SERVICE MANUAL

MULLARD RECEIVER MAS 225

FOR A.C. SUPPLIES ONLY

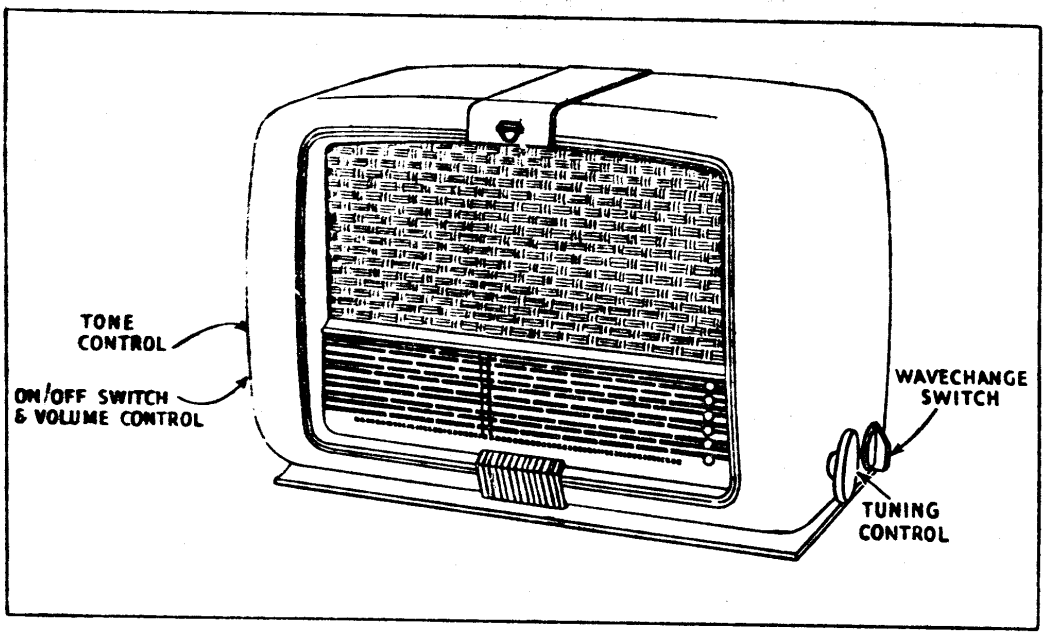


FIG. 1. FRONT VIEW OF RECEIVER.

VALVE COMBINATION

ECH21.	Frequency Changer.
EAF41.	I.F. Amplifier and A.V.C.
EAF41.	A.F. Amplifier and Detector.
EBL21.	Output Pentode.
AZ31.	Rectifier.

SCALE LAMPS

Philips type 8028. 6.5v. 0.3 amps.

WAVE BAND RANGES

S.W.5.	11.1 –16.04 metres.	18.7 Mc/s–27 Mc/s.
S.W.4.	16.04–23.65 „	12.7 „ 18.7 „
S.W.3.	23.65–34.55 „	8.7 „ 12.7 „
S.W.2.	34.55–50 „	6.0 „ 8.7 „
M.W.	192 –560 „	536 Kc/s–1,563 Kc/s.
L.W.	900 –2,000 „	150 „ 333.3 „

INTERMEDIATE FREQUENCY

470 Kc/s.

TRIMMING FREQUENCIES

S.W.5.	22.7 Mc/s.
S.W.4.	15.5 Mc/s.
S.W.3.	10.5 Mc/s.
S.W.2.	7.2 Mc/s.
M.W.	600 Kc/s and 1,465 Kc/s.
L.W.	155.3 Kc/s and 357.4 Kc/s.

EXTENSION LOUDSPEAKER

5 – 7 ohms.

MAINS CONSUMPTION

60 watts maximum.

VOLTAGE RANGE

100–250 volts at 50–100 C.P.S.

DIMENSIONS OF CABINET

Height 12⅜". Width 1' 7½". Depth 9¼".

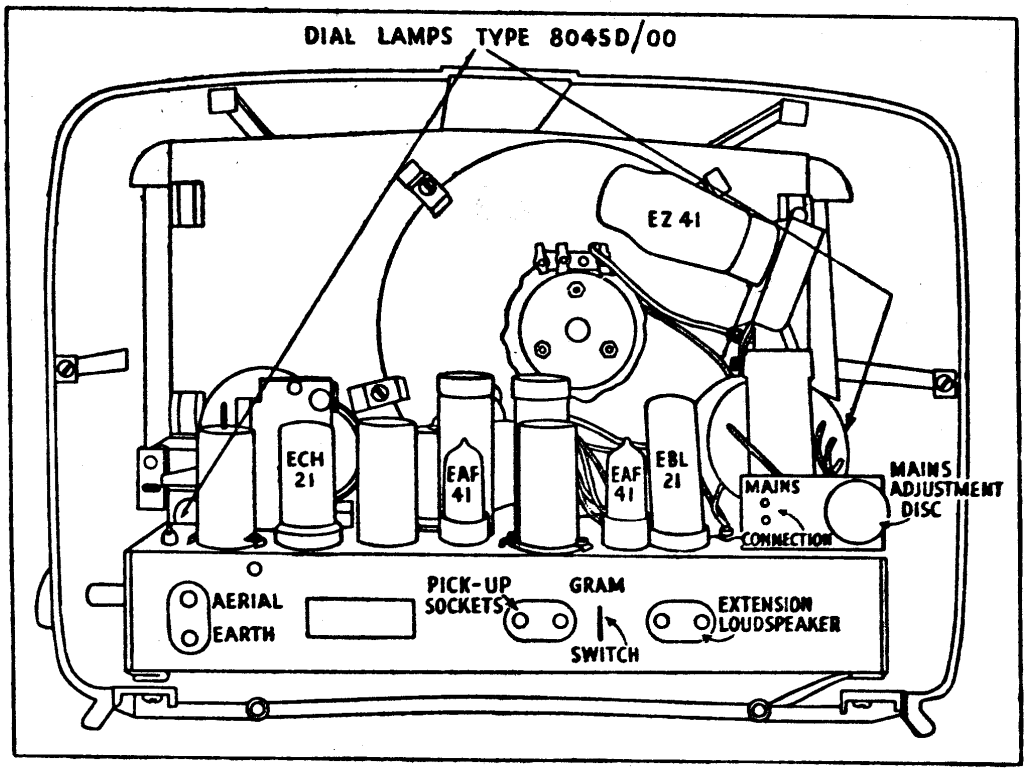


FIG. 2. BACK VIEW OF RECEIVER.

