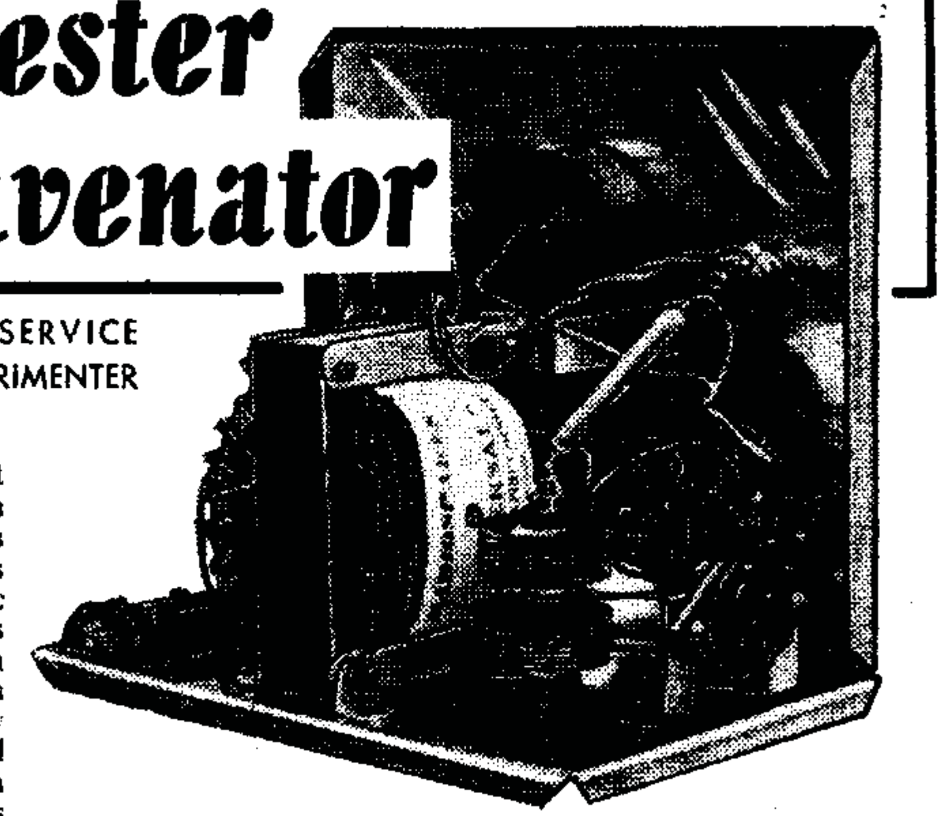
A C.R.T. Tester and Rejuvenator



A HANDY UNIT FOR THE SERVICE WORKSHOP AND THE KEEN EXPERIMENTER

By J. Hillman

IN TV servicing one of the great problems is whether the tube is at fault or whether the fault lies in the video circuit. In most cases it is difficult to decide which is the trouble, and extensive testing is necessary before a definite conclusion can be reached. This, of course, takes time and adds to the cost of any repairs, so this tester was designed to overcome these difficulties. With this tester the tube can be tested at its correct heater voltages and its emission checked, any leakage between cathode and heater, cathode and anode, grid and anode being located. All these tests can be carried out without removing the tube or having the set on, and, of course, this can be done at a customer's home. Another advantage is that new tubes can be tested without taking them out of their cartons and thus time is saved, for it has been known for new tubes to be faulty and the fault only becomes apparent when it has been fitted to a set. The operation of the tester is quite simple and consists of applying a low H.T. voltage between cathode and grid and checking the reading on a meter. The right heater voltage is selected by means of a switch and the test is selected by means of another switch. Adaptors are used to suit the particular tube to be tested and thus any make of tube can be tested. The reason for using a low H.T. voltage is to avoid breaking down the insulation between electrodes and thus creating faults. The tester can also be used to rejuvenate old tubes by applying the H.T. between the cathode and grid and gradually increasing the heater voltage by means of the variable resistor and heater switch until the emission current rises as far as possible.

