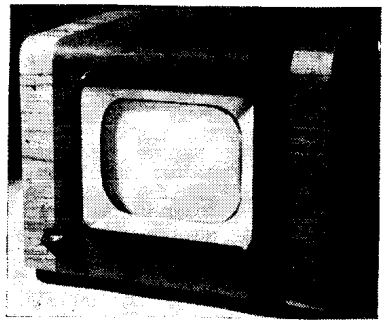
FERGUSON
941, 951

Nineteen-valve AC-DC television receiver with 9in. CRT giving a 7½ by 6in. picture. Walnut veneered cabinet. For 200 to 250V AC or DC mains. Model 941 is for London frequencies and 951 for Midlands. Ferguson Radio Corporation, Ltd., Enfield, Middlesex.



THE receiver has a TRF circuit with permeability tuned coils. First two RF amplifiers are common to sound and vision. Vision interference and sound noise suppression circuits are incorporated. EHT is obtained from line flyback pulses. The receiver is assembled on 14½ by 12 in. chassis.

Model 941T is for operating within 30 miles of Alexandra Palace. In Model 941TS RF alignment is adjusted to give a greater vision sensitivity. ains consumption at 225V is approximately 125W.

Aerial.—75-ohm coaxial feeder is coupled by L1, L2 to first RF amplifier V1. Outer screen of coaxial should be connected to earth and is coupled to receiver chassis through C63.

Vision channel consists of four RF amplifiers, V1 to V4, signal rectifier and interference suppressor V5, and video output V6.

Single peak transformer coupling is used between V1, V2, V3, V4 and signal rectifier V5A. Secondaries L4, L6 are damped by R7, R14 respectively to provide a wide bandwidth to cover both sound and vision frequencies. Tuning of RF stages is staggered to give an overall bandwidth of approximately 4.5 mc/s at 6dB down. Gain of V1, V2 is controlled by R4, the contrast control, in the common cathode circuit.

