

Mullard

Radio

MODEL MAS 221



**THE MULLARD WIRELESS
SERVICE CO., LTD.**

**SERVICE DEPT.,
WADDON FACTORY ESTATE,
CROYDON, SURREY, ENGLAND**

SERVICE MANUAL

MULLARD RECEIVER MAS 221

FOR A.C. SUPPLIES ONLY

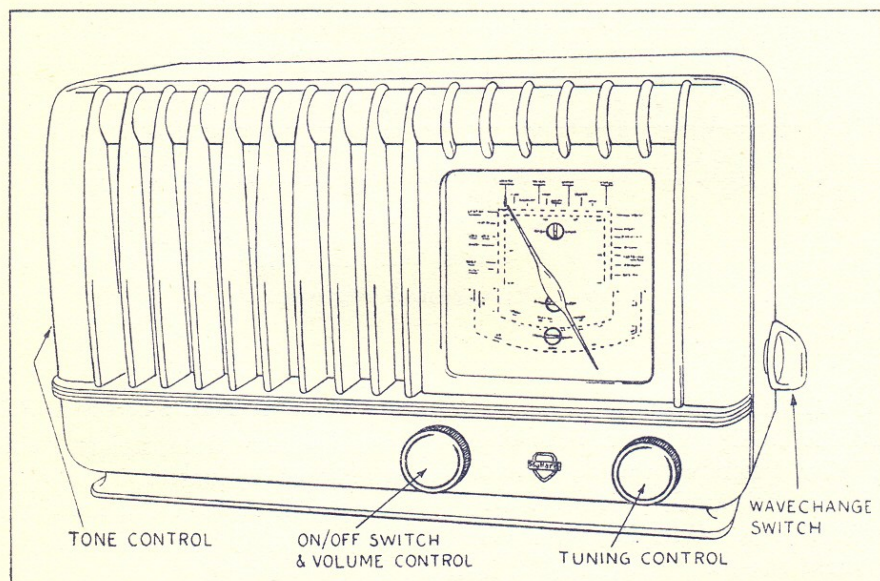


FIG. 1. FRONT VIEW OF CABINET.

VALVE COMBINATION

ECH35. Frequency Changer.
 EF 39. I.F. Amplifier.
 EBC 33. I.F. Amplifier, Detector, and A.V.C.
 EL 33. Output.
 AZ 31. Rectifier.

PILOT LAMP

8045/D00 (6 volts 0.32 Amp.).

WAVE RANGES

S.W. 16.3 - 51 Metres.
 M.W. 192 - 560 „
 L.W. 900 - 2,000 „

INTERMEDIATE FREQUENCY

470 Kc/s.

TRIMMING FREQUENCIES

S.W. 18.5 Mc/s and 6 Mc/s.
 M.W. 1,500 Kc/s „ 600 Kc/s.
 L.W. 380 Kc/s „ 175 Kc/s.

EXTENSION SPEAKER

5 - 7 Ohms.

CONSUMPTION

50 watts at 220 V. (maximum)

VOLTAGE RANGE

100 - 260 Volts, 50 - 100 cycles.

DIMENSIONS

Width 16½". Height 9¼". Depth 8¼".

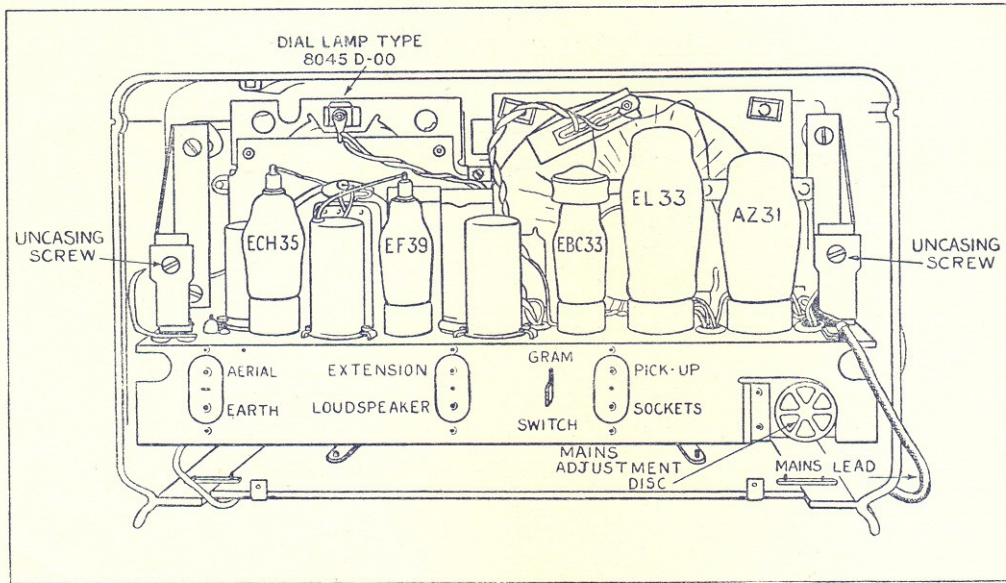


FIG. 2. BACK VIEW OF RECEIVER.

REMOVING CHASSIS FROM CABINET

Remove the knobs from the Tuning, Volume, Tone and Wavechange controls. (The latter two can be located through slots in the back of the chassis). Remove the two screws indicated in Fig. 2. Unsolder the leads to loudspeaker. Withdraw chassis.

