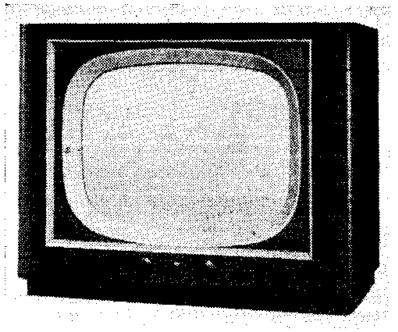
FERRANTI
14T3, 17T3, 17K3

Prices and release dates: 14T3, £65 2*s.* 0*d.* (£48 13*s.* 11*d. plus* £16 8*s.* 1*d. tax*), *April* 1953; 17T3, £82 19*s.* 0*d.* (£62 0*s.* 11*d. plus* £20 18*s.* 1*d. tax*), *April* 1953; 17K3, £111 6*s.* 0*d.* (£83 5*s.* 1*d. plus* £28 0*s.* 11*d. tax*), *April* 1953.

Fifteen-valve five-channel television receivers fitted with single-lever channel-selector switch. Suitable for 200-250V 50c/s AC and DC. Mains consumption is 140W. Manufactured by Ferranti, Ltd., Moston, Manchester, 10.



THE receivers employ a superheterodyne circuit operating on lower sideband of vision carrier, with RF, frequency-changer, and first IF stages common to both vision and sound channels.

Channel selection is by means of a single lever positioned at rear of chassis.

Aerial input, RF anode, and oscillator coils have special sliding spring loaded tuning cores with insulated extension plungers. Cores are depressed to their individual tuning points by adjusting screws carried on circular disc operated by Channel Selector lever. Separate screws are provided for each channel, the appropriate screws being brought into position over each coil plunger when selector lever is moved into any one of its five locating slots. Vision interference and sound noise suppression circuits are incorporated. EHT is derived from line flyback pulses.

Model 14T3 employs a 14in. rectangular grey-screen CRT and is housed in a table cabinet. Models 17T3 and 17K3 are fitted with a 17in. rectangular grey-screen CRT and are housed in table and console cabinets respectively.

Aerial input circuit is designed for 80 ohm coaxial feeder. Outer screen of feeder, which is connected direct to earth terminal of receiver, is isolated from chassis by R1 C1.

RF stage. Aerial signal is transformer coupled by RFT1 to grid of RF amplifier V1, the gain of which is controlled, together with that of common vision and sound IF amplifier V3, by **Contrast** control R64 in their common cathode circuit. Negative feedback developed across R2 preserves shape of input response curve with variation of gain of V1. Amplified RF signals at anode V1 are developed across L3.

Frequency-changer is V2 operated as a combined oscillator and mixer. A Colpitts type oscillatory tuned circuit, formed by L4 C7 C8 C9, is connected between screen and grid through C11, the screen voltage being obtained from R7. Automatic bias for grid is developed on C11 with R6 as leak.

RF signals at anode V1 are capacitively fed through C6 and mixed with oscillator signal on grid V2 to produce across L5 in the anode circuit a vision IF of 15.75Mc/s and a sound IF of 19.25mc/s. R8 provides damping to give wide bandwidth.

Vision and sound IF signals at anode of frequency-changer V2 are fed by C14 to tuned coil L6 damped by R12 in grid of common vision and sound IF amplifier V3. Gain is controlled, together with that of RF amplifier V1, by **Contrast** control R64 in their common cathode circuit. Negative feedback developed across R9 preserves shape of IF input response curve with variation of gain of V3. Amplified vision and sound signals are developed across L7 in anode circuit.

Vision channel consists of one further IF amplifier V4, demodulator diode V5A, interference limiter V5B, and video amplifier V7.

Vision signal at anode of V3 is fed by C18 through series sound rejector L8 C21 to grid of final vision IF amplifier V4. Amplified signal developed across tuned coil L9, damped by R17, in the anode circuit, is passed by C24 to tuned circuit L10 C26 in demodulator anode V5A. Further sound frequency rejection at 19.25mc/s is given by L11 C28 which is comparatively long time constant of R45 C46 the connected through C27 between anode V5A and chassis.

Demodulated signal, filtered by L15, is developed across R28 in grid of video amplifier V7. Cathode bias of this valve is stabilised by connecting its cathode load resistor R25 in series with earthy end of sync separator V8 screen voltage potential divider R29 R33. L16 C42 C43, tuned to 3.5mc/s, in cathode V7 eliminates a "dot" interference pattern produced by beat frequency of vision and sound IF signals. Video output at anode is fed direct to cathode of CRT.

Interference limiter is diode V5B. Rectified video signal is applied to its anode and its cathode is biased positively through R26, from **Limiter** control R41. R41 is normally adjusted so that at peak white signal V5B just remains cut off. When interference pulses greater than peak white occur then diode conducts and provides a low impedance path to chassis through C41.

Sound channel. Sound signal of 19.25mc/s is taken from anode V3 and fed by C18 C32 to L12 in grid of sound IF amplifier V6.