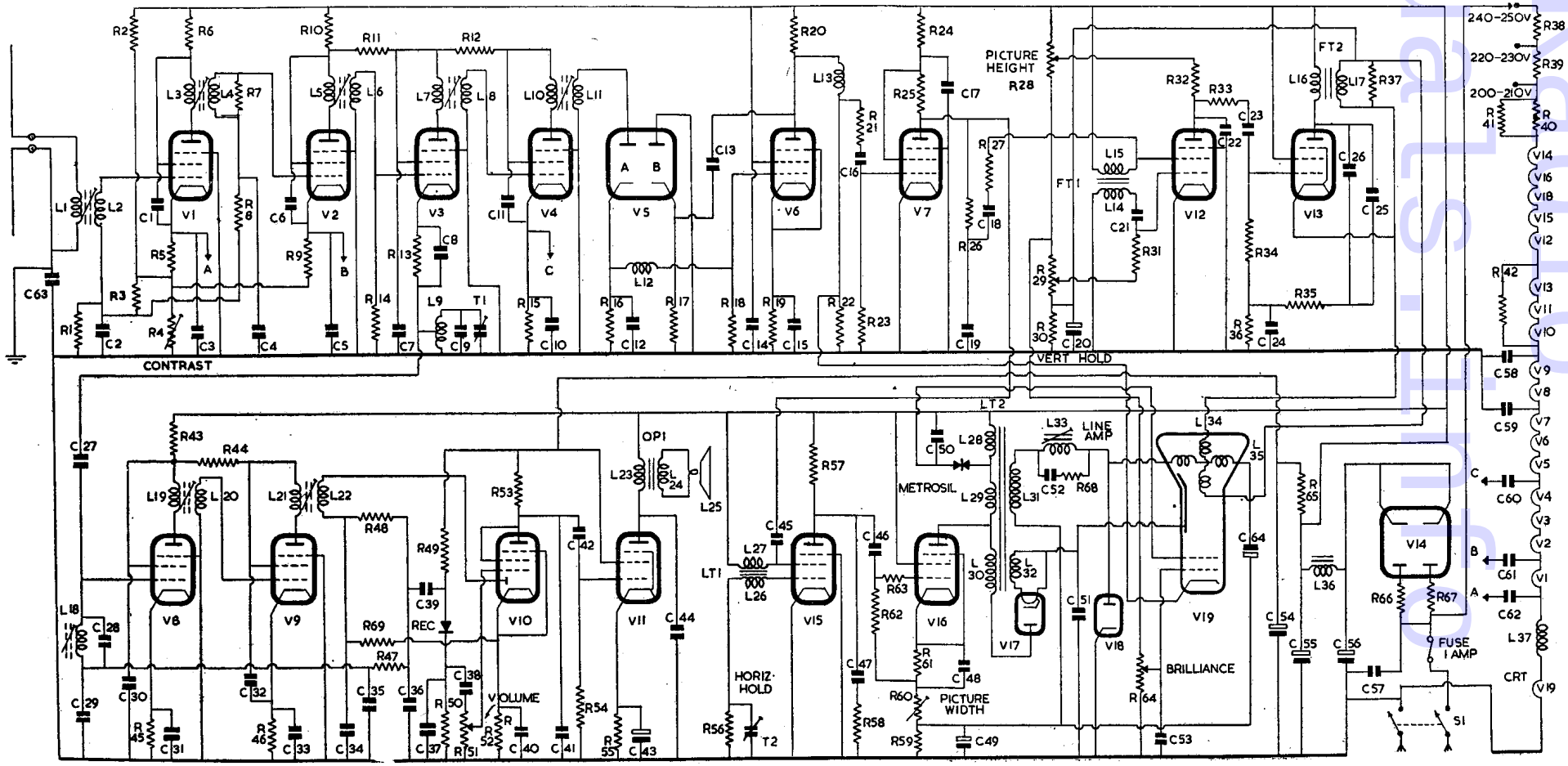
Suppressor grids of V1, V2 are earthed and control grid circuits are returned to a point (junction of R1, R3) which is less positive than the cathodes. This arrangement maintains reasonably constant the input capacity and resistance of the valves irrespective of the setting of R4.

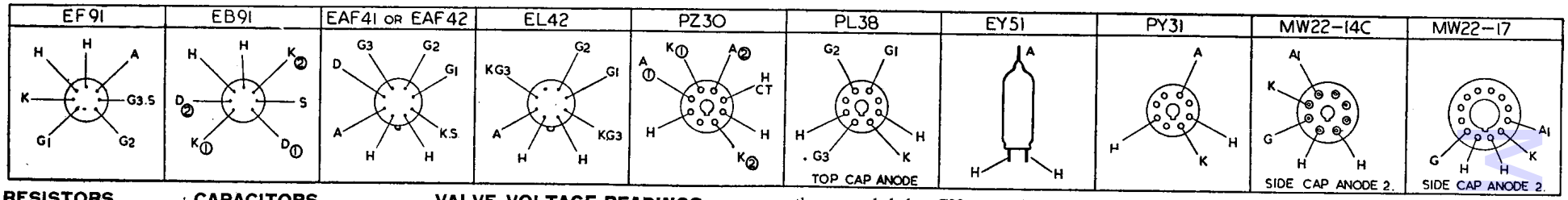
L9 trimmed by C9, T1 in the cathode of V3 is a sound rejector tuned to 41.5 mc/s.

Rectified signal across R16 is DC coupled through peaking choke L12 to video output amplifier V6. V6 is DC coupled through RF choke L13 to cathode of CRT. R22 limits the DC potential between cathode and heater of CRT.

Interference suppressor.—Diode V5B is coupled via C13 to anode of V6, and cathode is normally held just below cut-off by charge on C13, which is equal to "peak white." When a high-frequency negative-going interference pulse appears at anode V6, then due to long time constant of R17, C13, the cathode of V5B is driven heavily negative and V5B conducts and short circuits the interference pulse to chassis.

