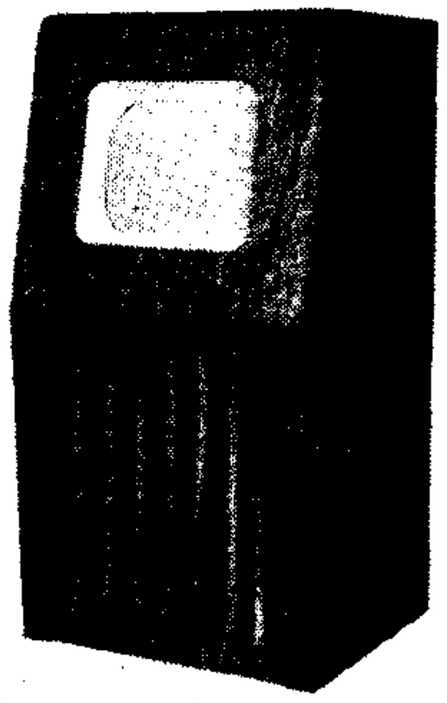
BEETHOVEN TV50, TV50M



Nineteen-valve television receiver fitted with a 12in. CRT giving a 10 by 7½in. picture. Housed in walnut veneered console cabinet. Suitable for 200-250V 50c/s mains. Model TV50 is for London and TV50M for Birmingham area. Manufactured by Beethoven Electric Equipment Ltd., Chapel Lane, Sands, High Wycombe, Bucks.

THE receiver employs TRF circuits with permeability tuned inductances operating on upper sideband (London) and lower sideband (Birmingham) of vision carrier. Sound noise suppression and vision interference limiter circuits are incorporated. EHT is provided by a separate RF oscillator and rectifier unit.

Model TV50 uses 6F13 valves in the RF stages of vision and sound channels. Model TV50M uses 6FI valves which have similar characteristics but are provided with connections to each end of the cathode.

MODEL TV50

Aerial input is designed for 80-ohm co-axial feeder, outer screening being connected to chassis.

Vision channel consists of three RF amplifiers V1 to V3, signal rectifier V4A, interference limiter V4B, video output amplifier V5, and DC restorer V6A.

Aerial signal is coupled by L1, L2 to first RF amplifier V1. Secondary L2 of input transformer is damped by R1 to provide a bandwidth covering both vision and sound frequencies. Bandpass transformer coupling is employed between V1, V2, V3 and signal rectifier V4A. Vision channel bandwidth is maintained by damping resistors R7, R13.

Gain of V1 and V2 is separately controlled by variation of cathode bias by R5 and R12, the **Sensitivity** and **Contrast** controls respectively.

Rectified video signal across diode load R17 is DC coupled to video output amplifier V5. L14 is upper frequency correcting choke.

Positive video signal at V5 anode is fed through C13 to grid of CRT. Signal is DC restored by action of V6A and B.

Interference limiter. Diode V4B, connected between anode of V5 and chassis through C11, is normally cut-off by charge on C11 which is equal to peak-white. When an interference pulse appears with video signal at anode V5, anode V4B is driven heavily positive but, due to long time constant of R16, C11, its cathode voltage remains unaltered. Hence V4B conducts and short circuits the interference pulse.

Sound channel. The sound signal, which is amplified with the vision by V1, is tapped from the anode circuit and fed by C28 to L19 and thence coupled by L20 to first sound RF amplifier V8. L19, C28 function as a sound-on-vision rejector circuit.

V8 is bandpass transformer coupled to V9 which in turn is bandpass transformer coupled to signal rectifier V10A Rectified signal across R53, C35 is fed by C36 through series noise suppressor diode V10B and coupled by C38 through R56 to **Volume** control R57 in grid circuit of beam-tetrode output valve V11. Audio output is fed by OP1 into a 6½ in. television type PM speaker.

Noise suppressor. Anode of diode V10B is positively biased from the HT line through R55 and therefore conducts and sets up a voltage across cathode load R54. The time constant of R55, C40 in the anode circuit is such that the voltage on C40 follows that of the audio signal which is fed by C36 to cathode V10B.

When a large-amplitude high-frequency interference pulse is passed by C36, because of comparatively long time constant of R55, C40, the cathode is driven more positive than its anode and the diode is cut-off.

Sync separator. Sync pulse separation and positive DC restoration for video signal are accomplished by V6A and V6B which, in effect, are series coupled between anode of VF output valve and chassis.

Anode of V6A is positively biased through R23 from R25 in cathode circuit of V7. The bias is adjusted by R25, the **Sync Control**, so that V6A conducts only on the negative sync pulses which are then passed on through R22 to sync amplifier V7.

