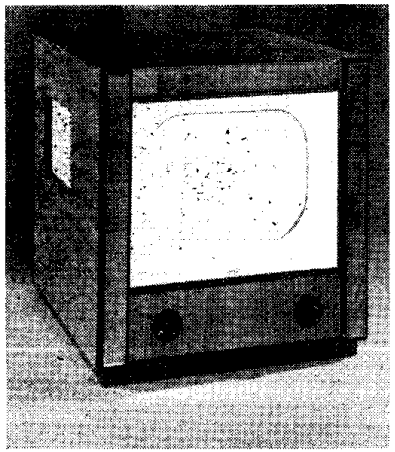
GEC BT2147, BT5144, BT4541



Sixteen-valve, plus CRT, television receivers or London or Birmingham frequencies. Models BT2147, BT5144 are table receivers fitted with 9 and 12-in. tubes respectively, and BT4541 is a console with 12-in. tube and daylight filter. Fringe area models are indicated by the addition of letter "C" and Birmingham frequency models by letter "M" to type number. Suitable for 200-250V 50c/s and also DC mains. Made by The General Electric Co., Ltd., Magnet House, Kingsway, London, WC2.

THE receiver employs TRF circuits with permeability-tuned inductances. On all except London fringe area models the receiver is aligned to operate on lower sideband of vision carrier. Fringe area receivers, which are available for London area only, are aligned to utilise the double sideband carrier and in addition gain of video output stage is increased by doubling the value of the cathode decoupling capacitor.

The first three RF amplifiers are common to both sound and vision channels. Sound noise suppression and vision interference limiting circuits are incorporated. EHT is obtained from line flyback pulses.

Mains consumption is approximately 125 Watts.

Aerial. Input is designed for a 60 to 65-ohm coaxial feeder. Outer screening of coaxial is isolated from chassis by C1 and connected direct to earth socket provided on rear of chassis.

Vision channel consists of four RF amplifiers V1 to V4, signal rectifier V5 or germanium crystal GEX33, video output amplifier V6 and interference limiter V11A.

Aerial signal is coupled by L1, L2 to first RF amplifier V1. Bandpass transformer coupling is employed between V1, V2 and V3. Signal at anode V3 is developed across single-tuned coil L7 and thence capacitively fed by C21 through series sound frequency rejector circuit L9, C22, T2 to L10 in grid of fourth RF amplifier V4. Further sound frequency rejection is given by L8, C19, T1 which is inductively coupled to anode tuned coil L7 of V3.

Output of V4 is bandpass transformer coupled by L11, L12 to diode signal rectifier V5 or to a germanium crystal type GEX33.

Tuned circuits of V1, V2, V3 are damped by R1, R5, R11, R14, R18 to provide wide bandwidth to cover both sound and vision frequencies. Bandwidth of final vision RF amplifier V4 is maintained by damping resistors R24, R26.

Gain of V1, V2 is controlled by R6, the **Sensitivity** control in the common cathode circuit.

Rectified video signal, developed across **Contrast** control R33, is DC coupled through frequency correcting network L14, R37, C32 to video output amplifier V6. Negative video signal at anode V6 is DC/AC coupled through R45, R46, C37 to cathode of CRT.

Interference limiter is diode V11A coupled between grid and cathode of CRT. Anode V11A is biased positively from potential divider R53, R51, R50, R52 and portion R55 which is connected across HT. With flylead plugged into "L" position R50, R51, R52 are shorted out and the bias voltage is such that the diode will only conduct on an interference pulse which is greater than peak white signal—thus the interference pulse is limited to that of peak white of picture signal.

In "M" and "H" positions of the flylead the anode bias of V11A is progressively made more positive by bringing into circuit R52 and R50. This allows V11A to conduct on interference pulses less in amplitude than peak white.

Sound channel. The sound signal, which is amplified with the vision by V1, V2, V3, is developed across rejector circuit L8, C19, T1 and fed by C7 to sound RF amplifier V7. The anode of this is choke-capacity coupled by L15, C11 to tuned coil L16 in strapped signal diode circuit of V8. Rectified signal is developed on R15, C16 and thence fed by C14 to triode section of V8 for amplification, after which it is fed by C20 through noise suppressor rectifier M1 and thence coupled by C24 to **Volume** control R28 in grid of output pentode V12.