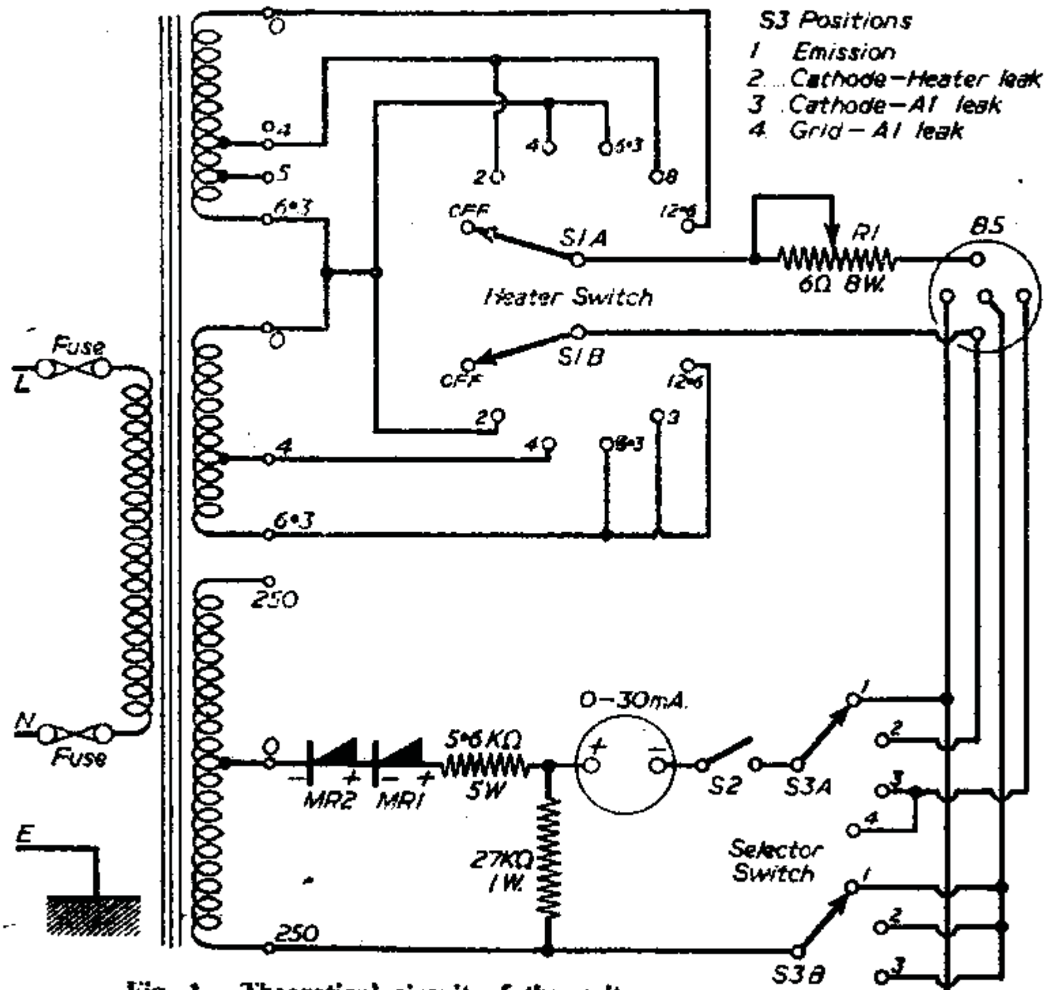


Fig. 1.—Theoretical circuit of the unit.

Construction

First mark off on a sheet of aluminium as in Fig. 6 and cut off the shaded portions, then bend up the ½in. sides. Note that the one edge has no ½in. side and this is the bottom of the front panel. Next mark off as in Fig. 2 and drill and file holes as shown, the hole marked A is first drilled ⅛in. and then filed larger to suit the size of toggle switch used. The hole marked B may be ⅜in. or ¼in. according to the type of variable resistor used. Now mark off and cut out the chassis, as Fig. 3 ,and bend up the ½in sides and mark out and drill as Fig. 4. The front panel and chassis may now be placed together, and by marking through the centre ⅛in. hole and drilling through the chassis the panel can be secured temporarily with a 6BA screw whilst the other two holes are then drilled and secured with 6BA screws. Now fit the mains transformer, using 4BA screws, then the rectifier, twin fuse-holder, 3 switches, resistor and meter. In fitting the meter place it in the hole and get it level and then mark through the holes on to the panel and drill ⅛in. holes securing with 6BA screws. Make up the bracket as in Fig. 5 and bend the two ends at right angles so that it appears as in Fig. 7. It will be seen that one end of the