Anode voltage of V7 is low to provide limiting action, thus ensuring that output pulses remain constant.

Frame sync pulses are integrated by R29, C17 and applied through R31, C18, R33 to grid of frame scan oscillator V12.

Line sync pulses are developed across R27 and fed by C20 through R70 to grid of line scan oscillator V14.

Frame scan oscillator is thyratron V12. Scan voltage is developed on C21 which charges up from HT through R34 and is discharged rapidly by V12 when positive sync pulses are applied to its grid. Adjustment of cathode bias by means of R37 gives **Vertical Hold** control.

Frame amplifier. Sawtooth waveform developed on C21 is fed by C24 through R38, R39, R40 to beam-tetrode amplifier V13. Amplified scanning voltage at anode is transformer coupled by FT1 to frame deflector coils L17, L18 on neck of CRT.

Height of picture is adjusted by R46, **Frame Amplitude** control, which varies feedback on V13. **Linearity** of frame is adjusted by R39 which forms part of a waveform correcting network R38, R39, R41 C23 in grid input to V13.

Line scan oscillator is thyratron V14. Scan voltage is developed on C52 which charges up from HT through R69A and is discharged rapidly by V14 when positive line sync pulses are applied to its grid. Adjustment of cathode bias by means of R74 gives **Line Hold.**

Line amplifier. Sawtooth waveform developed on C52 is fed by C53 through R76 to beam-tetrode amplifier V15. Amplified scanning voltage at anode is transformer coupled by LT1 to line deflector coils L34 L35 on neck of CRT. **Width** of picture is adjusted by feedback variation by R78 whilst **Linearity** is controlled by adjustment of deflector coil and output transformer damping by R82.

To prevent any possibility of line oscillator being triggered by random noise the cathode bias of V14 is increased to a much higher voltage than normal. This bias, during the scan, is gradually offset by feeding to grid through R72 a positive going sawtooth voltage, obtained from C56 in cathode circuit of line amplifier V15. Thus at commencement of line scan, V14 is heavily biased back by the full cathode voltage and the possibility of retriggering due to sudden noise pulses on its grid is greatly reduced, but towards end of line scan the cathode bias is reduced to normal value by the positive voltage fed to grid and when line sync pulse appears V14 is triggered to recommence the scanning sweep.

(*See note, page* 20).

EHT of 5.5kV is provided by a separate HF oscillator unit operating at a frequency of approximately 100k/cs. Oscillator is a beam-tetrode V17 with anode to grid coupling by L29, L31 Anode coil L29 is tuned by T1 and provided with overwind L30 which in conjunction with L29 functions as an auto-transformer to step up oscillator output. Automatic bias for oscillator grid is developed on C47 with R64 as leak resistor. Oscillator output is rectified by V16, smoothed by R63, C45, C46 and fed to anode of CRT. Heater current of rectifier V16 is obtained from a secondary L28 coupled to oscillator coils.

HT is provided by a pair of indirectly heated rectifiers V18, V19 connected in a full-wave circuit. Anode voltages for strapped anodes of each rectifier are obtained from HT secondary L43 of mains input transformer MT1. R89, R90 are fitted to prevent or limit any flash-over in rectifiers.

HT feed to sound and vision channels, sync separator and screen of line amplifier is choke and resistance-capacity smoothed by L37, C61, C60, R88, C59. RF decoupling is provided by C9, C37. HT for frame and line scan circuits and EHT oscillator is separately choke-capacity smoothed by L36, C58.

On later models dropper R87 is omitted. HT for anode and screen of EHT oscillator V17 is RF decoupled by R67, R68, C50. Reservoir smoothing capacitor C61 is rated to handle 450mA of ripple current. A 500mA fuse is fitted in negative HT lead to chassis.

Heaters of V1-V11 are parallel connected and obtain their current from secondary L39 of MT1. RF decoupling of feed to heaters of V3-4, V9-10 is given by L38, C26, C27.

Heaters of V12-V15 and V17 are fed from secondary L40 of MT1.

CRT is a 12 in. Mazda type CRM121 with permanent-magnet focussing. **Brightness** is controlled by variation of cathode bias by R84. S1 which is ganged with ON/OFF switch S2 and operated by Brilliance control spindle brings into circuit R61 when receiver is switched off, to prevent CRT cathode bias on C44 falling too rapidly.

On later models of this receiver this feature is not incorporated and S1, R61 with R62, R86 omitted.

Mains input transformer primary L44 is tapped for 200-250V 50c/s. S4, ganged to Brilliance control spindle, is the ON/OFF switch.