Audio output is fed by OP1 into a 6½-in. television type PM speaker. On model BT5144 negative feedback is applied through C70, R90, R91 and **Volume** control R28 from anode to grid of output valve V12.

Noise suppressor. Anode of rectifier M1 is provided with a positive bias from HT line through R25, causing it to conduct to set up a voltage across R23 and C23. The time constant of R25, C23 is such that voltage on C23 will follow that of the audio signal which is fed to it by C20 through M1. When a large amplitude high frequency interference pulse appears with the audio signal, then, because of comparatively long time constant of R25, C23, the cathode of rectifier M1 is driven positive with respect to its anode—thus during the interference pulse no signal is passed.

On later models the noise suppression circuit is fitted between signal diode and grid input of triode AF amplifier section of V8, as shown by dotted lines on circuit diagram. A germanium crystal rectifier type GEX34 or GEX44 is used and audio signal is fed to its anode. In this circuit the rectifier is cut off by negative-going interference.

Sync separator. Video signal at anode V6 is fed through R44, C39 to sync separator V10. The positive sync pulses drive V10 into grid current, and a steady negative bias is set up across R57 sufficient to place the negative video signal below cut off. Thus only the positive sync pulses are amplified by V10. Anode and screen voltages of V10 are kept low to provide a short grid base to ensure separation of sync pulses on weak signals. Line sync pulses are developed across R60 and fed by C36 through R43 to anode of line scan oscillator V13A. Frame sync pulses are developed across R62, C45 and fed by C49 to cathode of interlace filter V11B.

Interlace filter. Cathode of V11B is provided with a positive bias from potential divider R66, R67, and is therefore held cut off. Due to long time constant of C49, R67 the line pulses do not affect the charge set up on C49. The longer duration frame pulses, however, build up a negative charge on C49 which is sufficient to drive cathode V11B negative to its anode—the diode conducts, and the resultant voltage produced across R65, C51 is fed by C55 to anode of frame scan oscillator.

Frame scan oscillator is triode V13B operated as a grid-blocking oscillator with anode to grid transformer back-coupling by FT1. Scan voltage is developed on C50. Variation of rate of charge of C50 by R63 gives **Vertical Hold** control.

Frame amplifier. Oscillator output is fed by C52 through R68 to **Height** control R70 and thence fed through R72 to pentode amplifier V17, the output of which is transformer coupled by FT2 to frame deflector coils L33, L34 on neck of CRT. Negative feedback from anode is applied by C58, R82, R83, R71 through R70 to grid. Variation of feedback by adjustment of R83 gives **Vertical Form** control.

Line scan oscillator is triode V13A operated as a grid-blocking oscillator with anode to grid transformer back-coupling by LT1. Scan voltage is developed in the grid circuit on C35. Adjustment of grid bias by R35 gives **Horizontal Hold.**

Line amplifier. Oscillator output is fed to beam-tetrode amplifier V14. Output waveform at anode is transformer coupled by LT2 to line deflector coils L27, L28 on neck of CRT.

EHT. When V14 is cut off and flyback occurs, the collapsing field in output transformer and scanning coils generates a high back EMF. This is stepped up by the overwind on primary L24 and rectified by V15 to provide EHT of 7kV. V15 heater is energised at line frequency by L25.

Efficiency diode. The back-EMF generated by flyback in its turn collapses. It drives a current through the scanning coils and provides the first part of the trace. Amplitude and rate of change of current are controlled by the damping action of efficiency diode V16, which is now conducting, and the series inductance, **Width** control, L17. During this part of the trace V14 is held off by its grid signal, but the valve comes into operation as the "over-shoot" current dies away.

During first part of trace, V16 conducts and absorbs excess energy, C48 becoming charged above HT. V14 is the load across C48. HT becomes available via V16 as C48 discharges.

