SERVICE CASEBOOK

Next time you solve a sticky problem, either radio or TV, describe your triumph in a letter to the Technical Editor, " Electrical and Radio Trading," 189, High Holborn, London, WC1. Practical workshop tips are also welcome and, like all contributions, are paid for on acceptance.

EKCO RADIO-TELEVISION T.S.C. 105

THIS set developed a loud hum after running about 15 minutes on television. Smoothing faults were ruled out as the set was normal with the volume control at minimum. As modulation hum was suspected, it was decided to check the RF section first. At this point the radio section was tried but no trace of hum was present.

Back to the television. A new set of valves was tried without result. There remained only the UY42 rectifier in the radio unit—but, as this section did not show any fault on broadcast surely this valve was OK ? However, a new rectifier was tried just to be certain. This cleared the fault.

As a further check, two more valves were tried, and they proved OK but the hum appeared with the original valve. I don't profess to know the answer to this fault but it does appear to be something to do with the difference in the radio and television frequencies.—T.W.

MURPHY V116

THE set came in for intermittent picture size and on test was found to work satisfactorily until suddenly the picture size would decrease and the focus alter. Test carried out revealed that when the picture size decreased the main HT voltage decreased.

Normally this fault is caused by one of the fuses in the anode circuit of V17 (UU8) being open circuit. However, in this case the fuses were OK and so C69 32mF reservoir condenser was next suspect. When a condenser was temporarily connected across it made no difference but if the condenser was connected between the chassis and the HT line the set became normal.

Careful examination revealed that the negative terminal of the condenser went to chassis via a solder tag under one of the mains transformer fixing nuts and this tag was not making a sound connection.—M.J.

FAULTY RF BYPASS

SYMPTOM : lack of contrast due to insufficient vision gain. Fortunately, most post-war television receivers use mica bypass capacitors having a value in the region of 1,000pF. The set was a pre-war superhet having a comparatively low vision IF, as a result, the bypass capacitors were of the non-inductive paper type, having a value of 2,000pF.

The set had three IF stages and it was noticed that when a 400c/s modulated test signal was fed into the first IF valve grid, the resulting output was less than that obtained when the signal was fed to the grid of the second IF.

Cathode bias was checked, and it was found that the voltage was less than half of the correct value. The anode voltage was checked and found to be normal but on checking the screen grid it was found that this was at only 10 to 15 volts. This was regarded as being a fairly accurate measurement since the meter had a resistance of 20,000ohms per volt. Since the screen voltage was obtained direct from the HT line via a series resistor, the only component fault possible was the RF bypass capacitor.

The capacitor was removed and tested on a 250V Megger. Resistance reading showed approximately 3,000ohms. This had caused an excessive current drain and a high IR drop in the series resistor. Before a replacement was made, a screen voltage check was taken and found to be normal.—K.K.

PYE D19T

THIS set came in for service and after being put right the normal check of the controls was undertaken. During this the line linearity control C25A was adjusted and the set left on test. After working satisfactorily for about an hour the vision suddenly went off. Adjustment of the brightness control failed to produce a raster and the EHT voltage was found to be nil.

A careful check of the line time base circuit revealed that the anode of VIL, the line scan oscillator, was short circuited to chassis. This was due to C25A the line linearity control. When the control had been adjusted the sharp edge of one of the moving plates had pierced through the mica insulator.—M.J.

LOW WATTAGE

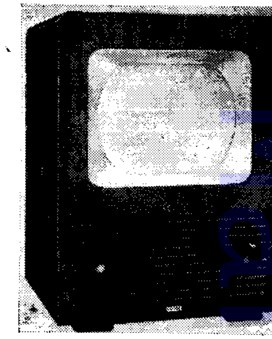
SYMPTOM : poor contrast and unstable time base locking. This fault occurred on a popular home-constructed television receiver, and was traced to the anode load resistor in the phase splitting valve which followed the VF amplifier. The valve was an EF50 connected as a triode, the sync. pulses being taken from the anode, and the picture signal being fed from the cathode. In the specification the load resistor R24 had a listed value of 4,700ohms and was rated at ¼watt. This appeared to be inadequate in this particular case, as it was noted that the resistor was badly blistered. On test, it showed a value of only 2,000 ohms, which meant that the sync. voltage output was reduced and the picture signal output was lower than the optimum for good contrast. The resistor was replaced with a ½ watt type and no further trouble experienced.—K.K.

