"TRADER" SERVICE SHEET
1101

MURPHY 168M Series

TWO versions of the Murphy 168M series are covered here, the A168M and the U168M. 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 A168M, 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 U168M.

The waveband coverage is 16.5-52m, 185-550m and 1,000-2,050m. 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 strong local transmissions. Either an external aerial and earth or the frame aerial provided on the cabinet back cover can be connected to the **A** and **E** sockets.

Two early versions of the 168M series are the A168 and U168. They are different in many respects from the A168M and U168M and are fully covered in *Service Sheet* 1089. Identifying features between the early versions and the models covered here are described under "General Notes" overleaf.

This *Service Sheet* was prepared from an A168M, but the differences in the U168M are explained throughout.

Release date and original price, both models: April, 1951; £18 6s 11d plus purchase tax.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L3** (S.W.) and **L4** (M.W. and L.W.) to single-tuned circuits **L5, C33** (S.W.), **L6, C33** (M.W.) and **L7, C33** (L.W.), which precede triode hexode valve **(V1, Mazda 6C9** (A.C. model) or **10C1** (A.C./D.C. model)**).** In areas of sufficient signal strength the frame aerial **L1** can be used, its leads being plugged into the **A** and **E** sockets instead of an external aerial and earth. I.F. filtering by **L2, C1.** In the A.C./D.C. model **C38, C39** and **C40** isolate the aerial and earth sockets from chassis, which is "live" to the mains, and **R22** provides a D.C. path between them to leak away static charges that may accumulate on the aerial.

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.

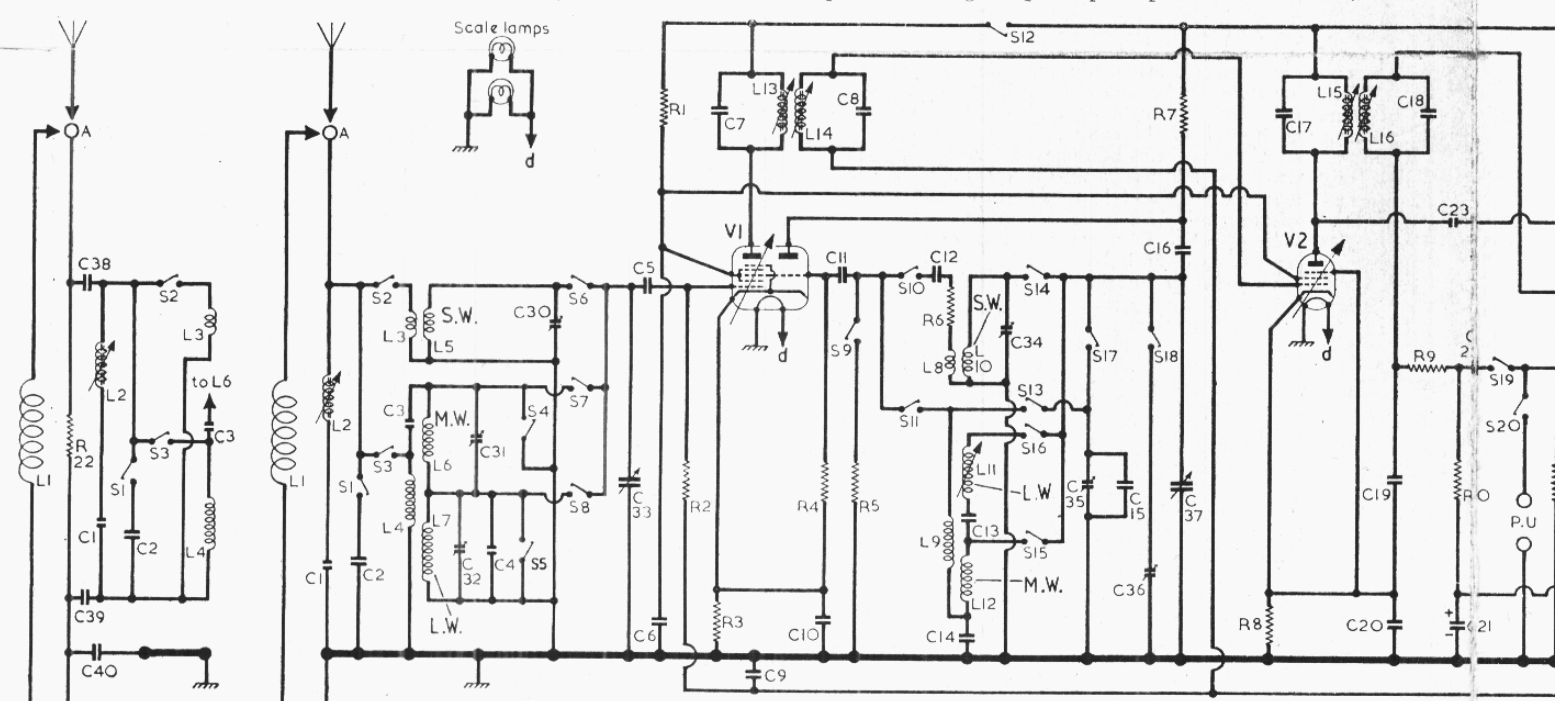
Oscillator anode coils **L10** (S.W.), **L11** (L.W.) and **L12** (M.W.) are tuned by **C37,** coils **L11** and **L12** being connected in series for L.W. operation. Parallel trimming by **C34** (S.W.), **C15, C35** (L.W.) and **C36** (M.W.); series tracking by **C13, C14** (L.W.) and **C14** (M.W.). Reaction coupling from grid by **L8** (S.W.) and **L9** (M.W. and L.W.) with additional coupling across the common impedance of **C14** on M.W. and L.W.