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. The valve holders B3, B4 are already wired to accommodate the EAF41 or its substitute, the EAF42.

REMOVING CHASSIS FROM CABINET

Remove the metallised plate from the underside of the cabinet. Release the pointer from the drive cord, by loosening the 3 mm. screw. Pull off all four knobs. Remove four base screws and earthing clip. Withdraw chassis about 3 inches, release scale lamp holders (¼ turn to the left). If necessary, the loudspeaker leads can be unsoldered. The chassis can now be withdrawn from the cabinet.

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. To recentre the speech coil, use non-magnetic feeler gauges of 0.01" thickness. The speech coil resistance is 3.6 ohms approximately.

VARIABLE CAPACITOR AND POINTER DRIVES

If both drives are being fitted it is necessary to fit the capacitor drive first.

At maximum capacitance and looking at the front of the chassis the slots in the drum will be at 9 o'clock.

VARIABLE CAPACITOR DRIVE (REAR GROOVE)

See Fig. 4.

Turn the gang to maximum capacitance. Hook the cord on to the spring, and the spring on to the anchorage stud. Lead the cord round lower boss and anti-clockwise round the stud near the slot in the drum, and down to the drive spindle. Wind 1½ turns round the pulley on the spindle winding in a clockwise direction as seen from the fly-wheel end. Pass the cord up to the right hand side of the drum, and wind on 1½ turns winding from back to front, on the rear section of the drum. Pass the cord through the slot, over the stud, and hook on to the spring.

POINTER DRIVE (FRONT GROOVE)

Make up cord as shown in Fig. 3. Turn gang to maximum. Hook the cord on to the spring, and the spring on to the anchorage stud. Lead the cord under the small stud near the slot and take 1½ turns in a clockwise direction round the drum. (Note the half turn is placed behind the first turn, i.e., away from you). Pass cord clockwise round Pulley "A," then clockwise round Pulley "B," then one turn clockwise round drum. Pass over stud on drum, and hook on to spring.

REPLACING SCALE LAMPS

The holders are withdrawable by giving a 90° turn anti-clockwise.

COIL REPLACEMENT

Unsolder the leads, remove the brackets holding the coil to the chassis, and lift coil vertically.

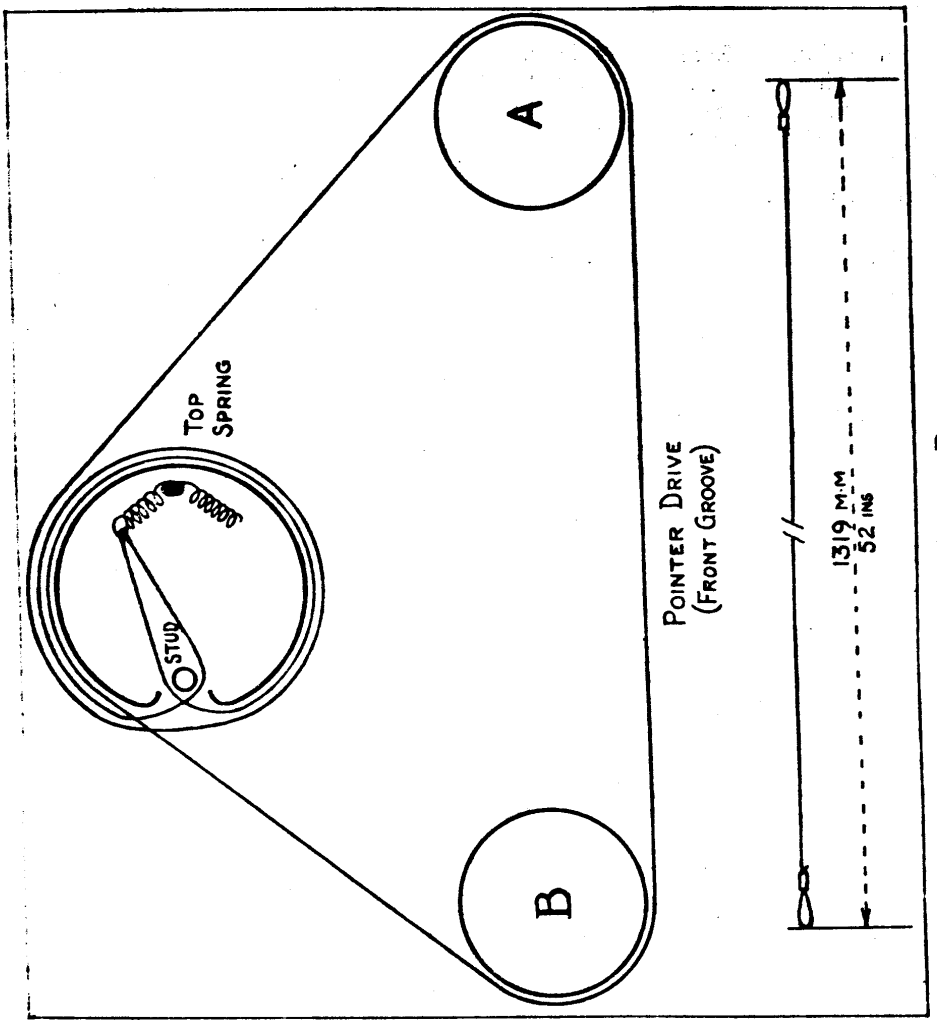


FIG. 3. POINTER DRIVE.