INVICTA MODEL 200

SYMPTOM : loud squeal at near or full volume. Not having a service sheet handy, the set was checked for faulty valves, voltages, etc., but to no avail. It was noticed that there was no fixed tone condenser and, knowing what can happen to new sets these days, a condenser was tried, which only made things worse. Borrowed a chart and found an unusual circuit with negative feed back. Apparently the set requires a bypass condenser up to its full value. This unit, which is across a split resistor giving bias to a double diode HF pentode and the output valve, was found to be about 3mF and fitting a new one cleared up the trouble.—T.W.

COSSOR 916, 917

Seventeen-valve superhet television receivers with 10in. CR tube giving a 9¼ by 7in. picture. For 200-250V 50c/s AC. Model 916 is table model with 6½in. speaker and model 917 a console with 8in. speaker. Made by A. C. Cossor, Ltd., Highbury Grove, London.



THE receiver, mounted on a sub-chassis, has a superhet circuit on both sound and vision ; the RF amplifier and frequency-changer stages are common to both channels.

Aerial.—The aerial input is designed for 80 ohm concentric cable, of which the outer is isolated from the chassis by C2, and the inner connected to the aerial coil L1 primary via C3. The RF valve V1 is coupled to the mixer V2 by an over-coupled bandpass circuit L2. The mixer has a coil L3 tuned by C8 in its screen feed and oscillates at 32mc/s by virtue of the screen-grid to control-grid capacity.

Vision channel.—The vision IF channel has bandpass circuits tuned to 13mc/s and the lower sidebands, with sound IF absorption circuits in coils L4 and L6 ; a further sound IF rejector circuit L8 is fitted in the cathode of V4.

Gain of V1 and V3 is controlled by R35 in the common cathode circuit. The valve input capacity is corrected by leaving R3 and R11 un-by-passed.

The rectifier diode (one-half of V5) is directly coupled via the IF filter L10 to the video valve V6. To maintain a good high frequency response a correction choke is fitted in the anode circuit of this valve. CRT cathode is connected directly to V6 anode.

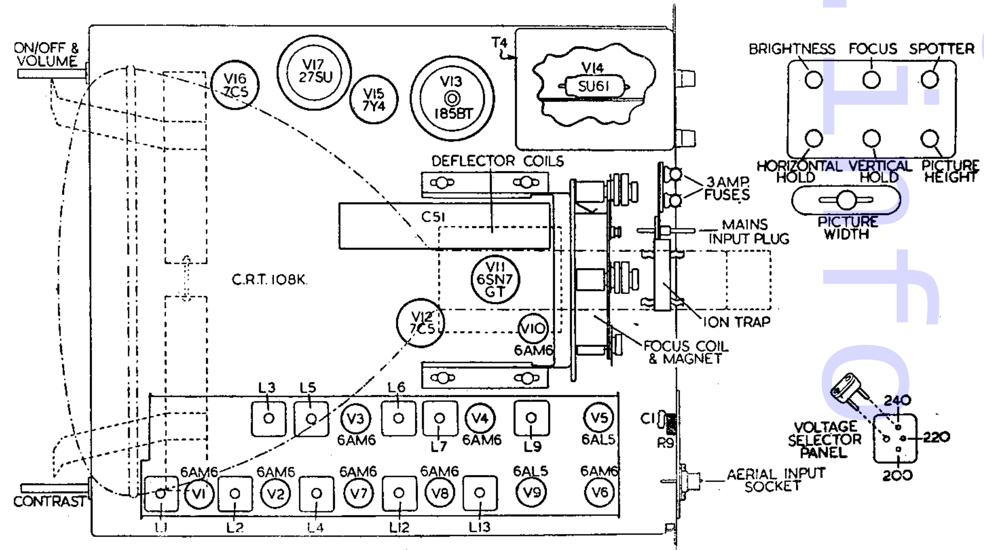
Sound channel.—Sound IF (9.5mc/s) is taken from the sound absorption circuit L4 and after passing through two stages of amplification (V7 and V8) is rectified by the first half of the double diode V9. The second diode in V9 is used as a limiter on impulsive noise interference in the audio signal, which is afterwards fed through volume control R73 and output valve V16 into an energised speaker.