Second valve **(V2, Mazda 6F15** (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 coupings **C7, L13, L14, C8** and **C17, L15, L16, C18.**

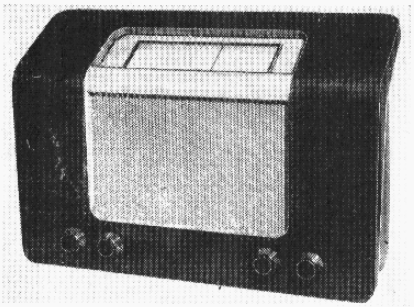
Intermediate frequency 470 kc/s.

Diode signal detector is part of double diode triode valve **(V3, Mazda 6LD20** (A.C. model) or **10LD11** (A.C./D.C. model)**).** Audio frequency component in rectified output is developed across diode load resistors **R9, R10,** and that across **R10** is passed via **C22** and manual volume control **R11** to triode section, which operates as A.F. amplifier.

Provision is made for the connection of a gramophone pick-up across **R11** via **S20,**



Circuit diagram of A168M A.C. receiver the modified aerial cir A.F., output and p (right) as they are ir A.C./D.C. model. Eith aerial and earth or the frame aerial may be co **A** and **E** soc



which closes in the gram position of the waveband control. **S12** (in the H.T. circuit) and **S19** open on gram to prevent radio break-through. In the A.C./D.C. model **C41** and **R23** provide pick-up tone correction, and **C42** isolates the pick-up from chassis. Socket **C** connects the screening of the pick-up lead via **C43** to chassis.

Second diode of **V3**, fed from **V2** anode via **C23**, provides D.C. potential, which developed across load resistor **R14**, is fed back as bias to **V1** and **V2**, giving automatic gain control.