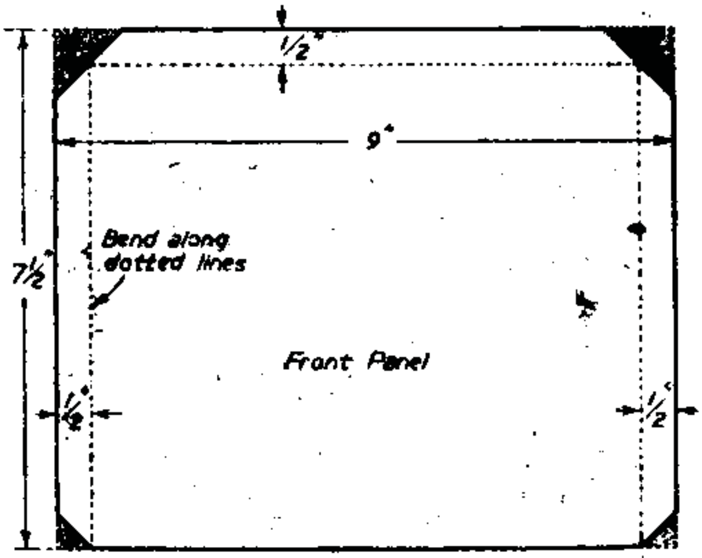


Fig. 8.—The front panel details.

bracket is secured to a bracket on the mains transformer whilst the other end is fastened to the front panel with 4BA screws. The object of this bracket is first to strengthen the support of the panel and second to provide a position for a dial bulb bracket. The cover can now be made as Fig. 6, bending the two 7in. sides first, then the ½in. sides and finally the remaining 7in. side. Now drill holes marked A in Fig. 6 and secure with 6 BA screws. Next mount the valveholder by means of two suitable brackets, as Fig. 10 in position as Fig. 7. Place cover in position and mark and drill a 3/32in. hole in the centre of the

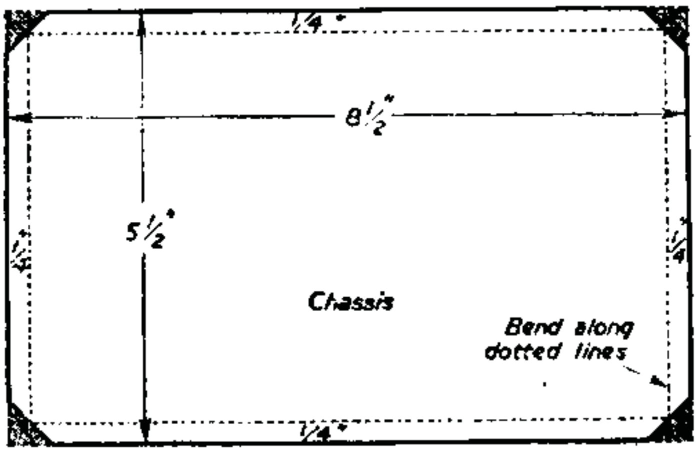


Fig. 3.—Details of the top of chassis.

top and secure with a self tapping screw, 6BA. Then get cover to fit properly and drill one hole at a time, securing with a self tap screw each time.