V7 has automatic gain control applied from the detector diode of V9 via filter network R27, C28. Delayed AGC is obtained since the metal rectifier W1 holds the AGC supply line at chassis potential until a rectified signal is available large enough to back off the positive potential applied through R28.

Sync. Separator.—Synchronising pulses are fed from the anode of V6 through R20 and C33 to the grid of the separator valve V10. The positive sync. pulses drive the valve into grid current and produce sufficient negative bias to cut off the valve during picture signals. Thus only synchronising pulses are amplified by the valve.

Frame trigger pulses are developed across the integrating circuit C34, R37. Separation of the

(Continued overleaf)



pulses is achieved because the longer frame pulses have sufficient time to build up across the condenser C34, whereas the line pulses are smoothed out. The integrated pulses trigger the frame blocking oscillator valve V11 on its anode. Stability of frame sync. in the presence of noise is maintained by feeding back the negative pulse generated in the grid circuit of the oscillator to the suppressor grid of V10, so that no further pulses can be passed for a short period following the firing of the timebase.

Line trigger pulses are developed across the anode and screen loads of V10 and fed via R39 and R43 through C36 to the anode of the line blocking oscillator valve. The values of the resistors are so proportioned that the amplitude of the line pulses is not materially affected by the suppressor grid potential.

Timebase generators.—A double triode valve V11 is used in conjunction with the back coupled transformers T1 and T2 to generate the saw-tooth waveforms required for the timebases. The frame frequency is primarily determined by the time constant in the grid circuit (C38 and R51) and is adjusted by varying the voltage applied to it from the potentiometer chain R55, R56. The amplitude of the frame is adjusted by varying the voltage applied to the blocking oscillator circuit from the potentiometer R57.

The line frequency is primarily determined by the time constant of the grid circuit (R46 and C37), and is adjusted by varying the voltage applied to it from the potentiometer chain R44, R45.