Resistance-capacitance coupling by **R12, C24** and **R16** between **V3** and beam pentode output valve **(V4, Mazda 6P25** (A.C. model) or **10P14** (A.C./D.C. model)**).** Tone control in anode circuit by **R19, C26.** 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, Mazda UU9).** Smoothing by **R17, R21** and electrolytic capacitors **C25, C28** and **C29.** Valve heaters are parallel-fed from windings **a** and **d** on **T2.**

The temperature fuse consists of a spring contact which is held by a low

(Continued col. 1 overleaf)

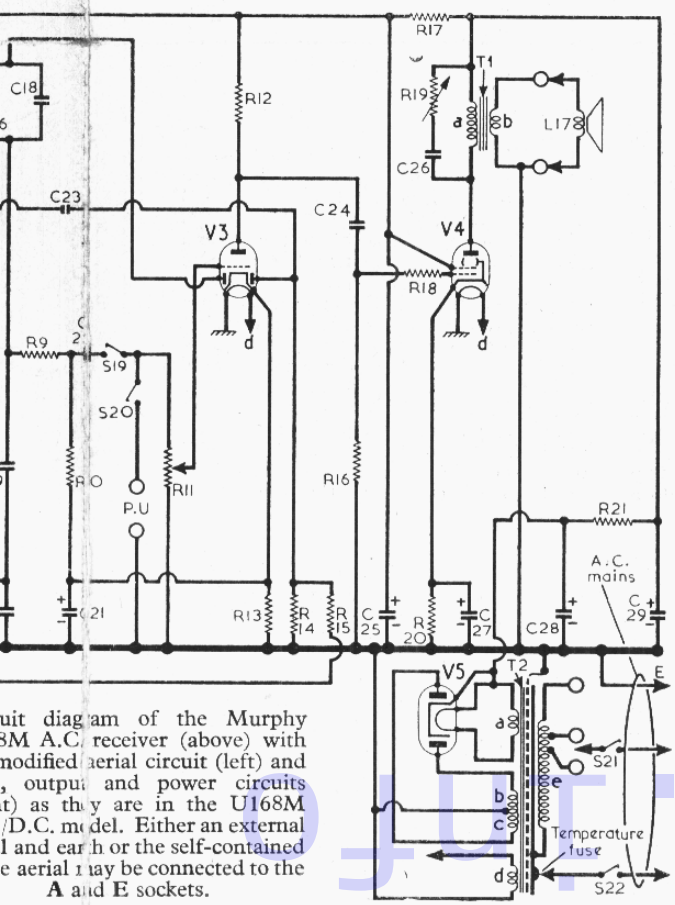
COMPONENTS AND VALUES

	RESISTOR	Values	Locations
R1	S.G. feed	12kΩ	F4
R2	V1 C.G.	470kΩ	F3
R3	V1 G.B.	270Ω	F3
R4	V1 osc. C.G. ...	47kΩ	F3
R5	M.W. osc. shunt ...	3·9kΩ	F3
R6	S.W. osc. stabilizer	82Ω	G3
R7	Osc. anode feed ...	33kΩ	F3
R8	V2 G.B.	270Ω	F4
R9	Signal diode load...	330kΩ	E3
R10		180kΩ	E4
R11	Volume control ...	1MΩ	D3
R12	V3 anode load ...	100kΩ	E4
R13	V3 G.B.	3·3kΩ	E4
R14	A.G.C. diode load...	1MΩ	E4
R15	A.G.C. decoupling	1MΩ	F3
R16	V4 C.G.	470kΩ	E4
R17	H.T. smoothing ...	1·8kΩ	D3
R18	V4 C.G. stopper ...	47kΩ	E3
R19	Part tone control...	20kΩ	D3
R20	V4 G.B.	150Ω	E4
R21	H.T. smoothing ...	*500Ω	D3
R22	Anti-static leak ...	1MΩ	—
R23	P.U. shunt ...	6·8MΩ	—
R24	V3 anode load ...	47kΩ	—
R25	V3 G.B.	2·7kΩ	—
R26	V4 G.B.	180Ω	—
R27	V5 surge limiter ...	47Ω	—
R28	Heater ballast ...	†1,030Ω	—

