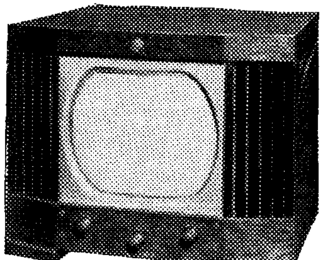
# BAIRD

# P167, T167



*Seventeen valve television receiver with 12 in. aluminised tube giving a 11¼ by 8¼in. picture. Incorporates self-contained mains-lead aerial as well as sockets for external dipole when necessary. Model P167 is housed in dark walnut table cabinet and Model T167 in a similarly-finished console. Receivers are available suitable for any of the five BBC channels use being made of appropriate plug-in RF and mixer sub-chassis. Suitable for 200-250V 50 c/s AC. Made by Baird Television, Lancelot Road, Wembley, Middlesex*

THE receiver employs a superhet circuit operating on lower sideband of vision carrier. The RF and mixer stages are common to both sound and vision channels and are on a sub-chassis coupled to main chassis through octal plug and socket. Different sub-chassis are used for each of the five BBC channels and a receiver can be converted for any reception area by changing to the appropriate unit.

Vision interference and sound noise suppression circuits are incorporated. EHT is provided by rectification of line flyback pulses. A section of the mains connecting lead can be used as an aerial in good reception zones but a normal input socket, with built-in attenuator, is provided for use with conventional aerials.

Mains consumption is approximately 170W.

**Mains aerial.** The permanently attached aerial is formed by winding a length of the mains lead on a spider to form a VHF choke in each lead at a distance of approximately half a wavelength from the receiver.

The negative or earthy mains lead is fed through a fuse link F3 to tap on aerial coupling coil L1 of RFT1 or, if the mains aerial is not required, through F3 down to chassis. Live side of mains aerial, which is fed to primary L24 of MT1 etc., incorporates an RF choke L36 to isolate that section of aerial from the receiver.

**External aerial** input circuit is designed for use with 75 ohm coaxial feeder. When external aerial is employed, the signal from it is fed either direct through isolating capacitor C2 to loop coupling coil L3 of aerial input transformer RFT1 or through one of the two built-in attenuator networks formed by R1 to R5 and thence coupled by C2 to L3. Earthy side of aerial is isolated from chassis by C1.

**RF amplifier.** Secondary L2 of RFT1 feeds signal to grid of RF amplifier V1, the gain of which is controlled, together with that of first IF amplifier V3, by VR1 the **Shade** control in the cathode. Negative feedback across R7 compensates for changes in input capacity of V1 with variation of cathode bias. Amplified signal at anode is bandpass transformer coupled by RFT2 to triode mixer V2A.

**Oscillator** is triode V2B in a modified Hartley circuit with permeability-tuned coil L6 between anode and grid through C9. R12 is anode load and automatic bias for the grid is developed by grid current through R13. Output of oscillator is taken from grid by C7 and applied to grid of mixer V2A.

**Mixer** is triode V2A functioning as an anode-bend detector with R11, decoupled by C6, providing high cathode bias. RF and oscillator signals, fed to its grid, are mixed to produce across primary L7 of IFT1 in the anode circuit a vision carrier IF of 13 mc/s and sound IF of 9.5 mc/s.

**Vision channel** consists of two IF amplifiers V3 V4, signal rectifier and interference limiter V5 and video amplifier V6. Bandpass transformer coupling by IFT1 IFT2 IFT3 is employed between mixer, IF and signal rectifier stages, damping to maintain wide bandwidth being given by R14 R15 R17 R18 and R20.

Gain of first IF amplifier V3 is controlled together with that of RF amplifier V1 by VR1 the **Shade** control and negative feedback across R10 preserves shape of IF response curve with variation of VR1. Sound-on-vision rejection at 9.5 mc/s is given by L9 C12 in cathode V3 and by L12 C16 in cathode V4.

Rectified video signal at cathode V5A is filtered by L15 R81 C17 and developed across R22 in grid of video output amplifier V6. Cathode of rectifier diode V5A is provided with a positive delay voltage from potential dividing network R25 R80 R22 and this produces clipping of the negative going sync pulses to clean up the pulse shape and reduce the effect of interference on the synchronising circuits. Video output at anode V6 is DC/AC fed by R82 L16 R26 C20 to cathode of CRT.

