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HIGH EMISSION CATHODE

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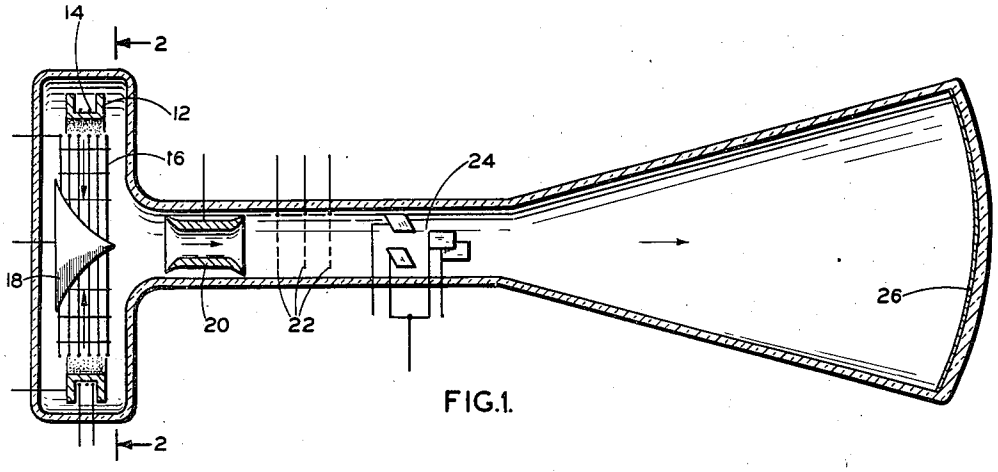


FIG.1.

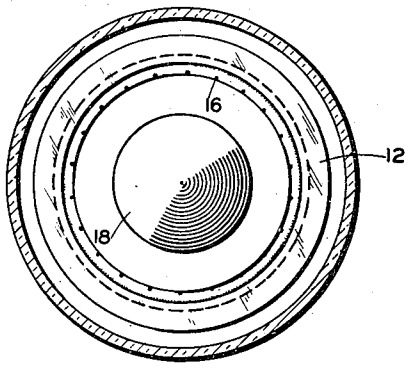


FIG.2.

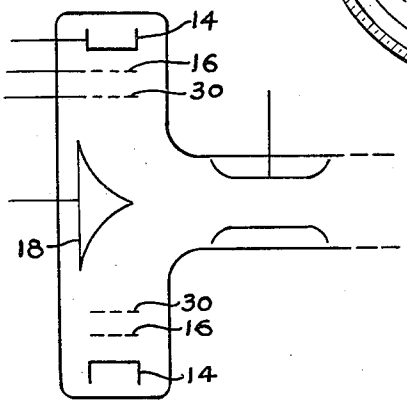


FIG.3.

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HIGH EMISSION CATHODE

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5 Claims. (Cl. 250—150)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to electron emission apparatus, and more particularly to electron emitting cathodes therefor.

The primary object of the present invention is to generally improve cathodes. A more particular object of the present invention is to provide a large area cathode, so that a large electron emission is obtained from a large cathode surface, but the electrons are gathered and used to produce secondary emission in a relatively small region, which region then constitutes a virtual cathode region.

To accomplish the foregoing general object, and other more specific objects which will hereinafter appear, my invention resides in the cathode elements, and other tube elements, and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing in which

Figure 1 is a longitudinal section through a cathode ray tube embodying features of the invention;

Figure 2 is a transverse section taken approximately in the plane of the line 2—2 of Figure 1; and

Fig. 3 is a schematic view of another embodiment of my invention.

Referring to the drawing, the primary or first cathode is a relatively large diameter ring or cylinder 12. A filamentary cathode may be used, but in the present case the cathode is a continuous surface which is preferably oxide-coated on the inside face, and which is indirectly heated, as by means of a heating coil 14. Electrons emitted by the cathode are attracted to and through an accelerating grid 16, and strike a target 18, which acts as a secondary emitter. In the particular case here illustrated, the target is approximately conical in shape. The electrons emitted at 18 may be considered as coming from a second or virtual cathode region of small dimension, compared to the large size of the actual cathode 12.