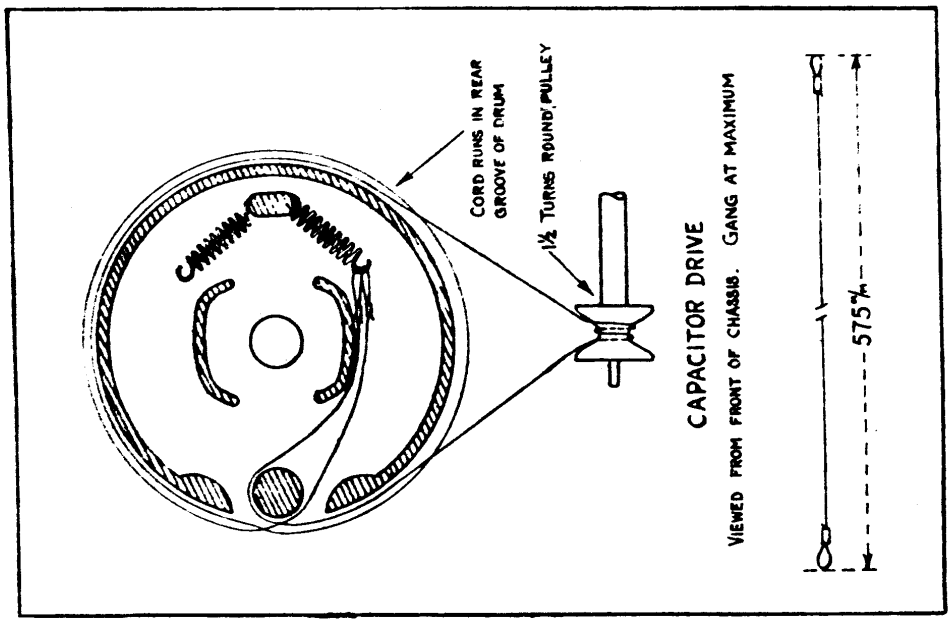


FIG. 4. CAPACITOR DRIVE.

REPLACING SCALE

Remove chassis from cabinet. Remove scale and pointer assembly by removing 4 × 4 mm. screws (two each side) holding the assembly to the cabinet. Remove scale by loosening the 4 × 3 mm. screws holding the four scale retaining clips.
Reassemble in the reverse order.

REPAIRS TO WAVECHANGE SWITCH AND TONE CONTROL SWITCH

Unsolder the leads to the defective section. Remove the spring at the rear of the switch. Pull out the flat spindle through the hole in the bracket, taking careful note of the positions of the rotor, stators and stop mechanism so that the parts may be reassembled as before and not, say, rotated 180° in respect of one another.

WAVERANGE SWITCHES IN CIRCUIT DIAGRAMS

The switch sections are numbered from the stop plate and are drawn as seen from that end. 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 switch section by a dotted stator outline and a circle. The small circles and dots represent respectively stator contact spoons (that portion which bears on the rotor contacts) and unused contact spoon positions. The outside ring of circles and dots is 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. 5) indicates contacts on the rotor front. Full line from inner ring to outer ring (X, Fig. 5) contacts which pass through the rotor and operate on both sides. Dotted lines against the inner ring (Z, Fig. 5) are the contacts on the rotor rear.

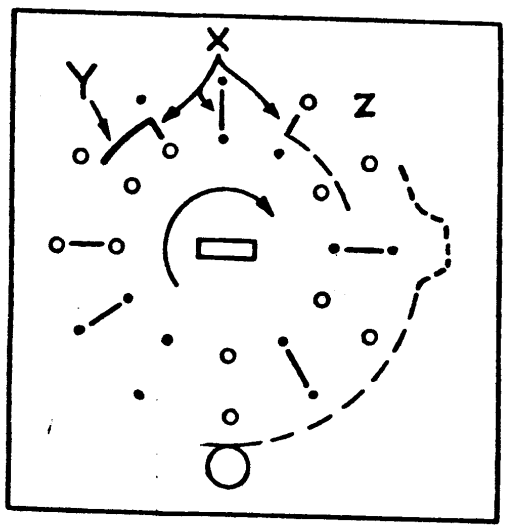


FIG. 5. WAVE CHANGE SWITCH.

CIRCUIT DESCRIPTION

On S.W.5 the aerial is coupled via S100 to S101, C119, C120 via Switch 1 to the control grid of valve B2 (ECH21). The oscillator circuit comprises S104, S105, C7, with trimming capacitor C130. The tuning range is spread by a series-parallel arrangement of capacitors C121, C122. Similar circuits cover the ranges S.W.2, S.W.3, S.W.4, but the capacitors C12, C124 are switched in on the aerial circuit, and C43, C34 are switched in on the oscillator circuit for spreading the range.
On M.W. and L.W., modified Colpitts circuits are used, C42 and R40 being included on M.W., and C49 and R65 on L.W., to keep the oscillator voltage more nearly constant over the wave bands.
An I.F. filter composed of S91, C91 is incorporated on M.W. and L.W. I.F. amplification is by S51, S52, S61, S62. Detection takes place at B4 (EAF41) and this signal is passed via the volume control R11 to the control grid of B4 via C84. Resistance (R51) capacitance (C83) L.F. amplification is employed and the output stage is of standard design, R33, R34, being the grid bias resistances. A.V.C. is developed from the diode of B3 (EAF41) and is passed via R52, C109, to the control grids of valves B3 and B2 respectively. A small amount of negative feedback is applied via R57, R46, etc., to the control grid of B4. Tone control is by fixed capacitors C117, C116 and switch.

TRIMMING INSTRUCTIONS

GENERAL

The oscillator frequency is higher than the signal frequency on M.W. and L.W.
The oscillator frequency is lower than the signal frequency on S.W.2, S.W.3, S.W.4 and S.W.5.
Connect an output meter across the external speaker sockets for trimming indication. Keep the R.F. inputs as low as possible to avoid A.V.C. action.

NOTE

It is essential to use a known good, and accurate signal generator for trimming.

AIR TRIMMERS

The wax on air trimmers can be broken off with tweezers.

I.F. TRIMMING (470 Kc/s)

Switch to M.W. Volume control to maximum. Variable capacitor at mid-position.
Apply a signal of 470 Kc/s to grid 1 of valve B2 (ECH21) via a capacitor of 47,000 pF. Fit a damper of 100 pF as instructed below.
Trim S62 (top).
Damp S51. Trim S52 (top), S61 (bottom).
Damp S52. Trim S51 (bottom).

I.F. FILTER

Switch to M.W. Variable capacitor to maximum. With an I.F. signal of 470 Kc/s to the aerial socket trim S91 for minimum output.

SHORT WAVE (2)

Turn the pointer to 93 on the log scale and feed a signal of 7.2 Mc/s into the aerial socket via a suitable dummy aerial. Trim S34 and S14 for maximum output.

SHORT WAVE (3)

Turn the pointer to 92.5 on the log scale and feed a signal of 10.5 Mc/s into the aerial socket via a suitable dummy aerial. Trim S32 and then S12 for maximum output.

SHORT WAVE (4)

Turn the pointer to 93.5 on the log scale and feed a signal of 15.5 Mc/s into the aerial socket via a suitable dummy aerial. Trim S107 and then S103 for maximum output.

