My invention relates to electron discharge apparatus, and particularly to electron " dissector tubes " such as are used for the electrical scanning and transmission of television pictures.

Objects of my invention are: to provide a dissector tube having increased sensitivity; to provide a target or auxiliary electrode for such a tube which will provide a multiplication of the received electrons by secondary emission; to provide a target wherein a secondary emitting surface may be formed after the tube has been evacuated, and in which the secondary emitting surface may be completely shielded so that heating by high frequency induction is impractical; and to provide a form of anode for receiving the secondary emission which is out of the path of the primary radiation and which therefore will carry only the secondary electron current.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of my invention herein described, as various forms may be adopted within the scope of the claims.

In the drawing, Figure 1 is an axial, sectional view of a dissector tube embodying my invention. Figure 2 is a detailed sectional view, on a greatly enlarged scale, of the target shown in the tube of Figure 1.

In general terms, the target which forms the subject matter of the present invention, comprises a shield having an aperture behind which is positioned a surface which is adapted for secondary emission of electrons. Between the aperture and the shield is an anode which substantially surrounds the path of the electrons entering the aperture but which itself lies without this path. The anode preferably comprises a filamentary electrode which is coated originally with the material which forms the secondary emitting surface, and after the tube has been constructed and evacuated the filament is heated electrically to vaporize the secondary emitting substance and deposit it upon the target. The surface thus formed is free from contamination and highly active as a secondary emitting surface. In my preferred form, my invention comprises a tubular envelope 10 having, at one end, a planar window 11 through which the image to be transmitted may be focused upon a photo-sensitive surface deposited upon the face of a front-silvered mirror 12. The mirror is preferably mounted by means of clips 13 to a glass pillar 14 carried by a stem 16 at the opposite end of the tube from the window.

Immediately in front of the photo-sensitive cathode is a screen anode 17. The screen is formed of extremely fine wire, and offers little obstruction either to the light forming the image or to the electrons emitted from the photo-sensitive surface. The screen is supported by a plurality of wires 18 which are welded or otherwise leaded 26 and 27, sealed through the stem 16.

Positioned in the upper or forward end of the tube, immediately behind the window 11, is the target. This comprises a tubular shield 30 which fits within a projecting side tube 31 and is held in position frictionally. An outer shield 32 fits over the projecting side tube and is connected to the shield 30 by a wire 33 sealed through the end of the side tube. A cap 35, over the end of the shield 30 prevents the entrance of stray electrons, and limits the discharge entering the shield to that which can pass through a small aperture 36 formed in the side of the shield facing the cathode.

Within the shield, and surrounding the electron path between the aperture 36 and the inner rear surface of the shield, is a filamentary anode 37, connected to leads 38, 38', which are insulated from the shield by glass beads 40. The leads are sealed out through the ends of the side tube 31, passing through an insulating button 41 mounted on the end of the outer shield 32.

The filamentary anode 37 is originally coated with a material which is particularly active in the emission of secondary electrons. Such materials are thorium, thorium, strontium oxide, and barium oxide. Any other material which is active in secondary emission, and which may be volatilized, may be used.

The tube is evacuated and the photo-sensitive surface formed by the usual methods. After this has been done, a current is passed through the leads 38, 38' and the anode 37, which is thereby raised to a high temperature, volatilizing the secondary emitting substance. This substance condenses upon the inner walls of the shield 30, where it forms the active surface of the target.

In the operation of the device the shield 30 is preferably operated at the same positive potential as the anode 17 and screen 21. The filamentary anode 37 is maintained at a slightly higher
positive potential. When the tube is in use, the anode is not heated.

A wide range of potentials may be used in operating this device. Potentials as low as 150 volts between the cathode 12 and the anode 17 have been used, and potentials as high as 2,000 volts have also been tested. An intermediate potential is usually to be preferred, the limitations being the vacuum to which the tube is pumped, the insulation of the device, and the particular materials used for photo-sensitive and secondary emitting surfaces.