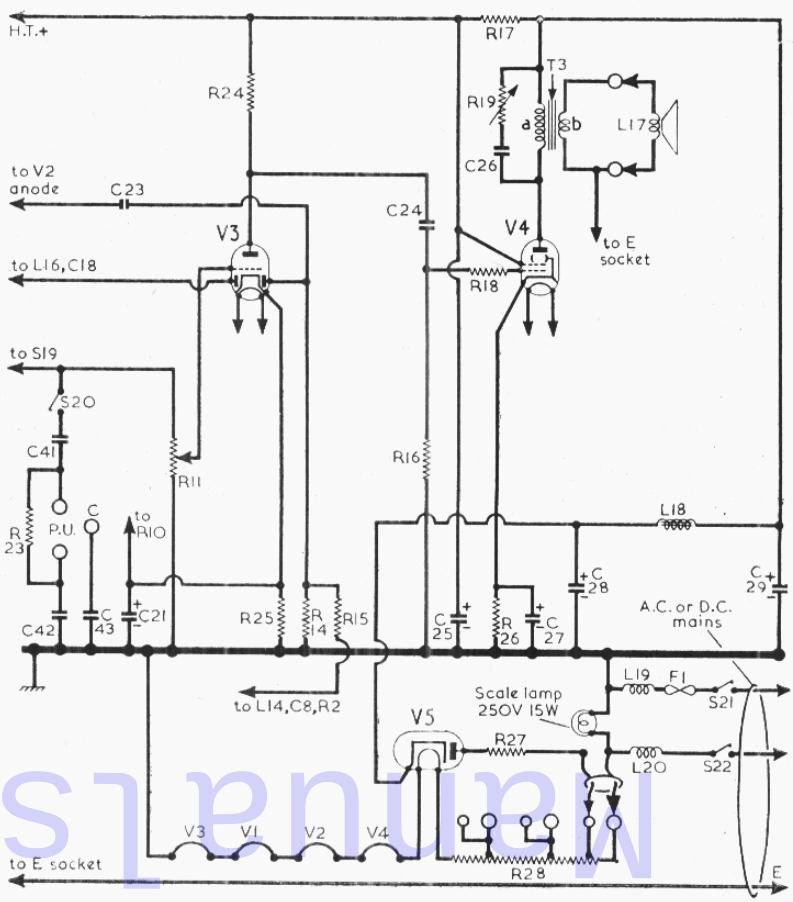
* Two 1kΩ resistors in parallel. † Tapped at 700Ω + 200Ω + 80Ω + 50Ω from V5 heater.

	CAPACITORS	Values	Locations
C1	Part I.F. rejector...	33pF	A2
C2	Aerial shunt ...	470pF	G3
C3	M.W. aerial coup....	2·7pF	G3
C4	L.W. aerial trimmer	56pF	G3
C5	V1 C.G.	470pF	F3
C6	V1 S.G. decoupling	0·01μF	F3
C7	1st I.F. trans.	150pF	B2
C8	tuning	150pF	B2
C9	A.G.C. decoupling	0·04μF	F3
C10	V1 cath. by-pass...	0·04μF	F3
C11	V1 osc. C.G. ...	220pF	F3
C12	Oscillator coupling	100pF	G3
C13	L.W. osc. tracker...	220pF	F3
C14	M.W. osc. tracker...	620pF	F4
C15	L.W. osc. trim. ...	100pF	F4
C16	Oscillator anode coup.	100pF	F3
C17	2nd I.F. trans.	150pF	B2
C18	tuning	150pF	B2
C19	I.F. by-pass ...	220pF	F4
C20	V2 cath. by-pass...	0·04μF	F4
C21*	V3 cath. by-pass ...	50μF	D4
C22	A.F. coupling ...	0·005μF	E3
C23	A.G.C. coupling ...	33pF	F4
C24	A.F. coupling ...	0·005μF	E4
C25*	H.T. smoothing ...	8μF	D4
C26	Part tone control...	0·05μF	E3
C27*	V4 cath. by-pass ...	50μF	D4
C28*	H.T. smoothing ...	16μF	C2
C29*		32μF	C2
C30‡	S.W. aerial trim. ...	35pF	G3
C31‡	M.W. aerial trim....	35pF	G3
C32‡	L.W. aerial trim. ...	35pF	G3
C33†	Aerial tuning ...	580pF	A1
C34‡	S.W. osc. trim. ...	35pF	G4
C35‡	L.W. osc. trim. ...	35pF	F4
C36‡	M.W. osc. trim. ...	35pF	F4
C37†	Oscillator tuning ...	580pF	A1
C38	Aerial and earth isolators ...	470pF	—
C39		0·0018μF	—
C40		0·01μF	—
C41	P.U. isolators ...	0·005μF	—
C42		0·01μF	—
C43		0·001μF	—

* Electrolytic. † Variable. ‡ Pre-set.

