

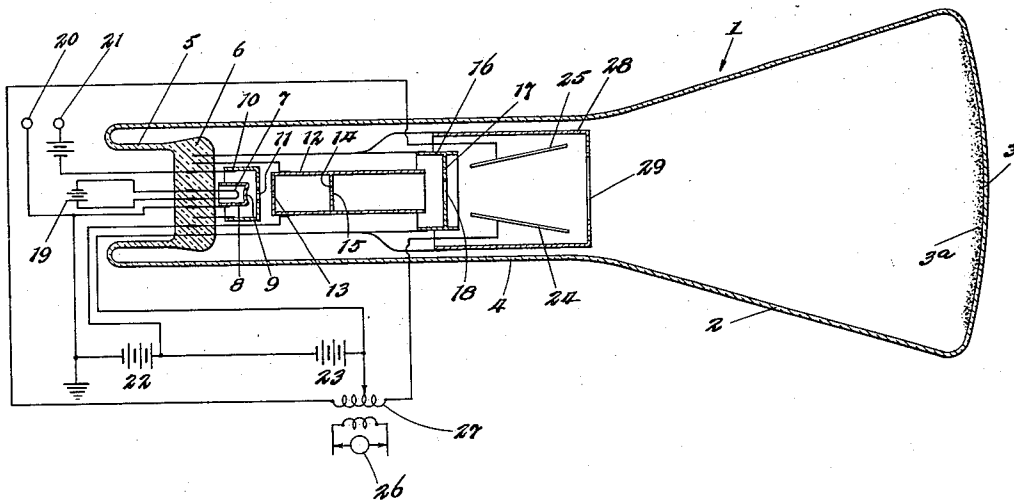
Oct. 17, 1939.

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2,176,199

ELECTRON-DISCHARGE TUBE

Filed May 10, 1934



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2,176,199

ELECTRON-DISCHARGE TUBE

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Application May 10, 1934, Serial No. 724,878

1 Claim. (Cl. 250—162)

This invention relates to electron-discharge devices and more particularly to an improved form of cathode-ray-tube.

An object of the invention is to provide a tube having a focussed electronic beam in conjunction with improved means for controlling the deflection of said beam.

Another object of the invention is to provide means for electrostatically deflecting an electron-beam, wherein the deflecting means are substantially unaffected by reversely flowing electrons.

A feature of the invention relates to a cathode-ray-tube of the electrostatic deflecting type wherein the deflecting members are shielded.

Heretofore, in cathode-ray-tubes of the type having a coating or screen which is rendered fluorescent by an impinging electron-beam, it has been the usual practice to provide a metallic coating on the interior wall of the tube which is maintained at a positive potential. The provision of these metallic coatings increases the cost of manufacture of the tube and also militates against the production of tubes having a long life. For example, it is very difficult to deposit a metallic coating which is substantially gas-free. Furthermore, such coatings are subject to peeling, discoloration during exhaust, and necessitate a special contact through the side wall of the tube. Accordingly, an important feature of the invention relates to a cathode-ray-tube wherein the beam is capable of accurate deflection without employing coatings on the glass wall of the tube.

A further feature relates to a cathode-ray-tube having a fluorescent screen at one end and an electron-gun at the other end, in conjunction with a pair of electrostatic deflecting members and a shield between said members and screen to prevent secondary emission from said shield affecting the potential of said deflecting members.

A still further feature relates to the novel organization, arrangement and relative location of parts which go to make up an improved and reliable cathode-ray-tube.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claim.

While the invention will be described herein as embodied in one typical form of cathode-ray-tube, it will be understood that the invention is not limited thereto but is capable of embodiment in any similar types of tube such as are used for

oscillograph purposes, television purposes or the like.

Referring to the drawing, numeral 1 indicates an enclosing envelope of glass or other suitable material, comprising a substantially conical portion 2 terminating in a flattened end wall 3, and a substantially cylindrical portion 4. Portion 4 terminates in a reentrant portion 5 which in turn terminates in a press 6 into which are sealed the lead-in and support wires for the various electrodes. The internal wall of the end portion 3 is preferably provided with a coating 3^a of material which becomes fluorescent when subjected to electron bombardment. Coatings for this purpose are well known in the art and a further description thereof is not deemed necessary at this point.

The electron-gun may comprise a heater filament 7 which is mounted within a metallic cathode thimble 8, which may be provided at its forward end with a depression 9 to contain the electron-emissive material or materials such as are ordinarily employed in cathode-ray-tubes. Surrounding the thimble 8 is a metal cylinder 10 having an opening 11 in its front end, the thimble 10 being preferably mounted so that the opening 11 is symmetrical with respect to the emissive coating on thimble 8. Electrode 10 is adapted to serve as an electron-control or grid electrode by means of which the intensity of the electron-beam from the electron-gun may be varied in any desired manner. Mounted in alignment with the electrodes 8 and 10 is an anode 12 in the form of a cylindrical metal tube having its front end completely open and its back end closed except for a small perforation 13 which is in alignment with the opening 11 in the grid or control electrode 10. Preferably also, anode 12 is provided on its interior with a diaphragm 14 which is provided with a perforation 15 in alignment with anode 12 is a supplementary anode 16 which is open at both ends and is provided on its interior with a perforated diaphragm 17. Preferably the perforation 18 is larger than either of the perforations 13 or 15. While members 7, 8, 10, 12 and 16 may be mounted in any suitable manner within the envelope 1, preferably they are supported by wires, as shown, from the press 6. Thus the filament 7 is supported by a pair of wires which provide lead-in connections whereby the said filament may be connected to a suitable source of current 19 for rendering it incandescent. Likewise the cathode 8 is provided with a support and lead-in wire by means of which it may be