When reassembling, make sure that the threaded holes in the switch spindles are in line with the slots in the chassis so that the screws can be refitted without difficulty.

GENERAL NOTE

The majority of repairs, replacements, trimming, etc., can be done without removing the chassis. The removal of the metallised screening plate from the underside of the cabinet is all that is necessary.

LOUDSPEAKER REPAIRS

Special attention must be paid to the following points. The bench must not be of iron and must be quite free from dust and filings. Never dismantle the magnet portion of the speaker. When repairs are completed, replace the dust cover immediately. For recentring the speech coil, use non-magnetic feeler gauges of 0.010" thickness. The speech coil D.C. Resistance is 4.0 Ohms approximately.

REPLACING THE SCALE ASSEMBLY

Remove chassis from cabinet. The scale assembly can be removed by unscrewing two screws. The pointer is a push fit on the spindle and can easily be removed.

CONDENSER AND POINTER DRIVE

Remove scale assembly as given under "Replacing Scale Assembly." Make up the drive cord as shown in Fig. 3. The fitting of the cord should be done exactly as shown in Fig. 3.

With the scale facing you, turn variable condenser to maximum. The condenser drum should then be so fitted that the flanged pin adjacent to the slot is at approximately 2.30. Secure one end of the cord on to the drum spring and pass over the flanged pin and round the left side of the drum (anti-clockwise). Wind 2½ turns around spindle winding towards you and up and round right side of drum (anti-clockwise) and secure remaining end to spring.

SPIRE CLIPS

To remove the clips holding scale glass and loudspeaker baffle, twist the clips with a pair of pliers and pull off.

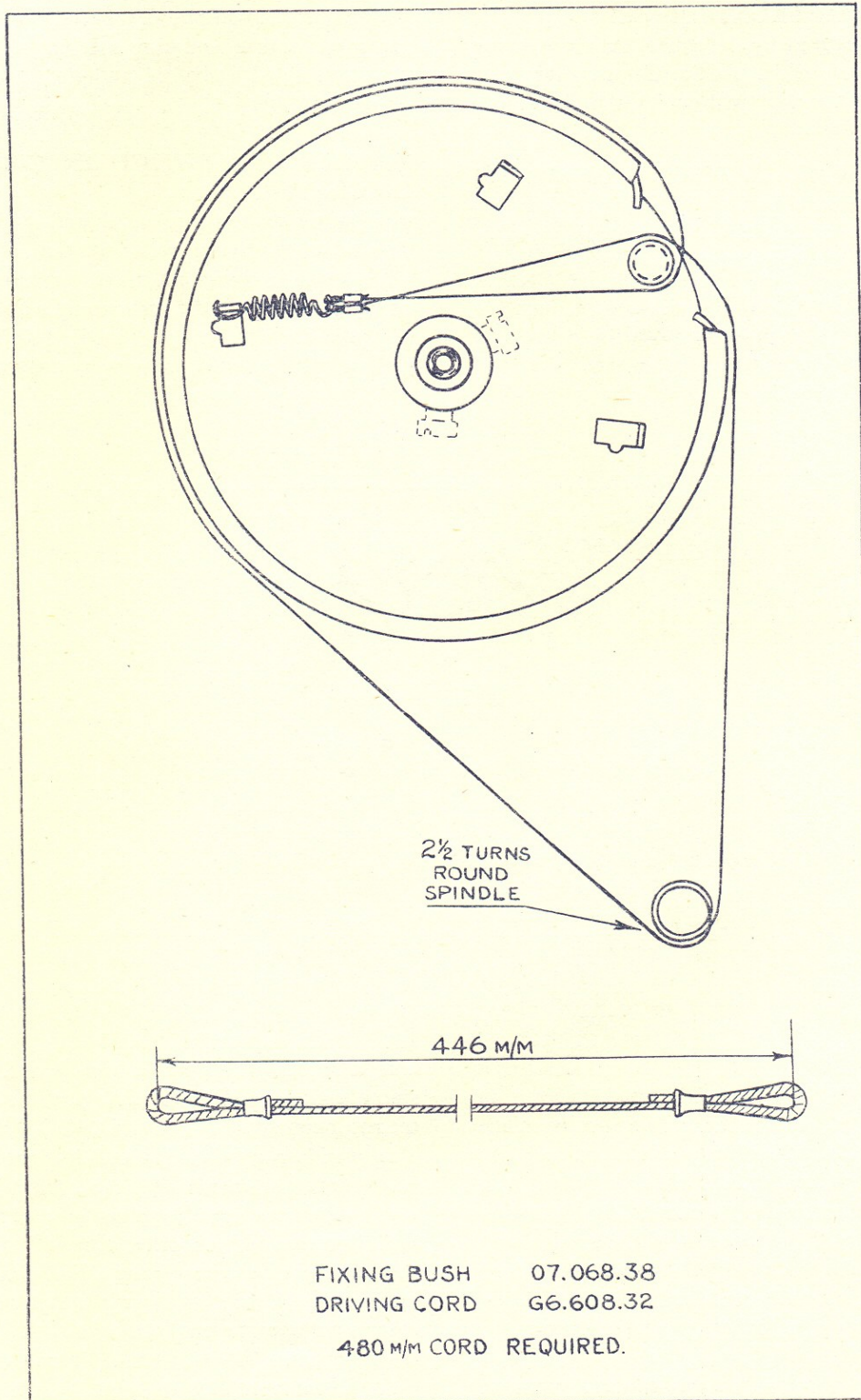


FIG. 3. CORD DRIVE.

