Mullard

Radio

MODEL MAS 305

THE MULLARD WIRELESS
SERVICE CO., LTD.

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

SERVICE MANUAL

MULLARD RECEIVER TYPE MAS 305

FOR A. C. MAINS SUPPLY ONLY

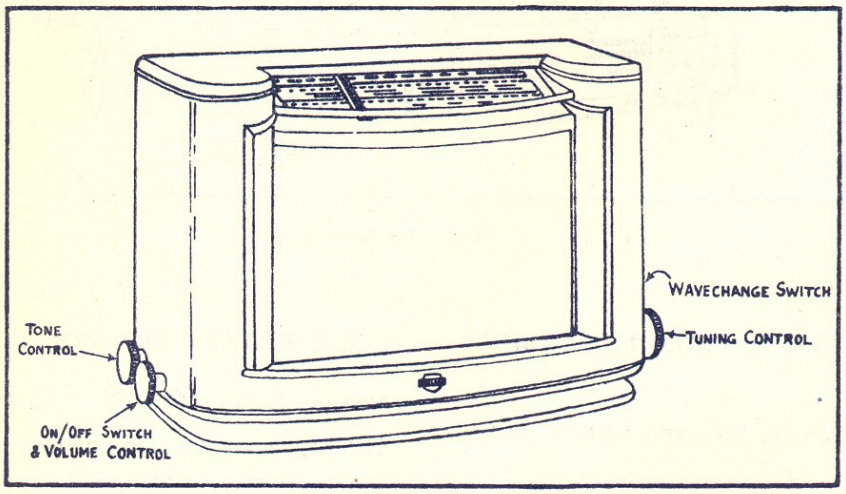


FIG. 1. FRONT VIEW OF CABINET.

VALVE COMBINATION

MULLARD E.C.H. 21 Frequency Changer.
„ E.C.H. 21 I.F. and L.F. Amplifier.
„ E.B.L. 21 Detector, A.V.C. and Output
„ A.Z. 31 Rectifier.

PILOT LAMPS (2)

PHILIPS TYPE 8045D–00 (6.3v.–0.32 Amps.).

WAVE RANGES

S.W.2. 16.2 – 52 Metres.
M.W. 185 – 560 „
L.W. 708 – 2,000 „

INTERMEDIATE FREQUENCY

470 Kc/s.

TRIMMING FREQUENCIES

S.W.2. 17.8 Mc/s and 6.1 Mc/s.
M.W. 500 Kc/s and 1,500 K/cs.
L.W. 160 Kc/s and 400 Kc/s.

VOLTAGE RANGE

100 to 260 Volts – 50 to 100 cycles.

EXTENSION SPEAKER

5 – 7 Ohms.

MAINS CONSUMPTION

53 watts at 220 Volts A.C.

DIMENSIONS OF CABINET (Including Knobs)

WIDTH 17¾". HEIGHT 11½". DEPTH 8½".

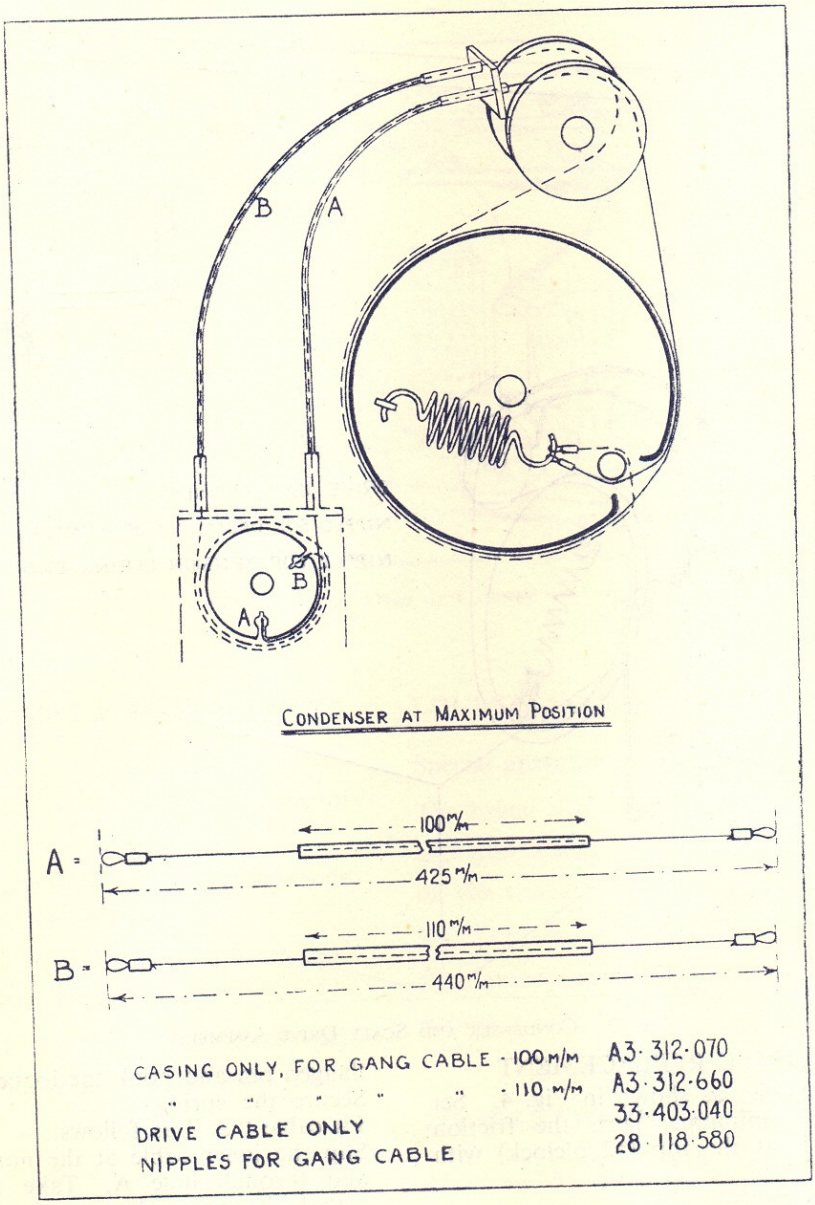


FIG. 4. CONDENSER DRIVE ASSEMBLY.

