

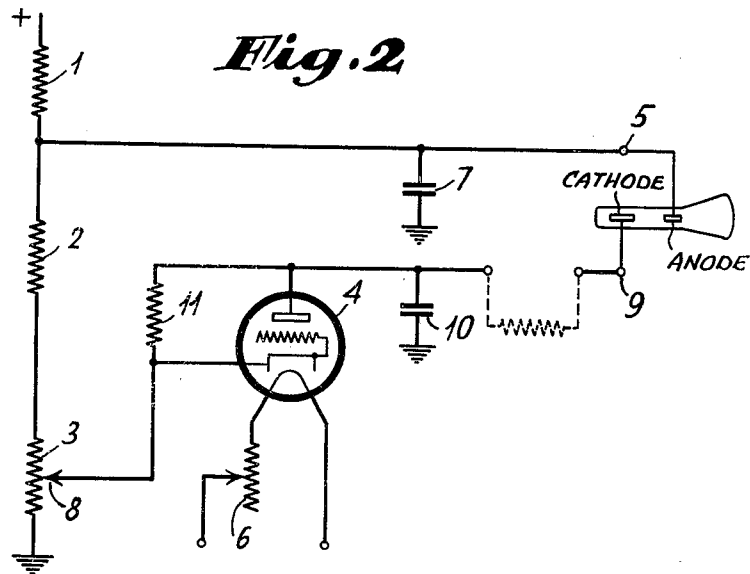
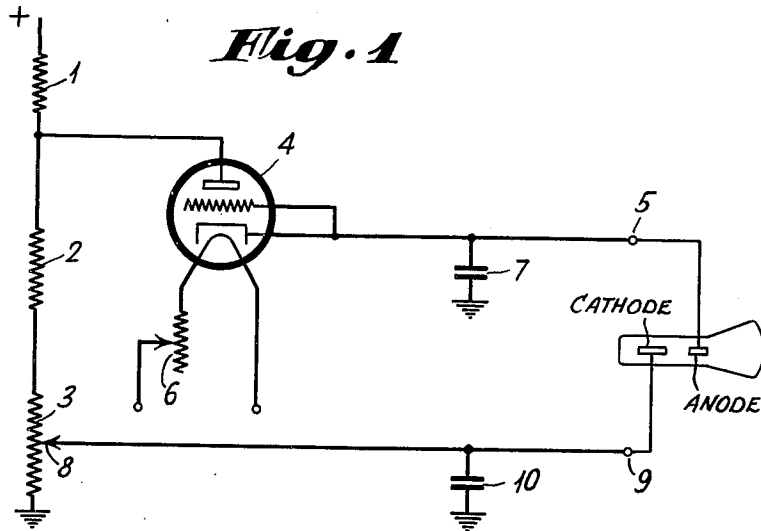
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CATHODE-RAY TUBE CIRCUITS

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CATHODE-RAY TUBE CIRCUITS

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This invention relates to a method of operating cathode-ray tubes.

It is well known that if the electron beam in a cathode-ray tube is allowed to remain stationary while incident upon the fluorescent screen of the tube, burning of the screen material may occur. Such may be the case for example when the operating voltages are applied to the tube and the beam is generated and focussed upon the screen before the deflecting fields become effective, and the beam may burn a hole through the screen.

In the case of a typical television receiver including a cathode-ray tube, from the instant at which the supply current is switched on, a period of five seconds may elapse before the beam spot is seen upon the screen. A further interval of seven seconds may elapse before the frame deflecting field is built up and a still further interval of five seconds before the line deflecting field is built up. The times specified do not take account of the delay which may be caused by the high tension supply unit itself which may not supply energizing current immediately it is switched on, as in the case for example, of supply units employing rectifying valves with indirectly heated cathodes. The figures mentioned apply to an experimental test in which batteries were used to energize the cathode ray tube and the time base apparatus was of the kind suitable for a cathode ray tube of the type known under the registered trade-mark "Emitron," having a screen diameter of 12 inches. The valves employed in the time base apparatus were of the pentode output type.

It will be seen from the example outlined that the electron beam may be incident upon the fluorescent screen for a period of seven seconds before it is moved and burning of the fluorescent screen may occur in that time. It is usual to apply to the control grid of the cathode-ray tube a bias potential such that the beam current is cut off when a picture signal representing black is applied to the control grid. If this bias potential is not applied and the energizing current is switched on, screen current will flow immediately the cathode has reached the requisite emission temperature.

It is the object of the present invention to provide for the prevention of damage to fluorescent screens due to the causes mentioned.

