July 25, 1933. H. W. PARKER 1,919,596

ELECTRON EMITTER FOR ELECTRON DISCHARGE DEVICES

Filed Dec. 4, 1931

Fig. 1

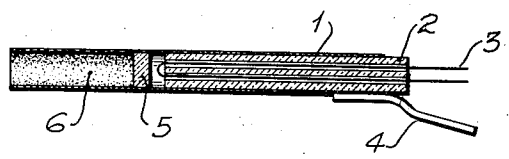


Fig. 2

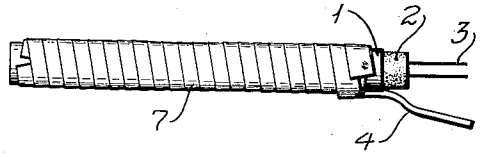
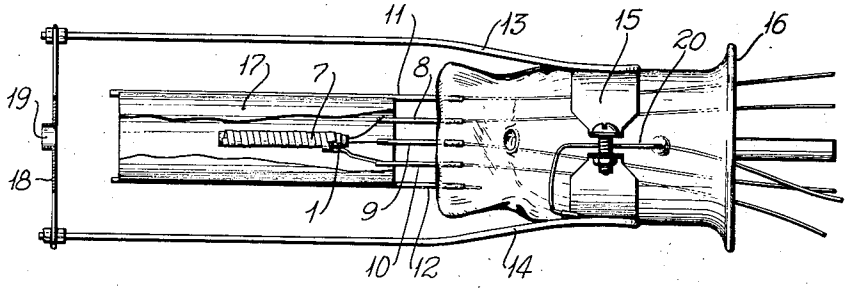


Fig. 3



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UNITED STATES PATENT OFFICE

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ELECTRON EMITTER FOR ELECTRON DISCHARGE DEVICES

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This invention relates to electron discharge devices and pertains particularly to the cathodes of such discharge devices as are termed Braun tubes.

An object of this invention is to provide a cathode for electron discharge devices which will be substantially free from destructive positive ion bombardment.

A further object of this invention is to provide a cathode having a relatively long emission life.

Another object of this invention consists in providing a cathode adapted to efficiently emit electrons from a cavity.

A still further object comprises providing a cavity cathode emitter which is effectively heated.

In Braun and similar tubes, especially of the type utilized now in television, the life of the tube is relatively short due to destructive positive ion bombardment of the cathode. Various means have been tried to overcome this defect, such as electrostatic shields arranged in various manner to reduce the positive ion bombardment of the cathode. Such ion bombardment unnecessarily limits the life emission of the cathode and seriously interferes with the commercial use of such tubes.

I have experimented with all of the known methods of reducing such positive ion bombardment of the cathode and have found that none of the methods now in use reduce such bombardment in a very appreciable manner. I have been able, by the novel form of cathode emitter hereinafter described, to avoid destruction of the cathode by positive ion bombardment to such an extent that electrostatic shields can be eliminated, the fabrication of the tube greatly simplified, and a reliable long life emitter achieved.

In the drawing accompanying and forming a part of this specification and in which like reference numerals designate corresponding parts throughout:

Fig. 1 is an enlarged sectional elevation of my improved emitter with the heat retaining covering omitted for the sake of simplicity;

Fig. 2 is an elevation of the same showing the heat retaining member thereon; and

Fig. 3 is an elevation of the assembly of the elements of a Braun tube showing my novel emitter and its relation to other associated electrodes.

Referring now particularly to Figs. 1 and 2, my novel cathode comprises a metallic tube 1, preferably of nickel, within which there is inserted a heating element composed of the refractory insulating member 2 and the heating wire 3. The inside of the other end of the tube 1 is coated with an electron emitting substance 6, such as barium or strontium oxides or combinations thereof, and this portion of the tube 1 is separated from the heater by means of a ceramic plug 5, the function of which is to prevent light from the filament 3 emerging through the open end of the tube 1. A contact terminal 4 is electrically connected to the tube 1. The physical principle involved is the efficient emission of electrons from a cavity. If a positive ion travelling at great speed enters the cavity, it will knock off active material from the inner walls of the cavity, but this active material obviously will remain in the cavity even though it may be splashed to the other side thereof. It is evident that loss of active material from the cavity is a very small probability and hence destructive action of the positive ion bombardment does not allow active material to be lost. Preferably the length of the coated portion of the tube 1 is greater than the diameter thereof. In practice I prefer to employ a tube having a diameter of about 0.08 of an inch and an overall length of about 1.0 inch, the coated portion being approximately four times the diameter of the tube.