REPLACING GLASS FRONT OF SCALE

The glass front is secured by 4 "spire" clips fitted on bosses which are part of the plastic cabinet. Removal of the chassis and spire clips will enable the glass front to be withdrawn.

REPLACING VOLUME CONTROL AND SWITCH

Remove chassis from cabinet. Unsolder the leads to the volume control and switch. The assembly can be removed by unscrewing two screws.

PILOT LAMP REPLACEMENT

The pilot lamp assembly can be removed by depressing both sides of the spring arms.

pull out the spindle and take care of the positions of the rotor, stator, and stop mechanism so that they can be reassembled as before and not, say, 180° in respect of one another.

WAVECHANGE SWITCH IN CIRCUIT DIAGRAMS

The switch sections are numbered from the stop plate. The rotor is usually shown in the fully anti-clockwise position and subsequent movements are in the direction of the arrow round the rotor spindle hole. The position of the stators with respect to the stop ball, is indicated on one of the switch sections by a dotted stator outline

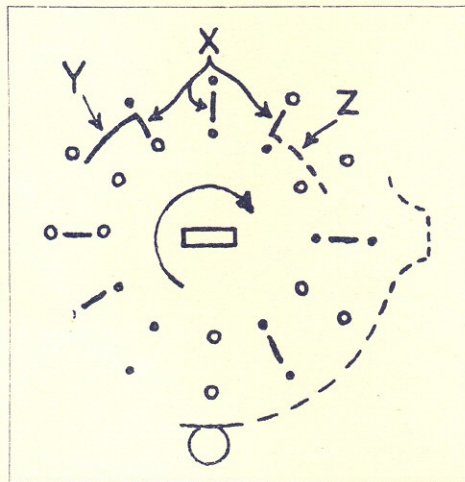


FIG. 4. WAVE-CHANGE SWITCH.

COIL REPLACEMENT

Unsolder the leads, unscrew the small brackets securing the coil to the chassis and lift the coil vertically, place the new component in position, secure the coil by means of the small brackets and restore the connections. Coils with spire fittings can be removed by squeezing the clips at the top of the chassis with round nosed pliers, and at the same time pushed downwards. New coils are supplied complete with spire fittings.

REPAIRS TO WAVE CHANGE AND TONE CONTROL SWITCHES

Unsolder the leads to the defective section. Remove the flat strip and springs of the switch and bend brackets,

and a circle. The small circles and dots represent stator contact SPOONS (that portion which bears on the rotor contacts) and unused SPOON contact positions. The outside ring of circles and dots are the front of the stator, and the inside ring the back of the stator. Rotor contacts are shown as follows :— Full line against the outer ring (Y Fig. 4) indicates contacts on the rotor front. Full line from inner to outer ring (X Fig. 4) contacts that pass through the rotor and operate on both sides. Dotted line against the inner ring (Z Fig. 4) are the contacts on the rotor ring. Note carefully that the switch turns $2 \times 90^\circ$ in Type MAS.221.

CIRCUIT DESCRIPTION

On the S.W.2 position the aerial circuit is untuned. (The M.W. aerial coil and trimmers are in circuit but they are included to simplify the switching arrangements). Therefore the aerial is connected (through the I.F. filter) by C13 and C100 to the grid of valve B2 (ECH35). On M.W. the aerial is connected via S18, C18, to the grid of B2 via C100 and on L.W. aerial connection is by means of S20, C20, to the grid of valve B2, via C100. C41 is common to both of these tuned circuits and completes the aerial circuit. R83 is for prevention of modulation hum. S19 is fitted to prevent break through of M.W. and L.W. when using the S.W. band.

It should be noted that when the plate aerial is in use the aerial coupling is by means of the trimming condensers and therefore the circuits, under these conditions, may not necessarily be accurately trimmed. The oscillator anode section is resistance (R39), capacity (C102) coupled to the common coupling coil S33. The grid circuits are tuned and S34, C34, are for short waves.

On M.W. the coil S38 and the condensers C38, C42, form the circuit. On L.W. S40 and C40, C45, together with C47, C42, form the circuit. R40 is for limiting grid current. The anode of B2 is connected to the I.F. transformer primary winding, S51, and Secondary S52, and is followed by a similar circuit and connected to the signal diode of B4 (EBC33). A.V.C. is applied via R47 to the grids of the two preceding valves. After detection the signal is passed to the volume control R11, via R42, C84 and R44 to the grid of valve B4; the anode of which is Resistance (R46) Capacity (C83) to the grid of the output valve. R44 is to prevent tone control from being inoperative at low volume control settings. Finally the anode of the output valve is connected to the output transformer and loud speaker. For gramophone reproduction the Radio Gram Switch is connected to the top of the volume control. A portion of the A.F. voltage is fed back to the M.W. and L.W. circuits via R52, R53, C109 and R55, C110 to the valve B4 to ensure satisfactory reproduction.

On short waves C110 is earthed via the switch.

R54 and C112 form an anti-hum circuit. Tone control is by fixed condensers and switch. The I.F. filter comprises S91, C91.

