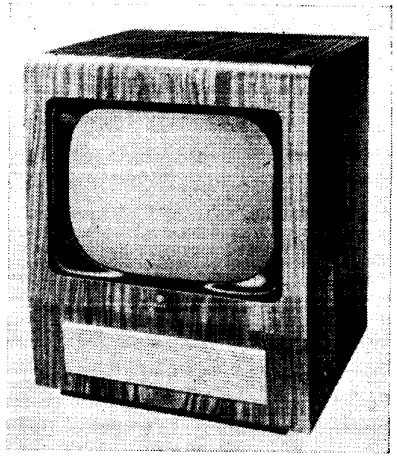
EKCO T164 and TC174

Eighteen-valve five-channel television receiver incorporating line diffuser or spot-wobble circuit that can be switched on as desired. Model T164 employs 15in. all-glass CRT and is housed in walnut veneered table cabinet. Model TC174, in similarly finished console cabinet, is fitted with 16in. flat-screen metal cone CRT. Suitable for 200-250V 50c/s AC. Manufactured by E. K. Cole Ltd., Ekco Works, Southend-on-Sea, Essex.



THE receiver is a superhet operating on lower sideband of vision carrier. Aerial, RF and oscillator circuits are tunable to any of the five BBC channels. Vision interference and sound noise suppression circuits are fitted. A spot-wobble circuit, by modulating the line-scan waveform on line deflector coils at a high frequency, removes the visible line structure of picture. Mains consumption is approximately 160W.

Aerial input is for use with 80-ohm coaxial which is coupled to receiver through primary L1A of aerial input transformer RFT1. Outer screen of coaxial and earthy side of L1A are coupled to receiver chassis through R42 C1.

Screening foil attached to inside face of rear cover panel is connected to receiver chassis and to internal screening of cabinet through isolating capacitor C80.

RF amplifier. Aerial signal is coupled by secondary L1B of RFT1 to grid of RF amplifier V1, the gain of which is controlled, with that of first vision IF amplifier V3, by VR1 the **Contrast** control in their common cathode. Amplified signal at anode is developed across L2 and fed by C7 to L3 in grid of frequency-changer V2.

Frequency-changer is V2 operating as combined oscillator and mixer. Oscillatory tuned circuit L4 C9-12 is connected, through C13, between screen and grid, oscillator anode voltage being obtained from R7. Bias for oscillator grid is developed on C13 with R9 as leak. RF signals on L3 are fed by C8 and mixed with oscillator signal on grid, to produce across primary L5 of IFT1 in the anode, a vision IF of 16.2 mc/s and a sound IF of 19.7 mc/s.

Wide bandwidth in aerial, RF and mixer stages, to cover both sound and vision frequencies, is ensured by damping resistors R1 R5 R11.

Vision Channel consists of two IF amplifiers V3 V5, signal rectifier V7A, video amplifier V9, and interference suppressor V7B. Vision signal at anode of frequency-changer V2 is bandpass transformer coupled by IFT1 to grid of first vision IF amplifier V3, the gain of which is controlled, with that of RF amplifier V1, by **Contrast** control VR1 in the cathode circuit.

Similar-type bandpass transformer coupling is employed between V3 and second vision IF amplifier V5 and between V5 and anode of signal rectifier V7A. Wide vision bandwidth is maintained by damping resistors R14 R16 R21 and R23.

Sound-on-vision rejection at 19.7 mc/s is given by L12 C30, connected through C29 between anode V3 and chassis.

Rectified video signal at cathode V7A is fed through peaking choke L17 and developed across R31 in grid of video amplifier V9. Amplified video signal at anode is fed through IF harmonic filter L26 and thence DC-AC coupled by R53 C60 R54 to cathode of CRT.

Interference suppression is given by diode V7B, shunted by R33 or R30 R33 and connected with its cathode to V9 anode and its anode to chassis through C45. C45 charges, through R33 or R33 shunted by R30, to a potential nearly equal to peak white of signal and V7B is held cut off. When a large-amplitude high-frequency interference pulse appears, cathode V7B becomes less-positive but, due to comparatively long-time constant of R33 C45, its anode potential remains unchanged and the diode conducts momentarily to short-circuit the pulse to chassis through C45. Degree of limiting is increased when R30 is brought into circuit by S3 but at the expense of picture quality.

Sound channel consists of two IF amplifiers V4 V6, signal rectifier V8A, noise suppressor V8B and sound output amplifier V10.

Sound signal of 19.7 mc/s is obtained from anode of frequency-changer V2 and fed by C18 to L9 C21 in grid of first sound IF amplifier V4, the gain of which is controlled by **Volume** control VR2 in its cathode. Bandpass transformer coupling is employed between V4 V6 and signal rectifier V8A.

Audio signal across R27 C40 is fed by C43 through series noise suppressor diode V8B and thence coupled by R32 C48 to grid of beam-tetrode sound output amplifier V10, the output of which is transformer coupled by OP1 to a 7in. eliptical PM speaker L34.