SHORT WAVE (5)

Turn the gang to maximum capacitance and feed a signal of 18.4 Mc/s into the aerial socket via a suitable dummy aerial.
Trim S105 for maximum output.
Turn the gang to minimum capacitance and feed a signal of 27.4 Mc/s into the aerial socket.
Trim C130 for maximum output.
Repeat the above procedure as a check on adjustments.
Turn the pointer to 94.5 on the log scale and feed a signal of 22.7 Mc/s into the aerial socket. Trim S101 for maximum output.

POINTER SETTING

With the gang at maximum the pointer should coincide with the mark 250 on the logging scale.
The pointer is secured to the cord by a clamp plate which can be released by loosening the associated 3 mm. screw.

R.F. AND OSCILLATOR TRIMMING

LONG WAVES

Turn the pointer to 206 on the log scale, and feed a signal of 155.0 Kc/s into the aerial socket via a suitable dummy aerial. Trim S40 and S20 for maximum output.
Turn the pointer to 23 on the log scale and feed a signal of 354.0 Kc/s into the aerial socket. Trim C40 and C20 for maximum output. Repeat the above procedure as a check on adjustments.

MEDIUM WAVES

Turn the pointer to 203.3 on the log scale and feed a signal of 600 Kc/s into the aerial socket via a suitable dummy aerial.
Trim S38 and then S18 for maximum output. Turn the pointer to 21.5 on the log scale and feed a signal of 1.465 Kc/s into the aerial socket. Trim C38 and C18 for maximum output. Repeat the above procedure as a check on adjustments.

SPARE PARTS LIST

CABINET ASSEMBLY

CABINET less all fittings ..	MK.905.30/258
Felt strip for ornamental recess	MK.676.53
Mullard emblem	28.711.17
Ornamental strip over scale ..	MK.077.10
Control knob—Tuning	MK.260.75/Brown 2
Control knob—Volume	MK.260.76/Brown 2
Control knob—Tone	MK.260.82/Brown 2
Control knob—Waveband ..	MK.853.17/Brown 2
Spire clip for knobs	MK.750.20
Valve position label	M.630
Fixing clips for backplate ..	MK.076.11

BACKPLATE less mains flex and plugs ..	MK.869.64
Metallised paper (170 × 165 mm.) ..	06.595.13
Eyelet for internal aerial lead	07.068.51
Single pin plug	08.281.72
Limited licence label	MK.701.00
Mains lead only (Gt. Britain)	33.981.08
Mains lead only (Export)	K3.977.62
Wallplug	08.280.35
Safety contact box	49.295.07
Pertinax retaining plate for above ..	49.313.01
Metal plate for above	A3.513.56

METALLISED BASEPLATE complete	MK.869.35

SCALE ASSEMBLY

Station scale (Gt. Britain)	MK.701.17
Station scale (North Europe)	MK.701.54
Station scale (Middle East)	MK.701.56
Station scale (Middle East-Arabic) ..	MK.701.57
Rubber bands for scale	28.451.14
Scale retaining clips	MK.045.50
Scale backplate	MK.035.35
Spacers between backplate & fixing brackets	07.005.22
Scale assembly fixing bracket (200M. end)	MK.824.22
Scale assembly fixing bracket (550M. end)	MK.824.21
Pilot lampholders	A1.326.30
POINTER ASSEMBLY	MK.869.11
Felt pads for above	A3.610.47
Clamp for drive cord	MK.277.04
POINTER CARRIER ROD with nipple	MK.886.71
BAFFLE BOARD only	MK.396.50
Speaker silk 185 × 375 mm.	G6.600.35

SPARE PARTS LIST—*continued.*

Speaker holding clamps	49.975.28
Cheesehead screws (2BA × $\frac{7}{8}$") ..	G7.790.53
Insert nuts for above	A3.315.14
Lock washers (2BA)	G7.045.05
Fixing clips—Baffle to cabinet ..	MK.926.49
SPEAKER complete (Type 9636) ..	MK.860.46
Cone & coil	28.220.51
Service ring (Cone securing)	28.445.82
Paper ring under above	28.445.39
Dust bag	28.838.22
Connection strip	28.279.88

CHASSIS ASSEMBLY

TUNING UNIT

Gang condenser only	49.001.22
Rear " L " bracket for above ..	A3.449.90
Rubber mounting bushes ..	28.725.52
Waisted screws for above ..	MK.645.45
Pertinax washers for above ..	07.034.03
Metal gear wheel assembly ..	MK.896.07
Springs for above	28.730.85
Moulded drum	MK.906.08
Spindle for above	MK.001.47
Tension springs for drive cords..	MK.740.05
Tuning spindle with pulley ..	MK.886.78
Locking ring for above	A1.756.56
End bearing bracket for spindle	MK.061.68
Flywheel	MK.910.03
Square nut for above	MK.926.52
Cord guide pulley on bracket ..	MK.869.06
Drive cord only	06.606.29
Cord loop grips	28.078.61

WAVEBAND SWITCH

Stop plate assembly	MK.869.14
Switch section No. 1 (Black spot) ..	MK.887.03
Switch section No. 2 (White spot) ..	MK.886.67
Switch section No. 3 (Red spot) ..	MK.886.68
Switch section No. 4 (Green spot) ..	MK.886.69
Flat spindle	MK.001.45
Rear spring for spindle	A3.208.21
TONE SWITCH complete	MK.886.77
Switch section only	MK.886.75
Flat spindle	49.531.06
Rear spring for spindle	A3.208.21
GRAM. SWITCH complete	MK.886.08

VOLUME CONTROL with switch ..	49.500.22
Mains switch only	08.529.38
Insulator between switch and control ..	28.315.23
Spindle	MK.001.53
Spacers for mounting control	07.005.28
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

MISCELLANEOUS

Mains connector panel complete ..	A1.358.14
Voltage adjustment disc only	28.855.29
Socket plate—Aerial/Earth	A3.378.51
Socket plate—Extn. speaker	A1.340.42
Socket plate—Gram. P.U.	A1.340.92
Single pin plugs	08.281.72
Valveholders for EBL21 & ECH21 ..	49.231.72
Valveholder for EAF41	MK.225.35
Valveholder for AZ31	49.231.73
Bracket for above	MK.076.98
Strip for mounting 2 trimmers	MK.886.55
Strip for mounting 3 trimmers	MK.885.46
Fixing clips—Canned coils to chassis ..	28.084.83
Nut for electrolytic condenser	07.093.02
Insulating washer for electrolytic cond.	07.028.77
Connecting tag for electrolytic cond.	08.532.47
Metal clamp plate for C3	MK.276.70
Chassis fixing bolts (5 × 15 mm.) ..	07.805.15
Distance pieces for above	A3.397.43
Rubber bushes for above	A3.559.17
Earthing contact spring	MK.750.29
Type plate..	28.698.71
' A6 ' licence plate on chassis	MK.699.15

GENERAL (SCREWS, NUTS, Etc.)