Amplified signal is developed across L13 damped by R22 in its anode, and capacitively coupled by C35 to tuned coil L14 in crystal demodulator X1 anode circuit. Audio signal produced across R23 C38 is fed through R24 to Volume control R43 and thence coupled by C51 to grid of triode AF amplifier V10A. Grid is returned to centre tap of a potential divider, formed by R46 R47, across the common cathode bias resistor R54, of V10A V10B, in order to give correct biasing conditions for triode section V10A.

Amplified audio signal at anode V10A is fed through series noise limiter diode V9B, and thence coupled by C56 to grid of pentode sound output amplifier V10B. Output is transformer coupled by OP1 to a 6½in. PM speaker in models 14T3, 17T3, and to an 8 in. PM speaker in console model 17K3.

Noise limiter. Cathode V9B is connected direct to anode of AF amplifier V10A, whilst its anode is biased positively from HT line via R61. Time constant of R61 C54 is such that at normal audio frequencies charge on C54 follows that of the signal applied to cathode V9B. When a large amplitude high-frequency interference pulse appears with the audio signal, then due to comparatively long time constant of R61 C54, the anode potential of V9B is unable to follow, and on the positive swing of interference pulse the diode is cut off.

Sync separator. Video signal at anode V7 is fed by C44 to grid of sync separator V8. Positive sync pulses of waveform cause grid current to flow and the resultant bias set up across R28 holds the valve cut-off during picture signal, but allows it to conduct on positive-going sync pulses.

Frame sync pulses are integrated on R31 C45 and fed by C46 to cathode of interlace diode V9A. Cathode V9A is positively biased from potential divider R44 R45 and is thus held cut off. Due to comparatively long time constant of R45 C46 the short duration line sync pulses are attenuated and charge built up on C46 remains unaffected. The longer duration frame sync pulses, however, build up a negative charge on C46, which is sufficient to drive cathode V9A negative to its anode—the diode conducts, and the resultant voltage produced across R48 is fed through C52 to anode of frame scan oscillator V11A.

Line sync pulses are developed across R32 and applied through C69 R104 to grid of line scan oscillator and amplifier V13.

Frame scan oscillator is triode V11A operated as a grid-blocking oscillator with anode to grid transformer back-coupling by FT1. Scan voltage is developed across R58 R59 in the grid circuit. Variation of grid voltage by R55 gives **Vertical Hold** control. Waveform appearing across charge capacitor C55 in the anode circuit, is fed by C71 to grid of CRT to cut off scanning beam during flyback period.

Oscillator HT is obtained from boosted HT line through R57 and **Height** control R49. Vertical hold is maintained with variation of picture height by connecting R55 R56 to slider of R49—thus as oscillator HT is varied the bias voltage applied to its grid is altered accordingly.

Frame amplifier. Oscillator scan voltage is fed by C58 through R70 to grid of pentode frame amplifier section of V11. Amplified output waveform at anode is auto-transformer coupled by FT2 to low impedance frame deflector coils L20 L21. C61 is DC isolating capacitor whilst R77 R78 provide damping and prevent interaction between line and frame deflector coils. **Vertical Linearity** is controlled by R74, which adjusts the amount of negative feedback applied from anode back to grid through feedback network C64 R71-73 C66 C65.

Line scan waveform is generated by self-oscillating pentode V13 in conjunction with efficiency diode V12. The valve is caused to oscillate by anode to grid back-coupling through secondary L36 of LT1 the grid current being limited by R85. Frequency of oscillation is controlled by **Horizontal Hold** R87 in the grid circuit. V12 is arranged to conduct on the overshoot of the flyback pulse and provides the first part of the scanning stroke. At the same time a DC charge is built up on C68 which is added to HT line voltage. The boosted HT voltage is used to feed anode V13, anode of frame oscillator V11A, and applied through decoupling network R81 C80 to first anode of CRT.

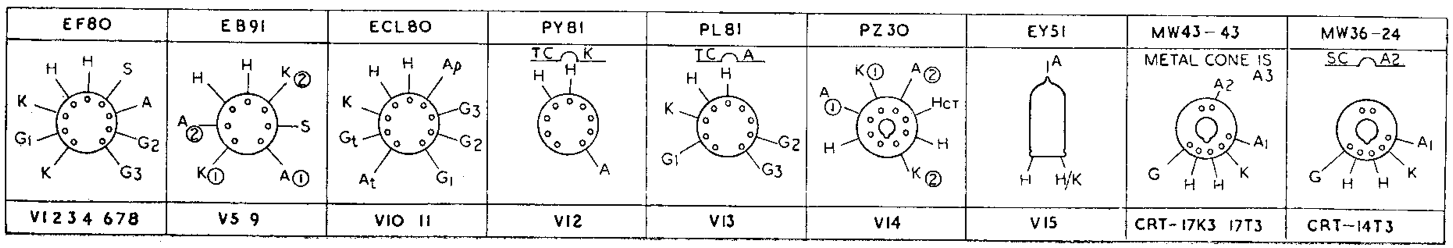
Scanning waveform is auto-transformer coupled

