CONVERSION OF THE HMV 904 TO USE A 5FP4 CRT.

Background:

The HMV 904 is one of the most important pre-WW2 British Television Sets.

The CRT used in this set was a special type, The EMISCOPE 3/1.

These CRT's are unavailable. If the HMV 904 is to be kept in functional condition, a substitute CRT is required.

The best substitute is the American CRT, the 5FP4. This tube is a little shorter than the 3/1 with a steeper deflection angle at 53 degrees. Other differences include the somewhat flatter face and the additional accelerating electrode in the electron gun structure. Despite these differences, there are the two fundamental similarities; the 5FP4 is magnetically deflected and focussed and it is a non-aluminised tube, similar to the 3/1. The neck on the 5FP4 is a few millimetres bigger in diameter than the 3/1.

The conversion involves attention to some subtle details, all of which combine to give an excellent result, at the same time as protecting the longevity of the picture tube.

1) To allow the yoke of the 3/1 to slip over the neck of the 5FP4 a small amount of cardboard needs to be removed from the inner aspect of the yoke.

2) The 5FP4 requires more deflection drive than the 3/1 pushing the deflection circuits close to maximum output. In the case of the frame stage the linearity suffers with a degree of compression of the scanning lines at the top of the picture. This problem is solved by adding a peaking resistor (4.7K) in series with the vertical sawtooth integration capacitor C73, see fig 1.

3) When the contrast control is set for satisfactory synchronisation, the video drive level to the CRT is too high for the sensitivity of the 5FP4, and the attenuator network is required, see FIG2.

4) The sensitivity of the 5FP4 gun is kept at its minimum value by running an A1 voltage of about 300V.Also this is best derived from the voltage bleeder chain see FIG 3, not another source. The reason for this is that when the set is switched back and fourth from TV to radio, it is important not to supply CRT anode voltages until the CRT heater has warmed. If the A1 voltage was from another source, this general "CRT rule" would be violated.

5) I believe it is desirable to short out the switch N—81, see fig 4. Otherwise when you switch out of TV mode, and into radio mode, with the TV mode previously running, you get rapid scan collapse and high intensity electron beam with phosphor burn. I think it's better to leave the scan HT supplied to the scan tubes while their heaters cool when you switch to radio, although not ideal, it is better than CRT phosphor damage. CRT preservation takes priority and phosphor is very easily damaged in these non-aluminised tubes.

6) On the topic of phosphor damage, when the set is switched off there is a bright defocused collapsing raster which can harm the phosphor in the central screen area. To help improve this situation the RC network and diode,(see FIG 5) is added. This results a substantial, negative, CRT grid voltage swing, at turn off, when the HT rail collapses and this reduces the damaging effects of this problem. Always set the brightness and contrast control to zero before switching off, or switch off in "radio mode". However this circuit results in the picture blanking out at turn-off, regardless of the brightness control setting. A massively current overrated diode is used to avoid diode failure. Ensure that you would trust the diode's earth connection with your life, as all electrolytic capacitors have leakage. The Oscillogram, Fig 6, shows the CRT grid voltage at turn-off.

See below for Figs 1 to 6. See the screen photo Fig 7, (close to actual size) for the result. There may be some interference (moire) effects between the scanning lines and the camera CCD and your VDU.