CHEESEHEAD 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
3 × 25 mm.	07.803.25
4 × 5 mm.	07.804.05
4 × 6 mm.	07.804.06

SPARE PARTS LIST—*continued.*

4 × 8 mm.	07.804.08
4 × 10 mm.	07.804.10
4 × 15 mm.	07.804.15
5 × 10 mm.	07.805.10
5 × 15 mm.	07.805.15
5 × 20 mm.	07.805.20

NUTS

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

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 I.F. dust iron core trimmers	02.851.36

VALVES & PILOT LAMPS

B2 Valve	ECH21
B3 Valve	EAF41
B4 Valve	EAF41
B5 Valve	EBL21
B6 Valve	AZ31
L1 Pilot lamp	8028D
L2 Pilot lamp	8028D

COILS

S91	I.F. Filter coil	MK.561.17
S17–20	Aerial coil L. & M.W. ..	MK.562.53
S13–14	,, ,, S.W.2. ..	MK.561.77
S11–12	,, ,, S.W.3. ..	MK.561.78
S102–103	,, ,, S.W.4. ..	MK.561.79
S100–101	,, ,, S.W.5. ..	MK.561.80
S37–38, S40	Oscillator coil L. & M.W.	MK.562.07
S33–34	,, ,, S.W.2. ..	MK.561.82
S31–32	,, ,, S.W.3. ..	MK.561.83
S106–107	,, ,, S.W.4. ..	MK.561.84
S104–105	,, ,, S.W.5. ..	MK.561.85
S51–52	1st I.F. coil	MK.562.41
S61–62	2nd I.F. coil	MK.561.16
S81–82	Speaker transformer ..	MK.511.84
S76	Cone & coil	28.220.51
S1–4	Mains transformer ..	MK.511.65

DUST IRON CORES

Cores for S12, S14, S18, S20, S34, S38, S40, S91, S101, S103	MK.904.95
Cores for S32, S105, S107	MK.905.66
Cores for S51, S52, S61, S62	MK.904.83

CONDENSERS

C1 ..	47 uF ..	330V ..	49.025.22
C2 ..	47 uF ..	330V ..	49.025.22
C3 ..	25 uF ..	25V ..	49.020.00
C6-7 ..	12–490 pF		49.001.22
C12 ..	62 pF		48.429.02/62E
C17 ..	100 pF		48.408.10/100E
C18 ..	3–30 pF		28.212.36
C20 ..	3–12 pF		MK.210.54
C34 ..	317 pF		48.429.01/317E
C38 ..	3–30 pF		28.212.36
C40 ..	3–30 pF		28.212.36
C42 ..	475 pF		48.429.02/475E
C43 ..	58 pF		48.429.01/58E
C49 ..	100 pF		48.429.02/100E
C51 ..	150 pF		In I.F. Coil
C52 ..	150 pF		In I.F. Coil
C61 ..	150 pF		In I.F. Coil
C62 ..	150 pF		In I.F. Coil
C81 ..	47 pF		48.408.10/47E
C82 ..	100 pF		48.408.10/100E
C83 ..	680 pF		48.751.10/680E
C84 ..	10,000 pF		48.750.10/10K
C85 ..	4,700 pF		48.757.20/4K7
C91 ..	560 pF		48.408.10/560E
C101 ..	100 pF		48.408.10/100E
C102 ..	150 pF		48.408.10
C103 ..	100 pF		48.408.10
C106 ..	47,000 pF		48.751.10/47K
C108 ..	47,000 pF		48.751.10/47K
C109 ..	0.1 uF		48.750.10/100K
C112 ..	0.1 uF		48.750.10/100K
C113 ..	0.1 uF		48.751.10/100K
C114 ..	0.1 uF		48.751.10/100K
C116 ..	82 pF		48.408.10/82E
C117 ..	150 pF		48.408.10/150E
C118 ..	47,000 pF		48.751.10/47K
C119 ..	200 pF		48.429.02/200E
C120 ..	90 pF		48.429.02/90E
C121 ..	244 pF		48.429.01/244E
C122 ..	33 pF		48.429.10/33E
C124 ..	277 pF		48.429.02/277E
C128 ..	33 pF		48.408.10/33E
C130 ..	3–30 pF		28.212.36

SPARE PARTS LIST—*continued.*

RESISTANCES

N.B.—Wattage is based upon an ambient temperature of 70°C.

R1	1,500 Ohm		3 watts	48.468.05/1K5
R11	1.0 M. Ohm			49.500.22
R33	33 Ohm		¼ watt	48.425.10/33E
R34	68 Ohm		¼ „	48.425.10/68E
R35	1.0 M. Ohm		¼ „	48.425.10/1M
R37	2 × 68,000 Ohm	(In parallel)	2 „	2×48.427.10/68K
R38	27 Ohm		¼ „	48.425.10/27E
R39	22,000 Ohm		1 „	48.427.10/22K
R40	5,600 Ohm		¼ „	48.425.10/5K6
R41	0.1 M. Ohm		¼ „	48.426.10/100K
R44	47,000 Ohm		¼ „	48.425.10/47K
R45	1.0 M. Ohm		¼ „	48.425.10/1M
R46	470 Ohm		¼ „	48.425.10/470E
R47	0.47 M. Ohm		¼ „	48.425.10/470K
R48	0.22 M. Ohm		¼ „	48.425.10/220K
R51	2.2 M. Ohm		¼ „	48.425.10/2M2
R52	0.68 M. Ohm		¼ „	48.425.10/680K
R53	0.47 M. Ohm		¼ „	48.425.10/470K
R54	0.47 M. Ohm		¼ „	48.425.10/470K
R55	0.1 M. Ohm		¼ „	48.425.10/100K
R56	56,000 Ohm		¼ „	48.425.10/56K
R57	12,000 Ohm		¼ „	48.425.10/12K
R60	0.39 M. Ohm		¼ „	48.425.10/390K
R61	1.0 M. Ohm		¼ „	48.425.10/1M
R62	1.0 M. Ohm		¼ „	48.425.10/1M
R63	0.1 M. Ohm		¼ „	48.425.10/100K
R64	47,000 Ohm		¼ „	48.425.10/47K
R65	47,000 Ohm		¼ „	48.425.10/47K
R81	47,000 Ohm		¼ „	48.425.10/47K