**Interference limiter** is diode V5B which, in effect, is connected across cathode load of signal rectifier V5A. It has its own cathode biasing by R21 C18, the voltage being approximately equal to peak-white of signal. With normal signal the diode only conducts sufficiently to maintain potential on R21 C18. When a large amplitude interference pulse appears with signal, anode V5B is driven heavily positive; the cathode remains unchanged due to comparatively long time-constant of R21 C18; thus the diode conducts the interference down to chassis through C18.

**Sound channel** consists of IF amplifier V16, signal rectifier and noise suppressor V15, AF amplifier V14 and sound output valve V13. Sound signal of 9.5 mc/s is taken from sound rejector circuit L9 C12 in cathode of V3 and is fed by C50 to L26, damped by R64, in grid of sound IF amplifier V16. The amplified output is bandpass transformer coupled by IFT4 to signal rectifier V15A.

Audio signal is developed across R61 C46 and fed by C48 through series noise suppressor diode V15B and filter R58 C43 and coupled by C42 to **Volume** control VR3 in grid of AF amplifier V14. The amplified signal is fed by C40 to beam tetrode output amplifier V13. OP1 in anode V13 feeds signal to a 6in. eliptical speaker L31.

Negative feedback is applied from anode to grid V13 by R53. Cathodes V14 V13 are coupled by R56, thus introducing positive feedback and obviating the need for decoupling.

**Noise suppressor,** diode V15B, is normally held conducting by positive bias on its anode through R59. Time constant of R78 C44 in its cathode is such that voltage set up across the network follows that of the audio signal fed by C48 to anode V15B. When a sharp-front interference pulse appears, due to relatively long time constant of R78 C44, the anode of V15B is driven negative to cathode and the diode cuts off.

**Sync separator.** Video signal at anode of video amplifier V6 is fed through R27 C21 to sync separator V7. Positive sync pulses drive V7 into grid current and the resultant bias developed across R28 is sufficient to place video portion of signal beyond cut-off, thus only sync pulses appear at anode.

Line sync pulses are applied direct to screen of line oscillator and amplifier V10 by virtue of the fact that its screen voltage is obtained from junction of R42 R29, which form the anode load V7.

Frame sync pulses are taken from screen V7, differentiated by C22 R31 and applied to grid of frame clipper V8. This valve functions as an anode-bend clipper with high value cathode bias obtained from R32 R36 between screen and chassis. Time constant of R31 C22 is such that grid is held cut-off except during frame pulses when grid is swung positively to produce negative short duration pulses at anode, which are further differentiated by C39 R49 before being applied to grid of frame oscillator V12.

**Frame oscillator** is double-triode V12 in a multivibrator type circuit. Cross coupling between the two sections is provided by C38 and common cathode load R48. Frame scan voltage is generated on C37, which charges from HT through R46 R79 and is discharged by V12B when it conducts at end of scan. Due to use of well defined and amplified pulses no frame hold control is provided.

**Frame amplifier.** Scan waveform on C37 is fed by C36 through correcting filter R43 C35 C34 to grid of triode-connected beam-tetrode amplifier V11, the amplified output of which is transformer fed by FT1 to frame deflector coils L34 L35 on neck of CRT.

Variation of effective cathode bias by VR8 gives **Frame form** control and adjustment of degree of cathode negative feedback by VR7 gives **Picture height** control.

**Line scan** waveform is generated by a self-oscillating tetrode output amplifier V10, which is caused to oscillate by anode to grid coupling provided by output transformer LT1. Frequency of oscillation is determined by bias developed across R41 and VR6, the latter—being variable—gives **Line hold** control. R39, a thermistor shunted across R41, eliminates any tendency to frequency drift due to thermal effects.

Output waveform is developed on secondary L18 of LT1 in grid circuit of V10 and applied through linearity correcting network L22 C29, shunted by VR9 the **Line form** control, and C28 to line deflector coils L20 L21 on neck of CRT.