Continued overleaf

VOLTAGE READINGS

V	Type	A	G2	K	Remarks
1	EF80	205	206	3-5.4	R64 Max.-Min.
2	EF80	206	85	0	
3	EF80	207	207	3-5.4	R64 Max.-Min.
4	EF80	208	208	2.8	
5A	EB91	—	—	.2	
5B	EB91	.2	—	1.5-5	R41 Min.-Max.
6	EF80	212	212	3.5	
7	EF80	155	205	3.5	
8	EF80	50	50	0	
9A	EB91	—	—	16	
9B	EB91	23	—	105	
10A	ECL80	105	—	8	
10B	ECL80	187	195	8	
11A	ECL80	95-135	—	8	R57 Min.-Max.
11B	ECL80	195	205	8	
12	PY81	212	—	410	
13	PL81	No Reading	130	7.5-9	R87 Max.-Min.
14	PZ30	210 RMS	—	220	
15	EY51	—	—	13kV	MW36-24
				14kV	MW43-43
CRT	MW36-24	13kV	20	155	Grid 0-40
CRT	MW43-43	14kV	20	155	R99 Min.-Max.

Total HT current = 250mA.
Mains current = 600mA.



by section of primary L38 of LT1 to low impedance line deflector coils L23 L24. Width is controlled by variable series inductance L25 shunted by R94 C74, whilst **Horizontal Linearity** is adjusted by movement of a permanent magnet in close proximity to a further series inductance L22 damped by R95. R101 C78 and R102 C79, which are shunted across deflector coils, damp out ringing oscillations set up during flyback. RF chokes L26 in the cathode, and L27 L28 in the heater V13 are fitted to reduce radiation of line pulses which cause interference with near-by radio receivers.

EHT of 13kV (model 14T3) or 14kV (models 17T3, 17K3) is obtained by rectification by V15 of the high surge voltages set up across primary L38 and its overwind L39 when V13 is cut off at end of line scan. EHT is smoothed by C77 and fed direct to final anode of CRT.

HT is provided by indirectly heated half-wave rectifier V14 which is fed from mains through 1 amp fuse F2 and tapped dropper resistor formed by