Between the anode 37 and the shield 30 a potential of about 45 volts has proved to be most advantageous, since this is sufficient to attract all of the electrons emitted from the shield without causing secondary emission from the anode itself. It is to be noted, that even though some secondary emission from the anode should occur, the emitted electrons are all drawn back to the anode which is at the highest potential in the system.

The particular advantages of the target here described reside in the fact that the anode is subject to no direct bombardment from the photo-sensitive cathode, and that the secondary emitting surface is freshly deposited after the tube is evacuated and is therefore not subject to contamination by gas in the tube. Experience has shown that the secondary emitting material can substantially all be evaporated from the anode. Moreover, the shield may be thoroughly heated by induction when the tube is formed and thus thoroughly de-gasified without raising the material on the anode to the vaporizing temperature. The whole device may then be allowed to cool, and when volatilization of the secondary emitter does occur it immediately deposits upon the cold surface of the shield.

In operation, magnetic means are used for focusing the electrical image substantially in the plane of the aperture 36. By electrical image, I mean a plane in the electron stream within which the electron density at any point, bears a direct relation to the light density at a corresponding point in the optical image which initiates electron discharge.

I claim:

1. A target for an electron discharge device comprising a shield having an aperture therein, a surface adapted for secondary electron emission disposed behind the aperture to receive electron bombardment therethrough, said surface being electrically connected to said shield, and an anode comprising a wire loop substantially surrounding the electron path between said aperture and said surface.

2. In combination, means for forming an electrical image, and a target mounted substantially in the plane of said image and comprising a shield having an aperture therein adapted to admit a portion of the electron stream forming said electrical image, a surface adapted for secondary electron emission disposed to receive the electrons admitted through said aperture, and an anode positioned between said aperture and said surface and having an opening therein between said aperture and surface.

3. In combination, means for forming an electrical image, and a target mounted substantially in the plane of said image and comprising a shield having an aperture therein adapted to admit a portion of the electron stream forming said electrical image, a surface adapted for secondary electron emission disposed to receive the electrons admitted through said aperture, and an anode positioned between said aperture and said surface and without the path of the portion of the electron stream entering the aperture.

4. An electron discharge device comprising a shield having an aperture therein and having an inner surface adapted for secondary emission of electrons, means for directing an electron stream through said aperture onto said surface, and an anode insulated from said shield and protected thereby from said electron stream for receiving secondary electrons from said surface.

5. An electron discharge device comprising means for forming an electrical image, a tubular shield having an aperture positioned substantially in the plane of said image and having an inner surface adapted to emit secondary electrons and opposite said aperture, and an anode within said shield and having an opening thereina and anode adjacent said surface and comprising a vaporizable material adapted for secondary emission of electrons, said anode being adapted to be electrically heated by the passage of current therethrough to deposit said material on said surface.

6. A target for an electron discharge device comprising a surface positioned to receive the electron discharge, and an anode adjacent said surface and comprising a vaporizable material adapted for secondary emission of electrons, said anode being adapted to be electrically heated by the passage of current therethrough to deposit said material on said surface.

7. A target for an electron discharge device comprising a surface positioned to receive the electron discharge, and a filamentary anode adjacent said surface and comprising a vaporizable material adapted for secondary emission of electrons.

8. A target for an electron discharge device comprising a hollow shield having an aperture therein positioned to receive the electron discharge, and a filamentary anode comprising a vaporizable material adapted for secondary emission of electrons, means for directing a portion of the emission from said photo-sensitive cathode through said aperture onto said inner surface, and an anode insulated from said shield and protected thereby from said emission for receiving secondary electrons from said inner surface.

9. An electron discharge device comprising a photo-sensitive cathode, a shield having an aperture therein and an inner surface adapted for secondary emission of electrons, means for directing a portion of the emission from said photo-sensitive cathode through said aperture onto said inner surface, and an anode insulated from said shield and protected thereby from said emission for receiving secondary electrons from said inner surface.

10. In combination, a photo-sensitive cathode, a target comprising a surface positioned to receive a portion of the electron discharge from said cathode, and an anode adjacent said surface and comprising a vaporizable material adapted for secondary emission of electrons, said anode being adapted to be electrically heated to deposit said material on said surface.

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