other.

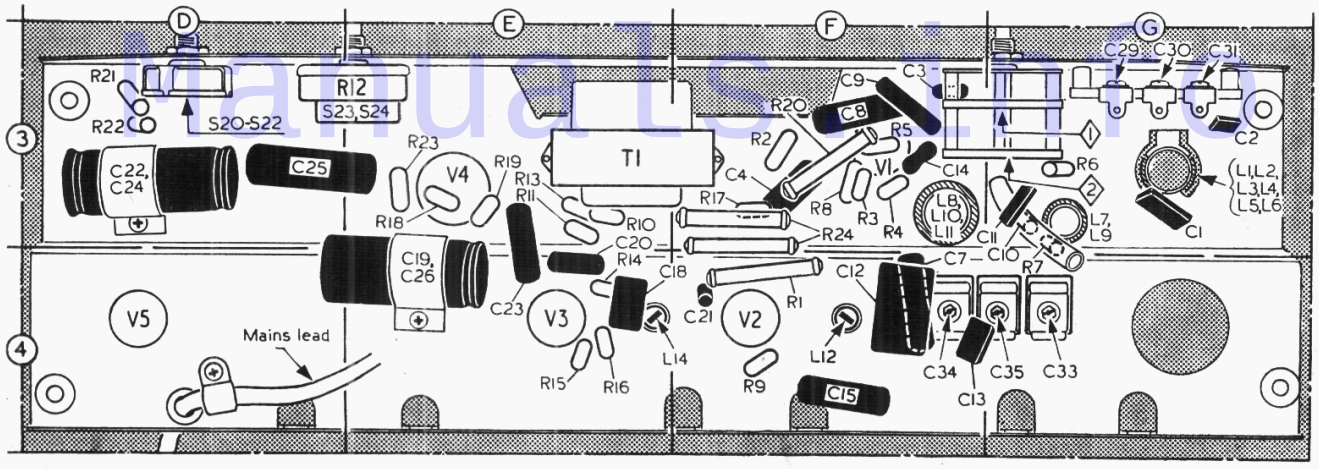
Speaker Type.—In the A.C. version, the loud speaker may be a Celestion (part No. 51645) or a Lectrona (part No. 55565), but in the A.C./D.C. version only a Celestion may be used. Owing to the design of the lamp filament and the stray field of the Lectrona speaker, the lamp filament (on A.C. mains) is subjected to excessive vibration when that speaker is used. This should be borne in mind when a replacement speaker is ordered.

Scale Lamp Holder.—Excessive mechanical strain on the lamp holder originally fitted to





Plan view of the chassis (left) of the A.C. model. Above is a detailed diagram of the tone control switch.



Underside view of the A.C. chassis. Diagrams of the waveband switch units appear in col. 2, and of the tone control unit below col. 3.

A.C. versions sometimes caused intermittent short-circuits to occur, with the result that the temperature fuse would open.

Where the fuse tends to operate for no apparent reason, the holders should be examined, and if necessary they should be replaced with a new type (part No. 56453) which is fitted on later models.

Resistor R6.—The value of this resistor is usually 3.9 kΩ, as shown in our tables, but in some receivers it is replaced by one of 4.3 kΩ, ±5%.

Transit Screw.—In order to prevent excessive vibration due to jolting in transit, a transit screw (coded with red paint) is provided on the tuning gang. It goes into a threaded hole in the bottom left-hand corner of the rear faceplate of the gang (as seen when viewed from the rear), where it holds the gang firmly in a rubber grommet mounted in a bracket bolted to the chassis deck.

It is important that the screw should be in this position while the receiver is in transit, and it is important that it should be removed when the receiver is installed. It should then be "parked" in the screw-hole provided for it in the top left-hand corner of the same faceplate. This is also coded red. See also note under "Dismantling."

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from 235 V A.C. mains, the voltage adjustment being set to the 240-250 V tapping. The receiver was tuned to the highest wavelength end of M.W. and the volume control was turned to maximum, but there was no signal input.

Voltage readings were measured with an Avo Electronic TestMeter, and as this instrument has a very high internal resistance, allowance should be made for the current drawn by other types of meter. Chassis was the negative connection in every case. The makers quote the U168 H.T. line voltage at about 160 V.

Valves	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 6C9 ...	200 (Oscillator) 80	3·7 3·6	105	5·7	3·7
V2 6F16 ...	200	5·6	106	2·0	2·0
V3 6LD20 ...	75	0·75	—	—	2·5
V4 6P25 ...	235	30·0	200	5·5	5·3
V5 UU9 ...	230*	—	—	—	280·0†

* A.C. reading, each anode.
† Cathode current, 57 mA.

DISMANTLING

Access to the chassis sufficient for most servicing operations may be obtained upon removal of the back cover, which is held by two screws at the back, two screws beneath the cabinet, and slots at top and bottom of the cabinet.

The chassis must be removed for re-alignment, because the aerial trimmers are otherwise inaccessible, and for the replacement of either of the tuning drive cords.