According to the present invention an operating circuit for a cathode-ray tube includes means for preventing the application of an operating voltage to an electrode of the cathode-ray tube until a field has been generated which serves to keep the electron beam in motion or until the

beam is otherwise rendered innocuous to the screen. In a particular circuit embodying the invention a diode valve is connected in series with the voltage supply to an accelerator electrode and the desired delay in applying the accelerator voltage is obtained by delaying the heating of the diode cathode by placing a resistance in series with the heater. In an alternative circuit a diode valve is connected in series with the cathode of the cathode ray tube in order to control the bias potential applied to it.

My invention will best be understood by reference to the drawing in which—

Fig. 1 shows one embodiment thereof, and

Fig. 2 shows a second embodiment thereof.

Referring to Fig. 1 of this drawing, a fragmentary circuit is shown including resistances 1, 2 and 3 connected across a source of direct current potential of 360 volts, and which serve to break down the voltage of the source to the values required for the electrodes of a cathode-ray tube not shown in the drawing. The resistances 1, 2 and 3 have values of 100,000, 200,000 and 50,000 ohms respectively, and a connection is taken from the junction between resistances 1 and 2 to the anode of a diode valve 4 connected in series with the accelerator electrode terminal 5 of the cathode ray tube. The diode valve may be an indirectly heated triode having its control grid and cathode connected together. The heater is supplied with current through a variable resistance 6 and a smoothing condenser 7 is provided.

The cathode of the valve 4 will of course be at a high potential, possibly of the order of 250 volts above earth potential, and in the case of a valve having a four volt heater, the latter may be energized from a winding separate from that supplying the heaters of other valves in the equipment. The separate energizing winding is not necessary in the case of a valve having a heater energized from a 13 volt source.

An adjustable tapping 8 in resistance 3 is taken to the cathode terminal 9 of the cathode-ray tube, and a further smoothing condenser 10 is provided.

In the operation of the circuit described using a diode valve with a four volt heater, when no resistance was inserted in series with the heater, a period of ten seconds elapsed before the accelerator electrode reached a potential of 100 volts. With 1.5 and 3.0 ohms inserted in series the periods were fifteen and thirty seconds respectively, the accelerating potential being 100 volts at the end of these periods. In the case of a

triode valve having its grid and cathode connected together, the periods taken for an accelerating potential of 100 volts to be reached when no series resistance and a series resistance of 1.5 ohms was inserted, were fifteen and twenty seconds respectively.

In an alternative method of operation shown in Fig. 2, the accelerator voltage is applied directly, but a diode is inserted in series in the lead to the cathode of the cathode-ray tube. The diode connections are similar to those in Fig. 1, but as in the present case the diode cathode is not at a high potential, a separate heater energizing winding is not required. In order to ensure that an excessive voltage will not be set up across the diode when it is non-conductive, a resistance of 100,000 ohms is connected across its anode and cathode.

The flow of beam current will be delayed until the diode valve becomes conductive, and as in this case and that of Fig. 1 the time delay due to heating up of the diode cathode is comparable with that of the valves in the frame and line deflecting circuits, the electron beam will not become stationary upon the screen but will be continuously deflected immediately upon formation. There will be no lag in operation as may occur if thermal delay switches are employed, the advantage of the present invention lying in the fact that the thermal capacities of the valve heaters are of the same order as that of the valves in the circuit.

It will be understood that the invention may be carried out in other ways. Thus, for example the greatest delay will be obtained when a source of

heater current is used having a voltage several times the rated heater voltage, and a suitable resistance is inserted in series. For example a heater rated at 4 volts may be used with a source of supply of 12 or 13 volts, and in such a case the series resistance would be of 8 or 9 ohms. The heater will heat up more slowly than in the cases previously described and it is possible to obtain the full rated output from the cathode without any risk of over-running.

I claim:

1. In a cathode-ray tube system, a cathode-ray tube having an envelope containing means for emitting a cloud of electrons, means for forming said electrons into a beam formation, and anode means for accelerating said electron beam, a unidirectional conductor having an operating period at least as great as the means for emitting a cloud of electrons, means for energizing said unidirectional conductor, a series circuit comprising the electron beam accelerating means, the unidirectional conductor and resistive means whereby potentials are impressed onto the electron beam accelerating means only after the elapse of a predeterminable period of time.

2. A system in accordance with claim 1 wherein said unilateral conductor comprises a diode.

3. Apparatus in accordance with claim 1, wherein said uni-directional conductor comprises a diode, and wherein the means for heating the emitting element in the diode is adjustable.

4. Apparatus in accordance with claim 1, wherein said resistive means is adjustable.

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