TRIMMING INSTRUCTIONS

The oscillator frequency is higher than the R.F. tuning. Connect an output meter across the external speaker sockets for trimming indication. Keep the R.F. inputs as low as possible to prevent A.V.C. action. The wax on air trimmers can be broken off with tweezers. For dust iron cores, insert a warm screwdriver into the slot of the core and rotate backwards and forwards to free the wax.

WIRE TRIMMERS

Capacity is reduced by removing turns of wire and in trimming wire is removed until the deflection of the output meter, having reached maximum, commences to fall back. Turns are then replaced, the surplus is cut off, and the windings fixed with a small quantity of wax. Do not attempt to increase capacity by adding more turns as extra turns cannot be wound tightly enough, and would cause varying capacity.

I.F. CIRCUITS

Switch receiver to M.W. and adjust condenser to mid position. Volume Control at maximum. Apply a signal of 470 Kc/s to the grid (G1) of valve B2 via a condenser of 47,000 pF. Damp the circuits with 100pF condenser by connecting it across the windings as instructed.

Damp S61. Trim S62 (top).

Damp S52. Trim S61, S51 (Bottom).

Damp S51. Trim S52 (top).

I.F. FILTER

Switch to M.W. Variable condenser to maximum. Trim S91 for minimum output.

GENERAL

Place variable condenser to minimum and adjust pointer to the mark opposite the gap of the inner scale on the left side of the scale when facing it. Keep input low.

**H.F. AND OSCILLATOR TRIMMING
MEDIUM WAVE**

Turn the condenser to 500 Metres and feed a signal of this frequency into the aerial socket via a suitable dummy aerial. Trim S38 (bottom) for maximum output. Turn the condenser to 200 Metres (the trimming mark is opposite this point) and feed a signal of this frequency into the aerial socket via a dummy aerial. Trim C38 for maximum output. Re-adjust condenser to 500 Metres and trim S18 (bottom) for maximum output. Return condenser to 200 Metres and trim C18 for maximum output. Repeat if necessary.

LONG WAVE

Turn the condenser to 1,720 Metres (the trimming mark is opposite this point) and feed a signal of this frequency to the aerial socket via a dummy aerial. Trim S40 (top) for maximum output. Turn the condenser to 790 Metres (the trimming mark is opposite) and trim C40 for maximum output. Re-adjust condenser to 1,720 Metres and trim S20 (top) for maximum output. Return the condenser to 790 Metres and trim C20 for maximum output. Repeat if necessary.

SHORT WAVE

Turn the condenser to 50 Metres and place a signal of 6 Mc/s to the aerial socket via a suitable dummy aerial. Trim S34 for maximum output. Adjust the

condenser to minimum and with an input of 18.5 Mc/s trim C34 for maximum output.

SPARE PARTS LIST FOR TYPE MAS 221

CABINET ASSEMBLY

Cabinet less all fittings	MK.950.47
Mullard Emblem	MK.700.23
Knobs, Tuning and Vol. control	MK.852.95/Brown 2
Grubscrews for above	G7.851.48
Knob—Waveband	MK.853.02/Brown 2
Knob—Tone control	MK.260.72
Screws for above	07.803.10

BAFFLE AND SILK Assembly	MK.823.71
Spire fix for above	MK.926.45

WINDOW GLASS	MK.335.71
Spire fix for above	MK.926.46

BASE PLATE	MK.868.53
Holding strips	A3.324.77

BACK PLATE	MK.868.72
Valve position label	M 565
Limited License label	MK.699.15
Top holding clip	MK.076.11

CHASSIS ASSEMBLY

Main support Scale side	MK.823.54
Main support Speaker side	MK.823.55
Screws for main support	07.805.10
" L " bracket	MK.076.37
Rubber bush for above	25.655.95
Tube for above	25.437.87
Washer	MK.446.12
Screw	07.805.15

SPEAKER Complete (type 5052-050) ..	MK.860.58
Cone & Coil	MK.950.28
Metal Service Ring	25.873.41
Paper ring	28.452.69
Dust bag	28.838.98

SCALE ASSEMBLY

Scale housing	MK.885.91
Rubber bushes	28.725.52
Station scale	MK.700.35
Press studs for scale	MK.615.29
Pointer	MK.930.48
Clip for above	MK.905.09
Pilot lampholder	A1.326.30

SPARE PARTS LIST (Continued)

TUNING DRIVE ASSEMBLY

Drive drum	MK.832.46
Cord only	06.606.29
Cord loop grips	28.078.61
Cord tension spring	A1.975.10
Tuning spindle	MK.001.33
Lock washer for above	07.891.01
Triangular washer for above	07.043.05

SWITCHES

Waveband Switch wafer	MK.885.65
Tone switch wafer	MK.885.64
Square spindles for Waveband & Tone switches	MK.001.19
Paxolin stop plates for above	A1.638.78
Locating springs	A3.648.30
Retaining clips for springs	A3.514.13
Pick-up Switch	MK.885.96

COMPONENT RACK for mounting resistances, etc.