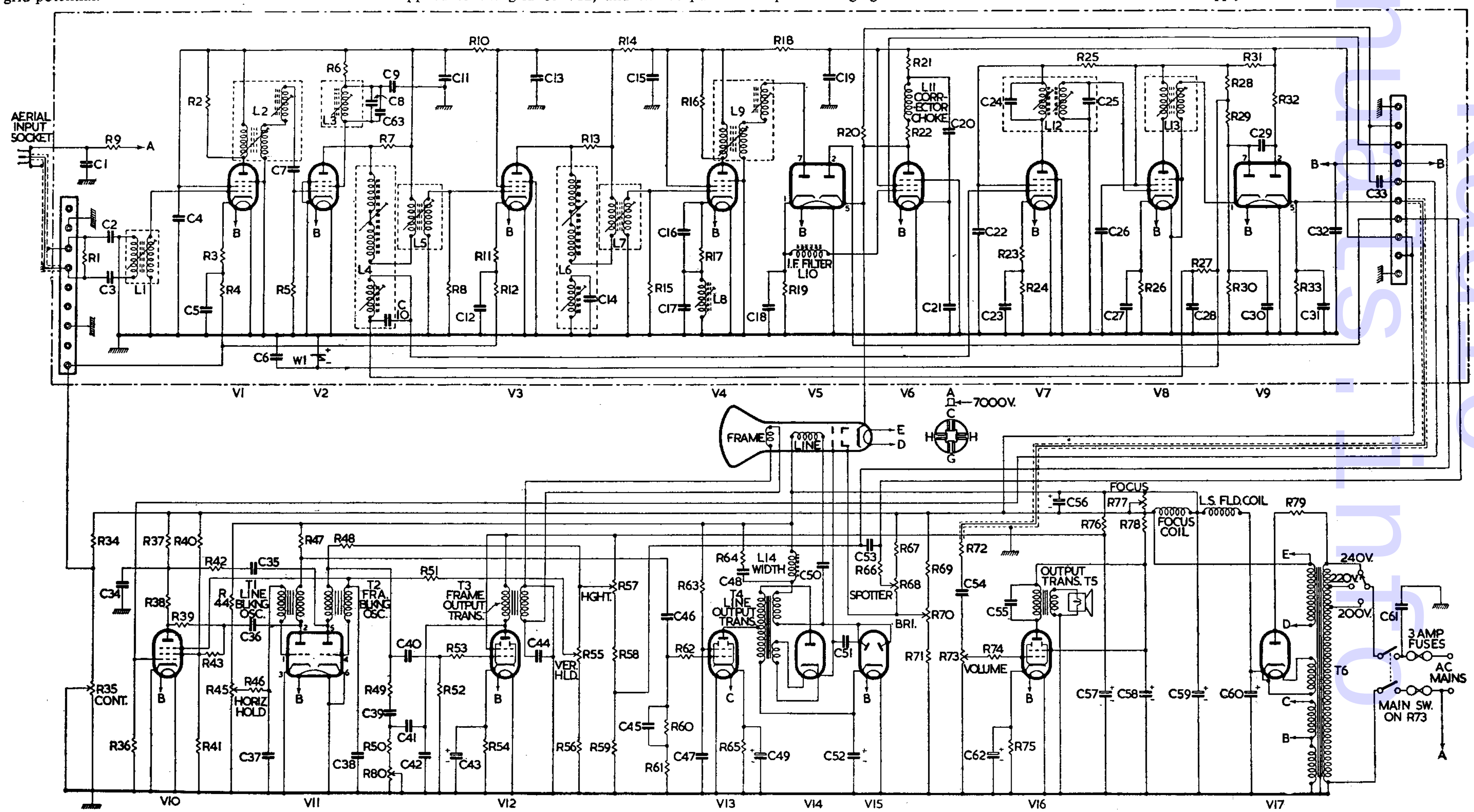
Frame amplifier.—The frame saw-tooth waveform is applied to the grid of V12, and the output is coupled to low-impedance frame deflector coils by means of the transformer T3. The output current waveform is linearized by means of the feedback network C41, R50, C39 and R49 connected between grid and anode. The value of R50 is selected to give the best overall linearity. Capacitors C42 and C44 are connected across the transformer to filter out line pulses which may be fed back through the mutual inter-action between the line and frame deflector coils.

Line amplifier.—The line saw-tooth waveform (adjusted to the correct amplitude by selection of R47) is amplified by V13, and the output coupled to the line deflector coils by means of the transformer T4. The amplitude of scan is varied by a series inductor L14, shunted by R64 and C48 to prevent ringing.

During the line scan the damper diode V15 conducts, and apart from maintaining the linearity of the scan, it uses the stored-up energy in the deflector coils to build up a voltage across the smoothing condenser C52 which is added to the HT supply obtained via L14, the secondary of the transformer T4, and V15, to provide extra HT for the amplifier V13.

EHT supply.—EHT for the CRT is obtained by rectifying the stepped-up voltage developed across the primary of the line output transformer when the valve V13 is cut off. V14 is the rectifier valve whose heater current is derived from a tertiary winding on T4. EHT is smoothed by C51 and applied direct to the anode of the CR tube.