Noise suppression is given by diode V8B which is biased from HT line through R28 and held conducting. Time constant of R28 C46 in the anode circuit is such that, when a high-frequency interference pulse appears with signal, cathode V8B is driven negative to its anode and the diode cuts off.

Sync separator. Video signal at anode of video amplifier V9 is fed by R50 C58 to grid of sync separator V12. Positive sync pulses cause grid current and resultant bias across R52 is sufficient to place video portion of waveform beyond cut-off, thus only sync pulses appear at anode.

Frame sync pulses are integrated by R59 C61, which makes them large compared with line sync pulses, the latter being then removed by clipping action of positively-biased rectifier MR. Frame sync pulses are fed by C79 through R83 to anode of frame scan oscillator V13A.

Line syne pulses are taken from anode V12 and fed through C63 to anode of V13B which forms one section of a multi-vibrator line scan oscillator.

Frame scan waveform is generated by triode grid blocking oscillator V13A. Adjustment of grid voltage by VR4 gives **Frame Hold** control.

Frame amplifier. Scan voltage on C65 is fed by C70 to **Picture Height** control VR5 and thence applied through R73 to grid of beam-tetrode frame amplifier V16. Anode is transformer fed by FT2 to frame deflector coils L22 L23 damped by R76. **Frame Linearity** is controlled by VR6, which adjusts the negative feedback applied from anode to grid V16.

Line scan waveform is generated by a self-oscillating multi-vibrator circuit formed by cross-coupling between triode V13B and screen and grid of line amplifier V14. Variation of V13B grid resistance by VR7 gives **Line Hold** control. Anode V14 is auto-transformer coupled by LT1 to line deflector coils L24 L25. **Picture Width** is controlled by adjustment of inductance of shunt coil L20, whilst **Line Linearity** is controlled by variation of inductance of series coil L19 by means of position-adjustable permanent magnet in proximity to coil.

Efficiency diode. First portion of line scanning stroke is produced by conduction of V15 when its anode is swung positive on second half cycle of shock oscillation set up in LT1 when V14 is cut-off at end of previous line. Charge built up on C75, by rectification by V15 of flyback oscillation, is added in series with normal receiver HT to give boosted HT voltage for anode of line amplifier V14 and, on model TC174, for screen of CRT.

EHT of 13.5kV for final anode of CRT is provided by V17 which rectifies high surge voltage set up across primary L35 and its overwind L36 when line amplifier V14 is cut-off. EHT is fed through R84 to smoothing capacitor C74 shunted by Metrosil R77 and thence fed to final anode of CRT.

HT is provided by indirectly-heated half-wave rectifier V18 with its four anodes fed, through current limiters R78 to R81, from 220-230V tapping on primary L41 of mains input tranformer MT1. Rectified output is obtained from strapped cathodes and choke-capacity smoothed by L21, C76, C77. Reservoir smoothing capacitor C77 should be rated to handle at least 600mA ripple current.

Heaters of valves, except V11, V15 and V17, are series connected in two paralleled circuits, which are fed from 200-210V tapping on primary L41 of MT1. R82 is voltage dropper inserted in series with one heater chain. CRT heater is fed from secondary L38 and V15 from L39.

EHT rectifier heater V17 is fed from winding L42 on line output transformer LT1. Secondary L40 of MT1 provides heater current of line diffuser V19 and pre-amplifier when used.

Primary L41 of MT1 is tapped for inputs of 200-210, 220-230, 240-250V 50c/s. Mains input is fused in each lead and fitted with filter capacitor C78. S1 which is ganged to **Brightness** control is the on/off switch.

Line Diffuser consists of triode V19 connected in a modified Colpitts circuit. Oscillator coils L28 are placed at right angles to line deflector coils on neck of CRT. Amplitude of induced vertical oscillation of spot is adjusted by VR10 so that adjacent 'lines' just touch, thus the usual visible line structure is removed.

In the TC174 the line diffuser circuit is slightly different, VR10 being deleted and replaced by a 5K WW variable in the cathode circuit, decoupled by a .001 mF capacitor. R96 becomes 33K, R97 68K.

ADJUSTMENT

Spot-wobble. To avoid "patterning," the frequency of line-diffuser oscillator V19 should be adjusted by T97 to appropriate channel frequency as follows: London, 12.2 mc/s; Birmingham, 11 mc/s; Holme Moss, 11.5 mc/s; Wenvoe, 12.2 mc/s; Kirk o' Shotts, 12 mc/s.

VR8 can be adjusted only with chassis removed from cabinet. Place **Brightness** control VR3 at minimum and adjust VR8 to give EHT of 13.5kV. Cathode current of V14 should be approximately 110mA.

Ion trap magnet (model TC174 only) should be positioned with its arrow pointing towards front of cabinet and immediately over line marked on neck of tube.

With receiver switched on and **Brightness** control set just to show raster, the magnet should be adjusted for maximum brightness. If raster cannot be centred by adjusting position of focus field magnet, ion trap magnet should now be rotated slightly to assist in centering, provided that this does not cause any decrease in brilliance.