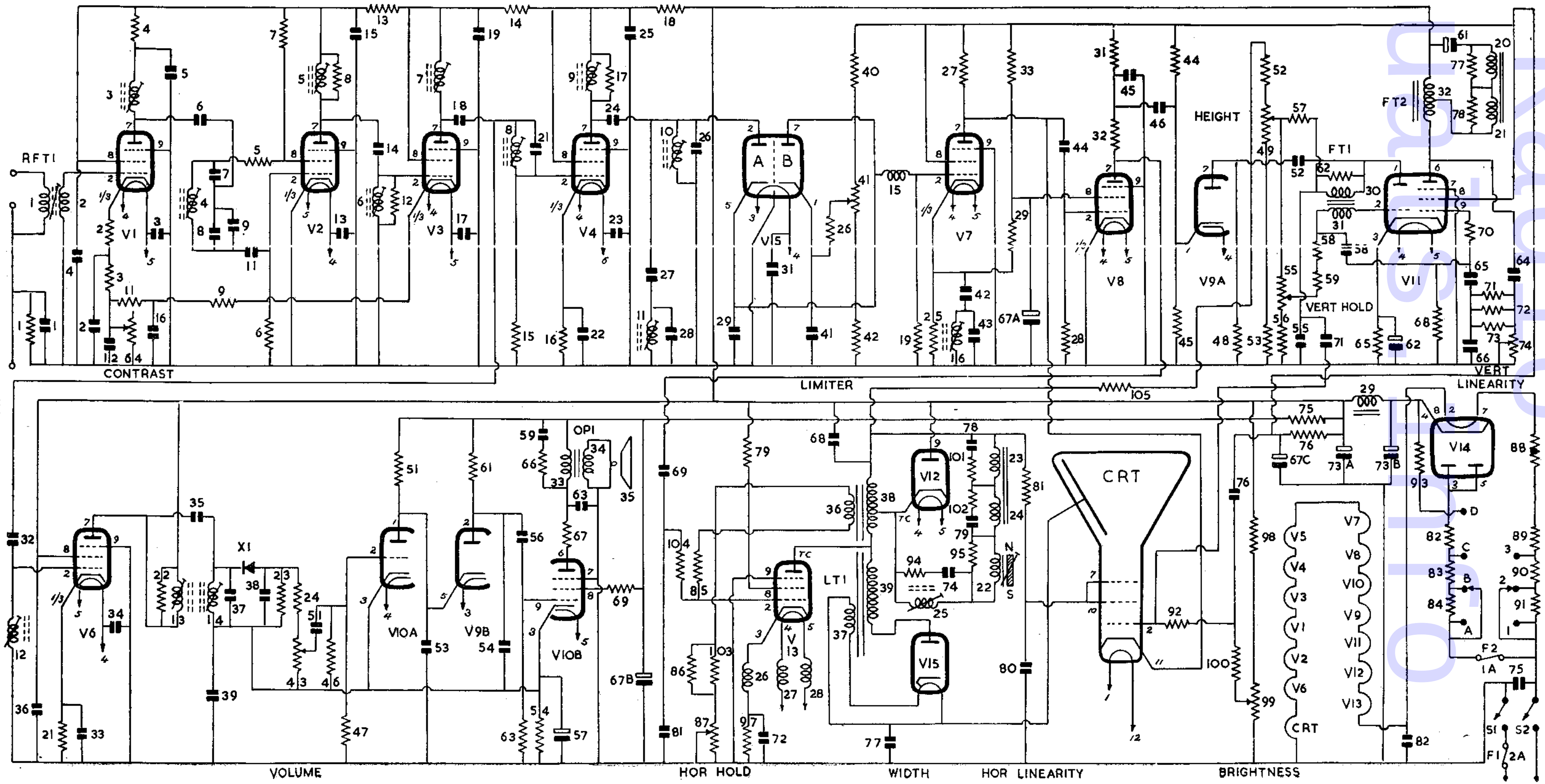
Continued on opposite page

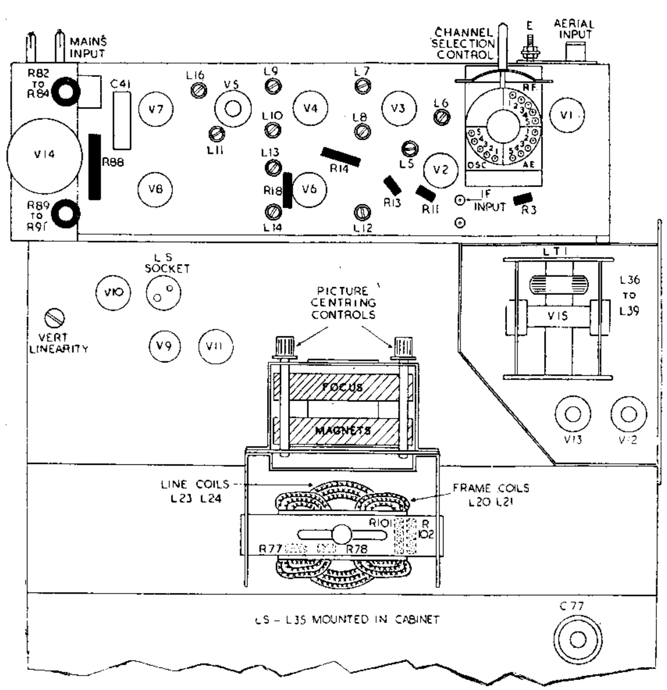
INDUCTORS

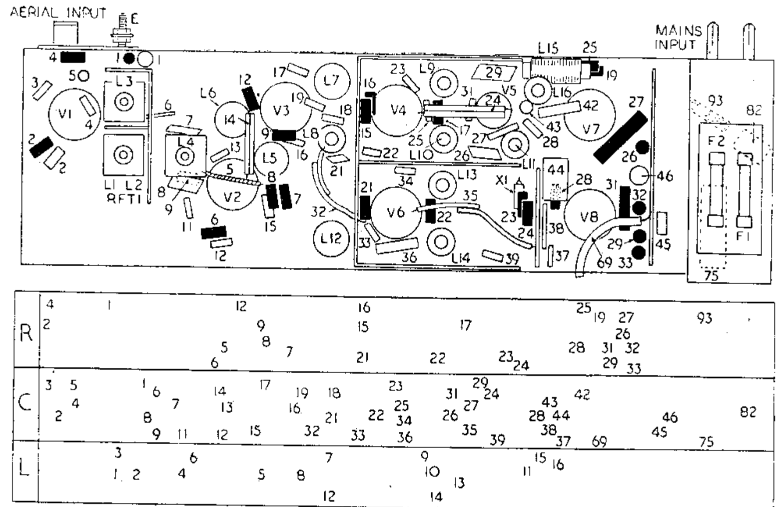
L	Ohms
1	Very Low
2	Very Low
3	Very Low
4	Very Low
5	.25
6	.25
7	.25
8	Very Low
9	.25
10	Very Low
11	Very Low
12	.25
13	.25
14	.25
15	6.5
16	Very Low
17, 18, 19	No Components
20, 21	165
22	5.5
23, 24	24
25	9
26	Very Low
27	Very Low
28	Very Low
29	33
30	550
31	1000
32	750 Tapped 125
33	700
34	.5
35	3
36	10
37	Very Low
38	23
39	10K