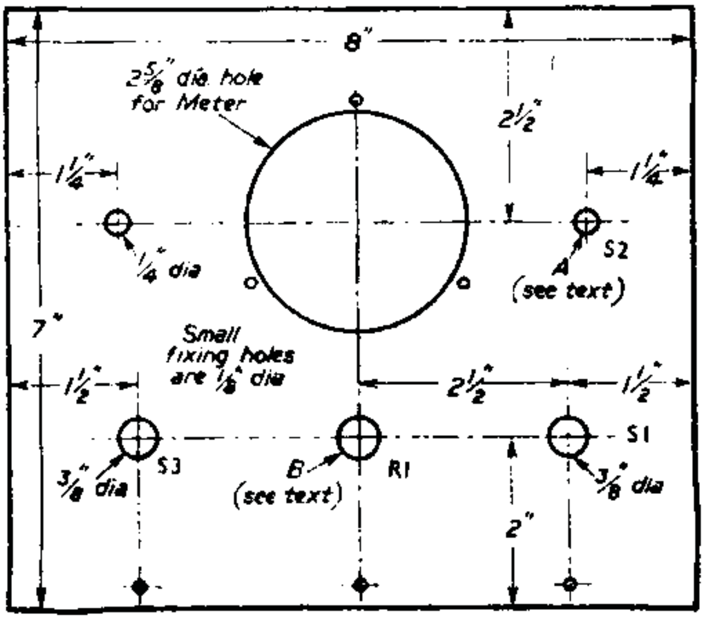


Fig. 2.—Drilling details for the panel.

The holes in the bottom of the cover where they go through the chassis are secured with 6BA screws. Finally remove cover and mark off position of a suitable hole to allow access to the valveholder and cut out the hole.

Wiring

Wire up the heaters, first using 20 s.w.g. T.C. wire and cover with sleeving. It may happen that the mains transformer heater windings are phased differently from that shown in Fig. 1; if so, then the circuit will be as Fig. 11. A check should be

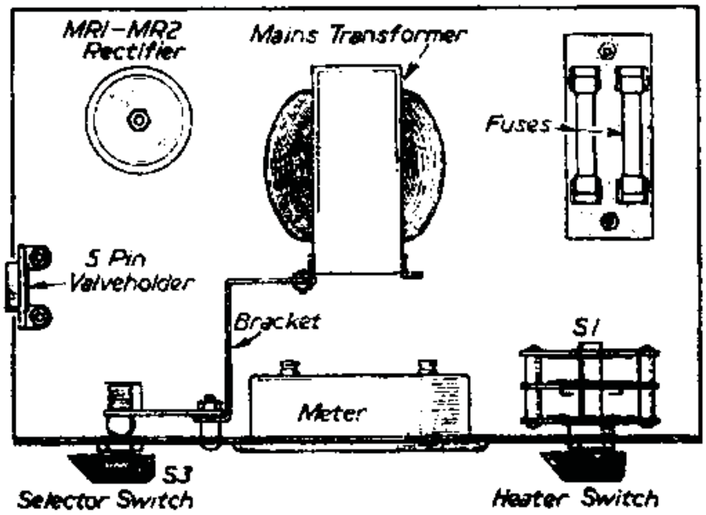


Fig. 7.—The layout.

made with an A.C. voltmeter across the two windings in series and if the voltage is about 13 volts then the two windings are phased correctly. If, on the other hand, the voltage is very low, then they are out of phase and the connections will need to be altered. Now complete the rest of the wiring, taking note of the correct polarity on the rectifiers and on the meter. The adaptors are made up, using an old valve 5-pin type with the glass envelope removed and the wires unsoldered from the pins and 7/33 coloured flex used to make a lead 3ft. long. Three adaptors are sufficient to cover most C.R.T.s, one with a

B12 valveholder, the other two a Mazda and an International octal valveholder. These are wired up as in Fig. 9.

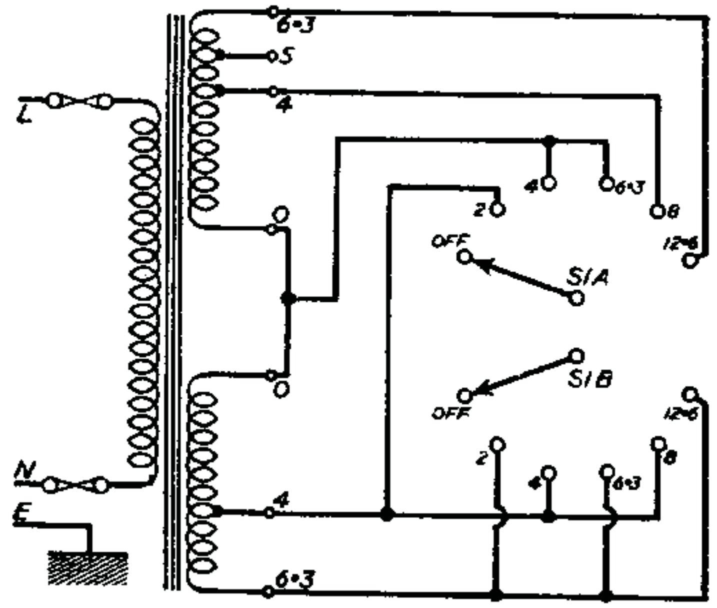


Fig. 11.—Alternative switch circuit.