Amplitude of line waveform is controlled by adjustment of HT to anode V10 by VR5 the **Picture width** control.

**EHT** of 10KV for anode of CRT is obtained by rectification by V9 of the high voltage surge set up across overwind on primary L17 of LT1 when V10 is cut-off at end of line scan. EHT is smoothed by C27. Rectifier heater current is provided by secondary L19 on LT1.

**HT** is provided by twin fullwave indirectly-heated rectifier V17 coupled as a single rectifier in a halfwave circuit. Anodes are fed from 250V tapping on auto-transformer primary L24 of CRT

# CASEBOOK

## SERIES RUN BATTERY VALVES

FAILURE of sets using 50mA filament valves in series is frequently due to low filament volts at the FC. Replacement of the valve in some cases reveals that new valves are little better.

Before condemning any particular make of valve a check should be made of filament voltage at the socket in question. If low, and batteries or mains are correct, most likely cause is change in value of filament shunt resistor and/or low emission of output valve.

Some makes of sets using these valves do not provide much ventilation and when on mains supply the temperature of the filament voltage dropping resistor rises considerably. Resistance increases and if the "cold" current at the filaments is already low for any other reason, it gets still lower, and the set may stop working after a little while.

To obviate this final checks on this type of set must be made with the chassis as nearly enclosed as in normal operation.—H.J.H., Enfield.

## EMERSON MIDGET AC/DC

THIS set came in with a burnt-out signal detector, type 12SQ7, and the customer told us the valve had been continuously renewed.

Examination revealed that the three-core mains lead was wired so that one main was connected to chassis and one end of the dropper resistance, this resistance being connected at the other end to the 35Z5 and thence, through the heater chain to the other main. As the HT connection to rectifier anode was made from the heater of the 35Z5, the 50mA HT current was being drawn, not via the dropper, but from the heater chain.

Apparently the 12SQ7 was least able to stand up to this extra filament current.—P.G., Port Erin.

heater transformer MT1 through limiter resistors R65 to R68.

Choke-capacity smoothing is by L25 C51A C51B. HT feed to part of vision and sound channels and for screen of sync separator V8 is further resistance-capacity smoothed by R77 C52A. Reservoir smoothing capacitor C51A should be rated to hand 600mA ripple current.

**Heaters** of all valves, except V9 and CRT V18, are series connected and divided into three sections.

CRT heater is fed from secondary L23 of MT1. S1, which is ganged to sound volume control VR3, is ON/OFF switch.

**CRT** is a 12in. triode Mazda CRM 123 with permanent magnet focusing. Video signal is fed to its cathode and picture brightness is controlled by variation of grid voltage by **Light** control VR2. CRT heater is RF decoupled by C26, and R37 prevents high voltage developing between heater and cathode.

## ALIGNMENT PROCEDURE

**Apparatus required** :—Signal generator covering 9-14 and 45-70 mc/s with internal modulation; good quality 0-50V AC rectifier type voltmeter for use as output meter; an insulated tuning wand with non-metallic screwdriver-shaped blade; a damping lead—this consists of a 500 ohm ¼W resistance in series with an .01 mF 350V working condenser with a 12in. wire end.

Connect the output meter via an isolating .5 mF condenser from anode of V6 to chassis. Set **Shade** control at maximum.

**IF stages.** Inject 11.5 mc/s to grid V4, connect damper between anode V4 and chassis, and tune L14 (bottom) for maximum. Connect damper across L14 and tune L13 (top) for maximum.

Inject 11.5 mc/s to grid V3, damp L10, tune L11 (bottom) for maximum. Damp L11 and tune L10 (top) for maximum.

Inject 11.5 mc/s to grid of mixer V2A, connect damper between anode and chassis, tune L8 (bottom) for maximum. Damp L8 and tune L7 (top) for maximum.

Inject 9.5 mc/s to grid of mixer V2A, tune L9 L12 for *minimum*—there are two positions of core at which minimum output is obtained and the correct setting is with core up at top end of coil. With modulation switched on, tune L28 L27 and L26 for maximum sound output. Readjust L9 to give maximum sound output.