PILOT LAMP REPLACEMENT

Give a half turn clockwise to pilot lamp holder. Unscrew pilot lamp and replace.

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 new coil by means of the small brackets and restore the electrical connections.

VOLUME CONTROL REPLACEMENT

Remove the bearing strip (2 screws) and the distance pieces. Unsolder the leads and withdraw the volume control through the slot in the chassis.

TONE CONTROL REPLACEMENT

Remove the bearing strip (2 screws). Remove the two screws securing the tone control to the bracket. Unsolder the leads and withdraw the tone control through the slot in the chassis.

REPAIRS TO WAVECHANGE SWITCH

Unsolder the leads to the defective section. Remove the flat strip and spring at the rear of the switch. Pull out the flat spindle taking careful note of the position of the rotors, stators and stop mechanism, so that they can be reassembled as before and not say, 180° in respect of one another.

WAVECHANGE SWITCH IN CIRCUIT

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 and a circle. The small circles and dots represent stator contact spoons (that portion which bears on the rotor contacts) and unused contact spoon 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. 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 line against the inner ring (Z Fig. 5) are the contacts on the rotor rear.

SCALE REPLACEMENT

Remove both the pilot lamp holders. Slacken the two screws holding the clamping brackets at one end and remove the two screws at the opposite end. Push the scale to the side from which the screws have been removed until the other end of the scale reaches the groove in the cabinet. Tilt the scale at this end and remove the scale from the cabinet. Reverse these operations when fitting a new scale and adjust the centre line on the scale to the centre mark on the cabinet above the scale.

CIRCUIT DESCRIPTION

In the S.W.2 position the aerial is connected to the tuned circuit S6, S7, C4, which is trimmed by C7. On the M.W. and L.W. the aerial is connected to S8, S9, S10, S11, S12, trimmed by C9, C11, and tuned by C4.

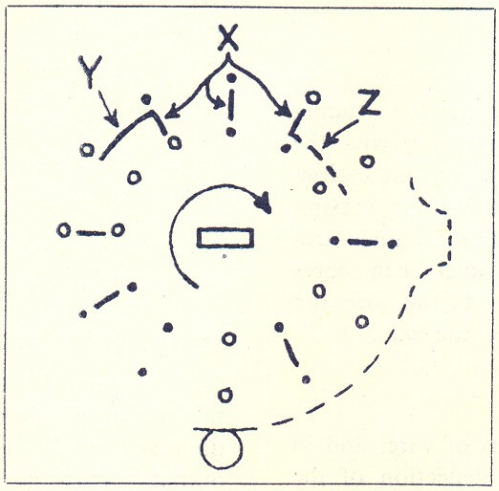


FIG. 5. WAVE-CHANGE SWITCH.

These circuits are connected to the grid of B1 (E.C.H. 21) via Switch 1 and C8.

The oscillator circuit, which has a higher frequency than the R.F. circuits is Resistance (R6) Capacity (C14) coupled to the tuned circuits, S13, S14, S15, S16, S17, S18, S19, tuned by C5, and their associated trimming and padding condensers. The anode of the frequency changer (heptode portion) of B1 is coupled to the succeeding valve by the I.F. coils, S20, S21, S22 trimmed by C22, C23 and this circuit is followed by a similar circuit which is coupled to the signal diode. After detection the signal is passed to the volume control (R15) and is coupled to the grid of the triode section of B2. The anode of this section is coupled to the grid of the output valve (B3) by a resistance (R12) capacity (C28) low frequency circuit. Finally the anode of

B3 is connected via S27, S28, S29, to the loudspeaker. A.V.C. is applied via R23, C35, to the control grids of the two previous valves. The delay voltage is provided by the voltage drop across R3. The winding S28 is for cancelling out hum and is so arranged that the two windings are opposite in phase.

For gramophone reproduction a switch operated by a pin plug, is connected to position 1 and consequently places R14 in circuit and also earths the radio circuit at the junction of R13, R14. A portion of the A.F. voltage across the loudspeaker circuit is fed back via S31 to the potentiometer circuit R17, S26 to the grid of the triode circuit of B2 to ensure satisfactory reproductions. R21, R20, C34, provide tone control. S5, C6 comprise the I.F. filter.

TRIMMING INSTRUCTIONS

The oscillator frequency is higher than the R.F. tuning on all ranges. 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 yellow wax on air trimmer 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 wire as extra turns cannot be wound tightly enough and would cause varying capacity.

I.F. CIRCUITS

Adjust the receiver to minimum capacity on the Medium wave band and volume control to maximum. Apply a signal of 470 Kc/s to the grid (G1) of valve B1 (E.C.H. 21), via a 47,000 pF. Damp the circuits with an 80 pF Condenser by connecting it across the coil windings as instructed.