The electrons are utilized in any desired or conventional manner. In the present case, the cathode assembly forms a part of a cathode ray tube, and the electrons pass through a focusing electrode 20, and then through one or more control grids 22. Appropriate deflecting electrodes 24 may be employed, depending on the use to

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which the electron beam is to be put. The electrons then strike a screen 26.

It will be understood that, if desired, a suppressor grid may be disposed about the secondary emitter in order to prevent the emitted electrons from being drawn back to the accelerating grid. Such a structure is shown in Fig. 3, wherein grid 30 is the suppressor grid which is, in accordance with usual practice, at cathode potential or lower. It will also be understood that by applying a sufficiently high positive potential to the secondary emitter, the accelerating grid may be omitted. It will be appreciated that for some purposes a single pair of deflecting plates will be adequate, instead of the two pairs here shown. A magnetic focusing means may be used instead of the electrostatic focusing means illustrated in the drawing. It will also be understood that magnetic deflecting means may be employed, instead of the electrostatic deflecting means shown. Although the grid 16 and target 18 have been referred to as positive, this is meant in a relative sense, for the electrodes 24 may be at mean ground potential.

It should be mentioned that while the cathode assembly has been illustrated as used in a cathode ray tube, it may also be used for an X-ray tube, and also for an ordinary electron emission tube (meaning ordinary in the sense that it is not of the beam type).

It is believed that the construction and operation of my improved cathode assembly, as well as the advantages thereof, will be apparent from the foregoing detailed description. The actual electron emitting surface may be made very large in area, yet the virtual source of electrons is confined to a relatively small region.

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention as sought to be defined in the following claims.

I claim:

1. A high emission cathode assembly, said assembly comprising a generally cylindrical cathode of large diameter, a target having an approximately conical surface disposed at the center of said cathode and concentric therewith, and means to polarize the target more positive than the cathode, whereby electrons emitted from the cathode strike said surface and release electrons by secondary emission, the region of said target constituting a virtual cathode region capable of supplying a relatively large electron current.

2. A high emission cathode assembly, said assembly comprising a generally cylindrical cathode of large diameter, a conical target surface disposed at the center of said cathode and concentric therewith, a cylindrical accelerating grid disposed between said cathode and said target, and means to polarize the target more positive than the cathode, whereby electrons emitted from the cathode surface strike said surface and release electrons by secondary emission, the region in the vicinity of said target constituting a virtual cathode capable of supplying a relatively large electron current.

3. A high emission cathode assembly, said assembly comprising a generally cylindrical cathode of large diameter, a target electrode disposed at the center of said cathode, cylindrical accelerating and suppressor grid electrodes disposed between said cathode and said target, and means to so polarize said electrode that electrons emitted from the cathode surface strike the target and release electrons by secondary emission, the region between the suppressor grid and said target constituting a virtual cathode capable of supplying a relatively large electron current.

4. A cathode ray tube comprising a glass envelope, a cathode assembly at one end of the envelope, an electron responsive element at the opposite end of the envelope, a focusing electrode disposed between said cathode assembly and said element, said cathode assembly comprising a large hollow cathode, a target disposed at the center of said cathode, a cylindrical suppressor grid between said cathode and target, and means to

polarize the target more positive than the cathode, whereby electrons emitted from the cathode strike the target and release electrons by secondary emission, said secondary emission being confined to a region between said grid and target, said region constituting a virtual cathode capable of supplying a relatively large electron current to the succeeding electrodes.

5. The method of generating and controlling an electron stream which comprises the steps of causing emission of primary electrons from the entire surface enclosing a given space, concentrating said electrons in a region near the center of said space, causing said electrons to produce secondary electrons in said region, and forming said secondary electrons into a beam directed along the axis of said space.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,954,231	Weinberger	Apr. 10, 1934
1,993,457	Schlesinger	Mar. 5, 1935
2,099,846	Farnsworth	Nov. 23, 1937
2,131,204	Waldschmidt	Sept. 27, 1938
2,197,033	Diels	Apr. 16, 1940

FOREIGN PATENTS

Number	Country	Date
356,978	Great Britain	Sept. 17, 1931