HT is provided by a halfwave metal rectifier fed from the input mains through dropper resistors R78, R81. On 230V and 200V mains the voltage adjusting plug at rear of chassis shorts out first R81 and then both R78, R81. On 200V DC provision is made to short out half of the rectifier. Choke-capacity smoothing is given by L18, C53, C56. Vision channel HT line is RF decoupled by C12, C29. Sound channel HT is further resistance-capacity smoothed by R20, C25 and R32, C26.

Reservoir capacitor C56 is rated to handle 500mA ripple current.

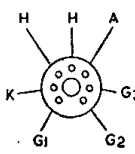
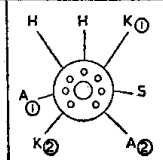
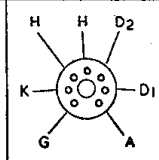
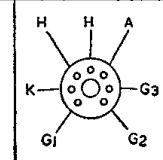
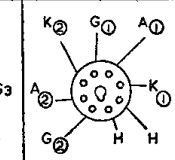
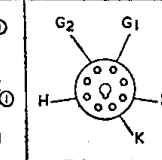
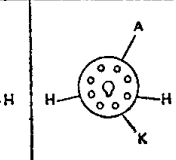
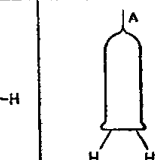
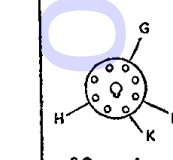
Heaters of all valves except EHT rectifier V15 are series connected and obtain their current from the input mains through dropper resistor R77, R79, R80 and thermal surge limiter R73 shunted by R74. On 230V and 200V mains the voltage adjusting plug shorts out first R80 and then both R79, R80.

CRT is either a 9-in. or 12-in. triode with permanent magnet ring focusing. Model 4541 is fitted with a "daylight" filter.

VALVE READINGS

V	Type	A	G_2	K
1	Z77	211V	211V	1.75V* To
2	Z77	211V	211V	4.2V
3	Z77	212V	212V	1.6V
4	Z77	212V	212V	1.8V
5	D77	—	—	—
6	Z77	199V	225V	2.3V
7	Z77	203V	203V	1.5V
8	DH77	144V	—	.9V
9	6704A	7KV	—	96V
10	Z77	160V	68V	0V
11A	D77	—	—	96V
11B	D77	—	—	35V
12	N37	153V	162V	9.5V
13A	B36	140V	—	0V
13B	B36	158V	—	0V
14	KT36	—	179V	8V
15	U37	—	—	7kV
16	U31	225V	—	275V
17	N37	195V	225V	20V

* R6 max. to min.
TOTAL HT CURRENT = 220mA

Z77	D77	DH77	N37	B36	KT36	U31	U37	6505A – 6704A
								
V1-4,6,7, 10.	V11, 5	V8	V12, 17	V13	V14	V16	V15	V9 - CRT

ALIGNMENT PROCEDURE

Apparatus required. Signal generator to cover 40—50 and 55—65mc/s with variable attenuator and output impedance of 65—70 ohms. AC voltmeter with 100V FSD and internal resistance of not less than 20K ohms, and a 0—500V DC voltmeter.

A non-metallic box-spanner and screwdriver ; a 300 ohm ½-watt damping resistor fitted with crocodile clips.

Procedure. Connect AC voltmeter across primary L19 of OPL. Connect DC voltmeter across anode load R38, R41 of video amplifier V6.

Disconnect lead with clip from video output terminal adjacent to V6. Unscrew two bolts holding RF chassis to side panels of main chassis and withdraw RF chassis to a position that gives access to all tuning cores and trimmers. Re-connect lead with clip to video output terminal. If cores are sealed with Bostick C, loosen the sealing with either benzine or white spirit. Remove screening plate beneath RF chassis.

Place Contrast control R33 and Volume control R28 at maximum. Adjust setting of Sensitivity control R6 to give a 10V change on vision output meter.

Inject 43.5 (L) or 60.25mc/s (M) via 3-ft. lead to co-axial aerial input socket. Connect damping resistor across L11 and tune core L12 for max. output on vision meter (minimum reading).

Remove damping resistor and replace screening plate.