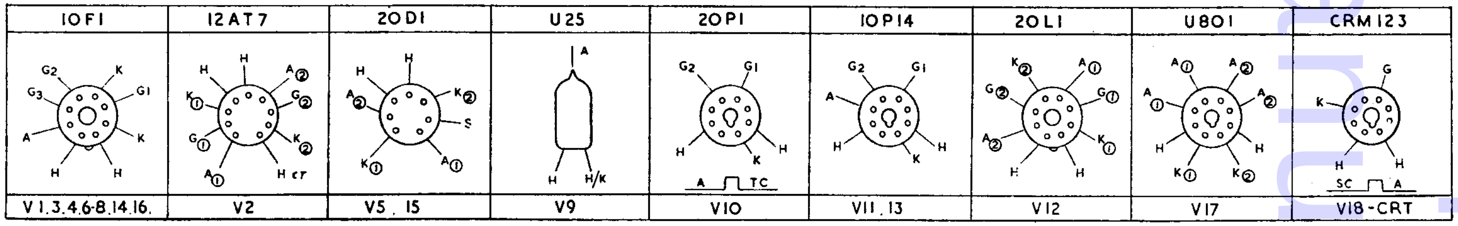
**RF stages.** Inject modulated signal of 41.5 (L) 48.25 (HM) 52.25 (K o' S) 58.25 (B) or 63.25 mc/s (W) into maximum aerial attenuator position and tune L6 for minimum vision and maximum sound.

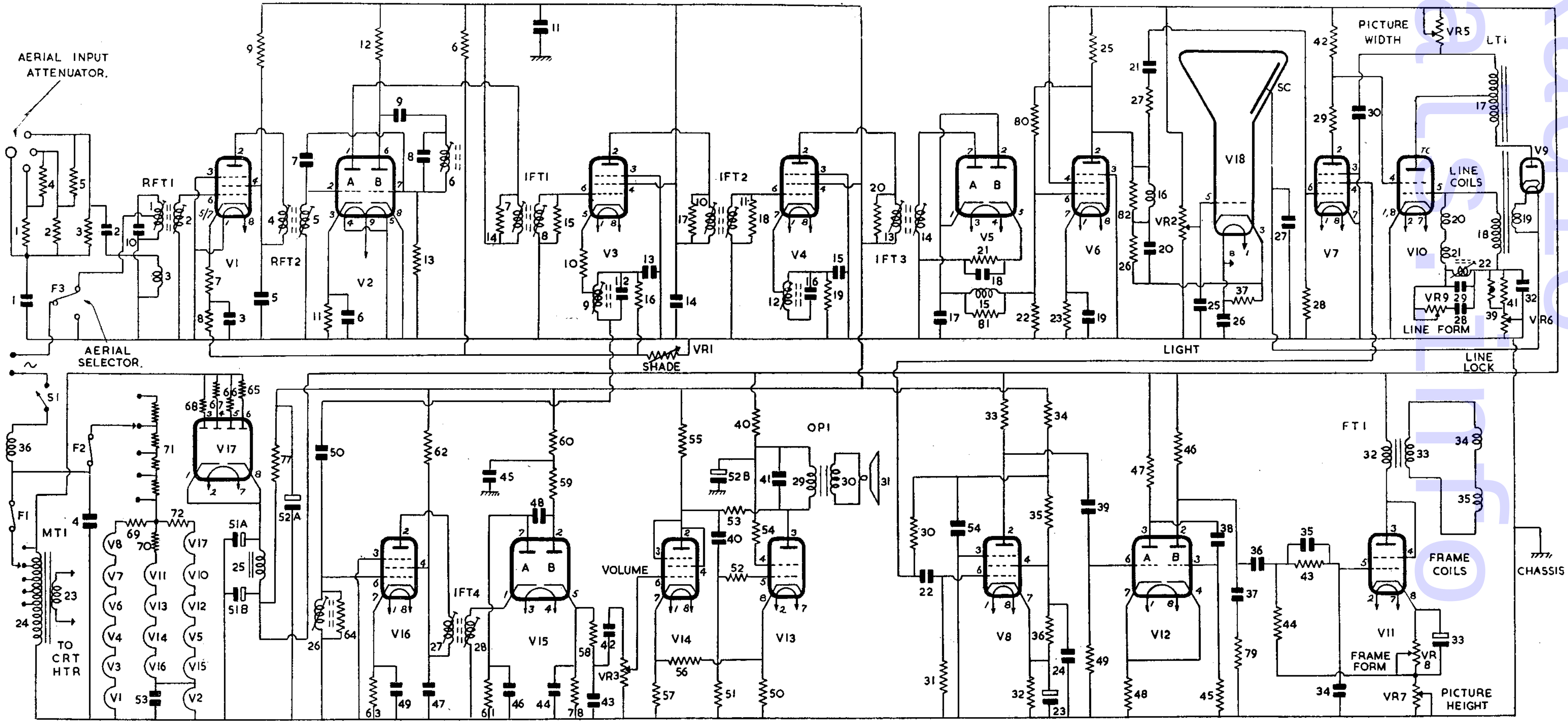
Change sig-gen to 43, 50, 55, 60 or 65 mc/s according to channel and tune cores of L1 L2 L4 L5 for maximum vision output.