.. .. .	28.682.08
Solder strip, Single way	28.032.86
Solder strip, Two way	28.032.84
Solder strip, Three way	28.032.83
Solder strip, Four way	28.032.82
Spacer for rack on gang	07.005.22

DETACHABLE SPINDLE POTENTIOMETERS

Volume control with switch	49.500.11
Mains switch only	08.529.38
Spindle only	A1.435.39
Insulating Disc	28.315.23

NON-DETACHABLE SPINDLE POTENTIOMETERS

Volume control only	MK.809.44
Mains switch	MK.885.26
Mounting plate	MK.306.14
Lever with pin for switch	MK.823.19
Insulating disc	MK.446.54
Switch mounting screws	07.800.10

CHASSIS LEAD THROUGH INSULATOR

Large Washers	A1.757.67
Small internal washer	07.034.03
Tag eyelet	07.068.25

MISCELLANEOUS

Valveholders for EL33 and AZ31	49.231.73
Valveholders (wafer type)	MK.225.05
Grid clip	MK.250.53
Grid Clip in cap	MK.831.93
Socket plate—Aerial	MK.885.66
Socket plate—Speaker and Pick-up	A1.340.42
Coil holding clips	28.084.83
Long strip for mounting trimmers	MK.885.42
Short strip for mounting trimmers	MK.885.49
Spacer tube for above	07.005.26
Nut for Electrolytic	07.093.02
Insulator for Electrolytic	07.028.77
Voltage adjustor	A1.138.12
Single pin plug	08.281.72
Mains flex only	33.981.08
Wall plug	08.280.35
Type plate	28.698.71

GENERAL. SCREWS, NUTS, Etc.

CHEESE HEAD SCREWS

3 × 5 mm.	07.803.05
3 × 6 mm.	07.803.06
3 × 8 mm.	07.803.08
3 × 10 mm.	07.803.10
3 × 15 mm.	07.803.15
4 × 5 mm.	07.804.05
4 × 6 mm.	07.804.06
4 × 8 mm.	07.804.08
4 × 10 mm.	07.804.10

NUTS

3 mm.	07.104.30
4 mm.	07.104.40
5 mm.	07.104.50

SPARE PARTS LIST (Continued)

WASHERS

3 mm.	.. .. .	..	07.035.30
4 mm.	.. .. .	..	07.035.40
5 mm.	.. .. .	..	07.035.50
Yellow wax for air capacity trimmers	..	..	02.771.69
Red wax for dust iron core trimmers	..	..	02.851.36

COILS

†S1 -S4	Mains Transformer	.. ..	MK.511.16
S18-S20	Aerial Coil M.W. and L.W.	.. ..	MK.561.19
S19	R.F. Choke	.. ..	MK.550.04
S33-S34	Osc. : Coil S.W.2	.. ..	MK.561.18
S38 S40	Osc. : Coil M.W. and L.W.	.. ..	MK.561.20
S51 S52	1st I.F. Coil	.. ..	MK.561.15
S61-S62	2nd I.F. Coil	.. ..	MK.561.16
S81-S82	Speaker Transformer	.. ..	MK.511.14
S91	I.F. Filter Coil	.. ..	MK.561.17
	† or		MK.511.30

RESISTANCES

R11 Pot. (Detachable spindle)				R44	0.1 Meg.	..	48.425.10/100K
	0.5 Meg.	..	49.500.11	R45	1.0 Meg.	..	48.426.10/1M
R11 Pot. (Non-Detachable spindle)				R46	0.22 Meg.	..	48.426.10/220K
	0.5 Meg.	..	MK.809.44	R47	0.68 Meg.	..	48.425.10-680K
R32	5,600 Ohm.	..	48.425.10/5K6	R48	0.68 Meg.	..	48.425.10/680K
R33	47 Ohm.	..	48.425.10/47E	R50	0.47 Meg.	..	48.425.10/470K
R34	82 Ohm	..	48.425.10/82E	R51	0.1 Meg.	..	48.425.10/100K
R35	1,500 Ohm	..	48.468.10/1K5	R52	4,700 Ohm	..	48.425.10/4K7
R36	1.0 Meg.	..	48.426.10/1M	R53	2,700 Ohm	..	48.425.10/2K7
R37	27,000 Ohm	..	48.427.10/27K	R54	0.15 Meg.	..	48.425.10/150K
R38	22,000 Ohm	..	48.427.10/22K	R55	220 Ohm	..	48.425.10/220E
R39	22,000 Ohm	..	48.427.10/22K	R56	180 Ohm	..	48.425.10/180E
R40	5,600 Ohm	..	48.425.10/5K6	R81	47,000 Ohm	..	48.425.10/47K
R41	0.1 Meg.	..	48.426.10/100K	R82	0.47 Meg.	..	48.425.10/470K
R42	47,000 Ohm	..	48.425.10/47K	R83	10,000 Ohm	..	48.425.10/10K
R43	1,000 Ohm	..	48.425.10/1K	R84	47 Ohm	..	48.425.10/47E

VALVES AND PILOT LAMPS

B2 .. .. .	.. .. .	..	Mullard ECH35	B5 .. .. .	.. .. .	..	Mullard EL33
B3 .. .. .	.. .. .	..	Mullard EF39	B6 .. .. .	.. .. .	..	Mullard AZ31
B4 .. .. .	.. .. .	..	Mullard EBC33	L1 Pilot Lamp	.. .. .	..	Philips 8045-00

SPARE PARTS LIST (Continued)