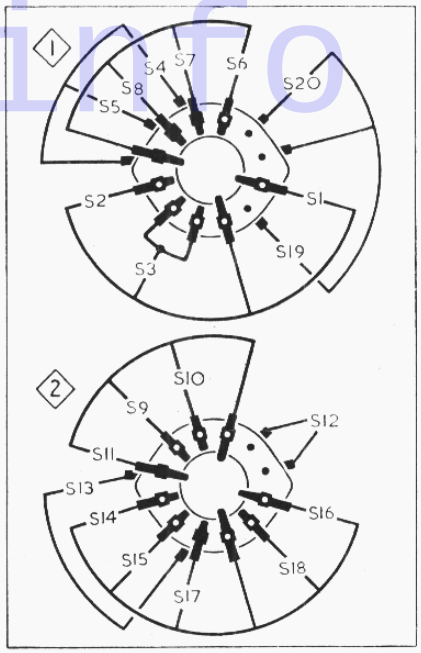


uit diagram of the Murphy 8M A.C. receiver (above) with modified aerial circuit (left) and , output and power circuits t) as they are in the U168M /D.C. model. Either an external l and earth or the self-contained e aerial may be connected to the **A** and **E** sockets.



	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	Frame aerial ...	10·0	—
L2	I.F. rejector ...	13·0	A2
L3	Aerial coup. coils...	—	A1
L4		24·0	A1
L5	Aerial tuning coils	—	A1
L6		5·5	A1
L7		21·0	A1
L8	Oscillator reaction coupling coils ...	—	G3
L9		—	F3
L10	Oscillator tuning coils	—	G3
L11		5·2	F3
L12		2·0	F3
L13	1st I.F. trans. Pri.	6·5	B2
L14	1st I.F. trans. Sec.	6·5	B2
L15	2nd I.F. trans. Pri.	6·5	B2
L16	2nd I.F. trans. Sec.	6·5	B2
L17	Speech coil ...	2·5	—
L18	Smoothing choke...	270·0	—
L19	Mains R.F. filter chokes ...	7·0	—
L20		7·0	—
T1	O.P. trans. (A168M) a ...	466·0	E4
	b ...	—	
T2	Mains trans. a ...	—	
	b ...	180·0	
	c ...	195·0	C1
	d ...	—	
	e, total	39·0	
T3	O.P. trans. (U168M) a...	466·0	—
	b	—	
S1-S20	Waveband and gram switches ...	—	F3
S21 S22	Mains sw., g'd R19	—	D3

Switches	S.W.	M.W.	L.W.	Gram
S1	—	—	C	—
S2	C	—	—	—
S3	—	C	C	—
S4	C	—	—	—
S5	C	C	—	—
S6	C	—	—	—
S7	—	C	—	—
S8	—	—	C	—
S9	—	C	—	—
S10	C	—	—	—
S11	—	C	C	—
S12	—	C	C	—
S13	C	—	—	—
S14	C	—	—	—
S15	—	C	—	—
S16	—	—	C	—
S17	—	—	C	—
S18	—	C	—	—
S19	C	C	C	—
S20	—	—	—	C



Diagrams of the waveband switch units, drawn as seen from the rear of an inverted chassis. In the column to the left is the associated switch table.