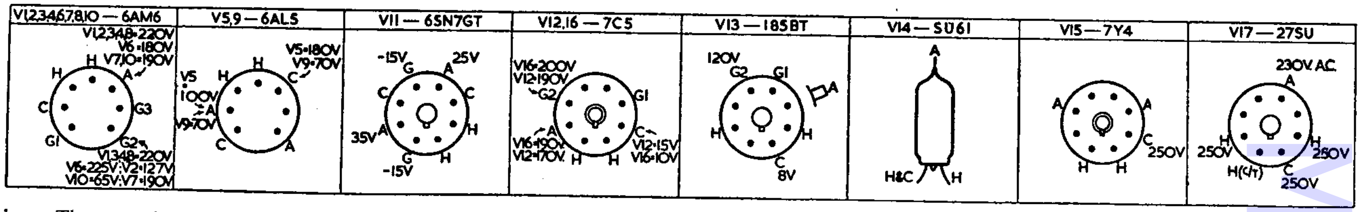
Power supply.—The mains transformer T6 is



used to provide heater supplies in the normal fashion, but the primary is used as an auto-transformer for the HT which is taken from the 240V tap, half-wave rectified by V17, and smoothed by the loudspeaker field plus C59 and C60. R79 is inserted to limit the peak current drawn by the rectifier to a safe value.

Cathode-ray tube.—This is a 10in. triode, fitted with an ion trap magnet to prevent ion burn on the tube, and focused by a ring permanent magnet with a subsidiary coil through which part of the HT current passes. The shunt resistance R77 determines the amount of this current and thus acts as a focus control. C56 by-passes any ripple in the HT which may affect the uniformity of focus. Picture brightness is set by R70 which adjusts the modulator grid bias.

Interference suppression.—Sound.—If a pulse of interference is rectified by the first diode in V9 then, as a very short time constant R30, C30 has been chosen, the anode potential can fall very rapidly. This negative pulse is transferred by C29 to the anode of the second diode in V9. Owing to the RC network in the cathode circuit, the cathode potential can fall only at a rate determined by its time constant, and so the diode open circuits, and the pulse are severely limited. The value of the cathode time constant R33, C31 has been chosen to give the most acceptable compromise between freedom from interference, and the possibility of clipping on the higher audio frequencies.



Vision.—The anode of the video valve V6 is directly connected to the cathode of the second diode in V5, whose anode is taken through R66 to the spotter control R68. C53 is connected between the diode anode and the cathode of the video valve.

In normal use the spotter control is adjusted so that the diode just begins to conduct on peak white in the picture. If a burst of car ignition interference of amplitude greater than peak white is received, the diode conducts and the condenser C53 acts as an effective short circuit while being charged by a pulse.

During the interval between ignition pulses, the extra charge on the condenser can leak away through R66. The effect of R66 is to make the setting of the control far less critical, by allowing the potential of the condenser to follow that corresponding to areas of peak white in the picture.

In the presence of very heavy interference, the interference itself becomes the effective peak white in the picture, and the control becomes ineffective. Under these conditions, by deleting R66, the diode can be made to limit at a definite value of peak white, but the setting will be fairly critical.

NOTES ON TESTING

Correct alignment of the vision coils requires the use of a wideband sweep generator and curve tracer, and is best undertaken by the manufacturers and for this reason no alignment procedure is given. For check purposes however, the response should be as follows: Flat within 1dB between 43 and 44mc/s, rise of not more than 1½dB at 42.5mc/s, between 4 and 6dB down at 45mc/s, and more than 45dB down at 41.5mc/s.

For Sutton Coldfield add 16.75mc/s to all the above frequencies.

Sound IF coils L12 and L13 are adjusted to give maximum sound output when injecting a modulated signal (400c/s at 30 per cent.) at 9.5mc/s into the grid of V2, keeping the signal small enough to avoid operating the AGC. The oscillator coil iron core can best be set by attaching a voltmeter across R24, and adjusting for a minimum reading on this meter using an actual transmission. It is important that the iron core be firmly sealed with wax after adjustment has been made.

Sensitivity is approximately 10 microvolts for 200mW watts sound output and 25 microvolts for full tube modulation (15V approx.).

Testing can be carried out by normal methods except for the timebases where an oscilloscope is of value. The EHT points are not lethal, but RF burns may be sustained from physical contact. The only dynamic test which can be carried out is with an electrostatic meter of less than 100 microamps loading. It is unlikely that the failure of the scan during testing will damage the tube except due to disconnection of the scanning coils.