Sound channel.—The sound signal of 41.5 mc/s is amplified with the vision by V1 and then developed across rejector circuit in the cathode of V3 and fed by C27 to L18 (tuned to 41.5 mc/s) in the grid V8. Single peak transformer coupling leads to RF amplifier V9 and to rectifier diode of V10. The rectified signal developed across R69 is fed by R48 through C39 and noise suppressor rectifier and





RESISTORS

R	Ohms	Watts
1	100K	½
2	68K	1
3	2.7K	½
4	5K WW potr.	
5	150	½
6	470	½
7	22K	½
8	5.6K	½
9	150	½
10	33	½
11	33	½
12	150	½
13	150	½
14	1K	½
15	150	½
16	5.6K	½
17	3.3M	½
18	22K	½
19	390	½
20	10K	2
21	12K	½
22	22K	1
23	1M	½
24	150K	½
25	22K	½
26	22K	½
27	220K	½
28	10K WW potr.	
29	10K WW potr.	
30	330	½
31	680K	½
32	330K	½
33	470K	½
34	1M	½
35	91K	½
36	220K	½
37	150	½
38, 39	50 + 50 (WW) 5	
40	Thermistor type CZ1	
41	350 (WW) 5	
42	190 (WW) 2	
43	150	½
44	470	½
45	470	½
46	1K	½
47	1M	½
48	5.6K	½
49	1M	½
50	1M	⅛
51	500K potr. with sw.	
52	1K	½
53	47K	½
54	1M	½
55	390	½
56	180K	⅛
57	330K	½
58	2.7K	½
59	3.9K	½
60	300 (WW) potr.	
61	33	½
62	150K	½
63	470	½
64	500K potr.	
65	3.9K	½
66, 67	50 + 50 (WW) 5	
68	500 (WW) 3	
69	33K	½

CAPACITORS

C	Capacity	Type
1	500pF	Tub. Ceramic
2	1000pF	Tub. Ceramic
3	500pF	Tub. Ceramic
4	1000pF	Tub. Ceramic
5	500pF	Tub. Ceramic
6	500pF	Tub. Ceramic
7	1000pF	Tub. Ceramic
8	1000pF	Tub. Ceramic
9	50pF	Silver Mica
10	500pF	Tub. Ceramic
11	500pF	Tub. Ceramic
12	4pF	Disc Ceramic
13	.1	Tubular 350V
14	1000pF	Tub. Ceramic
15		Silver Mica
16	.01	Tubular 750V
17	.5	Tubular 350V
18	.1	Tubular 350V
19	.01	Tubular 750V
20	50	Electrolytic 12V
21	.02	Tubular 750V
22	.1	Tubular 350V
23	.5	Tubular 350V
24	.01	Tubular 750V
25	.005	Tubular 1000V
26	.02	Tubular 500V
27	2pF	Ceramic Disc
28	50pF	Silver Mica
29	500pF	Tub. Ceramic
30	500pF	Tub. Ceramic
31	500pF	Silver Mica
32	500pF	Silver Mica
33	500pF	Silver Mica
34	50pF	Silver Mica
35	.1	Tubular 350V
36	50pF	Silver Mica
37	500pF	Mica
38	.01	Tubular 1000V
39	.01	Tubular 1000V
40	1000	Tub. Ceramic
41	50pF	Silver Mica
42	.01	Tubular 1000V
43	.25	Electrolytic 25V
44	.005	Tubular 1000V
45	50pF	Silver Mica
46	.01	Tubular 750V
47	1000pF	Silver Mica
48	.25	Tubular 350V
49	25	Electrolytic 50V
50	1000pF	Silver Ceramic
51	.001	Cathodray 12.5kV
52	.01	Tubular 750V
53	1000pF	Tub. Ceramic
54	8	Electrolytic 350V
55	200	Electrolytic 275V
56	100	Electrolytic 275V
57	.005	Tubular 1000V
58	1000pF	Tub. Ceramic
59	1000pF	Tub. Ceramic
60	500pF	Tub. Ceramic
61	500pF	Tub. Ceramic
62	500pF	Tub. Ceramic
63	1000pF	Tub. Ceramic
64	25	Electrolytic 25V