Trim for maximum output as follows :—

Damp S23, S23a	Trim S24, S25 (upper core).
Damp S21, S22	Trim S20, S23, S23a (lower cores).
Damp S20	Trim S21, S22 (upper core).

I.F. FILTER

Apply a signal of 470 Kc/s to the aerial socket via an artificial aerial. Trim C6 for MINIMUM output.

R.F. AND OSCILLATOR CIRCUITS

General

Turn the gang condenser to minimum and adjust the pointer so that it lines up with the right hand leg of the letter "M" printed at the left hand end of the S/W scale calibrated in metres. At maximum capacity the pointer should line up with the left hand leg of the letter "W" of W450 printed at the bottom right hand corner of the scale.

SHORT WAVES

Turn the pointer to 17.8 Mc/s and feed a signal of this frequency into the aerial socket via a suitable dummy aerial. Trim C17 to the first signal from minimum and then C7 for maximum output. Turn the pointer to 6.1 Mc/s and feed a signal of this frequency into the aerial socket via a suitable dummy aerial. Trim C16 in small steps ; the tail of the winding being cut short. Retrim C17, C7 and C16 for maximum output as a check. Seal trimmers.

MEDIUM WAVES

Turn the pointer to 1,500 Kc/s and feed a signal of this frequency into the aerial socket via a suitable dummy aerial. Trim C19 and C9 for maximum output. Turn the pointer to 550 Kc/s and feed a signal of this frequency into the aerial socket. Trim C38 for maximum output. Check C19, C9 and seal trimmers.

LONG WAVES

Turn the pointer to 400 Kc/s and feed a signal of this frequency into the aerial socket via a suitable dummy aerial. Trim C21 and C11 for maximum output. Turn the pointer to 160 Kc/s and feed a signal of this frequency into the aerial socket.
Trim C20 for maximum output.
Recheck C21 and C11, and seal trimmers.

CALIBRATION

Adjust the wave range switch to M.W. Volume control to maximum. Apply a modulated signal of 260 Metres and tune the receiver to this frequency. Slacken the milled pointer screw which fastens holder to cable and adjust pointer accurately to 260 Metres. The tuning must not be altered during this adjustment.

SPARE PARTS LIST

CABINET less all fittings	23.640.75/258
Mullard Emblem	28.711.17
Knob (W/C)	23.614.96/Brown 2
Knob (Tone and Vol. Control)	23.614.98/Brown 2
Knob (Tuning)	23.611.72/Brown 2
Grubscrew for knobs	07.461.12
Station scale (English)	MK.700.17
Station scale (M.E.)	MK.700.29
Main bracket for scale (200 m. end)	A3.336.72
Main bracket for scale (500 m. end)	A3.336.73
Clip for scale	A3.336.09
Bracket for lamp holder	A3.449.58
Pilot lamp holders	MK.860.55
Pointer assembly	A3.422.67
Knurled screw for above	07.743.05
Rod with nipple for above	MK.885.62
Bracket for pointer rod (500 m. end)	A3.449.94
Bracket for pointer rod (200 m. end)	A3.449.93
Back Plate	MK.868.46
Safety contacts assembly	49.295.07
Wallplug	08.280.35
Mains twin flex	33.981.08
Metal strips for fixing base plate	A3.324.77
Base plate	A3.376.95
Clips for securing back plate	MK.076.11
Baffle board only	A3.245.49
Speaker silk (320 × 220 mm.)	G6.600.21
Insert nut for speaker fixing bolt	A3.315.14
Clamp plates for baffle board	A3.513.62
Clamp brackets for speaker	49.975.28
Cheese head screw for above 2BA × ¾	G7.790.51
SPEAKER complete (9636)	MK.860.46
Cone & Coil	28.220.51
Metal fixing ring	25.873.42
Paper ring	28.445.39
Speaker dust bag	28.838.22
Speaker connection strip	28.279.88
CHASSIS ASSEMBLY	
Chassis fixing bolt	07.805.20
Bush for chassis fixing bolt	A3.397.43
Rubber ring for above	A3.559.17
Pointer pulley frame assembly	A3.358.50
Bracket for one large pulley	A3.337.13
Bracket for two large pulleys	A3.337.15
Bracket for small pulley	A3.337.17
Large pulley	23.644.22
Small pulley	MK.930.43
Washer for large pulley	07.014.20
Washer for small pulley	07.034.15
GANG CONDENSER ONLY ALUMINIUM	49.001.22
Rear " L " Bracket for gang	A3.449.90
Metal base plate for above	A3.465.69
Rubber block on above	A3.642.00
Metal cap for rubber block	A3.500.12
Transit lock pins for gang	A3.320.74
Support springs for gang	A3.652.13
Special shaped washer for above	A3.500.10
Gang bracket with two pulleys	A3.337.08
Cable ferrules for above	A3.512.03
Drum on Gang	A3.417.06
Tension spring for above	MK.740.05
GANG CONDENSER BRASS	MK.210.87
FRICTION DISC ASSEMBLY	
Main bearing bracket	A3.336.13
Pointer cable drum	23.644.39
Friction discs	A3.574.20
Gang cable hub	MK.250.59
Tuning spindle	MK.885.79
Lock washer for above	A1.756.56
Casing for gang cable 100 mm.	A3.312.70
Casing for gang cable 110 mm.	A3.312.66
Drive cable only	33.403.04
Nipples for above (Drum end)	28.118.58
Nipples for above (Pointer end)	28.618.21
TENSION UNIT FOR POINTER CABLE	
Pointer securing bracket	A3.397.76
Tension spring	MK.730.04
Slotted washer	28.454.62
OTHER SPARE PARTS	
Screen for E.B.L. 21	MK.885.39
Connection washer for C1 and C2	28.447.90
Insulating washer for C1 and C2	07.028.77
Nuts for C1 and C2	07.093.02
Clip for C12	A1.524.10
Octal valveholder for A.Z.31	49.231.73
Loctal valveholders	49.231.72
Screen plate for valveholder	A3.325.09
Bearing plates for V/C and T/C	A3.514.58
Socket plates (Aerial and Speaker)	A1.340.42
Sockets with switch for pick-up	MK.868.59