MODEL TV50M

Model TV50M has a slightly modified vision RF circuit incorporating a separate sound rejector circuit L45, C68 in anode V2 and an adjacent channel rejector circuit L46, C72 in anode V3.

In addition, both vision and sound RF valves are changed to type 6F1 which have separate end cathode connections for improved decoupling. The modified theoretical circuits of V1, V2, V3 and V8, V9 are shown together with a separate list of components which differ or are in addition to those in model TV50.

ALIGNMENT INSTRUCTIONS

Connect a 0-1mA meter, shunted by a .01mF capacitor, in series with earthy end of L14. Connect a 470 ohm damping resistor across each coil as indicated.

(1) Inject 46.7mc/s (60.75mc/s with Birmingham model) to gl of V3. Damp L10 and tune L9. Damp L9 and tune L10.

(2) TV50M only : inject 63.25mc/s and tune L46 for *minimum* output.

(3) Inject 46.7mc/s (60.75mc/s) to V2. Damp L7 and tune L6. Damp L6 and tune L7.

(4) TV50M only : inject 58.25mc/s and tune L45 for *minimum*.

(5) Inject 46.7mc/s (60.5mc/s) to V1. Damp L4 and tune L3. Damp L3 and tune L4.

(6) Inject 46.7mc/s (58.25mc/s) to aerial socket and tune L1, 2.

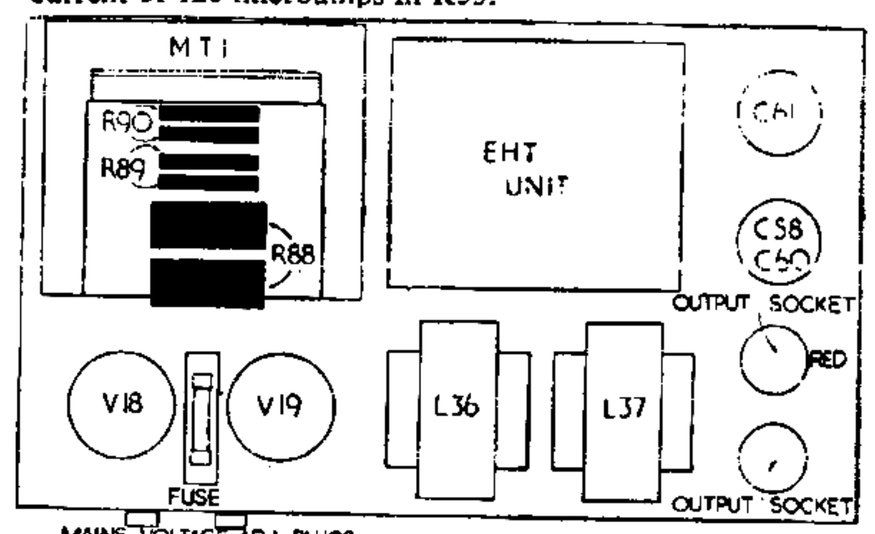
(7) Inject 41.5mc/s (58.25mc/s) to aerial socket and tune L19 for *minimum*.

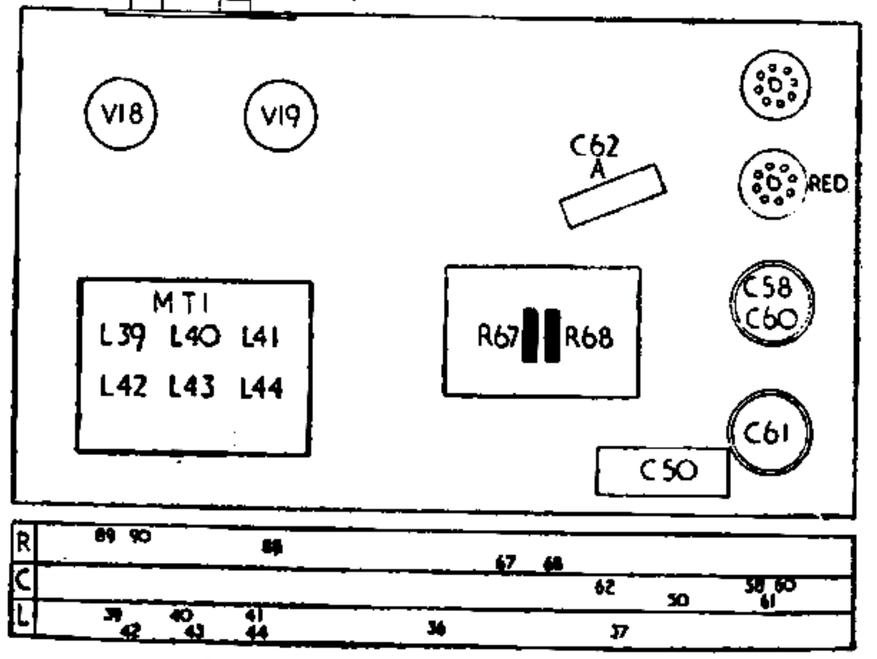
(8) Connect an output meter across primary of OP1. Inject modulated 41.5mc/s (58.25mc/s) to aerial socket and tune L20, L21, L22, L23, L24 for maximum.