When optimum conditions are obtained magnet should be clamped in position by thumb screw, taking care not to alter position.

If a position of maximum brilliance cannot be obtained another magnet should be tried.

The magnet should never be adjusted to remove a shadow from the raster if, by so doing, the brightness of the image is decreased. In such cases shadow should be eliminated by adjusting position of the focus coil and/or deflection coils.

An alternative position which is sometimes more convenient mechanically is with the magnet diametrically opposite the line marked on the edge of the tube, and with the arrow pointing *away* from the screen.

CRT removal, T164. Disconnect EHT lead, tube socket and two plugs from cradle assembly. Release wires held in clamps on cradle assembly. Remove chassis and control panel from cabinet and turn cabinet upside down on a suitable surface.

Undo the four nuts holding cradle to top of cabinet. Lift tube assembly clear of the cabinet and stand face down on a suitable cushion. Remove mask and rubber dust excluder ring. Remove magnet assembly held by two 2BA screws, exposing four 4BA screws which must be loosened to release rubber clamp ring from tube neck. Loosen large circular front clamp sufficiently to allow the cradle and scan coils to be lifted off tube.

In general reassemble in reverse order. Rubber dust excluder ring should be stretched over the circular front clamp as soon as it is fitted. A polythene washer and strip should be placed on neck of tube before the coils are slipped on. A second polythene washer and a felt washer should be inserted between coils and cradle assembly.

Scan coils should be positioned so that adjusting lever is between the main wings of the cradle. After mask has been fitted the dust excluder ring should be correctly positioned with the special corner pieces added.

CRT removal, TC174. Disconnect EHT lead tube socket and 12-in. plug. Release leads held by clips on tube cradle. Remove chassis and control panel from cabinet. Release tube cradle, then place face down on a suitable cushion.

Remove ion trap from CRT neck. Remove magnet assembly held by two 2BA screws. Loosen the four 4BA screws holding rubber locking ring to neck of tube.

Remove four 4BA screws holding lateral members of cradle to front clamp. Lift rear half of cradle and scanning coils off tube. Remove mask, then loosen front clamp ring sufficiently to be able to remove it and special polythene ring.

Replace in reverse order. Before scanning coils are fitted a polythene washer should be slipped over neck of tube and a strip of polythene wound round the neck so that coils will rest on it when in position. A second polythene washer and a Bakelite washer should be inserted between coils and cradle as they are fitted. If mask does not fit correctly in the cabinet it may be adjusted by the circular nuts on mounting bolts.

Note: Shudder and tearing at top of picture was experienced on early models due to interaction within double triode 20L1. The manufacturers have now modified the internal arrangement of electrodes to obviate this, and the above fault may be corrected by changing this valve.

ALIGNMENT INSTRUCTIONS

Apparatus required. A signal generator capable of producing modulated signals accurately at frequencies mentioned below. A 0-20 range DC milliammeter or a 0-10 range 20,000 ohms/volt DC voltmeter (or valve voltmeter). An AF output meter or low-range AC voltmeter. A 560-ohm carbon damping resistor.

Connect milliammeter between R40 and HT line, or connect voltmeter across R31. Connect AF output meter across speaker tags.

IF stages. Use 560-ohm carbon resistor for damping. With modulated input to junction of C7, C8, L3 :—

Damp L13 : tune L14 at 17.5 mc/s for maximum vision output.
Damp L14 : tune L13 at 17.5 mc/s as above.
Damp L7 : tune L8 at 17.5 mc/s as above.
Tune C30 at 19.7 mc/s for *minimum* output on vision.
Damp L8 : tune L7 at 17.5 mc/s for maximum vision.
Retune C30 at 19.7 mc/s for *minimum* output on vision.
Damp L5 : tune L6 at 17.5 mc/s for maximum vision.
Damp L5 : tune L9 at 19.7 mc/s for *mimimum* output.
Damp L6 : tune L5 a 117.5 mc/s for maximum vision.
Damp L15 : tune L16 at 19.7 mc/s for maximum sound.
Damp L16 : tune L15 at 19.7 mc/s as above.
Damp L10 : tune L11 at 19.7 mc/s as above.
Damp L11 : tune L10 at 19.7 mc/s as above.
Retune L9 at 19.7 mc/s for *minimum* output on vision.

RF stages. Input to aerial socket.

For London area : (a) Tune C12 trimmer or L4 core (yellow) with 43.25 mc/s input for a reasonable output on vision meter. (b) Tune L1 core (green) at 43.25 mc/s for maximum output on vision meter. (c) Tune L2 core (red) and L3 core (black) as for L1. (d) Tune C12 or L4 core (yellow) with 41.5 mc/s input for *minimum* output on vision meter.

For Sutton Coldfield area : adjustments (a), (b) and (c) at 60 mc/s. Adjustment (d) at 58.25 mc/s.

For Holme Moss area : adjustments (a), (b) and (c) at 50 mc/s. Adjustment (d) at 48.25 mc/s.