Connect damping resistor across L5 and tune L6 for max. Connect damping resistor across L3 and tune L4 for max. Remove damping resistor and tune L1, L2, L3, L5, L10 and L11 for max.

Inject 41.5 (L) or 56.25mc/s (M) to aerial socket and trim T1, T2 for minimum vision output (maximum reading).

Short circuit T1 and adjust L7 for max. vision output. Carefully re-trim T1, T2 for minimum vision output.

Switch on audio modulation to sig-gen. output and tune L16 for max. on sound output meter.

Sound interference with vision. Should sound interference with vision be experienced, a complete re-alignment may not be necessary and one of the following methods should be adopted to clear it.

Slip line sync. on a BBC programme, so that edge of picture is in centre of screen. With a non-metallic trimming tool adjust T1 and T2 in turn, starting with a low setting of gain and gradually increasing until adequate rejection is achieved.

Carry out 41.5 or 56.25mc/s section alignment procedure.

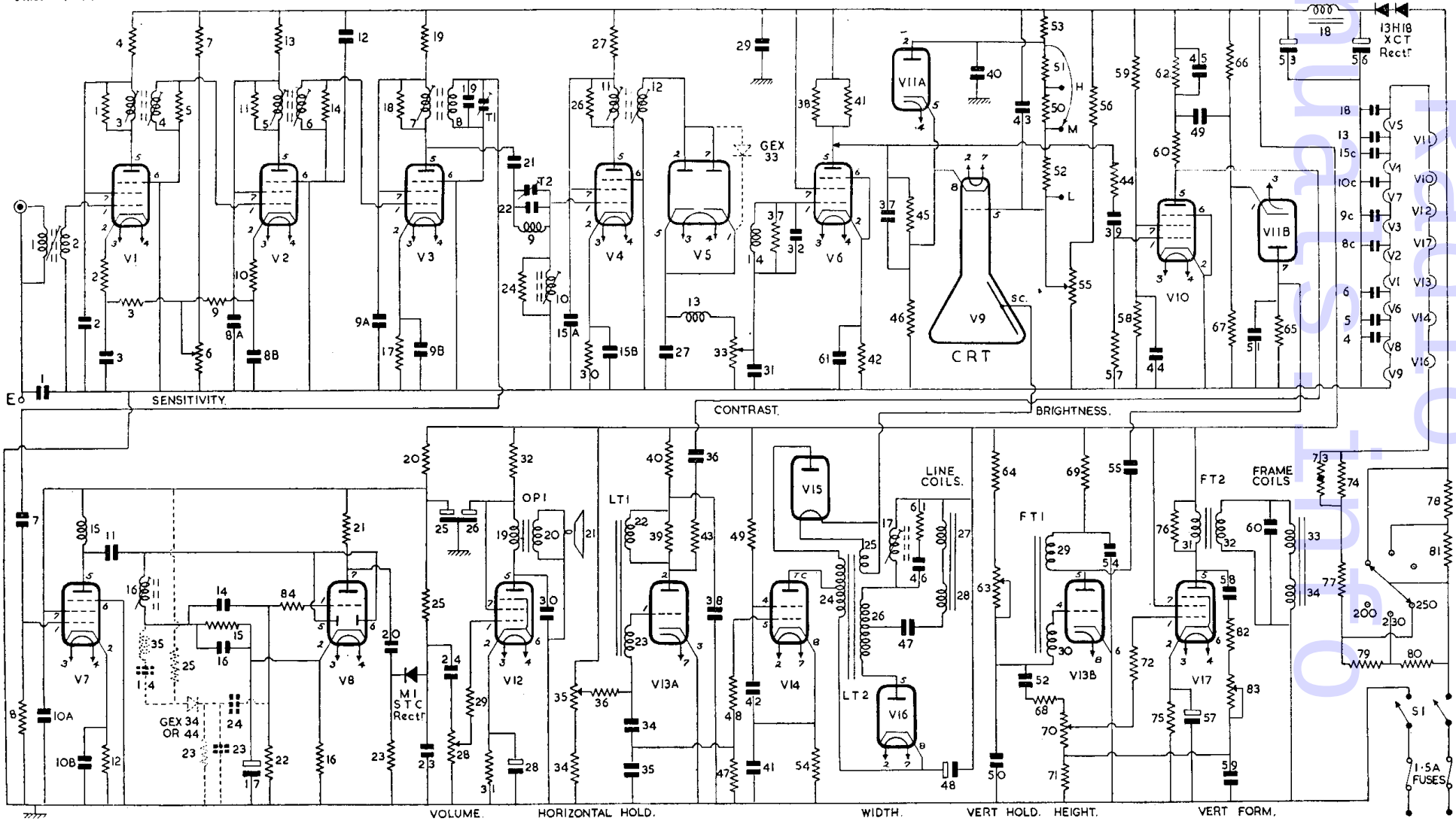
Ensure accurate adjustment of signal generator by beating with a BBC sound transmission before adjustments are carried out.