Video sensitivity. TV50 : 100 microvolts for meter reading of .5mA. TV50M : 150 microvolts for meter reading of .37mA.

Video responses. TV50 : flat between 45.48mc/s. TV50M : flat between 59.5-60.75mc/s.

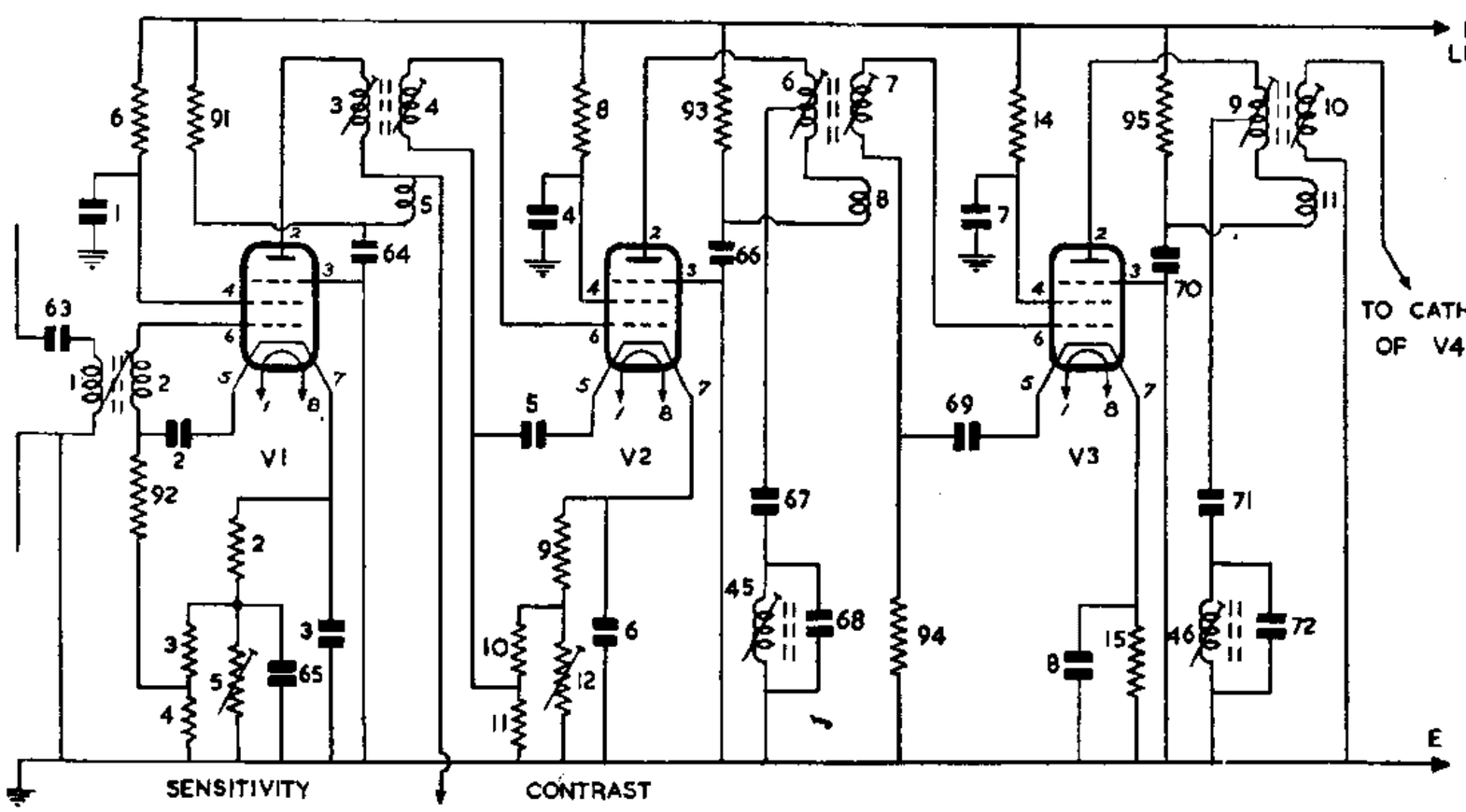
Sound sensitivity. Both models : 250 microvolts for current of 120 microamps in R53.

