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ELECTROSTATICALLY CONTROLLED ELECTRIC DISCHARGE DEVICE

Filed March 5, 1931

Fig. 1.

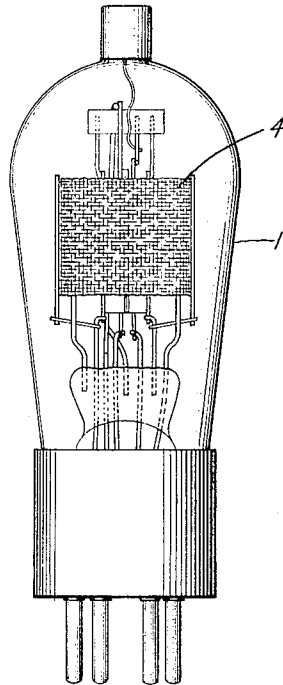
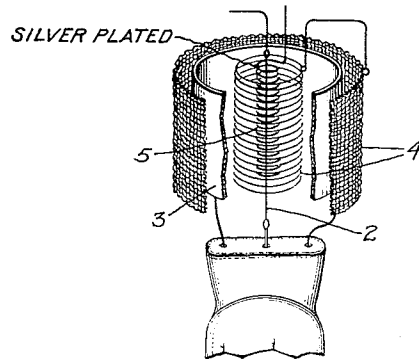


Fig. 2.



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UNITED STATES PATENT OFFICE

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ELECTROSTATICALLY CONTROLLED ELECTRIC DISCHARGE DEVICE

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New York

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and in Great Britain March 15, 1930

4 Claims. (Cl. 250—27.5)

My present invention relates to electro-statically controlled electric discharge devices having cathodes of the oxide coated type and the object is to reduce grid emission in such devices.

5 With this object in view, according to my invention, the grid is coated with a layer of silver or other similarly acting metal in any convenient manner, preferably by electro-plating.

It has previously been proposed to coat the grids of power tubes with some material which will prevent thermionic emission from the grid due to the active coating sputtering or volatilizing on to the grid. Such materials have heretofore been of a nature deleterious to thermionic emission. It has been proposed, for example, to coat the grid of a tube with chromium oxide. Apparently any barium which is volatilized on to the grid is converted into barium chromite which does not emit appreciably. However, it is found that when grids are coated with substances deleterious to emission for the purpose of preventing or reducing grid emission, some of this material during the manufacture or operation of the tube may be deposited on the cathode and thus inhibit cathode emission also. I have discovered that if the grid is coated with silver, grid emission is prevented and at the same time the use of such a silver coated grid is not deleterious to the cathode, which may be explained by the fact that silver in the coating of the cathode is found not to be deleterious to emission and possibly even to be slightly beneficial, so that if any silver from the grid is transferred to the cathode no harm will result. It is not clear why silver and other suitable metals operate so that they prevent grid emission and yet if applied to the cathode do not prevent cathode emission, but it is thought that a possible theory is that the silver on the grid is slowly sputtered by any positive ion bombardment due to residual gas in the tube, and this sputtering carries away with it any active material deposited from the cathode or it may be that owing to the operating temperature of the cathode any silver deposited thereon is completely, or nearly completely, volatilized. However, I do not wish to be restricted to the above mentioned theories.

It will be clear that other metals which prevent grid emission and do not inhibit cathode emission may be employed, for example, copper and lead.

In carrying out the invention, a molybdenum or nichrome grid provided with a nickel support wire may be treated in the following manner.

55 The grid may be first cleaned by washing in caustic soda or by firing in hydrogen. It may then be plated with silver, using a plating bath containing a mixed solution of potassium cyanide and potassium silver cyanide. After plating, the grid may be washed and dried, and then

placed in a vacuum oven at 700° C. for about thirty minutes. The grid is then ready for assembly in the tube with the other electrodes. The tube is heated and exhausted in the usual manner except for the matter of grid temperature. It has been found that the latter should be higher than that ordinarily employed for this purpose, in fact, so high that any silver oxide remaining on the grid is reduced. This temperature will ordinarily be in a range whose upper limit is about 250° C. Unless the optimum temperature is reached during exhaust, a portion of the silver oxide may remain and become objectionable. On the other hand, heating the grid to a red heat or above, appears to have a deleterious effect on the metal so that the best range of temperatures for the deoxidizing treatment is between 250° C. and a very dull red heat. The invention is illustrated in a typical screen grid tube, shown on the drawing, in which Fig. 1 is an elevational view of the tube while Fig. 2 shows a diagrammatic representation of the tube, partly broken away. In the drawing, numeral 1 designates an evacuated envelope which contains a filamentary cathode 2, and anode 3, a double-section screen grid 4 and a control grid 5 improved in accordance with the present invention. While I have explained my invention in connection with a screen grid tube, it is evident that the advantages of a silver plated grid apply also to other forms of tubes which employ an electrostatic control member.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric discharge device comprising an envelope containing a cathode, an anode and a control member constituted entirely of metal, said control member being coated with a metal included in the following group: silver, copper, lead.
2. An electric discharge device comprising an envelope containing a cathode, an anode, and a control member constituted entirely of metal and plated with silver.
3. An electric discharge device comprising an envelope containing a cathode, an anode, and a control member consisting of molybdenum plated with silver.
4. An electric discharge device comprising an envelope containing a cathode, an anode and a control member, said control member constituting a wire helix surrounding the cathode and coated with a metal of the following group: silver, copper, lead.

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