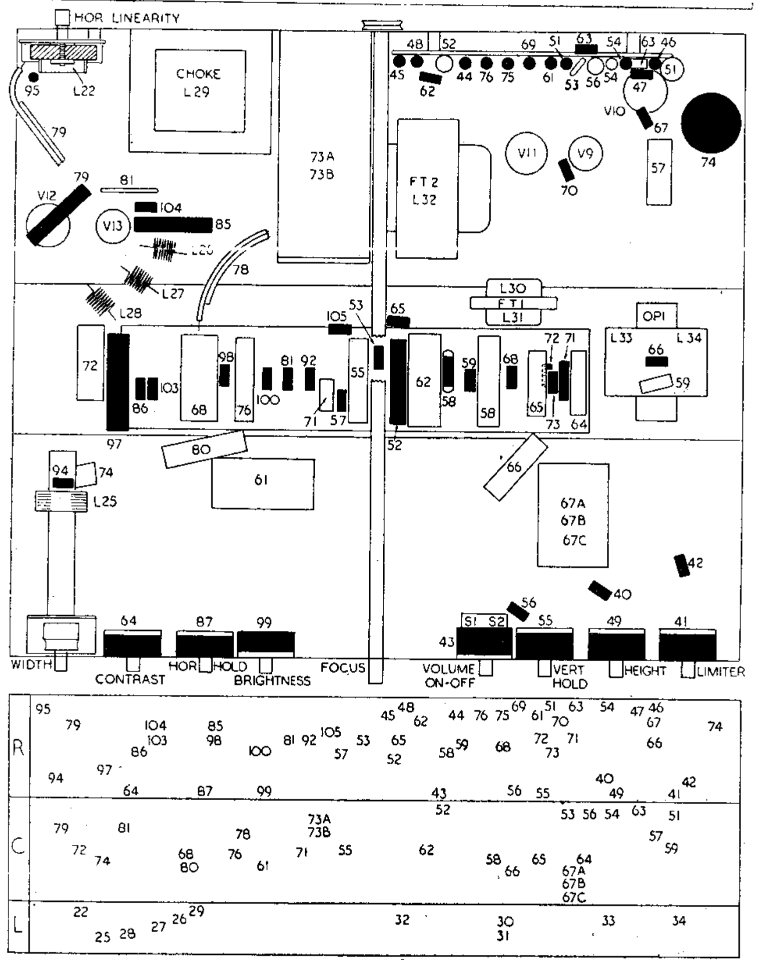
CAPACITORS

C	Capacity	Type
1	5000pF	Tubular 400V-AC
2	2000pF	Tubular Ceramic
3	2000pF	Tubular Ceramic
4	2000pF	Tubular Ceramic
5	500pF	Tubular Ceramic
6	20pF	Silver Mica
7	15pF	Silver Mica
8	15pF	Silver Mica
9	10pF	Tubular Ceramic
10	No Component	
11	500pF	Tubular Ceramic
12	2000pF	Tubular Ceramic
13	2000pF	Tubular Ceramic
14	2pF	Formed with covered flex
15	2000pF	Tubular Ceramic
16	2000pF	Tubular Ceramic
17	2000pF	Tubular Ceramic
18	2000pF	Tubular Ceramic
19	2000pF	Tubular Ceramic
20	No Component	
21	150pF	Silver Mica
22	2000pF	Tubular Ceramic
23	2000pF	Tubular Ceramic
24	2pF	Formed with Covered flex
25	2000pF	Tubular Ceramic
26	20pF	Silver Mica
27	3.5pF	Silver Mica
28	75pF	Silver Mica
29	2.5pF	Silver Mica
30	No Component	
31	2000pF	Tubular Ceramic
32	1pF	Formed with flex
33	2000pF	Tubular Ceramic
34	2000pF	Tubular Ceramic
35	1pF	Formed with Covered Flex.
36	2000pF	Tubular Ceramic
37	15pF	Silver Mica
38	20pF	Silver Mica
39	2000pF	Tubular Ceramic
40	No Component	
41	.1	Tubular 350V
42	1500pF	Tubular 350V
43	1500pF	Tubular 350V
44	.05	Tubular 350V
45	3000pF	Tubular 350V
46	.01	Tubular 500V
47-50	No Components	
51	.05	Tubular 350V
52	.01	Tubular 500V
53	25pF	Silver Mica
54	100pF	Tubular 350V
55	.1	Tubular 350V
56	.01	Tubular 500V
57	25	Electrolytic 25V
58	.1	Tubular 350V
59	.01	Tubular 500V
60	No Component	
61	500	Electrolytic 6V
62	50	Electrolytic 25V
63	1000pF	Tubular 500V
64	.05	Tubular 350V
65	.05	Tubular 350V
66	.1	Tubular 350V
67A		Electrolytic 275V
67B	32	Electrolytic 275V
67C	32	Electrolytic 275V
68	.5	Tubular 200V
69	12pF	Formed in Wiring
70	No Component	
71	.005	Tubular 350V
72	.25	Tubular 350V









C	Capacity	Type
73A	200 Electrolytic	275V
73B	100 Electrolytic	275V
74	200pF Silver Mica	
75	.05 Tubular 300v AC	
76	.1 Tubular 350V	
77	500pF Erie HIKR410—15kV	
78	15pF	Formed with Covered Flex
79	15pF	Formed with Covered Flex
80	.1 Tubular 500V	
81	100pF Silver Mica	
82	100pF Silver Mica	