VALVE VOLTAGE READINGS

	A	G2	K	
V1	233	233	2–56	Contrast max. and min.
V2	238	238	1.9–56	
V3	238	238	2	
V4	235	235	2.1	
V5	—	—	—	
V6	127	238	2.7	Contrast minimum
V7	30	55	—	
V8	236	236	4.7	
V9	235	235	3.2	
V10	89	89	2.9	
V11	219	217	10.4	A = 19.5mA 92 = 3.2mA
V12	70	238	—	
V13	202	238	11.7	A = 20.5mA 92 = 3.4mA
V14	220 RMS	—	247	Total HT current = 230mA
V15	44	238	—	
V16	235	238	2.75 Bias.	A = 70mA 92 = 22mA
V17	—	—	5.5KV approx.	
V18	-24	—	—	A = 96mA
V19	A_2— 5.5KV	A_1— 402	127	G1–k bias for 1 microamp beam current = 41V.

Readings taken with receiver connected to 225 Volt AC mains supply. Mains consumption is .57 Amps.

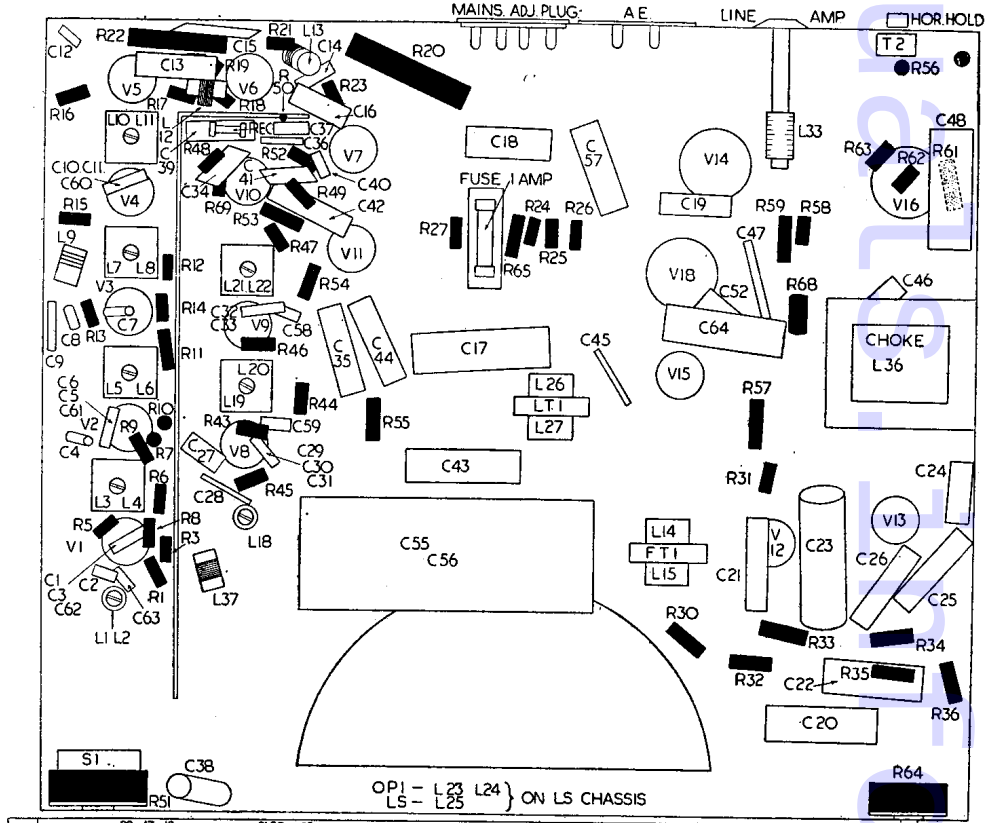
INDUCTORS

L	Ohms	L	Ohms
1–11	very low	27	11.5
12	3.25	28	19
13	1	29	28.5
14	400	30	350
15	200	31	10
16	1500	32	very low
17	7	33	7
18–22	very low	34	6
23	500	35	6
24	.5	36	32
25	2.5	37	1.5
26	23		

then coupled by C38 to volume control R51. After audio amplification by V10, V11, the signal is fed into a special 6½in. television type PM speaker.

Noise suppression.—The metal rectifier is provided with positive voltage from HT by R49. It conducts and produces a voltage across R50. At the same time the rectified audio signal is fed by C39 through rectifier to R50. The time constant of R50, C37 is such that the voltage across R50 will follow that of the audio signal. When a high frequency interference pulse is passed on by C39 the rectifier will be cut off, due to the sudden negative potential on its anode—its cathode remaining substantially positive, due to the comparative longer time constant of R50, C37. Thus, during the period of interference no signal is passed by the rectifier and the interference pulse is removed from the audio signal.

AVC.—The DC component of the rectified



audio signal is fed by R48 through decoupling network R47, C35, C36 and L18 to grid of V8.

Sync. separator.—Signal at anode of video amplifier V6 is fed through R21, C16 to grid of sync. separator V7. The positive sync. pulses drive V7 into grid current and a steady negative bias is set up across R23. This bias is sufficient to place the negative video signal beyond cut-off, and therefore only the positive sync. pulses are amplified by V7. R24, C17 function as a voltage dropping network to reduce anode and screen voltages, thus shortening valve grid base to ensure sync. separation on weak signals.