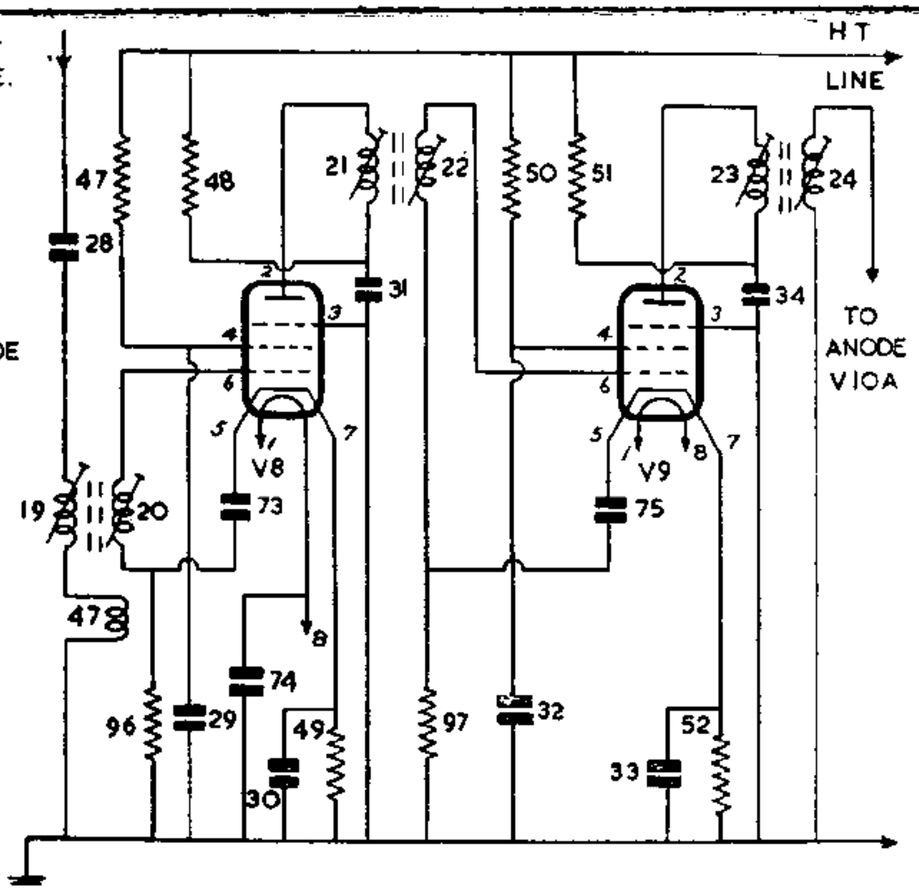




Power pack chassis. All other diagrams are on the following spread

V1 SENSIT-IVITY. V2 CONTRAST V3 V4 A B V5 V6 A B V7 SYNC 25 16 17 FRAME HOLD. V12 FRAME LINEARITY. V13 FT1 FRAME COILS FRAME AMP. V10 V4 V9 V3 V1,2,5-8, & V11 HTRS V12-15, & V17 HTRS CRT HTR MT1 VOLUME. V8 V9 V10 OP1 V11 CRT S1 V16 T1 V17 LINE HOLD. V14 LINE AMP. V15 LINEARITY. LT1 BRILLIANCE. V18 V19 F.I.





Left : Modifications in Midlands model and, below, component changes

RESISTORS

R	Ohms
1	Deleted
3	1.2 K
6	15 K
7	Deleted
8	15 K
10	4.7 K
13	Deleted
14	15 K
15	150
91	1.2 K
92	3.3 K
93	3.3 K
94	3.3 K
95	1.2 K
96	3.3 K
97	3.3 K

CAPACITORS

C	Capacity
6	300 pF
7	500 pF
8	500 pF
9	Deleted
28	8 pF
30	300 pF
33	300 pF
63	50 pF
64	1,000 pF
65	1,000 pF
66	1,000 pF
67	10 pF
68	100 pF
69	1,000 pF
70	1,000 pF
71	10 pF
72	100 pF
73	1,000 pF
74	1,000 pF
75	1,000 pF

INDUCTORS

L	Ohms
6	Centre Tapped
9	Centre Tapped
45	Very Low
46	Very Low
47	Additional Coupling Coil

