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CATHODE RAY TUBE

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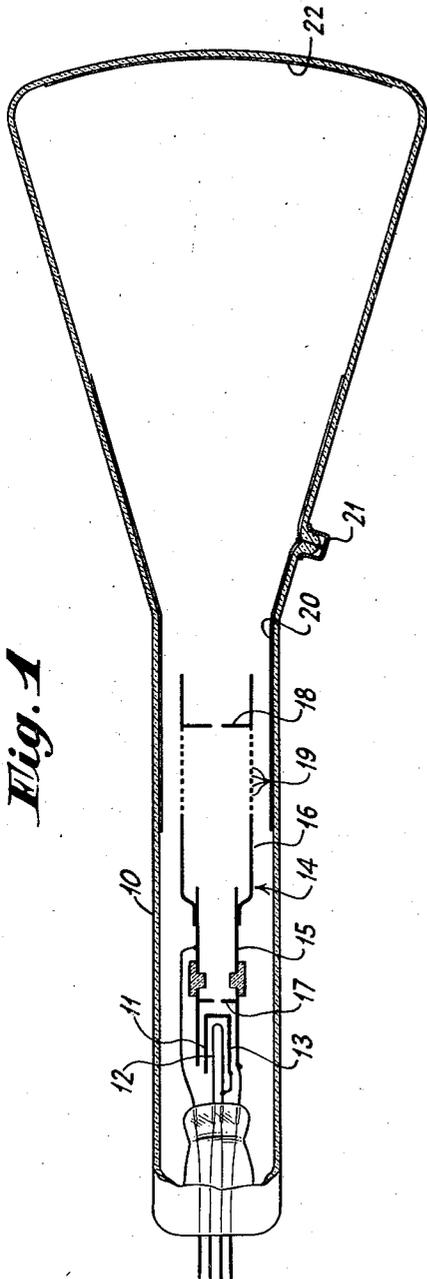


Fig. 1

Fig. 4

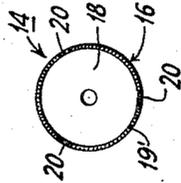


Fig. 3

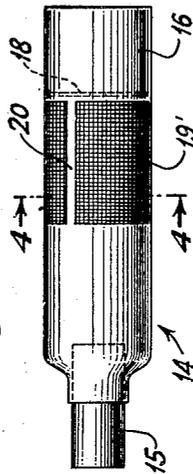
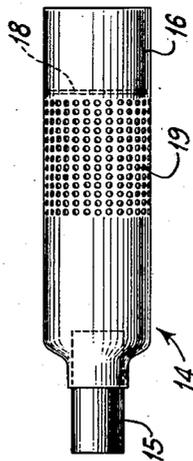


Fig. 2



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CATHODE RAY TUBE

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4 Claims. (Cl. 250—155)

This invention relates to improvements in electronic tubes and particularly tubes of the cathode ray type which are widely used in the reproduction of television pictures and for oscilloscope work.

In order to utilize all of the contrast that a particular tube is capable of giving, or, in other words, in order to be able to use the intensities of the luminous spot on the fluorescent screen of the tube all the way from zero to a maximum, it is necessary to have substantially no current on the first anode of the tube. Any substantial amount of current on the first anode limits the extent to which the contrast capabilities of a particular tube may be utilized.

It is, therefore, the purpose of this invention to produce a tube in which the first anode current will be zero or substantially zero.

In order to accomplish this purpose, it is necessary that the first anode be so constructed as to reduce the possibility of secondary electronic emissions from the surface thereof due to the impact of the primary beam therewith. Furthermore, whatever secondary electronic emissions actually do take place and are present, as well as the extraneous electrons from the primary beam, are caused to be drawn toward the second anode rather than to be conducted from the tube by way of the first anode. As a result of these considerations an electronic tube of the above type, when constructed in accordance with my invention, embodies an electrode structure unlike those customarily used. In one preferred form the first anode construction differs from the usual disc or cylinder type, in that this anode, or a portion thereof, is provided with a plurality of openings or is formed partially of a fine mesh screen portion.

My invention may best be understood by referring to the drawing in which:

Figure 1 represents a section of a cathode ray tube embodying my invention;

Fig. 2 shows a plan view of the first anode;

Figures 3 and 4 show a plan and section view respectively of a modification of my invention.

Referring to the drawing, the glass or vitreous envelope of the cathode ray tube is represented by the character 10. Within the neck portion of this tube there are supported and positioned the usual electron gun elements comprising a filament or heater element 12, a cathode or emitter 11, a control electrode or grid 13, and a first anode, shown generally at 14.

Application of suitable voltages between the anode 15 and the emitter 11 causes an electron beam to be developed when the emitter is in a heated state. This electron beam is projected longitudinally of the tube and variable voltages applied to the control electrode 13 serve to alter the intensity of the electron stream or beam flowing through the tube.

The first anode is preferably formed in two sections which are of different internal diameters, the smaller section 15 being positioned adjacent the control electrode or grid while the larger section 16 is connected to the smaller section and axially aligned therewith but longitudinally spaced in the direction of the screen or target electrode upon which the developed electron beam will impinge. The several elements of the gun may be supported within the tube by any appropriate supporting means, such as those well known in the art, and disclosed, for example, in copending application of John C. Batchelor, Serial No. 584,924, filed January 6, 1932.

The control electrode or grid 13 is provided with a beam limiting aperture 17. A similar aperture 18 is located within the first anode and near the end thereof and serves to limit the beam cross-sectional area.