For Kirk o' Shotts area : adjustments (a), (b) and (c) at 55 mc/s. Adjustment (d) at 53.25 mc/s.

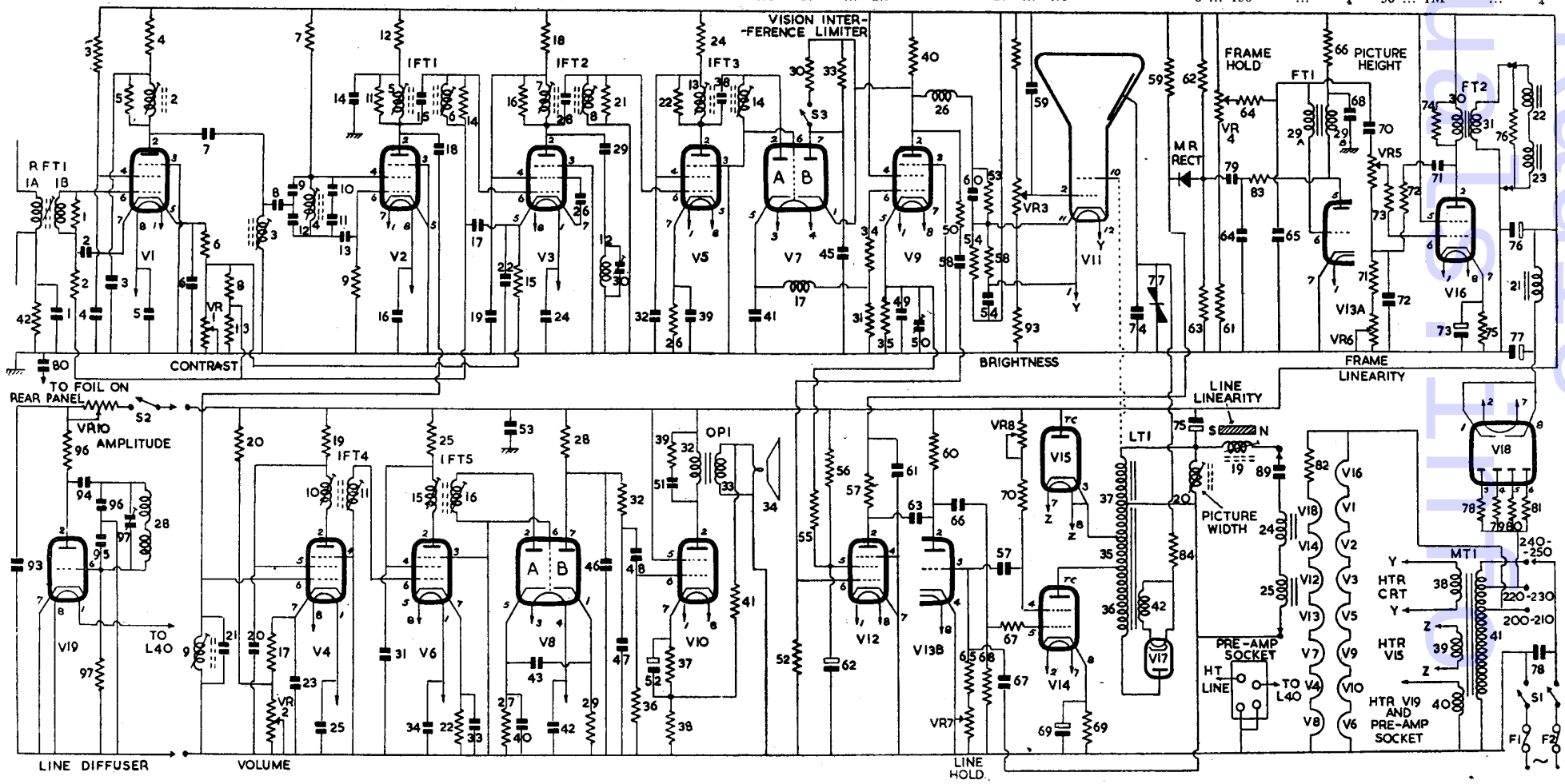
For Wenvoe area : adjustments (a), (b) and (c) at 65 mc/s. Adjustment (d) at 63.25 mc/s.