connected to a terminal 20 of a signal input circuit. The other terminal 21 of the signal input circuit is connected through a lead-in wire as shown to the grid or control electrode 10. Likewise the anode 12 is provided with a support and lead-in wire for connection to a source of high positive potential represented schematically by the battery 22 the negative end of which is returned to the cathode 8 which in turn is preferably grounded as shown. Likewise the anode 16 is provided with a support and lead-in wire by means of which a steady high positive potential may be impressed thereon. Preferably the potential of electrode 16 is higher than the potential of electrode 12. In accordance with the accepted theory of operation of tubes of this type the electrons emitted from the cathode 9 pass through the perforation 11 in the control electrode 10 and, dependent upon the instantaneous potential of this control electrode, the intensity of the electron-beam emerging therefrom is correspondingly varied. Because of the disposition and arrangement of the opening 11 the electron-beam is subjected to a preliminary electrostatic focussing. The varying intensity electron-beam then passes through the anode 12 where it is subjected to a principal focussing action and in this connection it should be noted that preferably the electrode 12 is cylindrical and that the openings 11, 13 and 15 are preferably circular. The electron-beam leaving the anode 12 is further accelerated by the high potential anode 16, the opening 16 of which acts in the nature of an electrostatic lens to focus the emerging electron-beam in a minute spot upon the screen 3^a.

In order to deflect the focussed electron-beam, there are provided two deflecting plates 24, 25. These plates may be given any desired configuration but are preferably flat and are inclined to the longitudinal axis of the tube as shown. Preferably also the plates 24 and 25 are symmetrically disposed with relation to the opening 18 so that the plates exert similar deflecting actions on the electron-beam. The plates 24 and 25 are connected by lead wires 25, 26 to a source of oscillatory current represented schematically by numeral 26, for example through a coupling transformer 27, the midpoint of which may be connected to the positive terminal of source 23. In accordance with the well known operation of cathode-ray-tubes, the varying potentials on the plates 24 and 25 cause corresponding deflections of the focussed electron-beam causing this beam to oscillate back and forth across the fluorescent screen. It will be understood of course, that while the drawing shows only a single pair of deflecting plates for causing traversal of the beam in one direction, a similar set of plates may be positioned at right angles to the plates shown and connected to another source of oscillatory current to cause the beam to be deflected in a different direction. In any event, as the focussed beam strikes the fluorescent coating, an appreciable quantity of secondary electrons are emitted from this coating which, because of the relatively high potential of plates 24 and 25, tend to travel to these plates and change the potential thereof. Unless special means are provided for preventing this return of the secondary reversely flowing electrons to the deflect-

ing plates, these plates will become charged to a potential which is independent of the oscillating source 26 with the result that inaccuracies in the deflection are produced.

In order to overcome this effect the plates 24 and 25 are enclosed within a metallic shield 28 which may take the form of a cylinder having its front end provided with an opening 29 to accommodate the maximum deflection positions of the beam. Preferably the shield 28 is connected to a source of high positive potential, for example, the same potential as is applied to the anode 16.

With the arrangement disclosed, the deflecting potentials of the plates 24 and 25 are substantially independent of any secondary or reversely flowing electrons, consequently the deflecting circuits for the plates 24 and 25 may be designed to have a relatively high impedance for example, of the order of 10 megohms or more. It has been found that a tube constructed in accordance with the above disclosure can be designed to have a plate impedance equivalent to that of the ordinary interiorly metal coated tube without having the serious disadvantages which are necessarily attendant upon thin metal coatings.

While the drawing shows one particular type of shield around the plates 24 and 25, it will be understood that the invention is not limited thereto, for example while a cylindrical plate shield is shown, it will be understood that a wire mesh shield may be employed. Furthermore, it is possible to choose a metal for the shield 28 which is non-sputtering and if desired, shield 28 may be provided with a suitable coating to prevent secondary emission from the shield itself.

It will be understood of course that the envelope 1 may be either highly evacuated or may contain a filling of one or more inert gases which act to focus the electron-beam.

It has been found however, that the arrangement of electrodes as shown, enables proper focussing to be attained in the absence of a gas-filling, and without employing metallic coatings on the interior wall of the tube.

Various changes and modifications may be made herein without departing from the spirit and scope of the invention.

What I claim is:

A cathode ray tube comprising a cathode, a screen, an electrode system for directing a beam of electrons from said cathode to form a small spot upon said screen, deflecting electrodes for deflecting said beam over said screen in response to potential differences applied to said electrodes, said electrode system including a first and a second hollow electrode positioned to be traversed in succession by said beam, said second hollow electrode disposed nearer said screen than said first hollow electrode and surrounding said deflecting electrodes, adjacent portions of said hollow electrodes spaced from each other to form an electron lens when maintained at different positive potentials for focussing the beam upon said screen, and an apertured diaphragm arranged between said electron lens and said deflecting electrodes substantially outside the electrostatic field of said electron lens.

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