Line sync. pulses are fed by C45 to screen (g2) of line scan oscillator V15. Frame sync. pulses are integrated by R26, C19 and fed through C18, R27, to screen of frame scan oscillator V12.

Frame scan oscillator is pentode V12 operated as a grid-blocking oscillator with screen to grid transformer back-coupling. Frequency is determined by time constant of R31, C21. Scan voltage is developed on C22. Adjustment of oscillator anode voltage by R28 gives control of picture height, and variation of bias voltage to g1 by R29 gives vertical hold control.

Frame amplifier.—Oscillator output is fed by R33, C23 to grid of pentode amplifier V13. Transformer FT2 in the anode circuit feeds scanning waveform to frame deflector coils L34 on the neck of CRT. R37 damps out line oscillations due to mutual inductance between line and frame deflector coils. Secondary L17 of FT2 is connected in series with cathode circuit of V13 to introduce negative feedback. Cathode resistor R30 decoupled by C20 is connected in series with bleeder network R28, R29, across the HT supply to provide a stabilised bias voltage. Negative feedback is also applied by C25, C26, R35, R36, C24 from anode to grid of V13. R33 maintains a high grid impedance to enable the negative feedback voltages to be applied to the grid.

Line scan oscillator is pentode V15 operated as a grid blocking oscillator with screen to grid transformer back-coupling. Frequency of oscillation is determined by time constant of R56, T2—adjustment of T2 gives horizontal hold control. Scan voltage is developed on C47. R58 gives waveform correction.

Line amplifier.—Oscillator output is fed by C46, R63 to grid of pentode amplifier V16. Transformer LT2 in the anode circuit feeds scanning waveform to line deflector coils L35 on the neck of the CRT. L33, which is a variable inductance in series with the line deflector coils, enables amplitude of line waveform to be adjusted. Fine control of picture width is given by R60, which varies the amount of negative feedback in the cathode of V16.