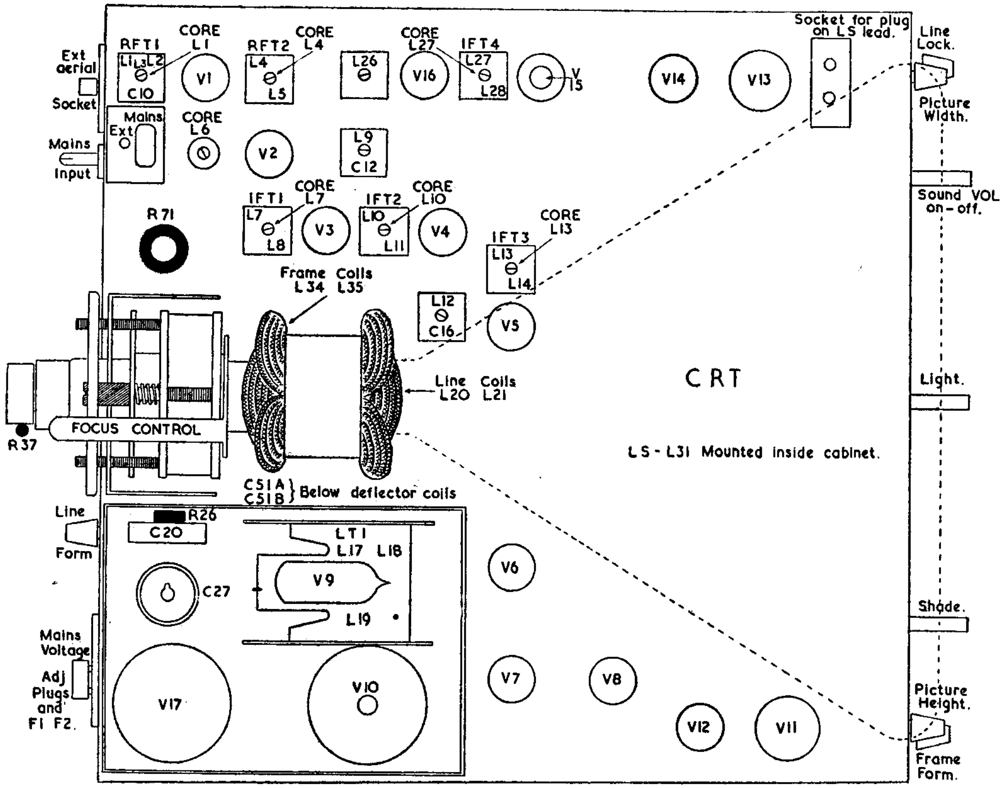
**Sensitivity.** With VR1 set at maximum, input of 20-40 microvolts should give 11V RMS at anode of video amplifier V6.