Circuit Description—*continued*

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 should the transformer become 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, Mazda U404).** Smoothing by **R17, L18** and electrolytic capacitors **C25, C28** and **C29.** Valve heaters, together with ballast resistor **R28,** are connected in series across the mains input, but the scale lamp is connected directly across the mains input. R.F. filtering by mains chokes **L19, L20. R27** protects **V5** from current surges, and **F1** protects the mains input circuit from overloads resulting from component breakdowns.

GENERAL NOTES

Switches.—**S1-S18** are the waveband switches, and **S19, S20** are the radio/gram change-over switches, ganged in two rotary units beneath the chassis. **S12** 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 on the right (column 3), 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.

Scale Lamps.—In the A.C. model, there are two of these, rated at 6.5 V, 0.3 A. They have small 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.

P.U.—Sockets are provided at the rear of the chassis, between the **A** and **E** and the speaker sockets, for the connection of a gramophone pick-up. A gram position is provided on the waveband switch to provide radio muting when the pick-up is in use.

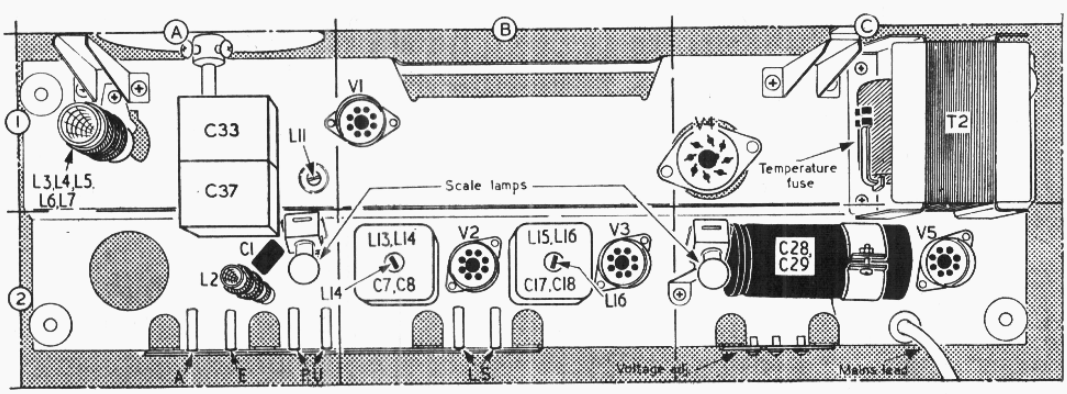
Aerial Filter.—When fitted, this is adjusted for minimum output while receiving the interfering station.

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.

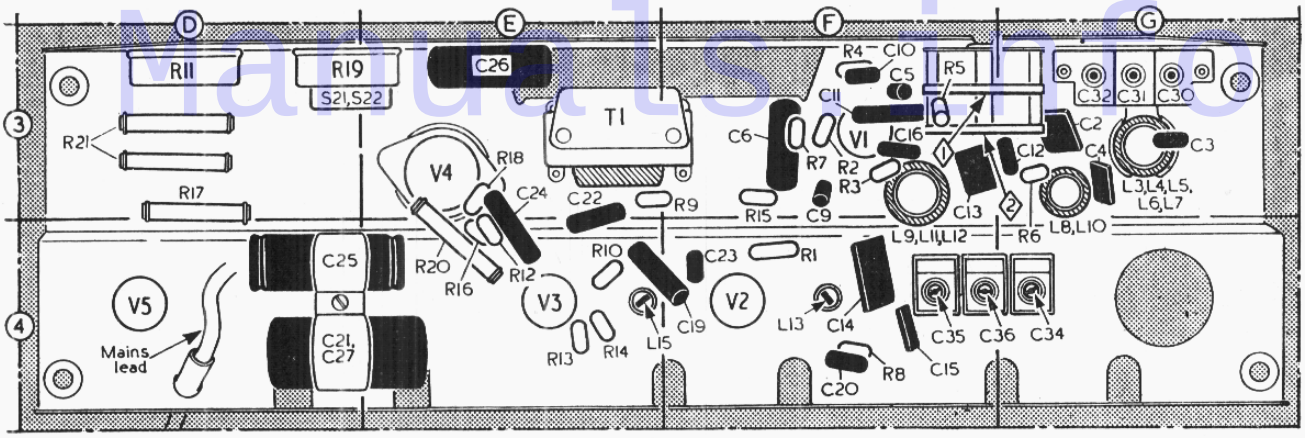
To re-set the fuse, the springy strip should be held down in position while a hot iron is applied to the solder at the point of contact. The iron must be clean, and no ordinary solder must be mixed with the special solder already there. If additional solder is required, it must be fusible alloy 0075/1,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

