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Many people are not aware of some of the fiendish effects that can occur when their TV picture tube either gets old or has a heart attack. Furthermore even less people know of the few "tricks of the trade" that will keep the tube going, sometimes for an amazing period of time.

I know of one particular TV set on which some ham-fisted idiot (me, of course), was in such a hurry to pull off the CRT socket that the whole wretched base came off in his hand, leaving a bunch of fine twisty wires hanging from the CRT neck.

Getting these leads back in through the base is in itself a major operation, requiring three hands, twelve soldering irons (to heat up all the pins at once), and infinite patience due to the fact that the tinned pins just do *not* tin.

In this particular case, this job was a walkover compared to the problem with the cathode lead. This was broken off level with the glass . . . charming.

The first repair tried, was to file away at the glass until there was enough wire showing to solder on to. This worked out OK until it was time to thread the wire back in through the base, whereupon the lead broke off level.

Cursing and swearing were tried in vain, followed by a ten minute hate period for CRTs (sometimes this works ever so well). Spot welding was tried and had even less success than the cursing and swearing.

After a couple of hours of thinking, discussing, beer drinking and crying, it was unanimously decided to give up, and, in order to keep the set going over the weekend (football ya know), the base was replaced and the cathode wire was made to touch the broken connection in the glass.

The whole preparation was performed with extreme caution, as the slightest vibration would have caused the lead to become disconnected . . . breathing was, of course, out of the question.

For some inapparent reason the set

was working the next day, and the next, *and* the next . . . it is now over three years since this operation was performed and the CRT is still going strong . . . can't understand it!

Let us now examine some of the devastating things that can happen to your picture tube and what, if anything can be done about it.

Low Emission. This is the most common fault and is due to cathode coating becoming oxidized. The effects of this are very bleak pictures which get dimmer and dimmer as time goes on until after a few months it is impossible to watch the set with the lights on and anyone coming into the room takes about ten minutes before they see the set at all. Focus is absent, and any attempt to turn up the contrast or brightness results in the picture going negative. The set takes a long time for the picture to come on and may improve a little by the time you are ready to switch it off and go to bed.

Most people would either throw out the CRT or have a picture brightener fitted. This is a device that puts a slight overload on the heater of the CRT causing it to emit a few more electrons than it was doing. However, this is quite often not enough to have any effect on many CRTs. A more effective way is to fit a suitable transformer to boost the heater voltage. Filament transformers can be modified by adding turns to the secondary winding. Find out the filament voltage (usually 6.3 volts) and try increasing it by 25%. If this fails try 50% or 75%. The latter is overdoing it a little and may blow the filament but it is a last resort anyway so live dangerously . . . after all, it can only cost money.

There is another approach to this problem. This is to pass a high voltage (around 400V) between the grid and cathode at the same time as increasing the filament voltage. This is only necessary for a few minutes as it has the effect of boiling off the oxide coating

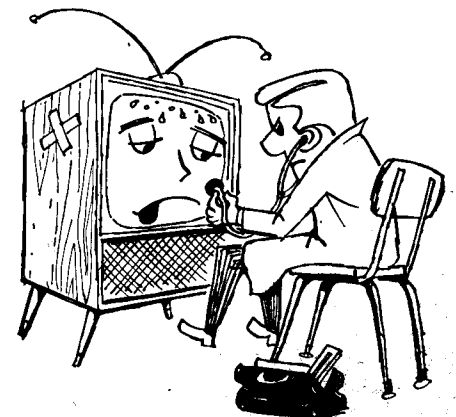
on the cathode, allowing it to emit once again. This should be tried before fitting a boost transformer as it is possible to extend the life of the CRT for many years. From my experience a pulsing voltage seems to be most effective and one can use a neon light 'starter' as a pulser.

Of course there are some commercial units on the market known as CRT reactivators which will do this, but they are fairly expensive.

Spot or Line in Centre of Screen
This is caused by the coating on the front of the CRT becoming burned. This fault was more prevalent in the older sets and there is nothing that can be done about it short of replacing the CRT. Only remember when that rogue of a TV service man is called in that a GOOD rebuilt tube may be as good if not better than a new one (i.e., thicker cathode coating sometimes put on by hand).

Filament Open Circuit The obvious effect of this is that there are no pretty coloured red lights inside the neck of the tube.