Sensitivities. Vision : unmodulated input required at aerial socket to produce a 40V change at VF anode : Midlands, 60.25mc/s, and London, 43.3mc/s=100 microvolts.

Sound : modulated input required at aerial socket to produce an output of 50mW is : London/Midlands, 41.5/58.25, 15 microvolts. Figures within +100 and —50 per cent. are considered satisfactory.

RESISTORS

R	Ohms	Watts
1	10K (L) / 22K (M)	½
2	47...	½
3	100	½
4	1K	½
5	3.3K	½
6	5K potr.	2
7	330K	½
8	100K	½
9	100	½
10	47	½
11	22K	½
12	150	½
13	1K	½
14	3.3K	½
15	47K	½
16	1K	½
17	150	½
18	22K (L) / Not fitted on Midland Model	½
19	1K	½
20	2.2K	½
21	56K	½
22	330K	½
23	1M	½
24	1K (L) / 3.3K (M)	½
25	1M	½
26	22K (L) / Not fitted on Midland model	½
27	1K	½
28	500K potr. with dpst switch	



R	Ohms	Watts
29	10K	¼
30	150	¼
31	220	1W
32	1.1K	7W
33	5K potr.	¼
34	56K	1W
35	20K WW potr.	5W
36	130K	¼
37	10K	¼
38	10K	¼
39	4.7K	¼
40	18K	1W
41	10K	¼
42	330	¼
43	22K	¼
44	10K	¼
45	68K	¼
46	68K	¼
47	680K	¼
48	330	¼
49	2.4K	2W
50	10K	½
51	22K	¼
52	10K	¼
53	150K	¼
54	100	1
55	100K potr	¼
56	56K	¼
57	1M	¼
58	33K	¼
59	68K	¼
60	33K	¼
61	390	2W
62	68K	½
63	100K potr.	3W
64	470K	¼
65	470K	¼
66	680K	¼
67	120K	¼
68	680K	¼
69	33K	¼
70	1M potr.	3W
71	470K	¼
72	330	¼
73	CZ1 Thermistor	
74	470 WW	5W
75	1.1K	½
76	33K	½
77	87 WW	8W
78	25 WW	5W
79	100 WW	9W
80	67 WW	7W
81	25 WW	7W
82	56K or 100K	½
83	100K potr.	3W
84	100K	¼
90	3.9K	¼
91	470	¼

C	Capacity	Type
30	.02	750V
31	10pF Tub. Ceramic	
32	18pF	
33	No Component	
34	2000pF Silver Mica	
35	3000pF	
36	200pF Mica	
37	.25 Tubular	350V
38	.01	350V
39	.05	500V
40	.05	500V
41	.1	350V
42	.25	350V
43	.1	350V
44	.05 Tubular	500V
45	.001	350V
46	.02	750V
47	1	250V
48	25 Electrolytic	50V
49	.01 Tubular	350V
50	.1	350V
51	.001	350V
52	.1	350V
53	120 Electrolytic	350V
54	.25 Tubular	350V
55	.01	350V
56	64 Electrolytic	350V
57	50	25V
58	.02 Tubular	750V
59	.01	350V
60	.05	500V
61	{ 815pF (L) Sil. Mica { 1500pF (M)	
70	·05 Tubular	500V