SPARE PARTS LIST (Continued)

Mains pin plate assembly	A3.227.22
Brass distance piece for above	07.005.40
Voltage adjustment disc	A1.339.01
VOLUME CONTROL ONLY	MK.808.71
Mains switch for above	MK.885.26
Lever with pin for mains switch	MK.823.19
Distance piece for V/C assembly	07.005.53
TONE CONTROL ONLY	MK.808.72
Support brackets for above	A3.449.92

WAVECHANGE SWITCH UNIT

Round spindle with ball spring	MK.885.53
Lock washer for spindle	A1.756.56
Bearing bush for above	28.265.53
Bearing cap ring	A3.208.23
Steel ball $\frac{7}{32}$ inch	89.205.80
Flat spindle	A3.194.07
Rear spring for flat spindle	A3.208.21
Rear bracket	A3.191.60
Side strip (upper)	49.529.28
Side strip (lower)	A3.208.83
Switch section No. 1	MK.885.77
Switch section No. 2	MK.885.51

MISCELLANEOUS

Strip for mounting two trimmers	MK.885.41
Strip for mounting four trimmers	MK.885.40
Component rack for mounting resistances, etc.	28.682.08
Solder strip for above (single way)	28.032.86
Solder strip for above (two way)	28.032.84
Solder strip for above (three way)	28.032.83
Solder strip for above (four way)	28.032.82
Clips for securing coils	28.084.83
Rubber grommet 11 mm.	25.655.51
Rubber grommet 3.5 mm.	25.655.69
Type plate	28.698.71
Licence plate on chassis	MK.699.15
Single pin plug	08.281.72

CONDENSERS, RESISTANCES, COILS, VALVES AND LAMPS

CONDENSERS

C1	Wet Electrolytic	330 V.	47 uF	49.025.22
C2	„ „	330 V.	47 uF	49.025.22
C3	Electrolytic	8–12V.	250 uF	MK.180.27
†C4 & 5	Ganged variable		480 pF	49.001.22
C6	Trimmer		30 pF	28.212.36
C7	„		30 pF	28.212.36
C8	Ceramic		220 pF	49.055.32
C9	Trimmer		30 pF	28.212.36
C10	Ceramic		39 pF	49.055.23
C11	Trimmer		30 pF	28.212.36
C12	Ripple		22,000 pF	49.129.90
C13	Ceramic		22 pF	49.055.27
C14	„		470 pF	49.055.36
C15	Moulded	400 V.	47,000 pF	49.128.22
C16	Wire Trimmer		200 pF	28.212.08
C17	Trimmer		30 pF	28.212.36
C18	Mica		390 pF	49.081.04
C19	Trimmer		30 pF	28.212.36
C20	Wire Trimmer		200 pF	28.212.08
C21	Trimmer		30 pF	28.212.36
C24	Moulded	400 V.	47,000 pF	49.128.22
C25	„	4,000 V.	47,000 pF	49.128.22
C26	„	100 V.	47,000 pF	49.127.22
C27	„	100 V.	10,000 pF	49.127.14
C28	„	4,000 V.	22,000 pF	49.128.18
C29	Ceramic		5.6 pF	49.055.13
C33	„		82 pF	49.055.27
C34	Moulded	400 V.	3,900 pF	49.128.09
C35	„	100 V.	47,000 pF	49.127.22
C36	Speaker		1,000 pF	49.129.80
C37	Ceramic		27 pF	49.055.21
C38	Wire Trimmer		200 pF	28.212.08

RESISTANCES

R1	Wire wound 1.5 w.	1,200 Ohm	49.356.28
or R1	Carbon (2×2,200 Ohm par)	1,100 Ohm	49.377.28
R2	„	68 Ohm	49.376.10
R3	„	33 Ohm	49.375.06
R4	„	0.82 M. Ohm	49.375.59
R5	„	47,000 Ohm	49.375.44
†Brass Gang Condenser			MK.210.87
R6	Carbon	22,000 Ohm	49.337.40
R7	„ (2×47,000 parallel)	23,500 Ohm	49.377.44
R8	„	39,000 Ohm	49.377.43
R9	„	0.1 M. Ohm	49.376.48
R10	„	0.47 M. Ohm	49.375.56
R11	„	2.2 M. Ohm	49.375.64
R12	„	0.1 M. Ohm	49.376.48
R13	„	1 M. Ohm	49.375.60
R14	„	0.1 M. Ohm	49.375.48
R15	„ Potentiometer V/C	0.7 M. Ohm	MK.808.71
R17	„	22 Ohm	49.375.04
R20	„	0.12 M. Ohm	49.375.49
R21	„ Potentiometer V/C	0.5 M. Ohm	MK.808.72
R23	„	1.5 M. Ohm	49.375.62
R24	„	0.82 M. Ohm	49.375.59