RESISTORS

R	Ohms	Watts
1	4.7K	¼
2	150...	¼
3	3.9K	¼
4	100K	¼
5	20K WW Potr.	
6	3.9K	¼
7	6.8K	¼
8	3.9K	¼
9	150...	¼
10	3.8K	¼
11	100K	¼
12	30K WW Potr.	
13	3.3K	¼
14	1K	¼
15	180...	¼
16	10M	¼
17	3.9K	¼
18	47	¼
19	3.3K WW	
20	10K	¼
21	1M...	¼
22	470...	¼
23	220K	¼
24	150...	¼
25	1K WW Potr.	
26	10K	¼
27	33K	¼
28	150K	¼
29	15K	¼
30	20K	¼
31	39K	¼
32	47K	¼
33	47K	¼
34	140K	¼
35	51	¼
36	3.9K	½
37	3.5K WW Potr.	
38	250K	½
39	500K Potentiometer	
40	470...	½
41	250K	¼
42	470K	¼
43A	20K	½
43B	20K	½
44	51	¼
45	180...	½
46	400 WW Potr.	
47	15K	¼
48	1.2K	¼
49	150...	½
50	15K	¼
51	1.2K	½
52	180	¼
53	68K	¼
54	1.2M	¼
55	2.2M	¼
56	33K	¼
57	1M Potentiometer	
58	10K	¼
59	6.8K	1
60	180...	½
61	10M	¼
62	4.7K	¼
63	250K	¼
64	33K	½
65	500 WW	
66	47K	1
67	3.9K	½
68	3.9K	½
69A	100K	1
69B	100...	¼
70	22K	¼
71	47K	¼
72	3.3K	¼
73	2.7K	¼
74	2K WW Potr.	
75	470K	¼
76	470...	1
77	100...	1
78	200 WW Potr.	
79	4.7K	¼
80	1K	¼
81	1.5K WW	
82	2K WW Potr.	
83	150K	¼
84	50K Potentiometer (with switch)	
85	10K	¼
86	4.7K	¼
87	250 WW	
88	2 x 1,000 WW	
89	2 x 180	1
90	2 x 180	1

Note : R59, R61, R62, R86. R87, R44, not fitted to this model tested.