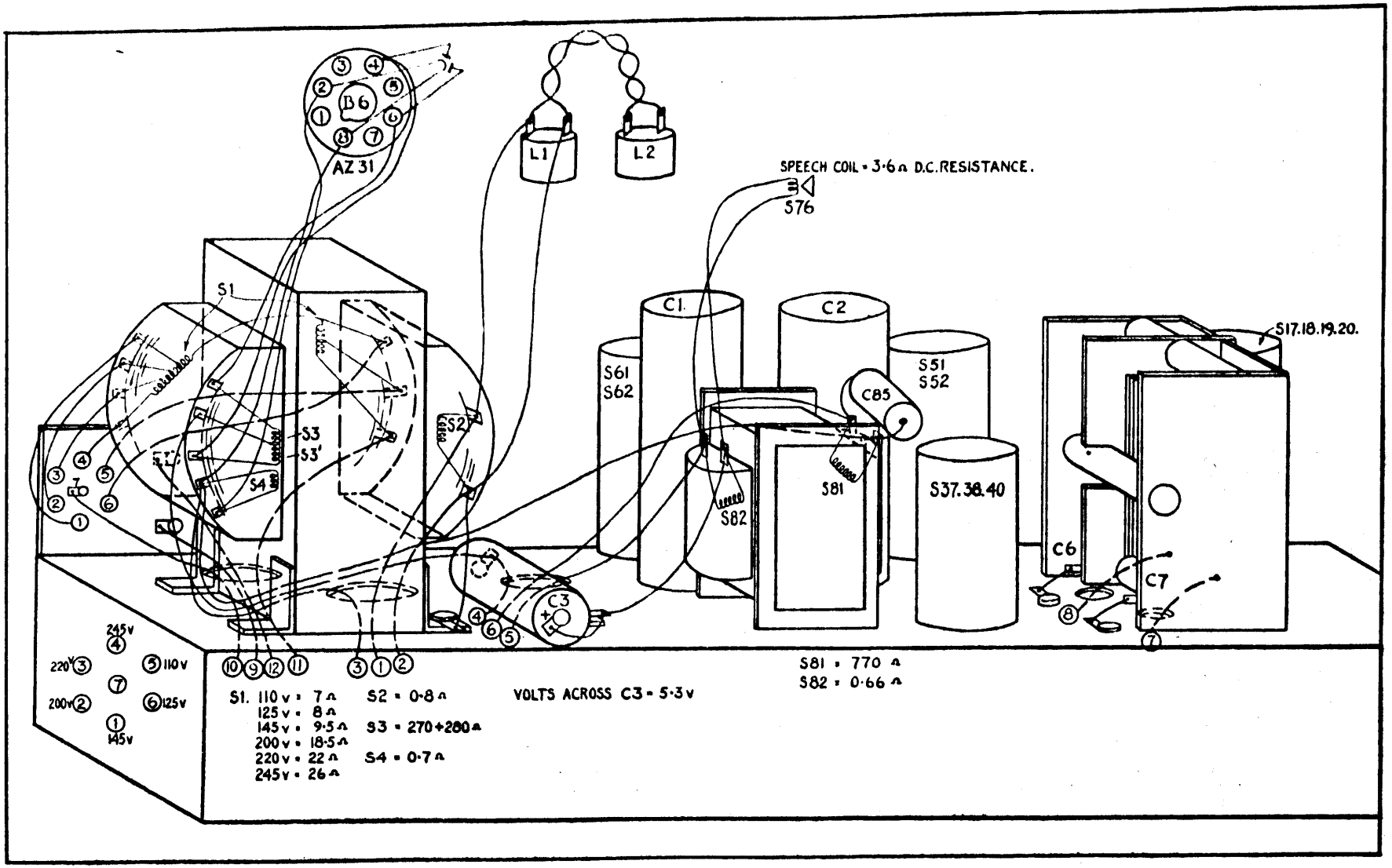
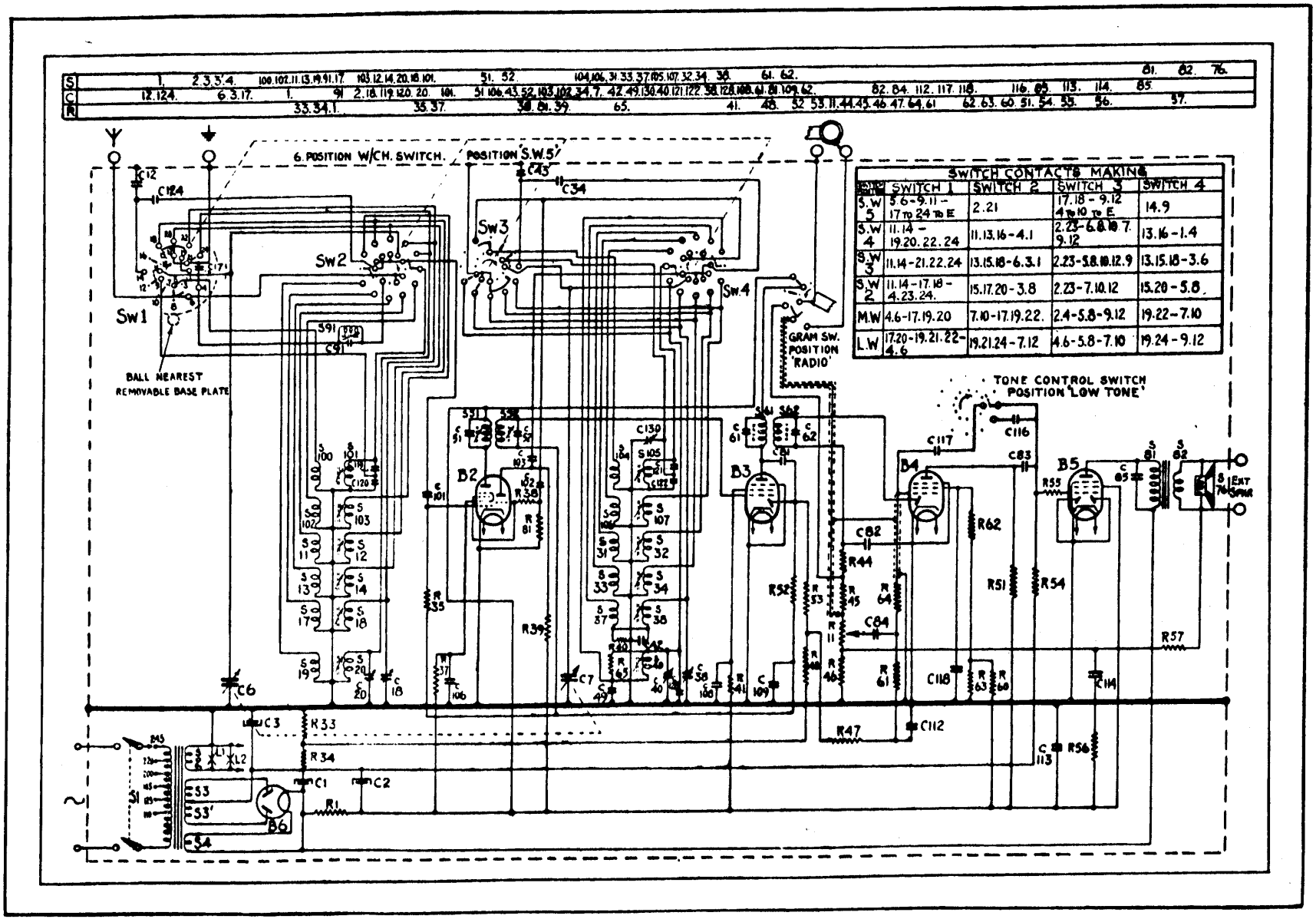