COILS

S1, 2, 3, 4	Mains transformer		MK.511.08
S5	I.F. Filter Coil		A3.110.09
†S6, 7, 8, 9, 10,	Aerial Coil, S.W. & M.W.		A3.121.64
†S11, 12, 13, 14, 15,	Aerial L.W. & Osc. S.W. Coil		A3.121.65
†S16, 17, 18, 19	Oscillator Coil, M.W. & L.W.		A3.121.66
S20, 21, 22, C22, 23	Ist I.F. Coil		A3.121.54
S23a, 23, 24, 25, C30, 31	2nd I.F. Coil		A3.121.55
S26	Low Tone Coil		A1.108.29
S27, 28, 29	Speaker Transformer		A3.151.15
S30	Speech coil with cone		28.220.51
S31	High Tone Coil		A3.110.08

VALVES AND LAMPS

B1	Valve	ECH 21
B2	„	ECH 21
B3	„	EBL 21
B4	„	AZ 31
L1	Pilot Lamp	00.080.45D/00
L2	„ „	00.080.45D/00
†S6 etc.	Used with	MK.561.21
†S11 etc.	Used with	MK.561.22
†S16 etc.	Brass Gang only	MK.561.23

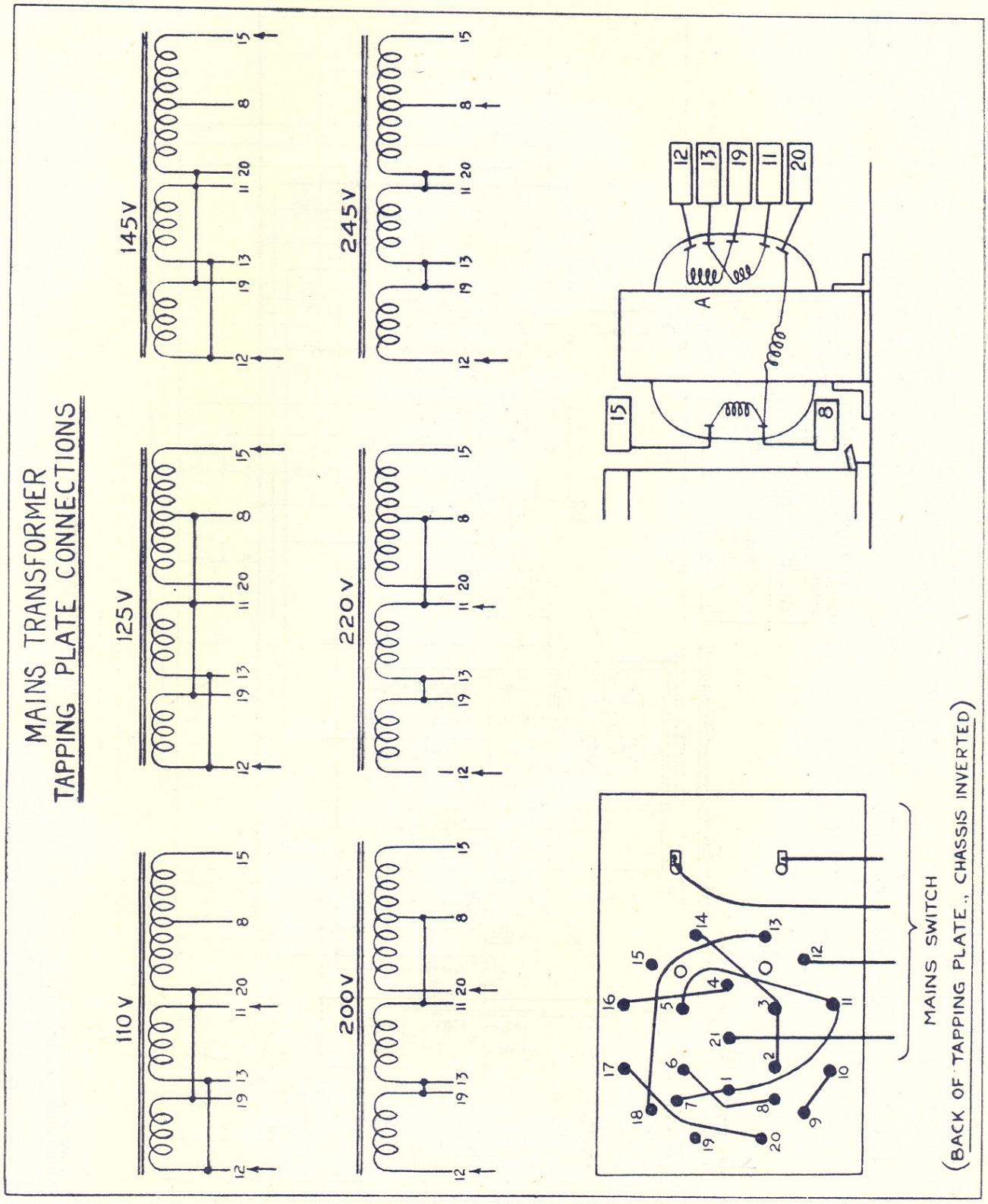


FIG. 6. MAINS TRANSFORMER TAPPING PLATE CONNECTIONS.