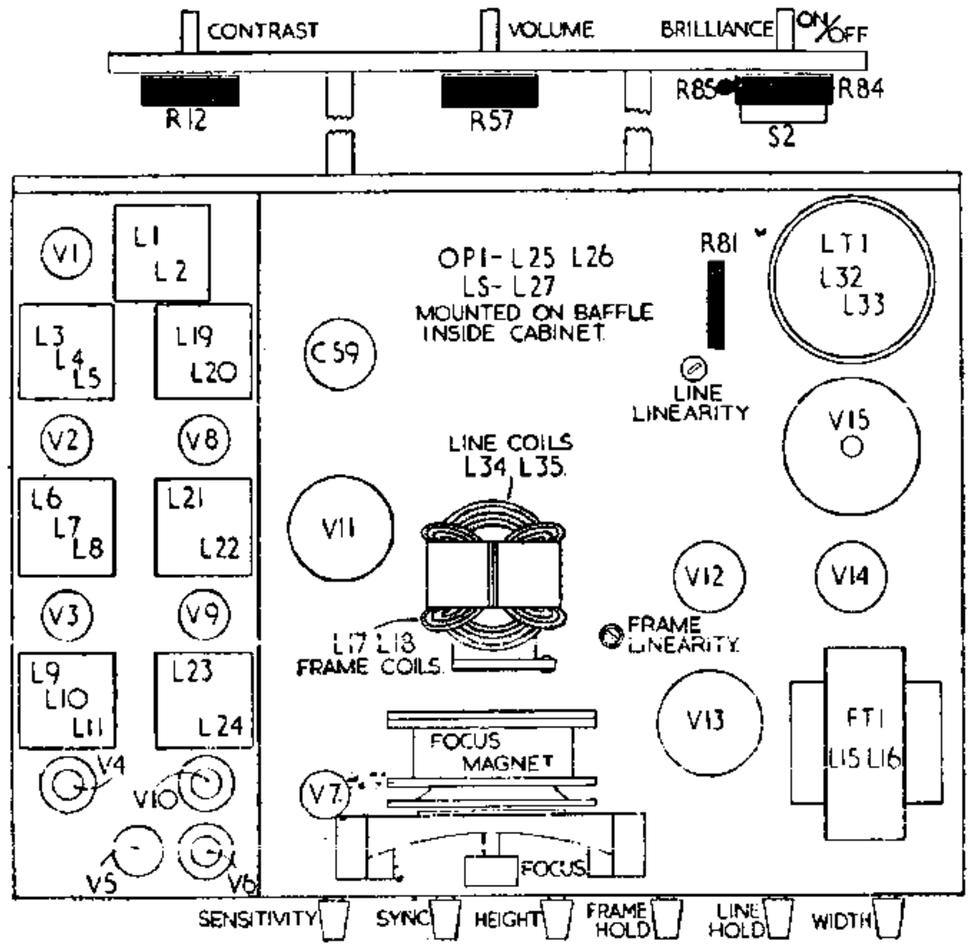
CAPACITORS

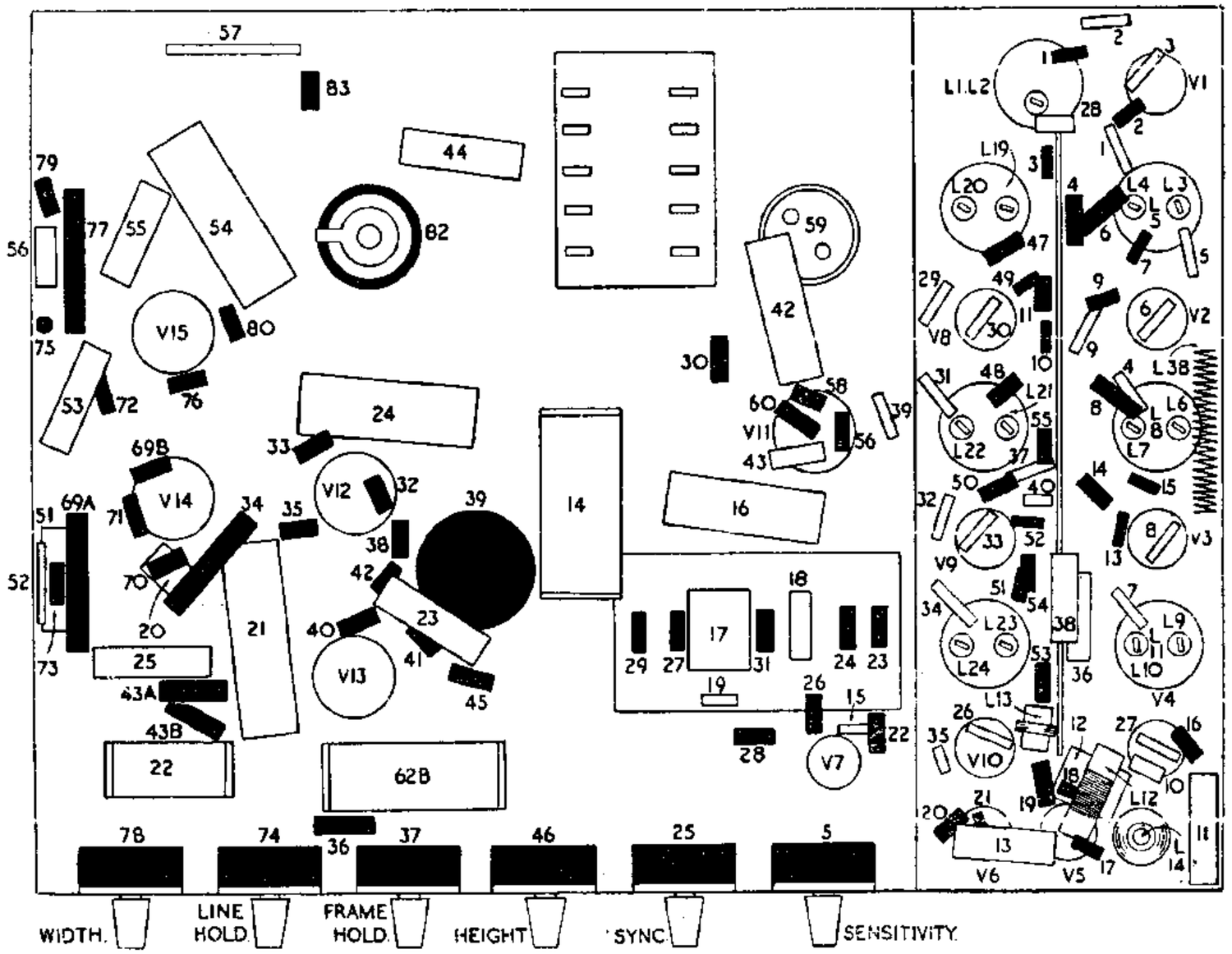
C	Capacity Type
1	1,000pF Tub. C'mic
2	1,000pF Tub. C'mic
3	1,000pF Tub. C'mic
4	1,000pF Tub. C'mic
5	1,000pF Tub. C'mic
6	1,000pF Tub. C'mic
7	1,000pF Tub. C'mic
8	1,000pF Tub. C'mic
9	1,000pF Tub. C'mic
10	6pF Tubular Ceramic
11	.1 Tubular 350V
12	.005 Mica
13	.1 Tubular 350V
14	16 Electrolytic 350V
15	30pF Tubular C'mic
16	25 Electrolytic 25V
17	1,500pF Silver Mica
18	1,000pF Tubular500V
19	20pF Tubular C'mic
20	50pF Mica
21	.5 Tubular 350V
22	50 Electrolytic 25V
23	.02 Tubular 1,000V
24	.5 Tubular 350V
25	.02 Tubular 1,000V
26	1,000pF Tub. C'mic
27	1,000pF Tub. C'mic
28	15pF Tub. C'mic
29	1,000pF Tub. C'mic
30	1,000pF Tub. C'mic
31	1,000pF Tub. C'mic
32	1,000pF Tub. C'mic
33	1,000pF Tub. C'mic
34	1,000pF Tub. C'mic
35	30pF Tubular C'mic
36	.05 Tubular 350V
37	1,000pF Tub. C'mic
38	.05 Tubular 350V
39	1,000pF Tub. C'mic
40	300pF Tubular C'mic
41	4 Electrolytic 350V
42	25 Electrolytic 25V
43	.002 Tubular 500V
44	.1 Tubular 350V
45	480pF Special 7KV
46	480pF Special 7KV
47	1,000pF Mica
48	.05 Tubular 350V
49	.05 Tubular 350V
50	.1 Tubular 1,000V
51	.05 Tubular 350V
52	7,000pF Silver Mica
53	.02 Tubular 1,000V
54	.5 Tubular 350V
55	.05 Tubular 350V
56	.005 Mica
57	5,000pF Silver Mica
58	32 Electrolytic 450V
59	16 x 32 Electrolytic 350V
60	32 Electrolytic 450V
61	16 Electrolytic 450V
62A	.01 Tubular 1,000V
62B	16 Electrolytic 350V
	C41, Not Fitted