Testing

Before testing C.R.T.s check all the voltages at the adaptors with different settings of the switches and R1. The voltages should be as follows: H.T. volts off load between cathode and grid 90 volts, and on load 15 volts: H.T. current off load is 3.5mA: the heater voltage on 12.6 position of S1 off load will be about 14 volts: on load voltage on 6.3v. range with resistor R1 at max. volts is 6.5v. and with resistor at min. volts is 4.75v.: on the 8 volt range resistor at max volts is 8.4v. and at min. volts at 6.5v. Having made sure that all the voltages and adaptors are correct a C.R.T. may now be tested. First put S2 to off, next

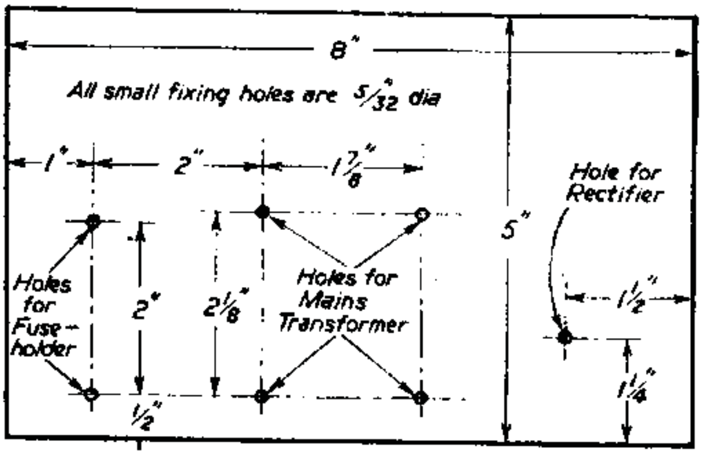
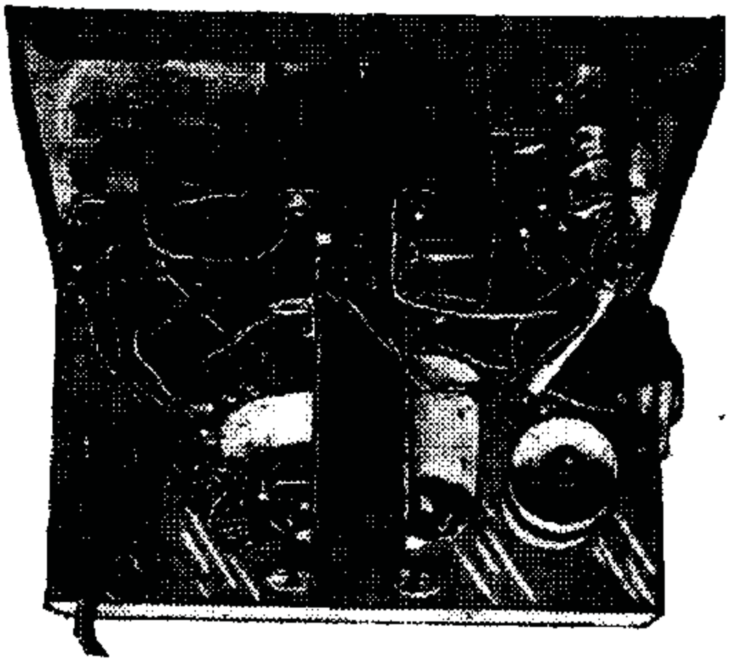


Fig. 4.—Drilling details for the chassis.

select the correct heater voltage to suit the tube to be tested, plug on the adaptor to suit the tube after first removing its holder. Now plug in to the mains and allow the heater to warm up, and then with S3 in position 1 switch on S2 and read off the value on the meter. This should be around 15mA for a new tube and will be below 5mA for a tube that has lost its emission, whilst for a complete loss of emission the meter will read zero. Having read the emission the switch S3 is put to position 2 and the cathode/heater leakage will be shown if the meter reads at all. A good tube will have a zero reading. Similarly, on position 3 the cathode/A1 leakage is checked, and on this it is quite in order for the meter to read slightly, providing it does not read more than the first division of the meter. Finally, on position 4 the grid/A1 leakage is read, and this should be zero for a good tube.