Although there are some instruments on the market which will sometimes join an open filament (I believe they pass an AC voltage to join it and then a DC voltage to weld it), to the best of my knowledge these are not very successful.



Before you rush out to buy a new tube remember that the filament wire inside the base pins could be loose.

Filament to Filament Short This is when the filament shorts to itself resulting in it suddenly being overrun. The emission increase causing the picture to increase in contrast or brightness. The filament may then revert back to its original condition and the emission will fall. If the filament has been overrun for a long period of time it may not work in the unshorted state.

This fault can be temporarily cured by tapping the neck of the CRT...



NO: put the sledgehammer down. Gently tap the tube with a pencil. There is no real cure for this condition; just a series of taps when the picture goes dim — pencils are available at any reputable TV repair shop or they may be substituted by pens, screwdrivers or little rubber hammers etc.

Filament Cathode Short This causes uncontrollable brightness, no picture at all or flashes across the screen. This is due to the signal on the cathode leaking to ground through the heater chain.

The cure is to isolate the CRT filament from the rest of the tubes and is achieved by fitting an isolating transformer to the CRT filament. It is necessary to disconnect the filament wires going to the base of the CRT and, in series heater sets, to connect the two disconnected wires together. Then run the wires from the secondary of a filament transformer to the CRT base. In parallel sets do not short the wires together as above or the power transformer will be ruined and they're expensive. Just leave them disconnected (taped of course). The primary of this isolating transformer should be connected through the on/off switch.

Filament Grid Short Although unusual this can happen particularly at the wires coming out of the CRT neck into the base and as well as causing the picture to go off, may just cause vertical slip. The cure is the same as described above.

Grid Cathode Short Sometimes as the CRT warms up the electrodes may sag causing the above short. A very simple and effective cure which sometimes works is to turn the CRT upside down. Only the EHT lead will have to be extended so it is worth a try. If this does

not work and the CRT is a pentode there is a good possibility that it will work to some degree as a triode . . . so convert it.

To do this disconnect the lead going to the grid. Disconnect the lead going to the first anode (this lead is not used anymore). Strap the grid and cathode together; connect the wire removed from the grid to the first anode. That's all folks, switch on and stand back.

Air in CRT This effect shows up as the highlights of the picture turning negative and becoming glossy.

No cure unless you have a high-

vacuum system handy although if you can get your hands on an RF heater you could try refiring the getters. It does sometimes work.

Graphite Coating Worn Away or Not Touching Ground This black coating is not just for decoration. It forms a low value condenser which is used to smooth the rectified EHT drive to the final anode.

If it is not operating it will cause such effects as sizzling noises, loud cracks, poor focus, reduced width and flashing across the screen.

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Save That Picture Tube

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If this coating is beyond redemption or if you have changed the CRT for another type which has no coating a filter condenser must be fitted. This will have to be about 0.001 uF 12KVW. This must be fitted across the final anode and ground. Do not forget that this coating can store a very high voltage, and whilst it is extremely good for drowsiness, hangovers etc., it is not to be recommended for heart conditions, children or old relatives. (unless they are filthy rich in which case see later article on how to electrocute filthy rich relatives).

Ion Traps Missalignment of these can give rise to all kinds of wierd effects such as poor focus, corners missing, no brightness, negative picture etc.

Inter Electrode Shorts Sometimes minute pieces of metal are thrown off the electrodes and cause shorts between them. A simple and often effective way of removing these is to remove the CRT socket, short one of the electrode pins to chassis and apply a few thousands volts at a few microamps to the other electrodes in turn. What do you mean you haven't got a power supply to give this... of course you have - in the TV set.

Disconnect the lead going to the final anode, switch on the set and watch the sparks (and onlookers) fly. On series sets it will of course be necessary to short across the CRT filament socket in order to obtain continuity.

Picture Tube Implodes This is probably the most impressive and interesting CRT fault. The symptoms are not too easy to observe so that it will be necessary to watch very closely. There will be a soft hissing noise followed by a large bang which will be heard several blocks away and will most likely wake up father from his afternoon snooze. The CRT will then disintegrate and small pieces will be followed by pieces of condensers, resistors, toffee apples, etc.

As the front of the TV set has safety glass on it nothing will come through the front. As it is now a little late to place safety glass all the way round the set, some obvious cures which spring to mind are . . . Contact insurance company . . . listen to radio . . . talk to your wife . . . go out and watch neighbors set implode . . .