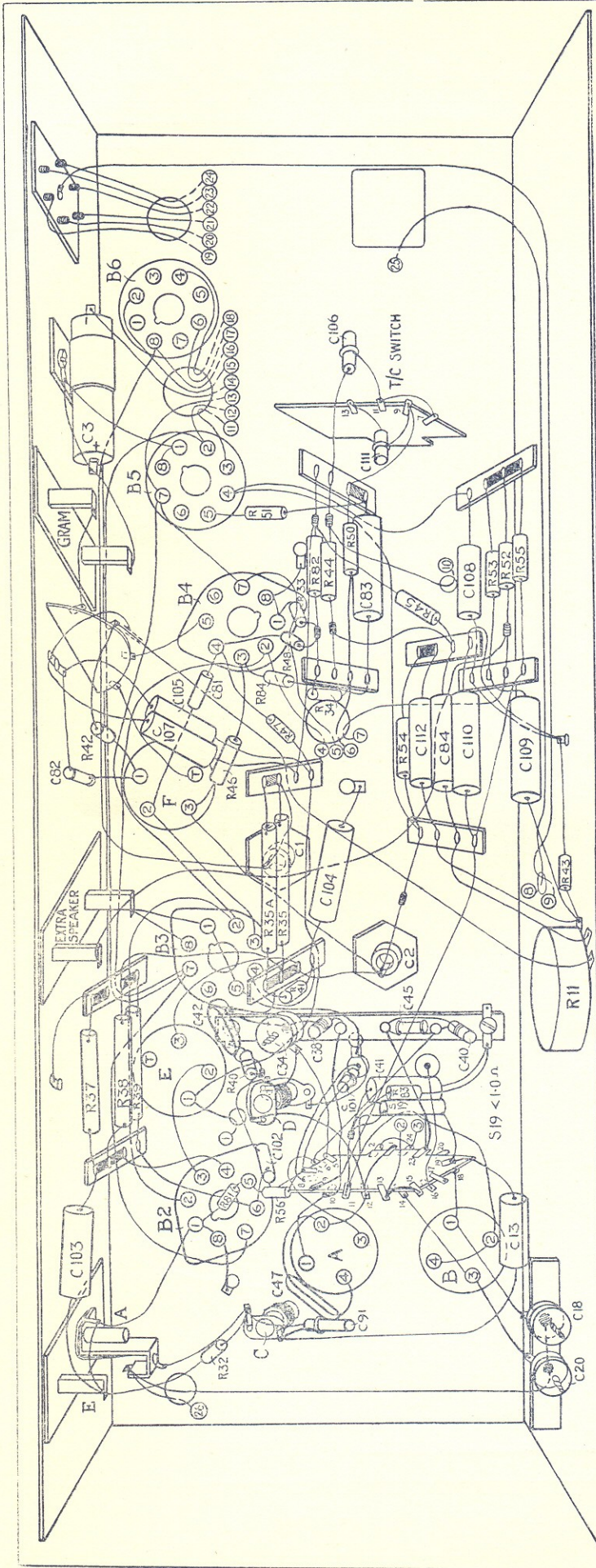
CONDENSERS

C1	..	32 uF	..	28.182.40	C82	..	100 pF	..	48.408.10/100E
C2	..	32 uF	..	28.182.40	C83	..	4,700 pF	..	48.751.10/4K7
C3	..	25 uF	25v.	49.020.00	C84	..	10,000 pF	..	48.751.10/10K
C6-7	..		..	MK.210.87	C85	..	1,000 pF	..	48.757.20/1K
C13	..	1,500 pF	..	48.751.10/1K5	C91	..	560 pF	..	48.408.10/560E
C18	..	3-12 pF	..	MK.210.54	C100	..	100 pF	..	48.408.10/100E
*C20	..	32 pF	..	28.212.06	C101	..	150 pF	..	48.408.10/150E
C34	..	3-30 pF	..	28.212.36	C102	..	100 pF	..	48.408.10/100E
*C38	..	3-30 pF	..	28.212.36	C103	..	47,000 pF	..	48.751.10/47K
C40	..	32 pF	..	28.212.06	C104	..	47,000 pF	..	48.751.10/47K
C41	..	3,300 pF	..	48.751.10/3K3	C105	..	0.1 uF	..	48.751.10/100K
C42	..	360 pF	..	48.429.02/360E	C106	..	150 pF	..	48.408.10/150E
C45	..	10 pF	..	49.055.16	C107	..	0.1 uF	..	48.751.10/100K
C47	..	150 pF	..	48.429.02/150E	C108	..	0.1 uF	..	48.751.10/100K
C51	..		..	In coil	C109	..	0.12 uF	..	48.751.10/120K
C52	..		..	In coil	C110	..	47,000 pF	..	48.750.10/47K
C61	..		..	In coil	C111	..	33 pF	..	48.408.10/33E
C62	..		..	In coil	C112	..	0.1 uF	..	48.751.10/100K
C81	..	47 pF	..	48.408.10/47E					

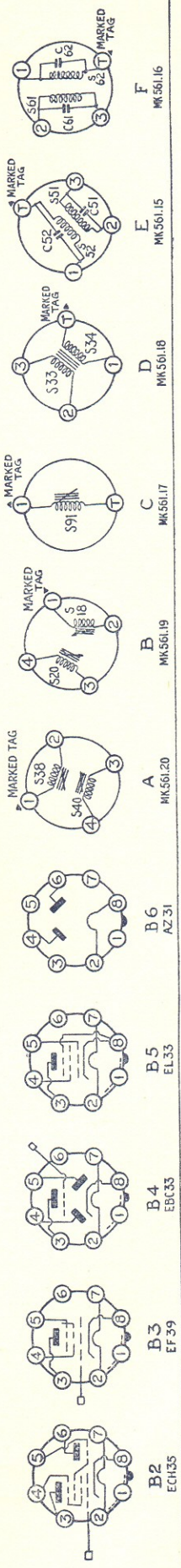
*C20 and C38 may be interchanged in some receivers.