RESISTORS

R	Ohms	Watts
1	1M	¼
2	33	¼
3	150	¼
4	100	¼
5	.2 Mumetal Wire	
6	100K	¼
7	47K	¼
8	47K	¼
9	33	¼
10	No Component	
11	150	¼
12	33K	¼
13	100	¼
14	100	½
15	2.7K	¼
16	150	¼
17	47K	¼
18	100	½
19	5.6K	¼
20	No Component	
21	470 or 150	¼
22	47K	¼
23	22K	¼
24	1K	¼
25	330	¼
26	22K	¼
27	8.2K 5%	1
28	1M	¼
29	12K	½
30	No Component	
31	33K	½
32	15K	¼
33	33K	½
34 to 39	No Component	
40	1M	¼
41	50K Linr. Carbon Potr.	
42	10K	¼
43	100K Log Carbon Potr. with DP Switch	
44	1M	¼
45	150K	¼
46	1.5M	¼
47	1.5M	¼
48	220K	¼
49	25K WW Potr.	3
50	No Component	
51	33K	¼
52	33K	1
53	100K	¼
54	470	¼
55	25K Linr. Carbon Potr.	
56	33K	¼
57	47K	¼
58	1M 5%	½
59	220K	¼
60	No Component	
61	1.5M	¼
62	22K	¼
63	470K	¼
64	3K WW Potr.	3
65	330	¼
66	10K	¼
67	47	¼
68	2.2M	¼
69	1K	¼
70	47	¼
71	47K 5%	½
72	220K	¼
73	330K	¼
74	500K Linr. Carbon Potr.	
75	1K	½
76	470	1
77	2.2K	¼
78	2.2K	¼
79	1.8K WW	3
80	No Component	
81	4.7M	¼
82	25 6.75	Tapped WW Dropper
83	25 6.75	Tapped WW Dropper
84	30 8.1	Tapped WW Dropper
85	22K	1
86	150K	¼
87	1M Linr. Carbon Potr.	
88	Mullard VA1005 Thermistor	
89	47 4.7	Tapped WW Dropper
90	64 6.4	Tapped WW Dropper
91	64 6.4	Tapped WW Dropper
92	82K	¼
93	10	½
94	2.7K	¼
95	6.8K	¼
96	No Component	
97	56	2
98	33K	¼
99	100K Linr. Carbon Potr.	
100	470K	¼
101	100K	½
102	100K	½
103	100K	¼
104	4.7K	¼
105	12K	¼

R82 R83 R84. When operating receiver on 200-210V DC mains, the adjusting fly-lead is plugged on to pin marked D, thus rectifier is by-passed through R93 to avoid unnecessary voltage drop.

Main HT line is choke-capacity smoothed by L29 C73A C73B. HT feed to sound channel AF amplifier V10A, noise limiter V9B, and output amplifier V10B, is separately voltage dropped and resistance capacity smoothed by R75 C67B. HT line to vision channel interference limiter V5B, video amplifier V7, sync separator V8, and screen of frame amplifier V11B, is separately resistance-capacity smoothed by R76 C67C. Reservoir smoothing capacitor C73B should be rated to handle 600mA ripple current.

Heaters of all valves, except V15, are series connected and fed from input mains through thermal surge limiter R88 and tapped dropper formed by R89 R90 R91.

Heater current for V15 is obtained from secondary L37 provided on line output transformer LT1.

Mains input is fitted with 2A fuse F1, in neutral lead to chassis, and filter capacitor C75. Mains on-off switches S1 S2 are ganged to **Volume** control R43.

CRT has video signal fed to its cathode, whilst variation of grid voltage by R99 gives control of picture **Brightness.** A negative sawtooth waveform, developed across C55 in frame oscillator circuit, is fed by C71 to grid to black out tube during flyback.

CRT for model 14T3 is Mullard MW36-24, and models 17T3 17K3 a Mullard MW43-43. The latter tube is a pentode, the second anode A2 being fed with same voltage as first anode A1.

ION TRAP

Check to see that CRT is correctly orientated—pins 6 and 7 should be to left when viewed from rear. Place ion trap, magnet downwards, on neck of tube, with about $\frac{3}{16}$in. clearance between it and base moulding of CRT. Partly tighten up clamping screw of ion trap and switch on receiver and allow to warm up. Adjust ion trap about and along neck of tube until it is positioned to give maximum raster brightness with no cut-off. No markings to indicate direction of magnet were visible on ion trap fitted to receiver handled by our laboratory. If no raster is obtained then remove ion trap, reverse it, and replace—still keeping magnet downwards.

Alignment Procedure

Check to see that chassis is connected to neutral (negative on DC) side of mains. During alignment maintain signal input at a level which produces a video output not greater than peak-white (25V DC change across video anode load), and a sound output of approximately 500mW (74V AC across primary L33 of OP1).

Output from signal generator is unmodulated except where otherwise stated.

IF stages. Inject signals into V2 grid via blank lead-through insulator on top of chassis (indicated on top chassis layout diagram—adjacent to V2).

Use shortest possible connections between signal generator and receiver and, where necessary, terminate signal generator with a non-inductive resistor of value equal to characteristic impedance of instrument.

Place control R64 and volume R43 at maximum

Inject 15.75mc/s—tune L6 L10 for maximum video.