Rejuvenation

This is carried out by first running the tube at its correct heater voltage and then putting R1 to min. volts position (i.e., with all resistance in circuit) and switching S1 to the next highest heater range and gradually increasing the heater voltage by means of R1 until the meter reading will not increase any more or until it reads 15mA. To take an example, say a 6.3v. C.R.T. First switch S1 to 6.3v. and advance R1 to max. volts and allow C.R.T. to heat up, then put R1 to min. volts and switch S1 to 8v., allow C.R.T. to heat



A view of the layout and wiring.

up and watch meter until current will not rise any more. Then advance R1 until current rises again, leave until current stops rising, and then increase R1 again and continue like this until

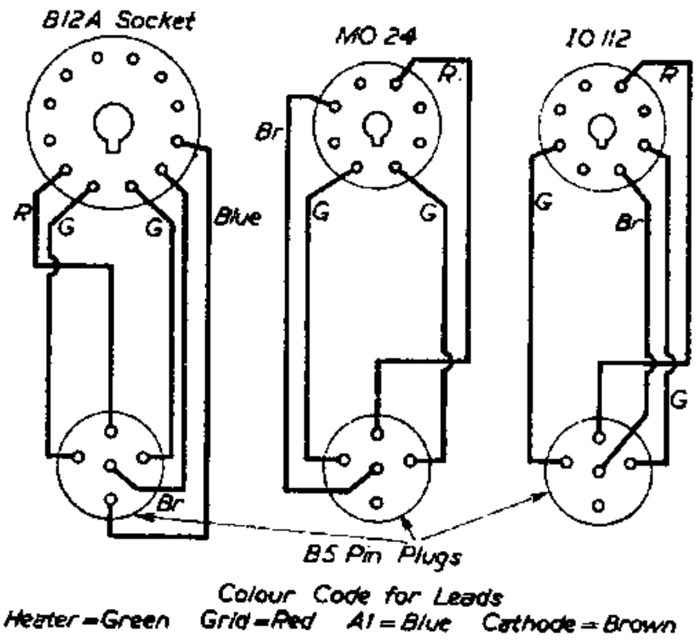


Fig. 9.—Tube base connections.