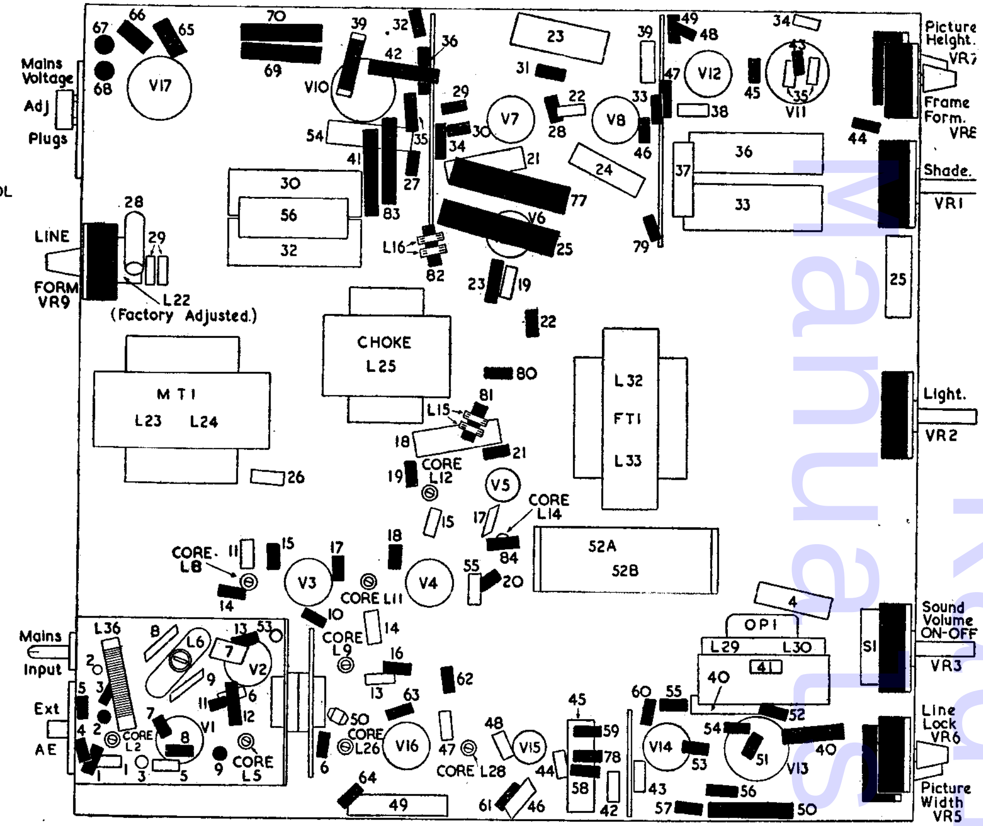
## MODIFICATIONS

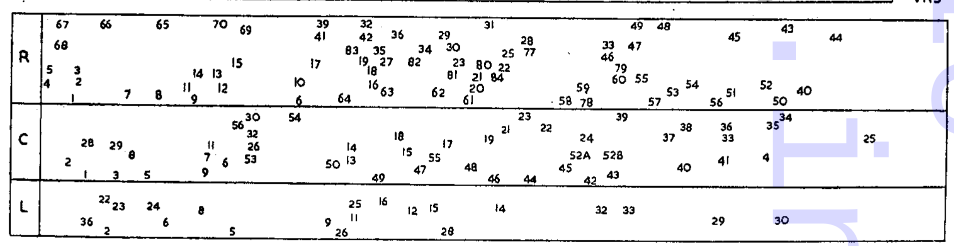
Some models may differ from the circuit below as follows: a 740 ohm 2W resistor R83 inserted between R39 R41 and top VR6; a 50 mF 12V wkg capacitor C56 inserted between bottom L18 and junction L22 R39 R41 C32. HT feed to anode and screen V4 decoupled by 47 ohm resistor R84 and .01 mF capacitor C55.