Power efficiency diode.—V18 rectifies the shock oscillations set up in LT2 at end of scan when V16 is cut off and provides a negative voltage of approximately 30V across R59, C49, which increases the effective anode and screen voltages to V16.

L33 shunted by R68, C52 damp out any shock oscillations which are not removed by V18. C64 isolates the DC set up by V18 from the deflector coils.

EHT of approximately 5.5kV for final anode of CRT is obtained by rectifying the high surge voltage developed across primary L28, L29, L30 of line output transformer LT2 when V16 is cut off. Filament current for the rectifier V17 is obtained from auxiliary winding L32. C51 is EHT smoothing and reservoir capacitor.

Screen or first anode of CRT is supplied with HT, obtained by rectifying by means of a Metrosil, the pulses set up across L28 and adding this to the line HT voltage. A potential of 200V is developed across reservoir capacitor C50, which, added to the line voltage, provides approximately 400V for the first anode of CRT.

HT is provided by an indirectly heated twin rectifier V14. Its anode voltages are obtained from the mains input through limiters R66, R67. Cathodes are strapped together. Choke-capacity smoothing is given by L36, C55, C56. C56 should be rated to handle 500mA of ripple current.

ALIGNMENT INSTRUCTIONS 941

(1) Connect signal-generator to aerial socket by short length of coaxial. Connect output meter across or in place of speaker.

An instrument for indicating sensitivity is also required. A Model 7 Avometer can be used if connected as follows: Set instrument to 2mA DC range and connect positive lead via a 50K resistor to cathode of CRT. The resistor must be connected close to pin of CRT base. Connect negative lead to slider of Vertical Hold control. Connected thus, the meter will indicate 100V full scale deflection.

With no signal input, adjust Vertical Hold so that 20V is obtained on the meter.

Turn Sound Volume (R51) and Contrast (R4) to maximum.

(2) Inject 41.5mc/s (modulated) and adjust T1 for maximum deflection on sensitivity meter.

(3) Adjust L21-22, L19-20, L18 for maximum deflection on output meter.

(4) Inject 43.5mc/s and adjust L10-11 for minimum deflection on sensitivity meter.

(5) Inject 48mc/s and adjust L7-8 for minimum deflection on sensitivity meter.

(6) Inject 43mc/s and adjust L5-6 for minimum deflection on sensitivity meter.

(7) Inject 48mc/s and adjust L3-4 for minimum deflection on sensitivity meter.

(8) Inject 44mc/s and adjust L1-2 for minimum deflection on sensitivity meter.

(9) Repeat operations (2) to (8) until no further improvement is obtained.

Alignment of model 94ITS is similar, with the exception that in operations (5), (7) and (8) signal generator should be adjusted for frequencies of 46.5mc/s, 46.5mc/s and 43.5mc/s respectively.

Sensitivity

Vision sensitivity at 45mc/s input should be 200 microvolts (94IT) and 50 microvolts (94ITS) for a meter deflection of 10V.

Sound sensitivity at 41.5mc/s modulated input should be 20 microvolts for an output of 50mW for both models.

CIRCUIT OF MODEL 951

The 951 table model television receiver closely resembles the 941, and almost the only difference lies in the vision and sound RF circuits. The differences are due to higher frequency and single side-band operation of the Sutton Coldfield transmitter. A circuit of V1 to V5A (vision channel) and of V8, V9 (sound channel) is given below, with a list of components which differ in value or are in addition to those of model 941. It should be noted that in certain instances decoupling capacitors are not only of a different value from those in 941, but also occupy a different circuit position.

Vision channel is aligned to 61.75 mc/s, the tuning being staggered to provide the requisite bandwidth. L39 tuned to 58.25 mc/s in series with the anode circuit of second vision RF amplifier V2, is a sound rejector.