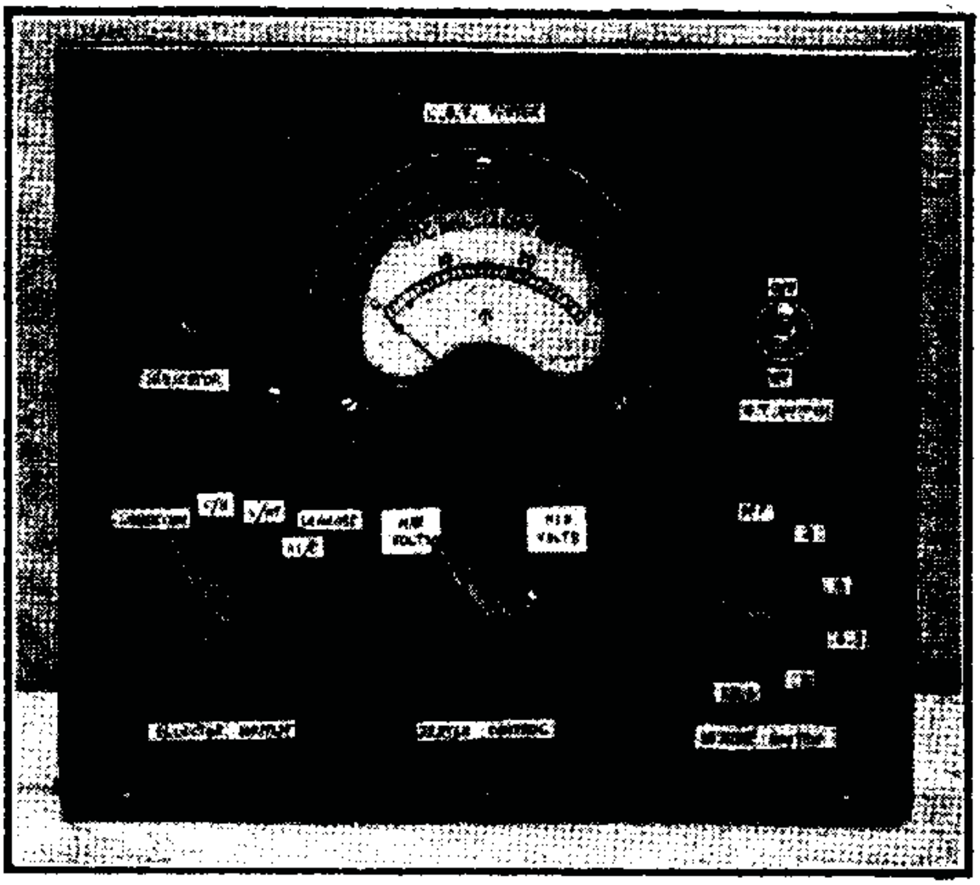
current ceases or meter reaches 15mA. Not all tubes will respond to this treatment, but a good proportion will have their useful life extended.

Tube Data

It is a good idea to type out a list of the tubes covered by the adaptors and to give their heater voltages, and then to glue this to the top cover of the tester. This will avoid the danger of putting the wrong voltage on a C.R.T. when checking at customer's house, and no data is available normally.

An examination of the various tube makers' catalogues will show that various tubes come under the different categories of bases. For instance, the majority of 6.3 volt tubes, with the exception of certain G.E.C. models, have the duodecal base and will therefore call for the B12A adaptor. The G.E.C. tubes 6501, 6502, 6504, 6504A, 6506A, 6703A, 6705A, 6802A, 6801A, 7101A and 6102A, although having 6.3 volt heaters, utilise the International Octal base. The Ferranti 8v. tubes, types T12/71U, T12/81U and T12/82U also require the Octal base.

The Mazda tubes C9A, C12A, CRM91, CRM92, CRM92A, CRM121, CRM121A, CRM121B, CRM123 and CRM151 all call for the Mazda Octal base.



A front view of the panel.

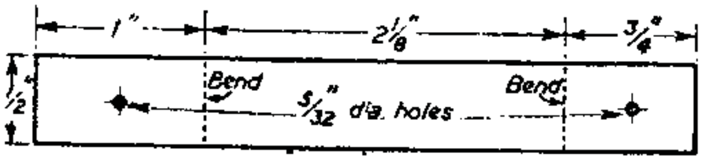


Fig. 5.—Bracket for bulb.

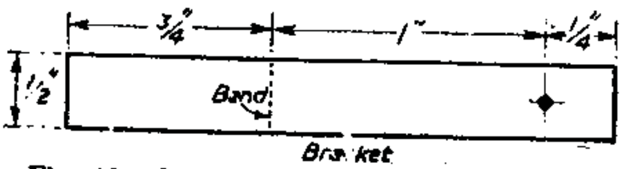


Fig. 10.—Valveholder brackets (two needed)