INDUCTORS

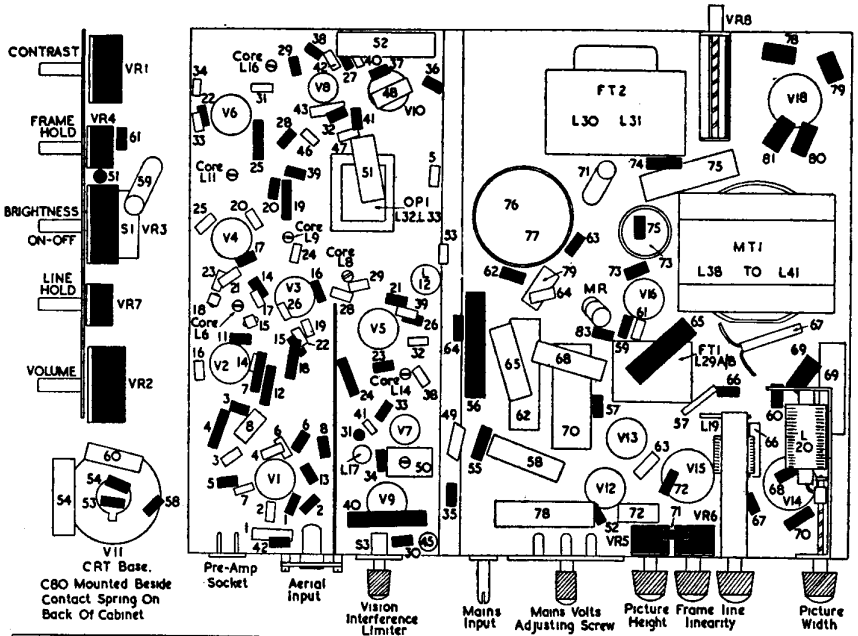
L	Ohms
1A–4	Very low
5, 6	.25
7, 8	.5
9, 12	Very low
10, 11	.25
13-16	.5
17	2.5
18	No Component
19	1.6
20	13.3
21	46
22	13
23	13
24	9.5
25	9.5
26	.75
28	Very low
29A	280
29B	161
30	687
31	1.7
32	635
33, 38, 40, 42	Very low
34	3.5
35	5.5
36	175
37	9
39	10
41	43 Total

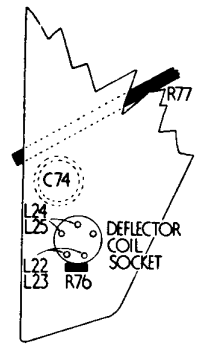
RESISTORS

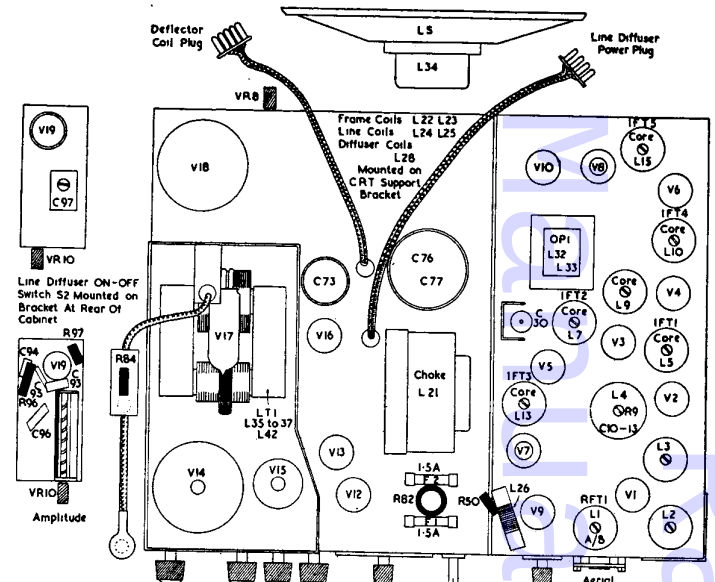
R	Ohms	Watts
1	10K	½
2	4.7K	½
3	15K	½
4	4.7K	½
5	6.8K	½
6	150	½
7	27K	½
8	3.6K	½
9	100K	½
10	No Component	
11	8.2K	½
12	4.7K	½
13	100K	½
14	8.2K	½
15	150	½
16	6.8K	½
17	270	½
18	4.7K	½
19	10K	½
20	150K	½
21	8.2K	½
22	150	½
23	15K	½
24	4.7K	½
25	4.7K	½
26	150	½
27	68K	½
28	4.7M	½
29	1M	½
30	1M	½

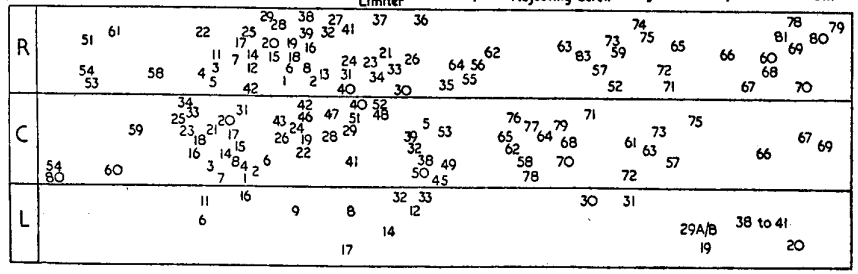


R	Ohms	Watts
31	3.9K	¼
32	33K	¼
33	4.7M	¼
34	150	¼
35	390	¼
36	820K	¼
37	390	¼
38	15	¼
39	4.7K	¼
40	6.8K	1
41	10	¼
42	1M	¼
43-49	No Components	
50	10K	¼
51	27K (T164) / 18K (TC174)	¼
52	470K	¼
53	100K	¼
54	220K	¼
55	5.6K	½
56	27K	2
57	10K	¼
58	100K	¼
59	22K	¼
60	1M	¼
61	330K	¼
62	150K	¼
63	330K	¼
64	1M	½
65	330K	2
66	390K	¼
67	1K	¼
68	820K	¼
69	100	5
70	2.2K	¼
71	100K	¼
72	150K	¼
73	10K	¼
74	27K	½
75	390	¼
76	390	¼
77	Metrosil	
78	100	5
79	100	5
80	100	5
81	100	5
82	225 Dropper	
83	100K	½
84	100K	½
85-90	No Components	
93	27K ½ TC174 only	
94, 95	No Components	
96	15K	½
97	150K	¼