Removing Chassis.—Remove four control knobs (recessed grub screws);
withdraw the speaker plugs from their sockets and free their leads from the clip on the chassis;
turn gang to maximum, and disengage drive cord from cursor carriage;
remove four large bolts (with two nuts and two cupped washers each), and lift out chassis.
When replacing, a cupped washer should be fitted to either side of the chassis grommets. Each fixing screw is provided with a nut and a lock-nut, and these should be run up tight if the receiver is to be transported. When it is installed, they should be slackened off so that the chassis floats on the grommets, but the nut and lock-nut should be firmly tightened together. The transit screw on the gang should also be "parked" correctly.

CIRCUIT ALIGNMENT

The chassis should be removed from its cabinet for the following alignment adjustments.

I.F. Stages.—When adjusting the I.F. transformers, a damping unit consisting of a 4.7 kΩ resistor in series with an 0.01 μF capacitor should be connected, via the shortest possible leads, across one winding while the core of the other is adjusted. Turn volume control to maximum and set the tone control to its fully clockwise position. Connect signal generator output, via an 0.1μF capacitor in each lead, to control grid (pin 6) of **V2** and chassis.

Switch set to M.W. and turn gang to maximum capacitance. Feed in a 465 kc/s (645.16 m) signal and adjust the cores of **L15** (location reference B2) and **L14** (E4) for maximum output. Transfer "live" signal generator lead to junction of **C32**, **C3** and adjust the cores of **L13** (B2) and **L12** (F4) for maximum output. Repeat these adjustments until no further improvement results.

R.F. and Oscillator Stages.—As the tuning scale remains fixed in the cabinet when the chassis is withdrawn, reference is made in the following instructions to the substitute tuning scale embossed on the front of the drive drum. Readings on this scale are taken against the "V" notch in the metal pointer mounted below the drum. Check that with the gang at maximum capacitance, the notch in the metal pointer coincides with "O" on the substitute scale. Transfer signal generator leads via a dummy aerial to **A** and **E** sockets.

L.W.—Switch receiver to L.W., tune to 31 on substitute scale, feed in a 158 kc/s (1,900 m) signal and adjust the core of **L10** (A1) for maximum output. Tune receiver to 167.5 on scale, feed in a 300 kc/s (1,000 m) signal and adjust **C34** (F4) and **C31** (G3) for maximum output. Repeat these adjustments.

M.W.—Switch receiver to M.W., tune to 155 on scale, feed in a 1,364 kc/s (220 m) signal and adjust **C35** (G4) and **C30** (G3) for maximum output. Repeat these adjustments.

S.W.—Switch receiver to S.W., tune to 154.5 on scale, feed in a 15.23 Mc/s (19.7 m) signal and adjust **C33** (G4) and **C29** (G3) for maximum output, rocking the gang while adjusting **C29** for optimum results. Repeat these adjustments.

Aerial Filter.—Where one of these is fitted, connect a voltmeter between the cathode of **V2** and chassis (that is, in parallel with **R9**), switch to the 10 V D.C. range, tune the receiver to the interfering station, and adjust the rejector core for maximum reading on the meter.

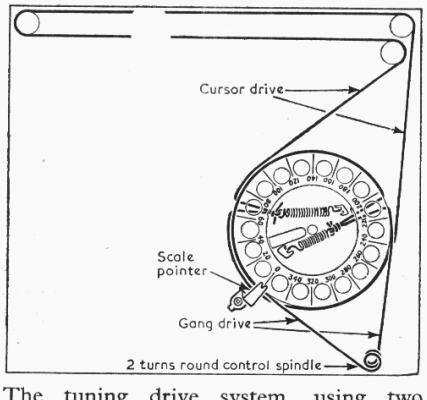
DRIVE CORD REPLACEMENT

There are two drive cords in this receiver: the tuning drive, and the cursor drive. It is unimportant which is fitted first. But the gang drive cord should be the front one in the drum groove. About seven feet of cord is required altogether for both cords, and suitable material (part No. 3962/1) can be obtained from the Service Department, Murphy Radio, Ltd., Welwyn Garden City, Herts. Before fitting, it should be stretched by suspending a weight of 3 or 4lb for an hour or so.

The complete system is shown in the accompanying sketch, where it is drawn as seen from the front with the gang at maximum capacitance. The calibration mark 0 (zero) should then register with the V-notch in the fixed pointer bracket at the lower left-hand corner of the drum assembly. Each cord makes just over half of a turn round the drive drum.

Gang Drive.—Take a 24in length of cord, tie one end to the lower tension spring, then follow the course of the lower cord shown in the sketch. Tie off so that the spring is extended to $1\frac{7}{16}$in, $\pm\frac{1}{16}$in, and cut off surplus cord.

Cursor Drive.—Take about 5 feet of cord, tie one end to the upper tension spring, then follow the course of the upper cord in the sketch. Finally, tie off so that the spring is extended $1\frac{3}{16}$in, $\pm\frac{1}{16}$in, and cut off surplus cord.



The tuning drive system, using two separate cords, drawn as seen from the front with the gang at maximum capacitance.

Printed in England by Cornwall Press Ltd., Paris Garden, London, S.E.1.