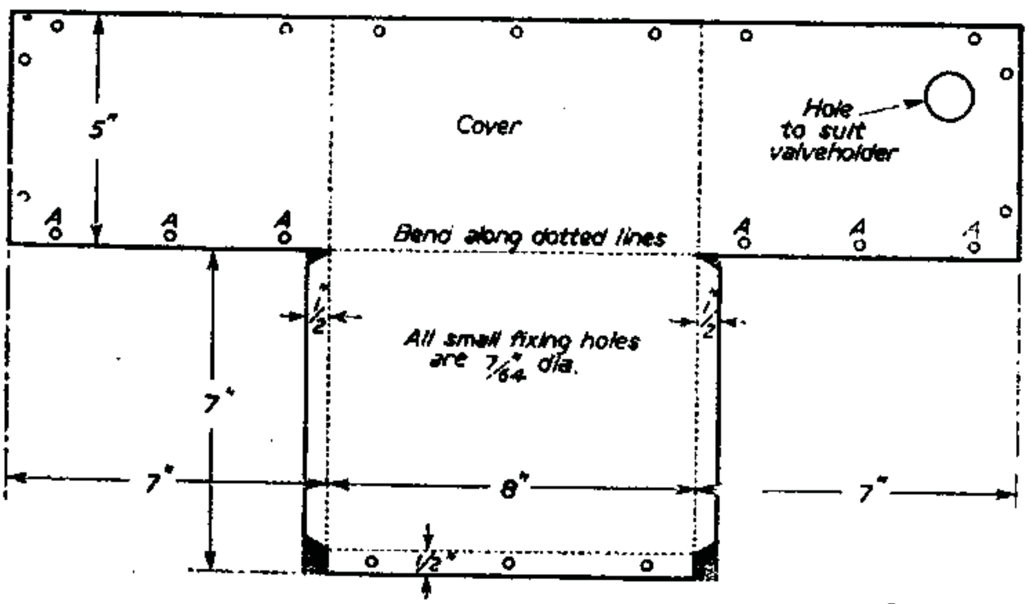


Fig. 6.—Details of the chassis cover.

Radio-telegraph Reception

IN telecommunications circles it is well known that errors can occur in messages transmitted by radio-telegraphy. Consequently, some messages, or parts of them, have to be re-transmitted so that the errors can be eliminated before the message is delivered.

In a new technique, developed by the G.P.O., frequency-shift keying is still used, but whereas in conventional equipment used for the reception of such signals a limiter and discriminator are employed, the new method makes use of the fact that all the signalling intelligence is impressed both on the marking and spacing frequencies. In other words, the information in the mark-channel duplicates that in the space-channel. Consequently, if all the available intelligence is derived independently from each frequency and then combined, a double-diversity arrangement is obtained. Frequency selective fading conditions often cause trouble on R.-T. circuits, but using the new arrangement they can be turned to advantage—if the signal on the marking frequency has faded, there is a second chance of obtaining the required information from the spacing frequency.

John Wakely
Warnham
West Sussex

Hello Paul,

I have at last scanned the article and attached it as requested. A good while ago now I removed the base adaptors and replaced it with miniature crocodile clips. This allows the rejuvenator/tester to be used with all CRTs including colour by simply looking up the base connections and connecting the clips as required.

My method of rejuvenation appears to be very much more effective and long lasting than the method mentioned in the article. I set the heater voltage as required by the tube and leave the ‘test’ switch i.e. the grid current OFF. When the tube has fully warmed up, switch to TEST. The needle usually hovers around half way but if the tube is good the needle will go over to almost full scale. With the needle hovering and the grid voltage applied [test on] reduce the heater voltage until the meter ‘kicks’ wildly. A visual examination of the gun will show a tiny discharge between the cathode and grid as the cooling cathode struggles to supply current. When the meter ceases to ‘kick’ return the heater volts to normal and the reading should now be as a 100% tube. The action is very gentle and tends to ‘peel’ off a very thin layer of dead emissive material revealing a fresh layer.

It will not operate with ‘dud’ tubes of course or tubes with o/c electrodes such as a disconnected cathode. It will also fail if the tube has been ‘boosted’ before and there is nothing left of the cathode coating. It will rejuvenate tubes with poised cathodes due to minute quantities of gas that have been liberated during original manufacture but the picture may suffer from astigmatism to some degree i.e. it will focus HORIZONTALLY or VERTICALLY but not 100% at the same time.

I would add that the process is somewhat similar to what is known as aging, the final process in new tube manufacture.

Finally I have used my unit on all types of tubes for decades and it has been very successful in most cases i.e. long term.

The selenium rectifier is still in place on my tester. The secret here is a ‘soft’ HT line and some experimentation may be needed if a modern silicon diode is used in its place. I don’t think the rectifier needs to be 100% and a slightly duff one (low output) may function better than a new one.

Trusting this information might help.

Regards.
John Wakely.