In order to heat the active material 6, it is necessary to transfer sufficient heat along the relatively thin wall of nickel tube 1 from the heater 3 to produce a temperature great enough for breaking down the alkaline earth oxides such as strontium or barium during the activating process and later, during the operation of the cathode, for maintaining sufficient temperature for

the purpose of generating evaporated electrons within the cavity. In order to effect efficiently such transfer of heat, I employ the physical principle involved in the transfer of heat across a multilayer of low thermal emissivity material and to that end loosely wind several layers of a very thin metallic tape 7 around the outside of the tubing to effectively thermally insulate it so that transfer of heat from the heater 3 along the length of the tubing 1 exists to a greater degree than would be the case if radiation perpendicular to the axis of the tube 1 were permitted. I prefer to employ a tape of thin nickel foil which is preferably highly polished, wound loosely about the tubing 1 several layers deep and fastened at one end by spot welding to prevent ravelling. Such winding of tape very efficiently thermally insulates the tube and directs the flow of heat along the tubing 1 at a much more rapid rate than would otherwise be the case and at a smaller fall of thermal potential.

Obviously, the tube 1 could be coated or covered with a ceramic heat insulator but such coating has been found to be much less efficient than the metallic tape I prefer to use and it is further difficult to degasify in the process of evacuating the tube in which the cathode is employed.

Referring now to Fig. 3, I have shown the relation of my novel cathode with respect to the usual associated anode and focusing cylinder employed in a Braun tube. The electrodes are mounted on the stem 16. The anode disk 18 containing the aperture 19 is supported on the stem by means of the standards 13 and 14 and the strap 15 to which is attached the contact terminal 20. A focussing cylinder 17 is supported in the press by means of standards as 11 and 12, while my novel cathode is supported in the press by means of standards as 8 and 9. The terminal of the cathode is united with the standard 10.

It will be noted that with my novel cathode the construction of the Braun tube of the type used in television is greatly simplified through the elimination of all electrostatic shields and the cost thereof consequently reduced. Further, due to the novel construction of my cathode, the emission life of the cathode is very greatly increased due to the elimination of destructive positive ion bombardment. It will be further noted that due to the novel thermal insulation of the cavity tube 1, that the transfer of heat from the heater to the emitter is efficiently effected and thus reliability of operation is increased.

Having thus completely described my invention, what I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a cathode for electron discharge devices, a tubular heat conducting member, a heating element electrically out of contact with said member and disposed near one of the extremities thereof, a coating of electron emissive substance disposed on the interior of said tubular member near the other extremity thereof, a ceramic plug in said member between said heater and said emissive substance and means for effectively transferring heat from said heater along the walls of said member to said emissive substance.

2. A cathode for electron discharge devices comprising, a tubular heat conducting member, a heating element within said member near one extremity thereof, a coating of electron emissive substance on the interior of said member near the other extremity thereof and at least one layer of a loose spiral winding of metallic foil on the outer surface of said member.

3. A cathode for electron discharge devices comprising, a metallic cylinder, a heating element within said cylinder near one extremity thereof, a coating of electron emitting substance on the interior of said cylinder near the other extremity thereof, and a winding of metallic foil on the outside of said cylinder.

4. A cathode for electron discharge devices comprising, a metallic cylinder, a heating element within said cylinder near one extremity thereof, a coating of electron emitting substance on the interior of said cylinder near the other extremity thereof, a ceramic plug in said cylinder between said emitting substance and said heater and a winding of metallic foil on the outside of said cylinder.

HENRY W. PARKER.