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 face-plate 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 face-



Plan view of the chassis in the A.C. model, showing the temperature fuse on the mains transformer **T2.** The chassis of the earlier 168 series, which is not covered in this *Service Sheet,* has no I.F. filter coil **L2** or capacitor **C1,** and the temperature fuse is mounted on the other side of **T2.**



Underside view of the chassis. Diagrams of the waveband switch units appear in col. 3 and their associated table in col. 2.

plate. This is also coded red. See also note under "Dismantling."

A168, U168.—These are early versions of the A168M and U168M and are fully covered in *Service Sheet* 1089. In case of difficulty arising where a model number is missing or unreadable, the later models on which this *Service Sheet* is based can be distinguished from early versions by the frame aerial fitted to the back cover, and the I.F. rejector coil **L2** mounted near the **A** and **E** sockets on the chassis deck.

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 need not be removed for re-alignment as all the adjustments are easily accessible through the base and back of the cabinet.

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.

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 5) 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 U168M H.T. line voltage at about 164 V.

Valves	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 6C9	186 Oscillator 60	1·0 3·8	106	5·4	3·0
V2 6F15	186	4·9	106	1·6	2·0
V3 6LD20	105	0·9	—	—	3·0
V4 6P25	220	34·0	186	6·0	5·8
V5 UU9 ...	240*	—	—	—	280·0†

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

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 0.1 μF 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 470 k/cs (638.3 m) signal and adjust the cores of **L16** (location reference B2) and **L15** (E4) for maximum output. Transfer "live" signal generator lead to junction of **C33, C5** and adjust the cores of **L14** (B2) and **L13** (F4) for maximum output. Repeat these adjustments until no further improvement results.

I.F. Rejector.—The core of the rejector coil **L2** (A2) has been accurately set at the factory and should not need re-adjustment. If necessary, however, the core can be moved with a non-metallic tool and should be adjusted for maximum voltage at **V1** or **V2** cathode, feeding a 470 kc/s signal into the **A** and **E** sockets.

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 62.2 on substitute scale, feed in a 176.5 kc/s (1,700 m) signal and adjust the core of **L11** (A1) for maximum output. Tune receiver to 167.95 on scale, feed in a 300 kc/s (1,000 m) signal and adjust **C35** (F4) and **C32** (G3) for maximum output. Repeat these adjustments.

M.W.—Switch receiver to M.W., tune to 156.42 on scale, feed in a 1,364 kc/s (220 m) signal and adjust **C36** (F4) and **C31** (G3) for maximum output. Repeat these adjustments.

S.W.—Switch receiver to S.W., tune to 156.2 on scale, feed in a 15.23 Mc/s (19.7 m) signal and adjust **C34** (G4) and **C30** (G3) for maximum output, rocking the gang while adjusting **C30** for optimum results. Repeat these adjustments.

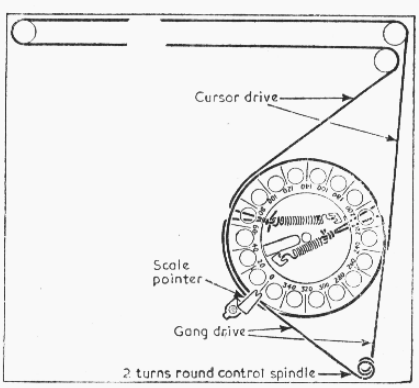
DRIVE CORD REPLACEMENT

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 $1\frac{3}{16}$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.

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