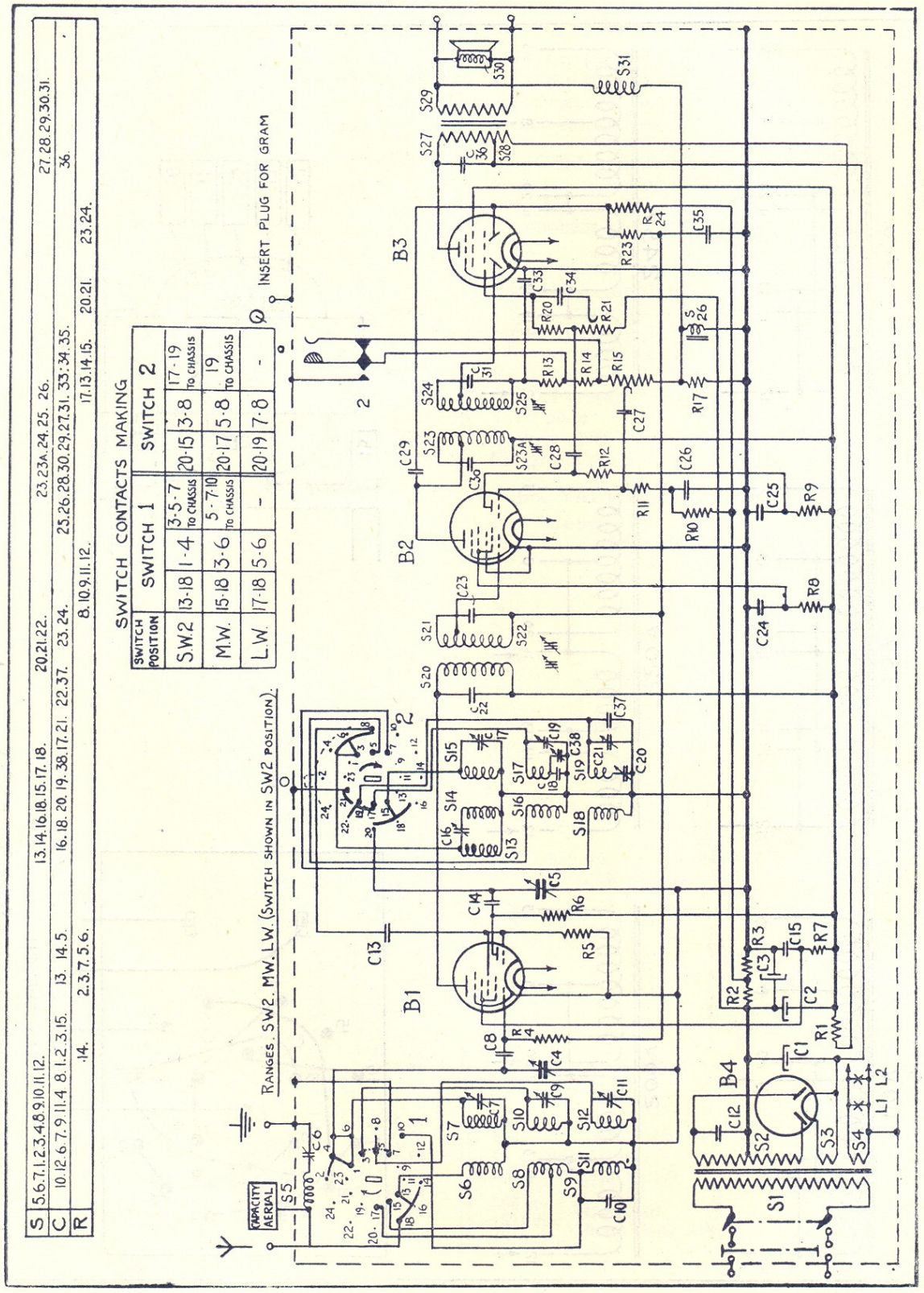
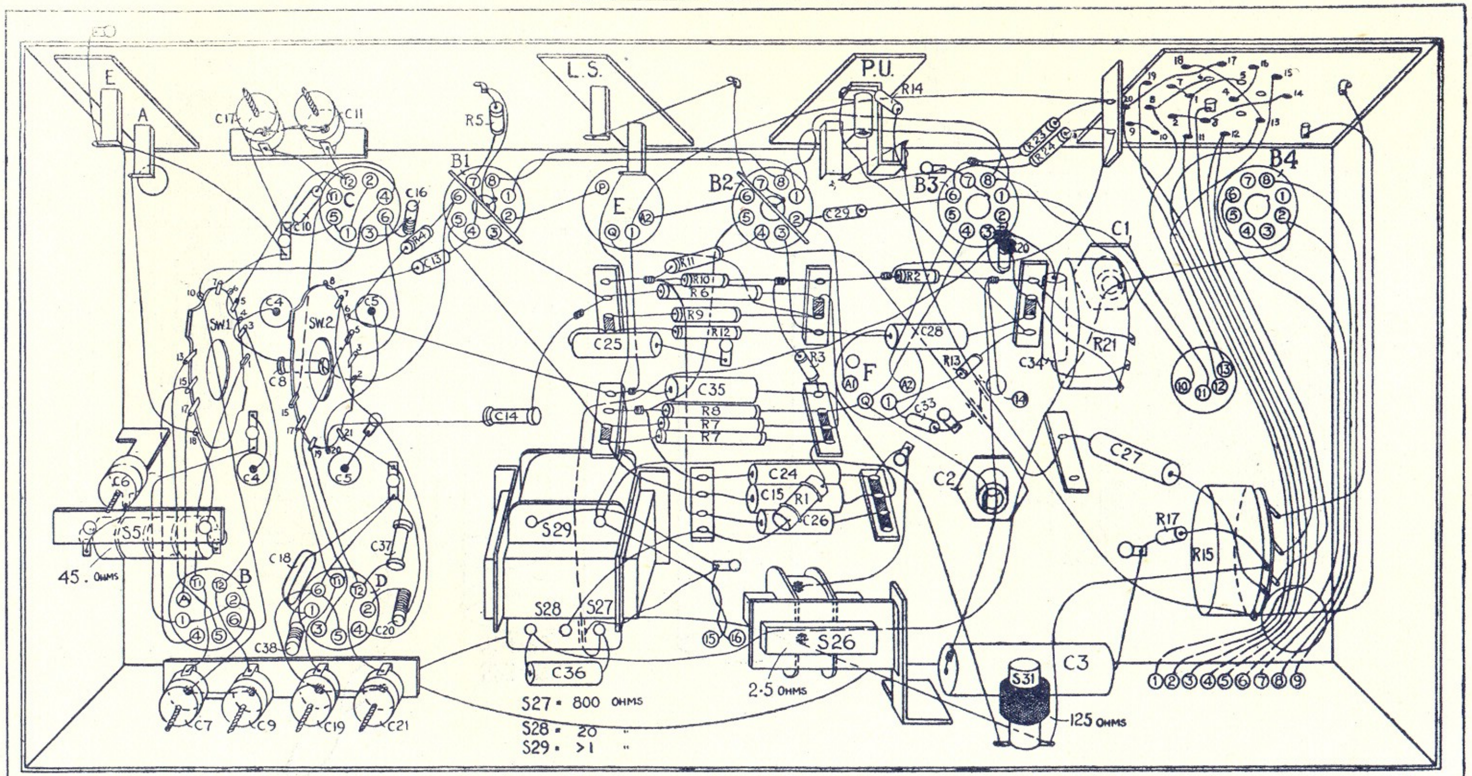