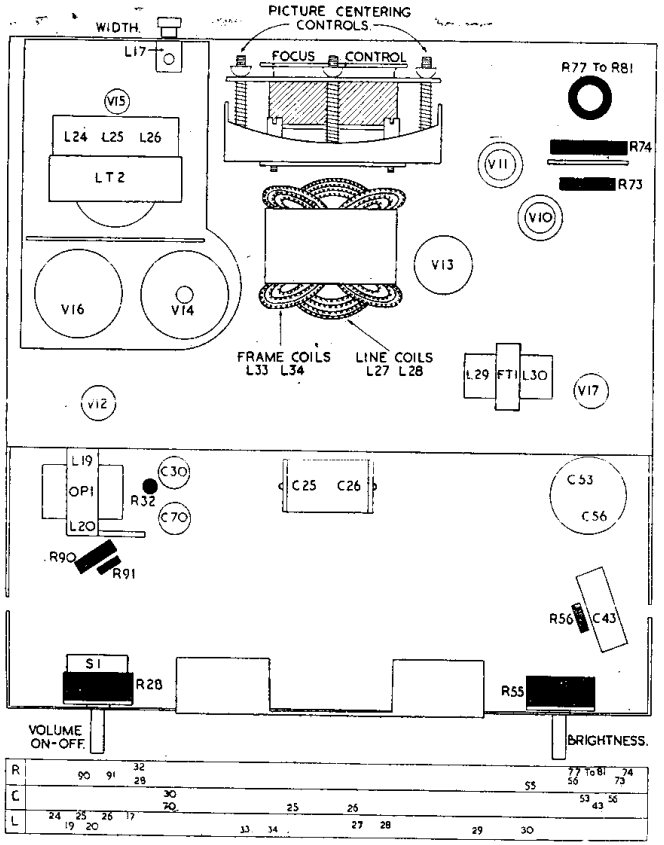
INDUCTORS

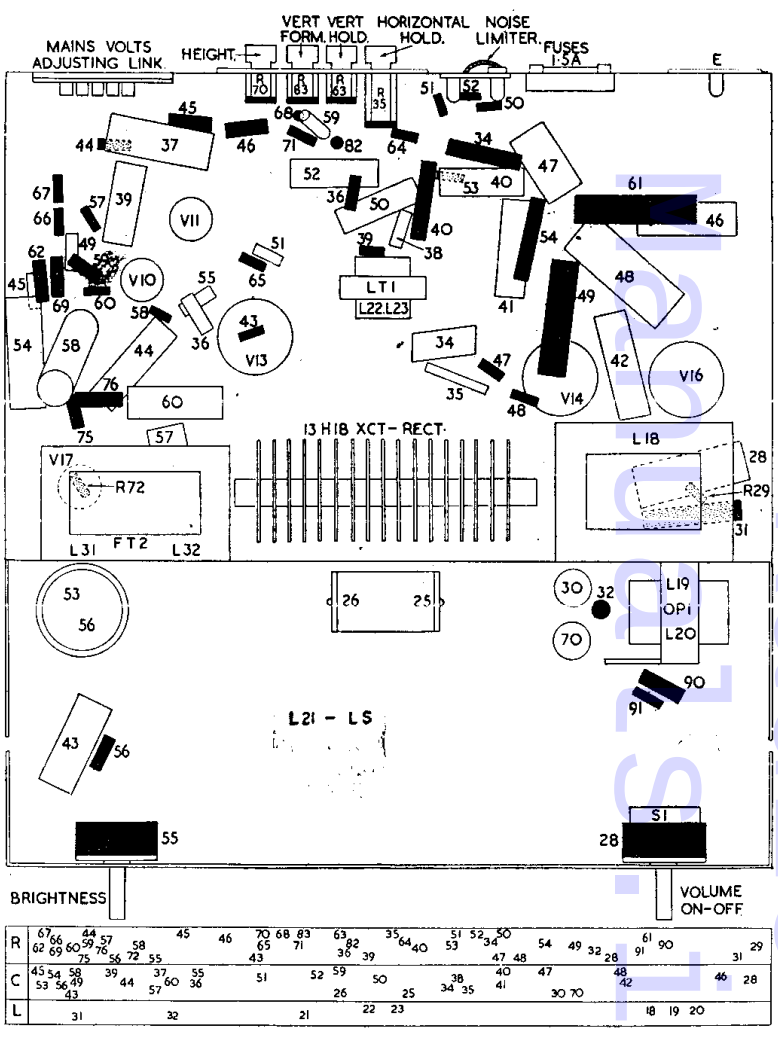
L	Ohms
1—12	very low
13	1.75
14	3.5
15	.25
16	very low
17	5.5
18	80
19	400
20	.5
21	3.5
22	11
23	18
24	280 tapped 65
25	very low
26	6
27 }	13
28 }	