CONDENSERS		WIRE TRIMMERS		CERAMIC		TUBULAR		RESISTANCES		WATTAGE	
C1	Electrolytic (320v)	32 uF	3-30 pF	C81	Ceramic	C104	Tubular	R11	47,000 pF	R40	5,600 Ohm
C2	Electrolytic (320v)	32 uF	100 pF	C82	Tubular	C105	"	R41	0.1 M. Ohm	R41	0.1 M. Ohm
C3	Dry "	25 uF	4,700 pF	C83	"	C106	Ceramic	R42	5,600 Ohm	R42	4,700 Ohm
C4	"	25 uF	10,000 pF	C84	"	C107	Tubular (125v)	R43	47 Ohm	R43	1,000 Ohm
C5	"	25 uF	1,000 pF	C85	"	C108	"	R44	82 Ohm	R44	0.1 M. Ohm
C6	Gang	10 pF	560 pF	C86	"	C109	"	R45	1,500 Ohm	R45	0.1 M. Ohm
C7	"	150 pF	150 pF	C87	"	C110	"	R46	0.22 M. Ohm	R46	0.22 M. Ohm
C8	"	150 pF	150 pF	C88	"	C111	"	R47	1.0 M. Ohm	R47	1.0 M. Ohm
C9	"	150 pF	150 pF	C89	"	C112	"	R48	27,000 Ohm	R48	0.68 M. Ohm
C10	"	150 pF	150 pF	C90	"			R49	22,000 Ohm	R49	0.68 M. Ohm
C11	"	150 pF	150 pF					R50	22,000 Ohm	R50	0.47 M. Ohm
C12	"	150 pF	150 pF								
C13	Tubular (400v)	1,500 pF	3-30 pF								
C14	Air trimmer	3-12 pF	3-30 pF								
C15	"	32 pF	3-30 pF								
C16	"	3-30 pF	3-30 pF								
C17	"	3-30 pF	3-30 pF								
C18	"	3-30 pF	3-30 pF								
C19	"	3-30 pF	3-30 pF								
C20	"	3-30 pF	3-30 pF								
C21	"	3-30 pF	3-30 pF								
C22	"	3-30 pF	3-30 pF								
C23	"	3-30 pF	3-30 pF								
C24	"	3-30 pF	3-30 pF								
C25	"	3-30 pF	3-30 pF								
C26	"	3-30 pF	3-30 pF								
C27	"	3-30 pF	3-30 pF								
C28	"	3-30 pF	3-30 pF								
C29	"	3-30 pF	3-30 pF								
C30	"	3-30 pF	3-30 pF								
C31	"	3-30 pF	3-30 pF								
C32	"	3-30 pF	3-30 pF								
C33	"	3-30 pF	3-30 pF								
C34	"	3-30 pF	3-30 pF								

*C20 and C38 may be interchanged in some receivers.



Part	Value	Part	Value	Part	Value	Part	Value	
S1	COIL C (591)	A	(5.28, 5.40)	B	(5.18, 5.20)	19	D	(5.33, 5.34)
S2	COIL C (591)	E	(5.52, 5.51)					
S3	COIL C (591)							
S4	COIL C (591)							
S5	COIL C (591)							
S6	COIL C (591)							
S7	COIL C (591)							
S8	COIL C (591)							
S9	COIL C (591)							
S10	COIL C (591)							
S11	COIL C (591)							
S12	COIL C (591)							
S13	COIL C (591)							
S14	COIL C (591)							
S15	COIL C (591)							
S16	COIL C (591)							
S17	COIL C (591)							
S18	COIL C (591)							
S19	COIL C (591)							
S20	COIL C (591)							
S21	COIL C (591)							
S22	COIL C (591)							
S23	COIL C (591)							
S24	COIL C (591)							
S25	COIL C (591)							
S26	COIL C (591)							
S27	COIL C (591)							
S28	COIL C (591)							
S29	COIL C (591)							
S30	COIL C (591)							
S31	COIL C (591)							
S32	COIL C (591)							
S33	COIL C (591)							
S34	COIL C (591)							
S35	COIL C (591)							
S36	COIL C (591)							
S37	COIL C (591)							
S38	COIL C (591)							
S39	COIL C (591)							
S40	COIL C (591)							
S41	COIL C (591)							
S42	COIL C (591)							
S43	COIL C (591)							
S44	COIL C (591)							
S45	COIL C (591)							
S46	COIL C (591)							
S47	COIL C (591)							
S48	COIL C (591)							
S49	COIL C (591)							
S50	COIL C (591)							
S51	COIL C (591)							
S52	COIL C (591)							
S53	COIL C (591)							
S54	COIL C (591)							
S55	COIL C (591)							
S56	COIL C (591)							
S57	COIL C (591)							
S58	COIL C (591)							
S59	COIL C (591)							
S60	COIL C (591)							
S61	COIL C (591)							
S62	COIL C (591)							
S63	COIL C (591)							
S64	COIL C (591)							
S65	COIL C (591)							
S66	COIL C (591)							
S67	COIL C (591)							
S68	COIL C (591)							
S69	COIL C (591)							
S70	COIL C (591)							
S71	COIL C (591)							
S72	COIL C (591)							
S73	COIL C (591)							
S74	COIL C (591)							
S75	COIL C (591)							
S76	COIL C (591)							
S77	COIL C (591)							
S78	COIL C (591)							
S79	COIL C (591)							
S80	COIL C (591)							
S81	COIL C (591)							
S82	COIL C (591)							
S83	COIL C (591)							
S84	COIL C (591)							
S85	COIL C (591)							
S86	COIL C (591)							
S87	COIL C (591)							
S88	COIL C (591)							
S89	COIL C (591)							
S90	COIL C (591)							
S91	COIL C (591)							
S92	COIL C (591)							
S93	COIL C (591)							
S94	COIL C (591)							
S95	COIL C (591)							
S96	COIL C (591)							
S97	COIL C (591)							
S98	COIL C (591)							
S99	COIL C (591)							
S100	COIL C (591)							