VARIABLE RESISTORS

VR	Ohms	Watts
1	5K WW Potr.	
2	25K WW Potr.	
3	100K Potr with DP Switch	
4	200K Miniature Potr.	
5	1M Miniature Potr.	
6	500K Miniature Potr.	
7	200K Miniature Potr.	
8	5K WW Slider Potr.	
10	10K WW Slider	

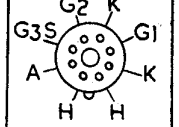
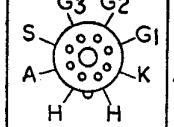
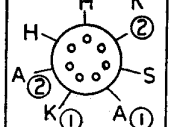
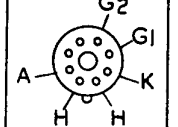
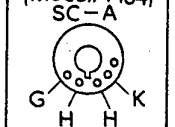
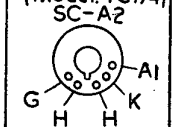
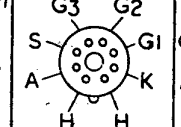
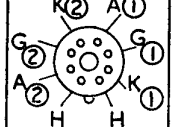
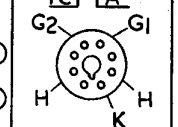
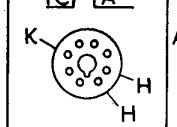
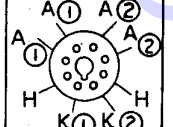
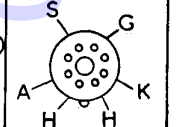
CAPACITORS

C	Capacity	Type
1	500pF	Mica
2	1000pF	Tubular
3	1000pF	Tubular
4	500pF	Tubular
5	1000pF	Tubular
6	300pF	Tubular
7	1.5pF	Tubular
8	30pF	Silver Mica
9	20pF	Silver Mica
10	6pF	Silver Mica
11	3pF	Tub. Ceramic
12	20pF	Silver Mica
13	33pF	Tub. Ceramic
14	3000pF	Tubular
15	2pF	Ceramic
16	1000pF	Tubular
17	3000pF	Tubular
18	2pF	Ceramic
19	3000pF	Tubular
20	3000pF	Tubular
21	33pF	Ceramic
22	3000pF	Tubular
23	3000pF	Tubular
24	1000pF	Tubular
25	1000pF	Tubular
26	1000pF	Tubular
27	No Component	
28	1pF	Ceramic
29	4pF	Ceramic
30	3-30pF	Trimmer
31	3000pF	Tubular
32	3000pF	Tubular
33	3000pF	Tubular
34	1000pF	Tubular
35, 36, 37	No Components	
38	1.5pF	Ceramic
39	3000pF	Tubular
40	30pF	Silver Mica
41	6pF	Ceramic
42	1000pF	Tubular
43	.01	Tubular 350V
44	No Component	
45	.1	Tubular 350V
46	300pF	Tubular
47	300pF	Tubular
48	.02	Tubular 350V
49	680pF	Silver Mica
50	150-700pF	Trimmer
51	.01	Tubular 600V
52	50	Electrolytic 25V
53	3000pF	Tubular
54...	.1	Tubular 350V
55, 56	No Components	
57	60pF	Silver Mica
58	.1	Tubular 350V
59	.1	Tubular 350V
60	.25	Tubular 150V
61	1000pF	Tubular
62	2	Electrolytic 350V
63	20pF	Ceramic
64	300pF	Tubular
65	.1	Tubular 350V
66	.01	Tubular 350V
67	20pF	formed with PVC Insulation and Wire
68	.1	Tubular 350V
69	25	Electrolytic 25V
70	.25	Tubular 350V
71	.02	Tubular 750V
72	.01	Tubular 350V
73	500	Electrolytic 25V
74	.001	Special 15kV
75	2	Electrolytic 350V
76	200	Electrolytic 350 V
77	100	Electrolytic V
78	.1	Tubular 300V AC
79	.01	Tubular 350V
80	.001	Tubular 750V
81-83	No Components	
89	.5	Tubular 350V (TC174 only)
93	.01	Tubular 350V
94	2000pF	Tubular
95	40pF	Silver Mica
96	40pF	Silver Mica
97	10-100pF	Trimmer