FIG. 7. CIRCUIT DIAGRAM.

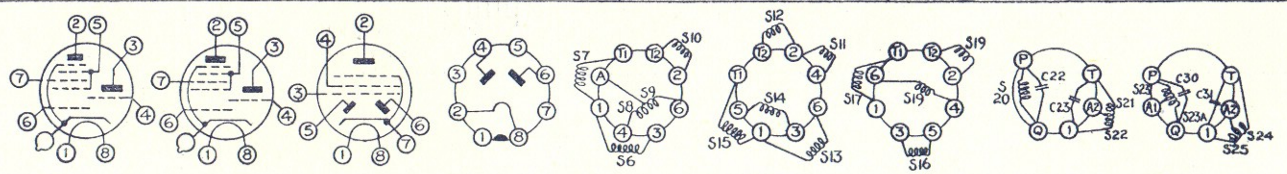
NOTE
IN SOME MODELS R14 IS NOT SHORT-CIRCUITED ON RADIO.

C1	330 V.	47 uF
C2	330 V.	47 uF
C3	8–12 V.	250 uF
C4 } C5 }	Gang	480 pF
C6	Trimmer ..	30 pF
C7	,, ...	30 pF
C8	Ceramic ..	220 pF
C9	Trimmer ..	30 pF
C10	Ceramic ..	39 pF
C11	Trimmer	30 pF
C12	Ripple	22,000 pF
C13	Ceramic ..	82 pF
C14	,, ...	470 pF
C15	Tubular	47,000 pF
C16	Wire Trimmer ..	200 pF
C17	Trimmer ..	30 pF
C18	Mica	390 pF
C19	Trimmer ..	30 pF
C20	Wire Trimmer ..	200 pF
C21	Trimmer ..	30 pF
C22 } C23 }	See Coils	
C24	Tubular	47,000 pF
C25	,, ...	47,000 pF
C26	,, ...	47,000 pF
C27	,, ...	10,000 pF
C28	,, ...	22,000 pF
C29	Ceramic ..	5.6 pF
C30	See coils	
C31	See coils	
C33	Ceramic ..	82 pF
C34	Tubular ..	3,900 pF
C35	,, ...	47,000 pF
C36	Speaker ..	1,000 pF
C37	Ceramic ..	27 pF
C38	Wire Trimmer ..	200 pF

R1	Wire Wound	1,200 Ohm
R2	0.5 watt	68 ,,
R3	0.25 ,,	33 ,,
R4	0.25 ,,	0.82 M. Ohm
R5	0.25 ,,	47,000 Ohm
R6	1.0 ,,	22,000 ,,
R7	1.0 ,, (2 × 47,000 in parallel)	23,500 ,,
R8	1.0 ,,	39,000 ,,
R9	0.5 ,,	0.1 M. Ohm
R10	0.25 watt	0.47 M. Ohm
R11	0.25 ,,	2.2 ,,
R12	0.5 ,,	0.1 ,,
R13	0.25 ,,	1.0 ,,
R14	0.25 ,,	0.1 ,,
R15	Pot & Switch	0.7 ,,
R17	0.25 watt	22 Ohm
R20	0.25 ,,	0.12 M. Ohm
R21	Pot	0.5 ,,
R23	0.25 watt	1.5 ,,
R24	0.25 ,,	0.82 ,,



C	6. 7. 17. 4. 9. 38. 8. 18. 10. 19. 5. 11. 37. 21. 20. 16. 13. 14. 36. 25. 35. 24. 15. 26. 29. 33. 28. 2. 34. 3. 1. 27.
R	4. 5. 11. 10. 6. 9. 12. 8. 7. 1. 3. 14. 2. 13. 20. 23. 24. 21. 17. 15.
S	5 (B-6.7.8.9.10.) (D-16.17.18.19.) (C-11.12.13.14.15.) 27. 28. 29. (E-20.21.22.) 26. (F-23.23A.24.25.) 31.