Further sound rejection is given by L9, C9 in cathode of V3. Adjacent channel sound rejection is provided for by L38, T3 tuned to 63.25 mc/s, which are tapped on to secondary L11 of transformer coupling final vision RF amplifier to signal rectifier V5A.

Sound channel.—The sound signal of 58.25 mc/s, which is amplified together with vision signal by RF amplifiers V1, V2, is developed across sound rejector circuit L39 in anode of V2, and coupled by C27 to L18, C28 (tuned to 58.25 mc/s) in grid of first sound RF amplifier V8.

ALIGNMENT INSTRUCTIONS 951

(2) Inject 58.25 mc/s (modulated) and adjust L9 for maximum deflection on sensitivity meter.

(3) Adjust L39 for maximum deflection on sensitivity meter.

(4) Inject 63.25 mc/s and adjust T3 for maximum deflection on sensitivity meter.

(5) Inject 61 mc/s and adjust L1-L2, L3-L4, L5-L6, for minimum deflection on sensitivity meter.

(6) Inject 59.75 mc/s and adjust L7-L8, L10-L11, for minimum deflection on sensitivity meter.

(7) Inject 58.25 mc/s (modulated) and adjust L18, L19-L20, L21-L22, for maximum deflection on output meter.

(8) Repeat operations (2) to (7) until no further improvement is obtained.

Sensitivity.—Vision sensitivity at 61.75 mc/s input should be 400 microvolts for a meter deflection of 10V.

Sound sensitivity at 58.25 mc/s modulated input should be 40 microvolts for an output of 50mW.

RESISTORS

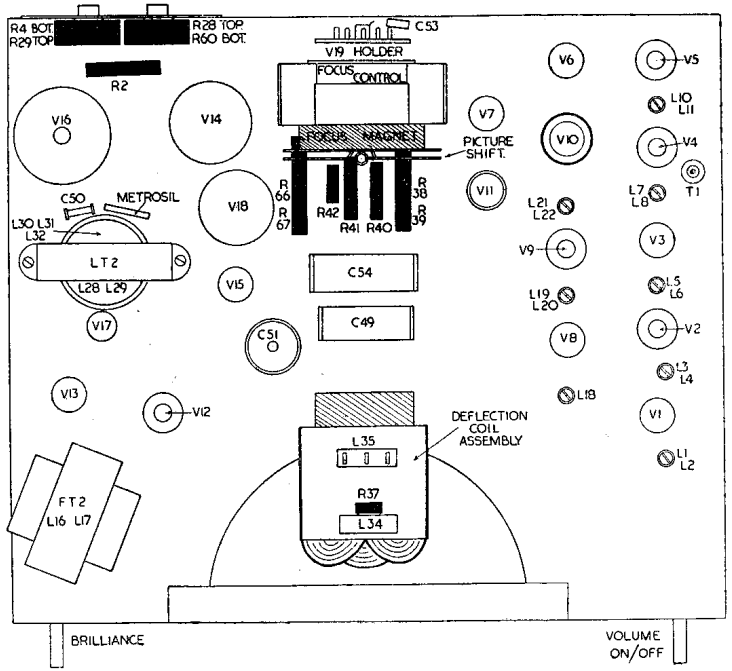
R	Ohms
3	3.3K
8	100K
14	680
45	1K
46	150

All ½W

CAPACITORS

C	pF
1-8 ...	680 Tubular Ceramic
9-12 ...	15 Silver Mica
14 ...	680 Tubular Ceramic
15 ...	300 Silver Mica
28 ...	30 Silver Mica
29, 32, 40, 53—680	Tubular Ceramic
58, 59—500	Tubular Ceramic
61, 62, 63—680	Tubular Ceramic
65 ...	500 Tubular Ceramic
66 ...	220 Tubular Ceramic
67 ...	680 Tubular Ceramic
68 ...	15 Silver Mica
69 ...	30 Silver Mica

TOP LAYOUT OF MODEL 941



HF CIRCUIT OF MODEL 951