FIG. 6. TOP VIEW OF CHASSIS.



SWITCH CONTACTS MAKING				
SWITCH POSITION	SWITCH 1	SWITCH 2	SWITCH 3	SWITCH 4
S.W 5	5.6-9.11-17 TO 24 TO E	2.21	17.18-9.12 4 TO 10 TO E	14.9
S.W 4	11.14-19.20.22.24	11.13.16-4.1	2.23-6.8.10.7.9.12	13.16-1.4
S.W 3	11.14-21.22.24	13.15.18-6.3.1	2.23-5.8.10.12.9	13.15.18-3.6
S.W 2	11.14-17.18-4.23.24.	15.17.20-3.8	2.23-7.10.12	15.20-5.8
M.W	4.6-17.19.20	7.10-17.19.22.	2.4-5.8-9.12	19.22-7.10
L.W	17.20-19.21.22-4.6	19.21.24-7.12	4.6-5.8-7.10	19.24-9.12

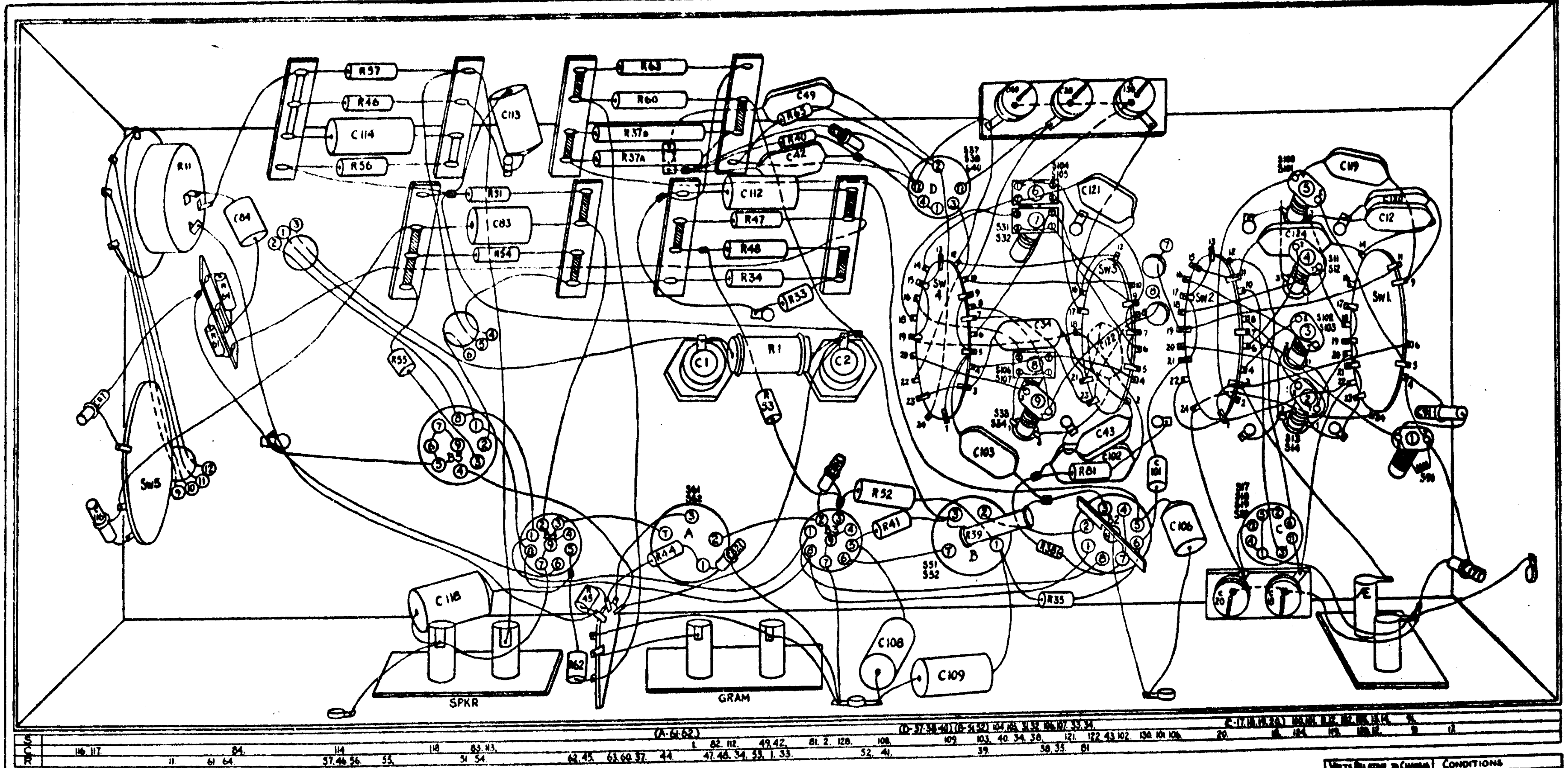
FIG. 7. THEORETICAL CIRCUIT DIAGRAM.