RESISTORS

R	*Ohms*	*Tolerance %*
1	4.7M	20
2	5.6K (L mdls.)	10
3	33	10
4	150	10
5	27K	10
6	33K	10
7	10K	10
8	56K	10
9	1M	20
10	270	20
11	33	10
12	150	10
13	10K	10
14	270	20
15	5.6K	10
16	22K	10
17	180	10
18	270	20
19	3.9K	10
20	10K	10
21	2.7K	10
22	4.7K	10
23	33	10
24	150	10
25	2.7K	20
26	180	10
27	27K	10
28	4.7M	20
29	470K	10
30	100K	10
31	270	20
32	1M	20
33	2.2M	20
34	270K	20
35	2K Pot.	
36	470K	20
37*	22K	20
38	10K	20
39	560K	20
40*	56K	20
41	39K	20
42	560K	20
43	220K	20
44	180K	20
45	30K Pot.	
46	270K	20
47*	390K / 470K / 560K	10
48*	1M	10
49	27K	20
50	100K 917L and M	10
	330K 916L and M	10
51*	2.2M	5
52	2.2M	20
53	10K	20
54	680	20
55	30K Pot.	
56	33K	20
57	10K Pot.	
58†	4.7K	20
59	120	10
60	330K	10
61	3.3K	20
62	1K	20
63	10K	20
64	1K	5
65†	82	20
66	270K	20
67	27K	20
68	30K Pot.	
69*	18K	10
70	20K Pot.	
71*	12K	10
72	33K	20
73	500K Pot.	
74	10K	20
75	330	20
76	1K	20
77	500 Pot.	
78†	470	20
79	210	5
80	0.5M Pots. 917L and M only	

All resistors ¼W type, except *½W and †1W and R63, R76, 2W, R64 3W(vit) and R79 5W (vit). R2 omitted from 916M, 917M.

CAPACITORS

C	*pF*	*Type*
1*-5*	1000	
6	0.1 mF	500V
7	100	5%
8	916L and 917L 47	2%
	916M and 917M 27	2%
9*	1000	
10	39	2%
11*	1000	
12*	1000	
13*	1000	
14	47	2%
15*	1000	
16*	1000	
17	1000	5%
18	5	20% Ceramic
19*	1000	
20	0.003mF	350V
21	0.01mF	150V
22	0.003mF	350V
23*	1000	
24	47	2%
25	47	2%
26*	1000	
27	0.01mF	150V
28*	1000	
29	0.01mF	150V
30	33	10% Ceramic
31*	1000	
32*	1000	
33	0.02mF	20% 350V
34	0.002mF	20% 350V
35	1000	10%
36	47	20%
37	220	10%
38	0.02mF	10% 350 V
39	0.02mF	10% 350V
40	0.1mF	20% 350V
41	0.02mF	10% 350V
42	0.01mF	20% 350V
43	100mF	25 V Elect
44	1mF	15% 350V
45	1000	10%
46	0.01mF	20% 350V
47	0.1mF	20% 350V
48	0.01mF	20% 350V
49	25mF	25V Elect
50	0.5mF	20% 350V
51	0.001mF	10K V
52	8mF	Elect. 350V
53	0.1mF	20% 350V
54	0.02mF	20% 350V
55	0.01mF	20% 1KV
56	100mF	50V Elect
57	16mF	350V Elect
58	16mF	350V Elect
59	100mF	350V Elect
60	60mF	350V Elect
61	0.01mF	25% 600V
62	25mF	25V Elect
63	10 (916M and 917M only)	5%

* *High K type*

INDUCTORS

Resistances in ohms.

		Prim.	*Sec.*
Line osc. trans.		43	61
Line output trans.		59	—
,, ,, ,,	EHT	355	7.5
Frame osc. trans.		220	320
Frame output trans.		1,180	3.2
Audio output trans.		407	V. low
Mains trans.	200V	15	V. low
,, ,,	220V	16.5	V. low
,, ,,	240V	18	V. low

Deflector coils, line and frame, 7 ohms each
Focus coil 500 ohms