Part	Value	Part	Value	Part	Value	Part	Value
A	538	B	530	C	S91	D	533
B	800	C	500	E	531	F	561
C	S40	D	500	G	500	H	500
D	500	E	500	I	500	J	500
E	500	F	500				
F	500	G	500				
G	500	H	500				
H	500	I	500				
I	500	J	500				
J	500						

Fig. 6. COMPONENTS AND WIRING. UNDERSIDE CHASSIS.

Voltages measured with a meter having 2,000 ohms per volt. Switch at M.W. Gang at maximum.

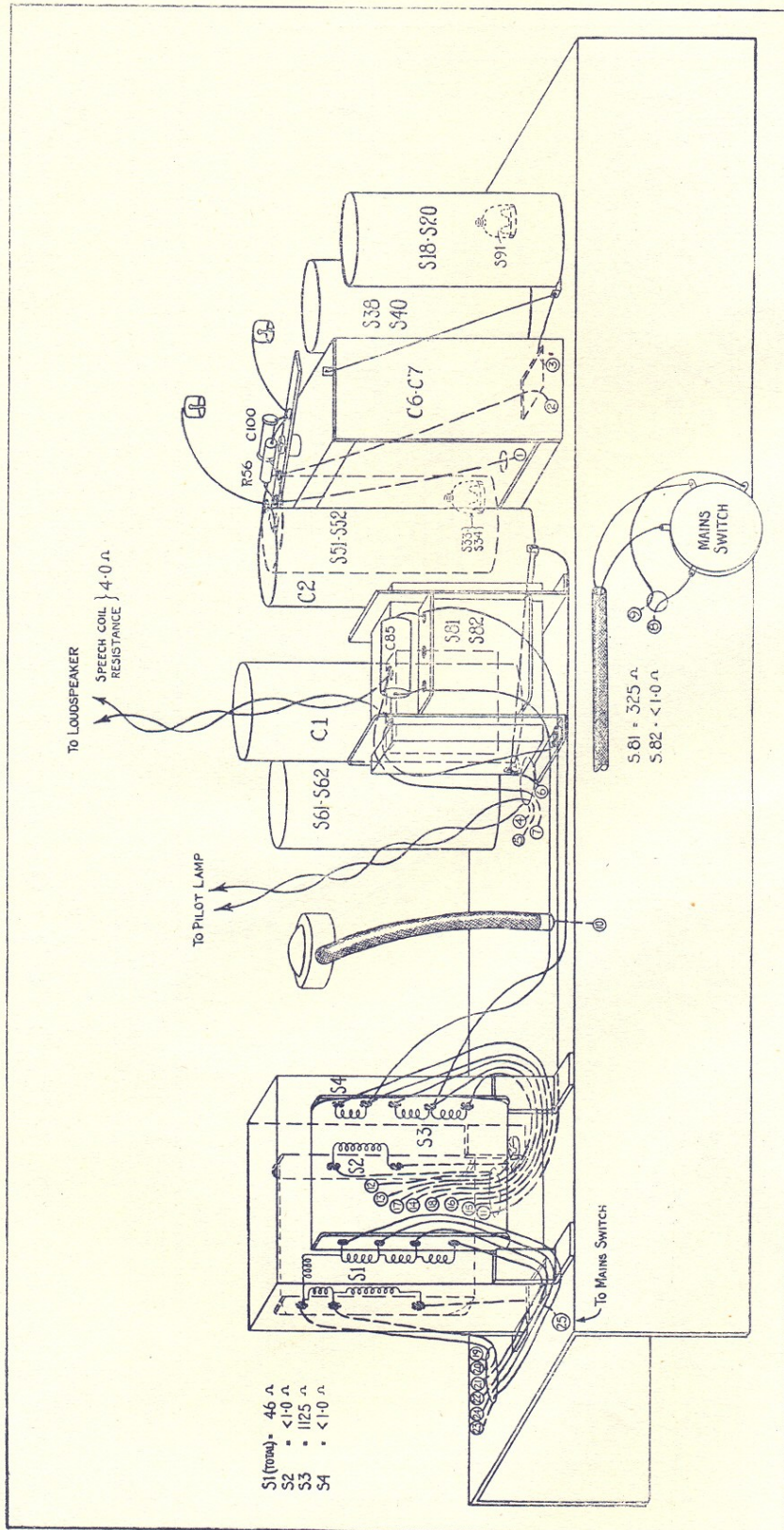


FIG. 7. TOP VIEW OF CHASSIS.