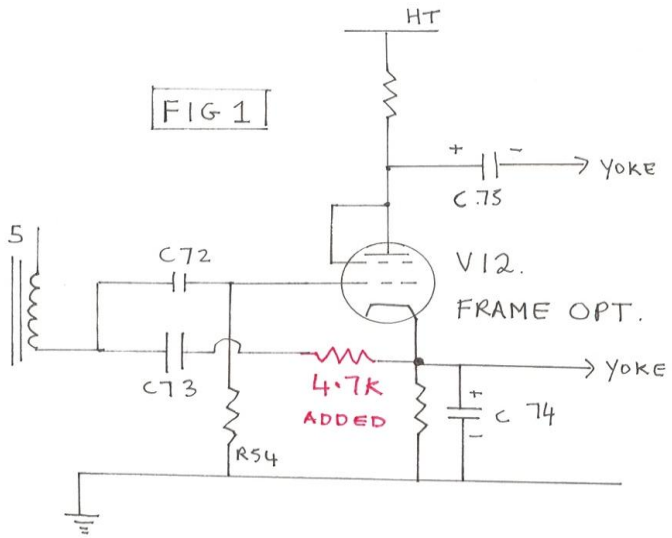


FIG 2

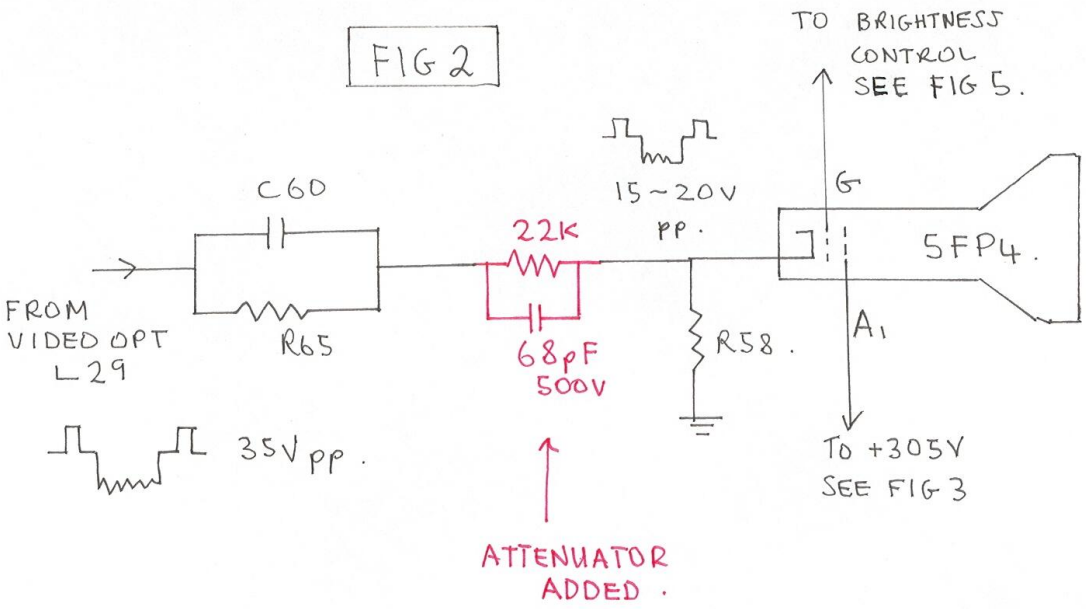
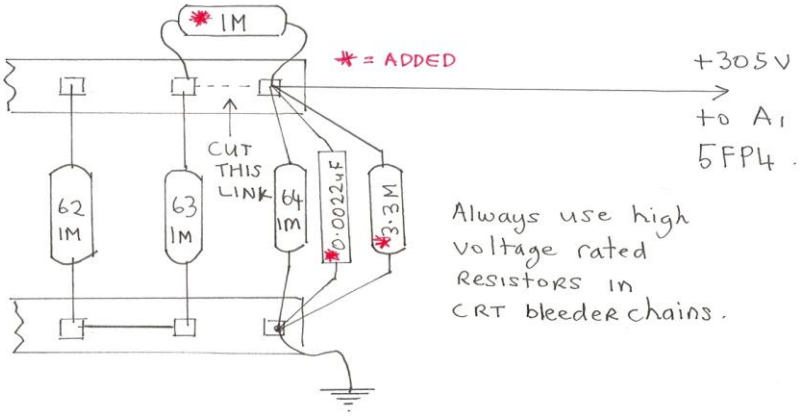


FIG 3

HMV 904 BLEEDER CHAIN MODIFICATION TO DERIVE +300 V FOR A_1 of 5FP4.



Always use high voltage rated resistors in CRT bleeder chains.