## VOLTAGE READINGS

| V | Type | A | $G_2$ | K |
|---|---|---|---|---|
| 1 | 10F1 | 225 | 225 | 4.5 |
| 2 A | 12AT7 | 235 | — | 3.5 |
| 2 B | | 115 | — | 0 |
| 3 | 10F1 | 235 | 235 | 4.5 |
| 4 | 10F1 | 235 | 235 | 2.4 |
| 5 A | 20D1 | — | — | — |
| 5 B | | | | |
| 6 | 10F1 | 165 | 260 | 4.3 |
| 7 | 10F1 | 35 | 130 | — |
| 8 | 10F1 | 250 | 35 | 13 |
| 9 | U25 | — | — | 10kV |
| 10 | 20P1 | — | 65 | 0 |
| 11 | 10P14 | 230 | 230 | 28 |
| 12 A | 20L1 | 60 | — | 5 |
| 12 B | | 13 | — | 5 |
| 13 | 10P14 | 205 | 220 | 12 |
| 14 | 10F1 | 60* | 60 | 1.3 |
| 15 A | 20D1 | 16 | — | — |
| 15 B | | 30 | — | 30 |
| 16 | 10F1 | 210 | 210 | 2 |
| 17 | U801 | 250V RMS | — | 275 DC |
| 18 | CRM123 | 10kV | — | 165 |

* A, $G_2$, $G_3$ strapped

Total HT current at V17 cathode, 280mA

Voltage at CRT grid, 0–260V.

Total mains consumption, 780mA.

## RESISTORS

| R | Ohms | Watts |
|---|---|---|
| 1 | 120 | ¼ |
| 2 | 120 | ¼ |
| 3 | 120 | ¼ |
| 4 | 390 | ¼ |
| 5 | 390 | ¼ |
| 6 | 220K | ¼ |
| 7 | 33 | ¼ |
| 8 | 100 | ¼ |
| 9 | 2.2K | ¼ |
| 10 | 33 | ¼ |
| 11 | 680 | ¼ |
| 12 | 10K | ½ |
| 13 | 10K | ¼ |
| 14 | 10K | ¼ |
| 15 | 4.7K | ¼ |
| 16 | 150 | ¼ |
| 17 | 10K | ¼ |
| 18 | 4.7K | ¼ |
| 19 | 150 | ¼ |
| 20 | 10K | ¼ |
| 21 | 10M | ¼ |
| 22 | 4.7K | ¼ |
| 23 | 200 | ½ |
| 24 | No Comp. | |
| 25 | 10K | 2W |
| 26 | 270K | ¼ |
| 27 | 15K | ¼ |
| 28 | 2.2M | ¼ |
| 29 | 4.7K | ¼ |
| 30 | 2.2K | ¼ |
| 31 | 39K | ¼ |
| 32 | 3.9K | ¼ |
| 33 | 10K | ¼ |
| 34 | 10K | ½ |
| 35 | 39K | ½ |
| 36 | 10K | ½ |
| 37 | 100K | ¼ |
| 38 | No Component | |
| 39 | CZ1 Thermistor | |
| 40 | 740 | WW10 |
| 41 | 470 | 1 |
| 42 | 3.5K | 10 |
| 43 | 470K | ¼ |
| 44 | 1M | ¼ |
| 45 | 1M | ¼ |
| 46 | 1M | ¼ |
| 47 | 100K | ½ |
| 48 | 4K | ¼ |
| 49 | 2.2K | ¼ |
| 50 | 180 | 1 |
| 51 | 470K | ¼ |
| 52 | 47K | ¼ |
| 53 | 470K | ¼ |
| 54 | 100 | ¼ |
| 55 | 270K | ¼ |
| 56 | 33K | ¼ |
| 57 | 1K | ¼ |
| 58 | 47K | ¼ |
| 59 | 2.2 M | ¼ |
| 60 | 1M | ¼ |
| 61 | 39K | ¼ |
| 62 | 2.2K | ¼ |
| 63 | 150 | ¼ |
| 64 | 47K | ¼ |
| 65 | 50 | WW2 |
| 66 | 50 | WW2 |
| 67 | 50 | WW2 |
| 68 | 50 | WW2 |
| 69 | 740 | WW10 |
| 70 | 740 | WW10 |
| 71 | 345MainsDropper 5W Tapped 245x25x25x25x25 | |
| 72–76 | No Components | |
| 77 | 680 | 2 |
| 78 | 1M | ¼ |
| 79 | 4.7K | ¼ |
| 80 | 1M | ¼ |
| 81 | 22K | ½ |
| 82 | 22K | ½ |
| 83 | 740 | 2* |
| 84 | 47 | ¼* |
| VR1 | 2K WW Potr. | |
| VR2 | 500K Potr. | |
| VR3 | 500K Potr. with Spdt Switch | |
| VR4 | No Component | |
| VR5 | 500 WW Potr. | |
| VR6 | 2K WW Potr. | |
| VR7 | 2K WW Potr. | |
| VR8 | 5K WW Potr. | |
| VR9 | 1K WW Potr. | |