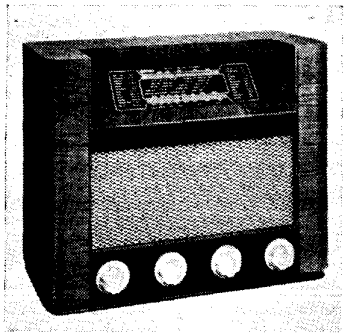
VOLTAGE READINGS

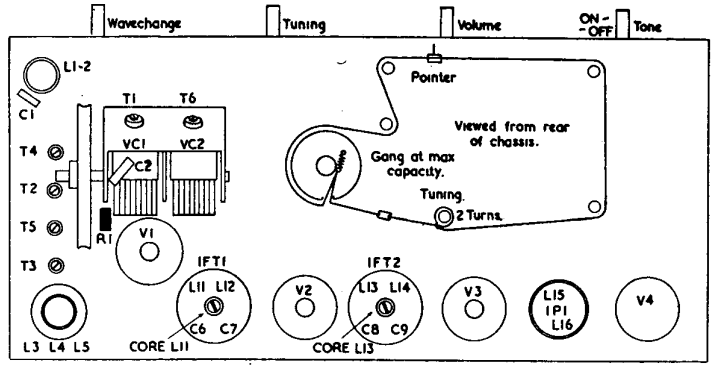
V	Type	A	G_2	K	
1	10F1	200-213	180-184	1.6-37	VR1 Max. Min.
2	10F1	180	137	—	
3	10F1	175-195	175-195	1.5-37	VR1 Max.- Min.
4	6F15	120-215-	120-215	3-25	VR2 Max. Min.
5	10F1	175	175	1.6	
6	10F1	170	170	1.7	
9	10F1	166	225	3	
10	10P13	206	225	12	
11	CRM152A	13.5kV	—	166	
11	MW41-1	13.5kV	480	166	
12	20F2	164	42	—	
13A	20L1	No readings possible under correct oscillating conditions			
13B					
14	20P1	—	170	11.5	
15	U282	225	—	480*	*Junction L37, C75
16	10P13	204	225	12	
17	U25	—	—	13.5kV	
18	U801	225 RMS	—	238V	
19	6L18	173	—	—	

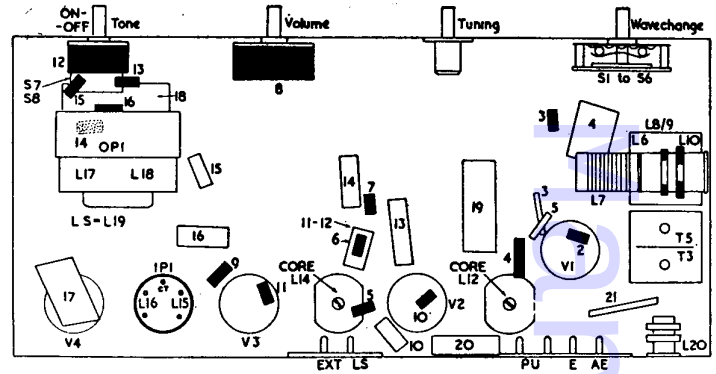
Total HT current = 280mA

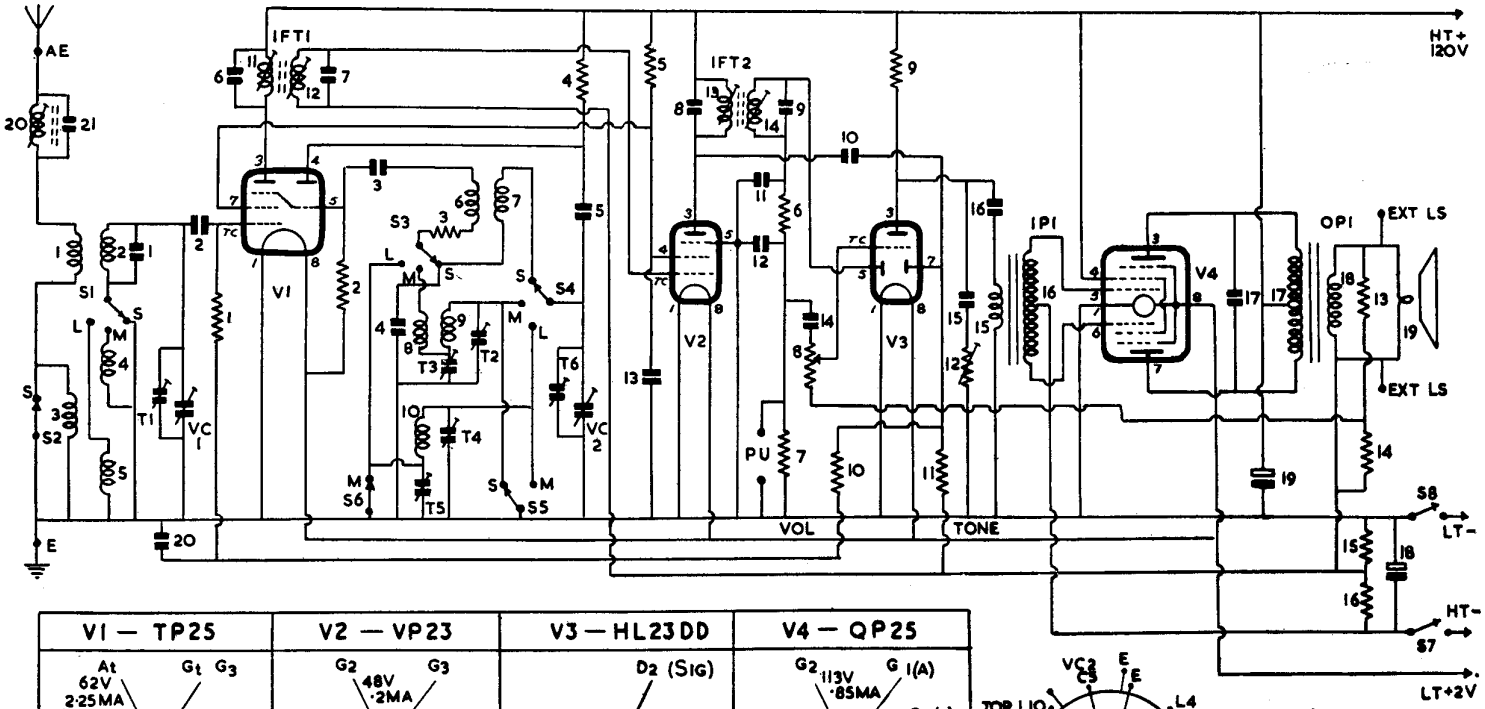
10F1	6F15	20D1	10P13	CRM152A	MW41-1	20F2	20L1	20P1	U282	U801	6L18
											