FIG 4

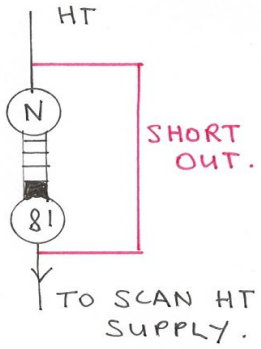
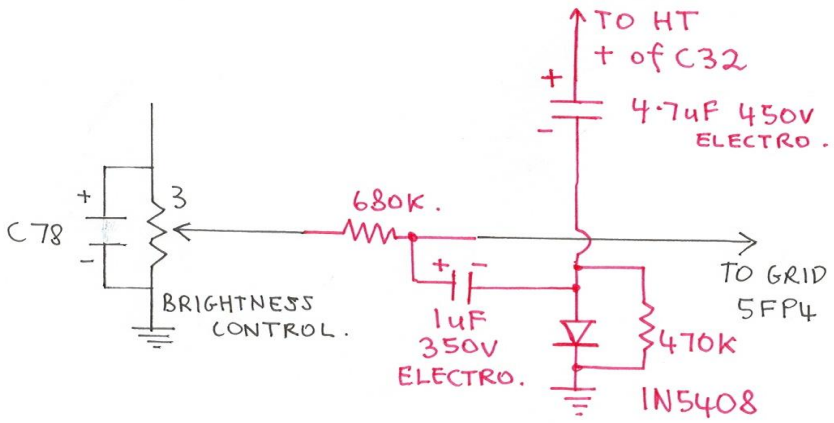


FIG 5



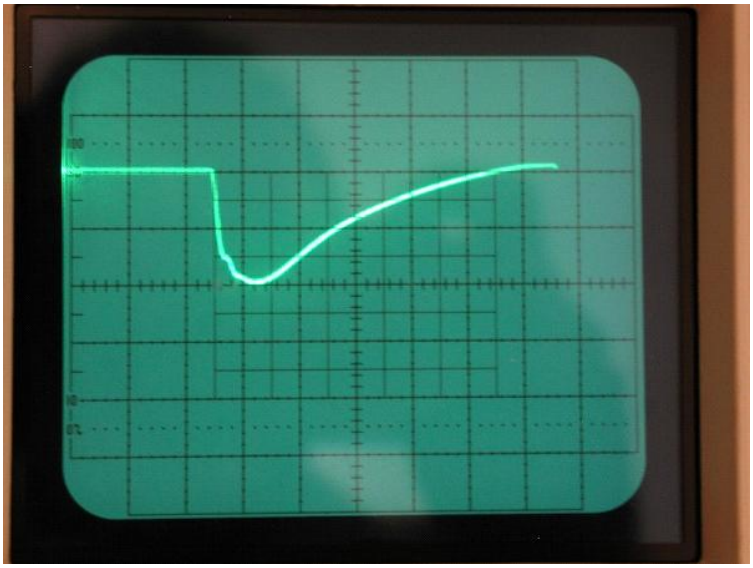


FIG. 6.

The oscillogram above was obtained with a TEK 464 storage oscilloscope, connected with a x10 probe to the grid of the 5FP4 CRT, with the modifications shown on Fig 5.

The scale is 50Volts / large division and time-base on 0.5 Sec/ large div. Before turn-off the voltage is zero (if brightness control set at min), after turn-off the voltage dips down to minus100 Volts. The voltage is below - 50 Volts for about 1 second in total. This is enough to keep the CRT beam well cut off while the scan is collapsing and allows time for the EHT to collapse shortly after that.

FIG 7.

The above image obtained with HMV904, with 5FP4 CRT. Signal source, Camcorder freeze frame, 625 video passed via 625/405 converter, RF signal approx 5 mVpp, to replicate Alexandra Palace's original signal. Photo taken directly from the 5FP4 face, with an Olympus C-3000 camera, with the flash disabled.

Dr Hugo Holden, Feb 2006. AUSTRALIA.