Inject 17mc/s—tune L7 for maximum video.

Inject 18.25mc/s—tune L5 L9 for maximum video.

Continued on page 19

PILOT 75—*Continued*

Switch S2 is in V1 grid circuit. On SW band L1B and SW trimmer T3 are returned to chassis via C2, while on MW band L1B T3 are switched to junction of L2 L4, which shorts out LW loading coil L4 and puts frame aerial L2 and MW trimmer T5 into circuit. On LW band L1B goes to chassis via C4, and L4 L2 L3 are introduced. Aerial tuning capacitor is VC1.

Aerial signals are fed to control grid of triode-heptode frequency-changer V1 via C7. AVC voltage, decoupled by R7, C16, is applied through R1, the grid load.

Cathode bias is provided by R2, decoupled by C8. Primary L7 C29 of IFT1 is in the heptode anode circuit.

Oscillator is the triode section of V1 connected in a tuned grid series-fed circuit. Grid coils L5A(SW) L6A(MW and LW) are trimmed by T12 T11 and T13 respectively, and switched by S3 to oscillator tuning capacitor VC2. C9 provides grid coupling, with R3 as leak. On SW band trimmer T11 (MW) and L6A C14 (MW and LW) are short circuited and earthy end of L5A (SW) connected to chassis. On MW band T11 is in circuit across L6A C14. With S3 in the LW position, trimmer T13 is switched across L6A.

Anode reaction voltages are obtained inductively from L5B (SW) L6B (MW and LW). HT for oscillator anode is fed through series-connected coils L5B L6B and SW limiter R4. On SW band L6B is short-circuited by S4, while on MW and LW bands L5B R4 are shorted.

IF amplifier. The 470kc/s IF signals appearing at V1 heptode anode are transformer coupled to grid of IF amplifier V2 by L7 L8 of IFT1. AVC voltage, decoupled by R7 C16, is fed to control grid of V2 through L8. Cathode bias is developed across R5 with C17 as bypass. Screen and anode voltages come direct from main HT line. Suppressor grid is earthed to chassis. Primary L9 C31 of IFT2 is in the anode circuit.

Demodulator. Secondary L10 C32 of IFT2 feeds amplified IF signal to one diode of the double diode triode V3 for demodulation. R8, volume control, provides the diode load, while R6 C18 C19 constitute an IF filter circuit. The other diode is earthed to chassis.

AVC. The DC component of the demodulated signal built up across R6 and volume control R8, is decoupled by R7 C16, and fed to control grids of V1 V2 for AVC.

Pickup sockets are provided at rear of chassis for connection of a high resistance magnetic or crystal type pickup. Output voltage from pickup is applied across R8. To prevent radio breakthrough, the receiver should be tuned to silent part of waveband, for instance, lower end of LW. Pickup should always be disconnected when broadcast reception is required.

AF amplifier. Demodulated signal appearing across volume control R8 goes to grid of triode AF amplifier section of V3. Automatic grid bias is developed across C20, with R10 as leak. R11 is the anode load and C21 provides RF bypass. The cathode is earthed.

Output stage. Signal at V3 anode is fed to control grid of beam tetrode output amplifier V4 via C22, with R13 as grid stopper. Negative feedback from anode to grid is achieved by R15 C25, the amount of feedback being governed by R12, Tone control. Cathode bias is built up across R14, bypassed by C23.

Amplified signal at anode is transformer coupled by OP1 to an 8in. PM speaker with a speech coil impedance of 3ohms. Connection for the low impedance extension speaker is provided on secondary L12 of OP1.

HT is provided by indirectly-heated full-wave rectifier V5, connected in half-wave circuit; the anode voltage for which is derived from secondary L15 of MT1. Heater current comes from L14. Main HT line, supplying V1 V2 anodes and screens and anode of V4, is resistance-capacity smoothed by R17 R18 C27. HT for V3 anode and V4 screen is further resistance-capacity smoothed by R16 C26. C28, the reservoir capacitor, should have a ripple current rating of 120mA.

Heaters V1 to V4 and dial lamps D1 D2 are parallel connected and obtain their current from secondary L16 of MT1.

Mains input is to primary L17 of MT1, which is tapped for 200-225V, 230-250V, 40-100c/s AC. S5-S6, mains On-Off Switch, is ganged to Tone control R12.

TRIMMING INSTRUCTIONS

Apply signal as stated below	Tune receiver to	Trim in order stated for maximum output
(1) 470kc/s to g1 of V1 via .01 capacitor	—	Cores L10, L9, L8 and L7
(2) 18.2mc/s to AE Socket via dummy aerial	16.5 metres	T12, T3
(3) 1.5mc/s as above	200 metres	T11, T5
(4) 600kc/s as above	500 metres	Cores L6, L3 and repeat operations (3) and (4)
(5) 230kc/s as above	1300 metres	T13 Core L4

NOTE.—In operation (2) two peaks will be obtained when adjusting T12—use setting with higher capacity (the second peak whilst screwing in trimmer).