V1-3.5.6.9	V4	V7 8	V10 16	CRT-V11	CRT-V11	V12	V13	V14	V15	V18	V19

STRAD 516









Four-valve three-waveband battery-operated superhet housed in walnut veneered table cabinet. Sockets for aerial, earth, high resistance magnetic or crystal pickup and low impedance extension speaker. For use with standard 120 volt HT battery and 2 volt accumulator. Manufactured by R.M. Electric, Ltd., Team Valley, Gateshead 11.

Circuit description and alignment instructions, see page 2

RESISTORS

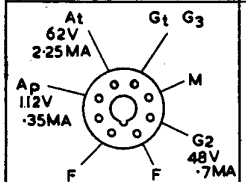
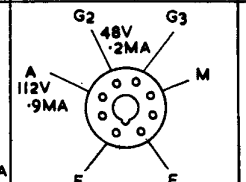
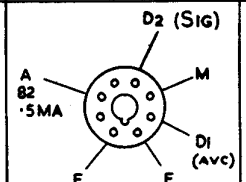
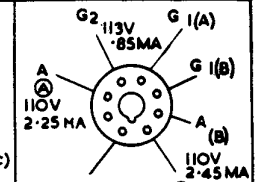
R	Ohms	Watts
1	1.2M	¼
2	47K	¼
3	50	¼
4	22K	¼
5	68K	¼
6	47K	¼
7	470K	¼
8	1M	Potr.
9	47K	¼
10	2.2M	¼
11	1.2M	¼
12	500K, Potr. with DP switch	
13	10K	¼
14	3.9K	¼
15	150	¼
16	680	¼

CAPACITORS

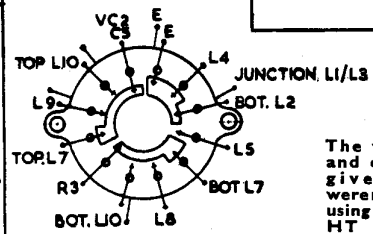
C	Capacity	Type
1	22pF Tub. Ceramic	
2	100pF Tub. Ceramic	
3	560pF Silver Mica	
4	3200pF Silver Mica	
5	100pF Tub. Ceramic	
6	120pF Silver Mica	
7	120pF Silver Mica	
8	120pF Silver Mica	
9	120pF Silver Mica	
10	10pF Silver Mica	
11	100pF	Silver Mica
12	100pF	Silver Mica
13	.01 Tubular 500V	
14	.01 Tubular 500V	
15	.04 Tubular 150V	
16	.1 Tubular 150V	
17	2400pF Silver Mica	
18	25 Electrolytic 25V	
19	4 Electrolytic 200V	
20	.01 Tubular 500V	
21	560pF Silver Mica	

INDUCTORS

L	Ohms
1	.5
2	Very low
3	14.5
4	4.5
5	16
6	1
7	Very low
8	.5
9	3
10	7
11	11
12	11
13	11
14	11
15	700
16	5000 Centre tapped
17	900 Centre tapped
18	Very low
19	2.5
20	3.5

V1 — TP25	V2 — VP23	V3 — HL23DD	V4 — QP25
			
TC G1	TC G1	TC G	

Total HT Current 10·5MA	LT Current 500MA	Bias Volts Across R15/16 = 7·7V



The voltages and currents given here were measured using a 120V HT battery, not a 136V unit of the type necessary to fit the cabinet space