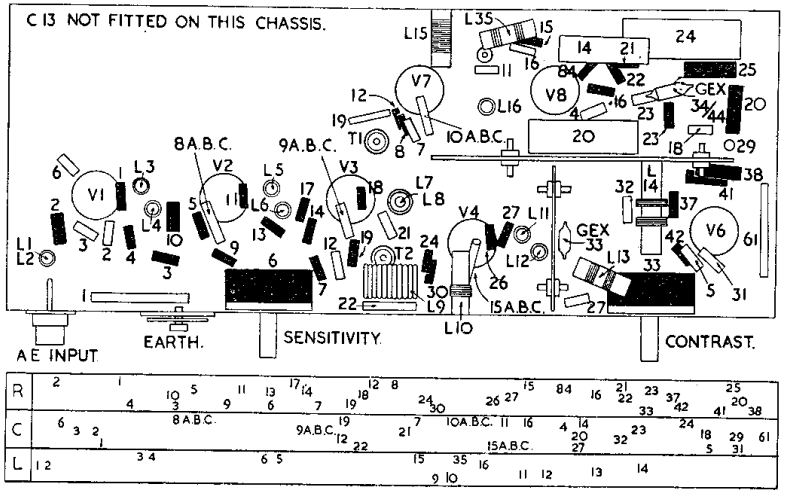
L	Ohms	L	Ohms
29	110	32	8.5
30	420	33 }	30
31	1250	34 }	
		35	2

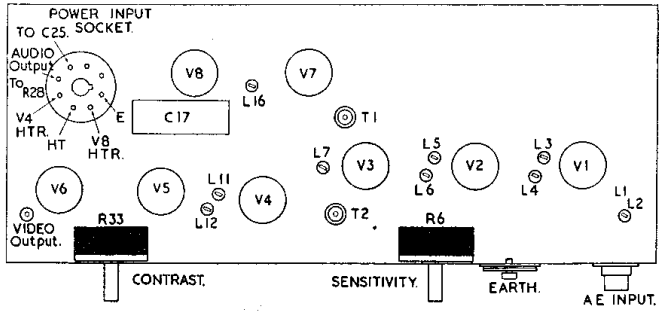
CAPACITORS

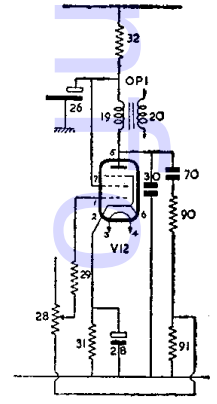
C	Capacity	Type
1	2000pF Silver Mica	
2-6	1000pF Tub.	Cer.
7	4.7pF	
8a-10c	1000pF	
11	4.7pF	
12-13	1000pF	
14	.02	350V
15a-c	1000pF	Cer.
16	4.7pF	
17	.25 Electrolytic	25V
18	1000pF Tub.	Cer.
19	{ 82pF (L) { 56pF (M)	
20	.02 Tubular	750V
21	1000pF	Cer.
22	30pF Silver Mica	
23	1000pF Tub.	Cer.
24	.02	750V
25	8 Electrolytic	450V
26	4	450V
27	10pF Tub. Ceramic	
28	25 Electrolytic	25V
29	1000pF Tub. Cer.	











Right—Sound output stage of BT5144