CONDENSERS

C1	330V	47 uF	C40	Trimmer	3-30 pF	C84	Moulded	[illegible],000 pF	C114	Moulded	0.1 uF
C2	330V	47 uF	C42	Mica	475 pF	C85	Speaker cond.	[illegible],700 pF	C116	Ceramic	82 pF
C3	25V	25 uF	C43	"	58 pF	C91	Ceramic	560 pF	C117	"	150 pF
C6-7	Gang	12-490 pF	C49	"	100 pF	C101	"	100 pF	C118	"	47,000 pF
C12	Mica	62 pF	C51	In coil	150 pF	C102	Mica	150 pF	C119	Moulded	300 pF
C17	Ceramic	100 pF	C52	" "	150 pF	C103	"	100 pF	C120	Mica	90 pF
C18	Trimmer	3-30 pF	C61	" "	150 pF	C106	Moulded	47,000 pF	C121	"	244 pF
C20	"	3-12 pF	C62	" "	150 pF	C108	"	47,000 pF	C122	"	33 pF
C34	Mica	317 pF	C81	Ceramic	47 pF	C109	"	0.1 uF	C124	"	277 pF
C38	Trimmer	3-30 pF	C82	"	100 pF	C112	"	0.1 uF	C128	Ceramic	33 pF
			C83	Moulded	680 pF	C113	"	0.1 uF	C130	Trimmer	3-30 pF

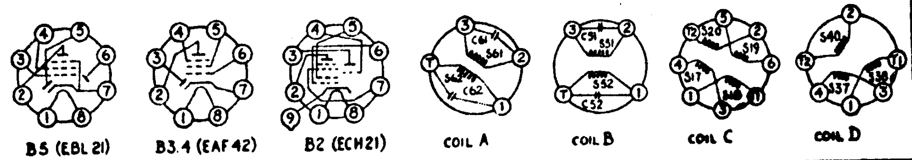
RESISTANCES

R1	Wire wound. 3W.	1,500 Ohms	R41	W	0.1 M. Ohm	R5[illegible]	W	[illegible] Ohms
R11	Pot.	1 M. Ohm	R44	W	47,000 Ohms	R57	W	[illegible] Ohms
R33	W	33 Ohms	R45	W	1 M. Ohm	R60	W	0.39 M. Ohm
R34	W	68 Ohms	R4[illegible]	W	470 Ohms	R61	W	1 M. Ohm
R35	W	1 M. Ohm	R47	W	0.47 M. Ohm	R62	W	1 M. Ohm
R37	W	2 × 68,000 Ohms	R48	W	0.22 M. Ohm	R63	W	0.1 M. Ohm
R38	W	27 Ohms	R51	W	2.2 M. Ohm	R64	W	47,000 Ohms
R39	1 W	22,000 Ohms	R52	W	0.68 M. Ohm	R65	W	47,000 Ohms
R40	W	5,600 Ohms	R53	W	0.47 M. Ohm	R81	W	47,000 Ohms
			R54	W	0.47 M. Ohm			
			R55	W	0.1 M. Ohm			



"S" N°	Resistance	Coil Pos^n	Connection	Coil Plan
S104	0·17 Ω	6	2.3	Marked tag. Coils 6.7 & 8
S105	0·04 Ω	6	T.1	
S31	0·33 Ω	7	2.3	
S32	0·14 Ω	7	T.1	
S106	0·36 Ω	8	2.3	
S107	0·08 Ω	8	T.1	

"S" N°	Resistance	Coil Pos^n	Connection	Coil Plan
S 13	0·22 Ω	2	2.3	Marked tag. Coils 2 & 9; Coils 3.4 & 5
S 14	0·17 Ω	2	T.1	
S 102	0·24 Ω	3	2.3	
S 103	0·08 Ω	3	T.1	
S 11	0·33 Ω	4	2.3	
S 12	0·17 Ω	4	T.1	
S 100	0·22 Ω	5	2.3	
S 101	0·03 Ω	5	T.1	
S 33	0·45 Ω	9	2.3	
S 34	0·19 Ω	9	T.1	



Volts relative to chassis		Conditions
C1	290 V	225 V mains input.
C2	250 V	Switched to M.W.
C3	-5·3 V	Gang at max.
R33	-1·8 V	No signals.
R34	-3·5 V	Meter resis. 20,000 Ω/V

B6 (EBL21)

Va	= 270V
Vg2(+4)	= 250V
—Vg1	= 5.3V
Ia	= 30.0mA
Ig2(+4)	= 5.0mA

B3.4 (EAF42)

B3		B4	
Va	= 250V	Va	= 20V
Vg2(+4)	= 95V	Vg2(+4)	= 17V
—Vg1	= 1.95V	—Vg1	= 1.95V
Ia	= 5.6mA	Ia	= 100uA
Ig2(+4)	= 1.6mA	Ig2(+4)	= 30uA

B2 (ECH21)

Va	= 250V
Vg2(+4)	= 75V
Vat	= 150V
—Vg1	= 1.95V
Ia	= 1.75mA
Ig2(+4)	= 5.6 mA
Iat	= 4.4 mA

Coil A
S61—8.2 Ohms
S62—8.2 "

Coil B
S.51—8.2 Ohms
S52—8.2 "

Coil C
S17—19.0 Ohms
S18— 3.6 "
S19—85.0 "
S20—55.0 "

Coil D
S37— 0.60 Ohms
S38— 7.3 "
S40—10.0 "

B3. 4. (EAF41).
(Alternative Valves).

B3		B4	
Va	= 250V	Va	= 20V
Vg2(+4)	= 95V	Vg2(+4)	= 17V
—Vg1	= 1.95V	—Vg	= 1.95V
Ia	= 5.6mA	Ia	= 100uA
Ig2(+4)	= 1.6mA	Ig2(+4)	= 30uA

Volts across C1 = 290V
" " C2 = 250V
" " C3 = —5.3V

Volts across R33 = —1.8V
" " R34 = —3.5V { All relative to chassis.

Voltages, etc., taken at 225V mains input. Switch at M.W. Gang at maximum and no signals.
Resistance of Voltmeter = 20,000 Ohms per volt.

FIG. 8. UNDER CHASSIS WIRING DIAGRAM.