B.1 ECH 21
Hep Anode · 235v 2·4mA
Hep Screen · 90v 6·4mA
Tri Anode · 139v 4·0mA
−VG · 1·6 and 11·3

B.2. ECH.21
Hep Anode · 235v 5·5mA
Hep Screen · 90v 3·8mA
Tri Anode · 40v 1·1mA
−VG · 1·6 and 1·6

B.3 EBL21
Anode · 250v 34mA
Screen · 240v 3·3mA
−VG · 5·2

B.4 AZ.31
Volts across C1 · 280
,, ,, C2 · 250
,, ,, C3 · 5·6

B
S.6 · 2 ohms
S.7 · <1 ·
S.8 · 55 ·
S.9 · 54 ·
S.10 · 5 ·

C
S.11 · 175 ohms
S.12 · 62 ·
S.13 · 1·5 ·
S.14 · <1·0 ·
S.15 · <1·0 ·

D
S.16 · 2 ohms
S.17 · 6·5 ·
S.18 · 4·2 ·
S.19 · 18·0 ·

E
S.20 · 9 ohms
S.21 —
S.22 · 6·5 ·

F
S.23 · 2·6 ohms
S.23A · 7·0 ·
S.24 —
S.25 · 5·0 ·

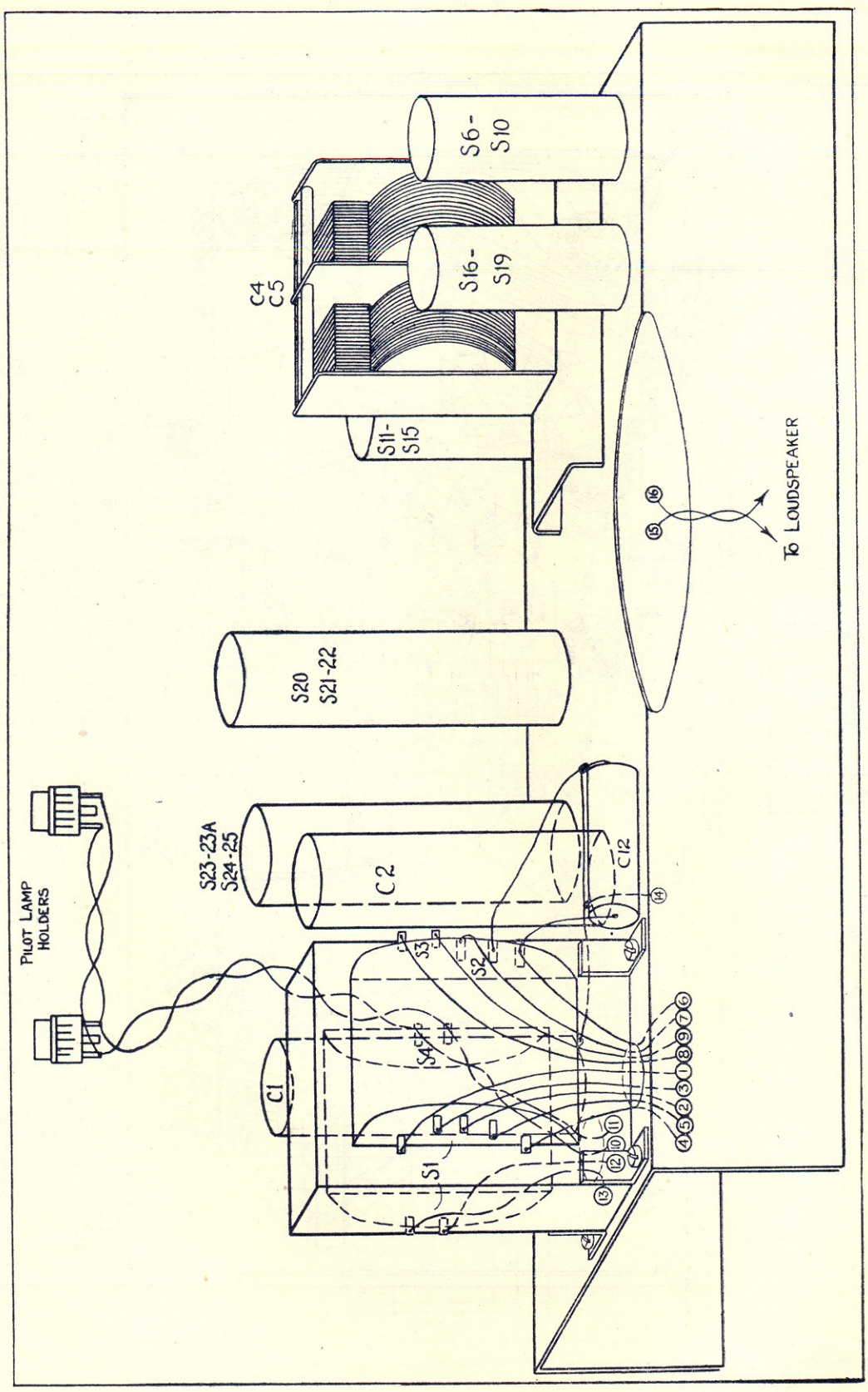


FIG. 9. LAYOUT OF TOP OF CHASSIS.