* Modifications

## INDUCTORS

| L | | Ohms |
|---|---|---|
| 1-6 | Very Low | |
| 7 | ... | .5 |
| 8 | ... | .5 |
| 9 | Very Low | |
| 10 | ... | .5 |
| 11 | ... | .5 |
| 12 | Very Low | |
| 13 | ... | .75 |
| 14 | ... | .75 |
| 15 | ... | 7.5 |
| 16 | ... | 7.5 |
| 17 | Total | 125 |
| 18 | ... | 9 |
| 19 | Very Low | |
| 20, 21 | ... | 21 |
| 22 | ... | 2 |
| 23 | Very Low | |
| 24 | Total | 59 |
| 25 | ... | 45 |
| 26 | ... | .5 |
| 27 | ... | 2.5 |
| 28 | ... | 2.5 |
| 29 | ... | 270 |
| 30 | ... | 1.5 |
| 31 | ... | 2.7 |
| 32 | ... | 640 |
| 33 | ... | 1.8 |
| 34, 35 | ... | 7.5 |
| 36 | Very Low | |

## CAPACITORS

| C | Capacity | Type |
|---|---|---|
| 1 | 1000pF | Tub. 300VAC |
| 2 | 1000pF | Tub. 300VAC |
| 3 | 1000pF | Tubular 350V |
| 4 | .01 | Tubular 1000V |
| 5 | 1000pF | Tubular 350V |
| 6 | 1000pF | Tubular 350V |
| 7 | 5pF | Silver Mica |
| 8 | 47pF | Silver Mica |
| 9 | 47pF | Silver Mica |
| 10 | 10pF | Silver Mica |
| 11 | .01 | Tubular 350V |
| 12 | 100pF | Silver Mica |
| 13 | .01 | Tubular 150V |
| 14 | .01 | Tubular 350V |
| 15 | .01 | Tubular 150V |
| 16 | 100pF | Silver Mica |
| 17 | 15pF | Silver Mica |
| 18 | .1 | Tubular 500V |
| 19 | 3000pF | Tubular 350V |
| 20 | .1 | Tubular 350V |
| 21 | .1 | Tubular 350V |
| 22 | 1000pF | Tubular 350V |
| 23 | 25 | Electrolytic 25V |
| 24 | .1 | Tubular 350V |
| 25 | .1 | Tubular 350V |
| 26 | .01 | Tubular 350V |
| 27 | 1000pF | Visconol 12KV |
| 28 | .02 | Tubular 350V |
| 29 | 2x1000pF | Tub. 350V |
| 30 | .5 | Tubular 350V |
| 31 | No Component | |
| 32 | .5 | Tubular 350V |
| 33 | 100 | Electrolytic 25V |
| 34 | .01 | Tubular 150V |
| 35 | .01 / .002 | Tubular 350V / Tubular 350V |
| 36 | .5 | Tubular 350V |
| 37 | .05 | Tubular 350V |
| 38 | .01 | Tubular 350V |
| 39 | 47pF | Silver Mica |
| 40 | .05 | Tubular 350V |
| 41 | 1000pF | Tub. 350V |
| 42 | .01 | Tubular 150V |
| 43 | 500pF | Tub. 600V |
| 44 | 500pF | Tub. 600V |
| 45 | .1 | Tubular 350V |
| 46 | 33pF | Silver Mica |
| 47, 48 | .01 | Tubular 350V |
| 49 | .1 | Tubular 350V |
| 50 | 2.20pF | Tub. Ceramic |
| 51A | 100 | Electrolytic 275V |
| 51B | 200 | Electrolytic 275V |
| 52A | 8 | Electrolytic 350V |
| 52B | 8 | Electrolytic 350V |
| 53 | .01 | Tubular 150V |
| 54 | .1 | Tubular 350V |
| 55 | .01 | Tubular 350V* |
| 56 | 50 | Electrolytic 12V* |

* Modifications