PYE FVI

UPON switching on this faulty receiver, after a few minutes the screen became illuminated, but the picture was unintelligible. Then with a sudden burst, the sound came on, emitting a terrific hum.

The sound fault was quickly traced to a faulty PL33. On the valve tester the emission was zero for some time, the next instant the needle was hard over.

The vision fault and hum was also quickly traced to C95 and C96 (ELECTRICAL AND RADIO TRADING service sheet) being completely open circuited. When these components were replaced the set was restored to normal.

I was interested to note that the receiver operated very well indeed on a double 32mF condenser in place of the 200+100mF specified, whilst I had to wait for the correct replacement.

I submit this contribution not because it was difficult to trace—it was too drastic to present any great difficulty—but because it was unusual. It may also preclude other engineers being caught on the wrong foot without a suitable capacitor. At the time I was staggered to find how many wholesalers had none in stock.—K. J. J., Bishop's Stortford.

FERRANTI—*Continued* *from p. 17*

Inject 19.25mc/s—tune L8 L11 for minimum video.

Inject 19.25mc/s modulated—tune L12 L13 L14 for maximum sound.

Finally recheck all the above operations and re-adjust where necessary.

RF Stages Place contrast R64 at approximately one-quarter of its travel. Place Channel Selector lever to appropriate channel setting.

Inject signals given in table below into aerial socket.

Tune oscillator coil for maximum sound output and aerial and RF coils for maximum video output

	Osc.	*Aerial*	*RF*
Channel 1	41.5 mc/s mod	44.25mc/s	42.25mc/s
„ 2	48.25 „	51 „	49 „
„ 3	53.25 „	56 „	54 „
„ 4	58.25 „	61 „	59 „
„ 5	63.25 „	66 „	64 „

Video Rejector. Unscrew core L16 to nearly full out position. If picture is free from an interfering " dot " pattern leave core set in this position. If not—adjust until interference is reduced to a minimum

Electrical Casebook

FAULTS CAUSED BY ABSENCE OF NEUTRAL CONNECTION

TWO three-phase 400V motors were used in a building, both being controlled by means of contactors operated by thermostatic switches. It was found that one motor would run only when the other motor was running, and vice versa.

Insulation resistance tests showed satisfactory results and neither of the contactor coils was o/c. The contactor coils were designed to operate on the phase-to-neutral voltage, but it was found that voltage between the phase and the neutral existed only when one or both of the thermostatic switches was closed.

Investigation revealed that there was no neutral connection from the supply to the three-phase and neutral distribution box to which the motors were connected. The contactor coils for the two starters were connected to different phases. The diagram (Fig. 1) shows that when only one thermostatic switch was closed there was no supply to the coil in circuit with this thermostat. However, when both thermostats closed the contactor coils in the two starters were connected in series across two of the supply phases, and thus were subject to 200V each (instead of the normal phase-to-neutral voltage of 230 volts) and 200V was sufficient to operate the contactors and start the motors.

A neutral conductor was brought into the distribution box to remedy matters.

Some large three-phase 400V motors were fed from a distribution box in one department, and a small 230V single-phase motor was later added. After stoppage for the summer holidays the single-phase motor refused to start, and tests showed that there was only a low voltage across the motor when the switch was closed. Further investigation revealed that no neutral connection had been brought into the distribution box ; the motor had been connected between one of the phase fuses and the neutral busbar in the distribution box, but the neutral busbar had merely been connected to the case of the distribution box. Furthermore, the case of the distribution box was not connected to earth (see Fig. 2).

Apparently the current for the single-phase

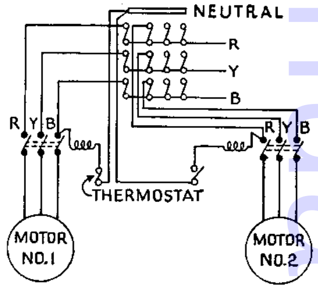
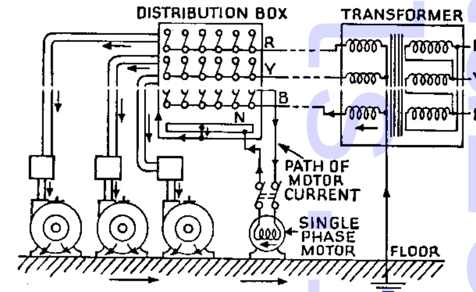


Fig. 1.—A neutral conductor was needed in the distribution box as shown. Fig. 2.—Damp floor replaced the neutral



motor had previously been returning to the earthed neutral point of the supply transformer through the rather damp floor on which the three-phase motors had stood, the framework of these motors being bonded to the case of the distribution box. During the summer stoppage the floor had dried out, thus interrupting the circuit of the single-phase motor.

This system, of course, was most dangerous In contravention of regulations the supply was earthed at more than one point (through the damp floor); the framework of the three-phase motors was not efficiently earthed; and when the single-phase motor was switched on with the floor dry, one phase of the supply was connected to the (unearthed) framework of the three-phase motors. A serious shock might have been received by any of the operators. A neutral connection was brought into the distribution box and the connection between the neutral busbar and the case removed, the framework being properly earthed.