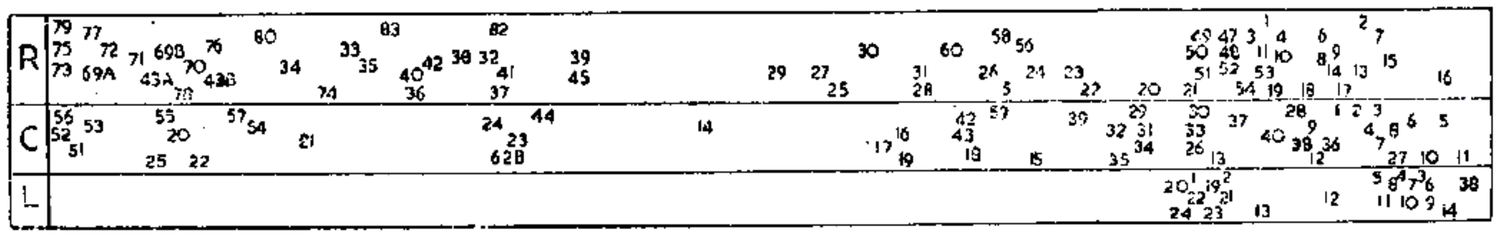
VOLTAGE READINGS

V	Type	A		G2		K	
		50	50M	50	50M	50	50M
1*	6F13/1	190	230	190	210	1.7	1.7
2**	6F13/1	190	210	190	200	1.7	1.6
3	6F13/1	215	220	215	190	1.9	1.9
5	6F13	180	180	235	235	1.0	1.0
7	6F14	10	10	90	90	5	5
8	6F13/1	220	220	190	190	1.9	1.9
9	6F13/1	220	220	190	190	1.9	1.9
11	6P25	220	220	230	230	7	7
12	6K25	110	110	—	—	8	8
13	6P25	310	310	200	200	13	13
14	6K25	70	70	—	—	7	7
15	6P28	320	320	220	220	21	21
16	EY51	—	—	—	—	5.5kV	5.5kV
17	6V6	300	300	150	150	—	—
18 } 19 }	5Z4G	350	350	—	—	400	400
CRT	CRM121	RM 5.5kV	S 5.5kV	—	—	15 to 85†	15 to 85†

Total HT Current, 275mA
* R5 at max. gain. ** R12 at max. gain,
† R85 max./min.







INDUCTORS

L	Ohms.
1-11	Very Low
12	.9
13	4.5
14	5
15	900
16	5
17, 18	9
19-24	Very Low
25	300
26	.5
27	2.5
28	Very Low
29	.5
30	120
31	8
32	100
33	2.5
34, 35	13
36	130
37	130
38-42	Very Low
43	150
44	4 Total

E H T—R F UNIT.