The first anode 16 is provided with a plurality of small openings 19, which in this particular invention consists of a series of rows of holes each about the size of a number 60 drill and each spaced apart a distance of about 1.5 mm. These apertures form a number of miniature lenses through which some of the primary electrons and a great many of the secondaries (resulting from the impact of the primary electrons on the aperture disk 18 and the walls of the cylinder) are drawn to the second anode coating 20. The second anode 20 preferably extends beyond the direction of termination of the first anode in the direction of the electron emitter and is so located as to surround the perforated part of the gun and extend a substantial distance over the enlarged portion of the electron gun structure. An electric connection for supplying operating voltages is made to the second anode 20 by way of terminal 21. The end of the tube is, of course, provided with a fluorescent or luminescent screen or target 22 which becomes luminous when struck by the cathode ray beam.

In a modified form of the invention, instead of using a plurality of drilled openings in the first anode a screen member may be interposed between the end sections of the first anode electrode. Such a modification is shown in Figures 3 and 4 wherein the anode 16 has a plurality of openings cut therein and in the particular form shown three of such openings are made. Rib members 23 are left between the openings in order to insure rigidity and to better support the end portion of the electrode. Over these openings may be secured by any appropriate means (such as spot welding, for example) a fine mesh screen 19' such as a 30 x 30 mesh of .005 inch wire.

In each form of my invention the perforations or the screens are positioned on the cathode side of the beam limiting aperture disk 18, and as close to the disc as is feasible. In each case, also,

the second anode 20 is extended into the neck of the tube a distance sufficient to at least overlap the perforations 19 or the screen 19'. In each case, also, the first anode is positioned concentric with the axis of the cathode ray as produced by the voltage applied between the cathode and the anode.

It is to be understood also that a similar cathode may also be constructed using a cylindrical screen element 19' in which case the ribs 20 would be omitted and the first anode formed in two separate sections which may be suitably supported and positioned in longitudinally spaced positions and anchored against independent lateral displacement as shown by the above mentioned Batchelor application.

From the above it will be seen that as the electron stream passes from the electron emitting surface of the cathode 11 to the target or luminescent screen 22 a certain number of electrons will strike the aperture disk 18 and the walls of the first anode cylinder and thereby release secondary electrons upon impact. These electrons, instead of being absorbed by the first anode, pass through the openings in this anode and are attracted to the second anode 20. Because of this action the number of secondary electrons which are continuously present within the first anode electrode is materially reduced and the diameter of the spot on the fluorescent screen as produced by the electron stream is decreased because of the greater ease of focusing. Furthermore, the control grid 13 is more effective to produce greater variations in the degree of intensity of the ray and consequently its effect as observed on the fluorescent screen. It may also be seen that the first anode current is materially reduced and in most instances may be brought to substantially zero.

While no specific means for deflecting the developed cathode ray beam across the luminescent screen or target has been shown it is, naturally, to be understood that any known means, such as electro-magnetic or electrostatic (or a combination of each), may be used although, in general, the electro-magnetic form is preferred. Further, while the invention has been herein described and shown particularly in connection with electronic tubes of the type wherein a luminous effect is produced by the impact of the electron beam upon the target it is, of course, intended that the invention is equally applicable to electronic tubes for translating optical values into electrical signalling impulses, and particularly so when high detail scanning requires an especially sharp focusing of the scanning beam upon the mosaic electrode target of those tubes known by the trade names "Iconoscope" and/or "Iconotron."

Various modifications may be made in my device without departing from the general features and embodiments thereof, and it is to be understood that any and all of such modifications which fall fairly within the spirit and scope of the hereinafter appended claims may be utilized.

I claim as my invention:

1. An electron tube comprising an envelope having positioned therein an electron emitter, a target element, a tubular accelerating electrode cooperatively positioned relative to the emitter and located intermediate the target and the emitter, said accelerating electrode being provided

with a plurality of openings each of which is covered with a fine mesh screen, and a conducting coating on the inside surface of the tube envelope intermediate the target and the first accelerating electrode and extending in the direction of the electron emitter sufficiently to partially house the first accelerating electrode, said coating adapted to form a second accelerating and focusing electrode.

2. A cathode ray tube comprising an evacuated housing envelope, an electron beam developing means including an electron emitter, a cylindrical first anode member and a second anode member, at least a part of which is cylindrical and of a diameter greater than that of the first anode, said first anode member having a multiplicity of electron permeable peripherally located apertures in its cylindrical wall in an area intermediate the end planes thereof and extending throughout the circumferential portion thereof, said electron permeable area having the same external diameter as the immediately adjacent portions of said first anode member, said second anode being positioned in axial alignment with the first anode and in such position that at least a part of the cylindrical portion thereof surrounds completely the apertured section of the first anode whereby stray electrons which pass through the electron permeable portion of said first anode will be collected by said second anode.

3. A cathode ray tube comprising an envelope, means for developing a cathode ray beam including an electron emitter, a cylindrical first anode and a second anode, said first anode having a plurality of electron permeable apertures circumferentially spaced thereabout and positioned in an area spaced from the ends thereof, said anodes being cylindrical in form, the diameter of the second anode being greater than the diameter of the first anode, and means for positioning the anodes such that their axes coincide with the axis of the tube, said second anode overlying the electron permeable portion of said first anode whereby stray electrons may pass through the electron permeable portion of said first anode and be collected by said second anode.

4. A cathode ray tube comprising an elongated vitreous housing envelope, means therein for developing a cathode ray beam including an electron emitter, a substantially cylindrical first anode and a second anode of which at least a portion is cylindrical and of a diameter greater than that of the first anode, a centrally perforated diaphragm member positioned within said first anode in a plane perpendicular to the axis thereof, said first anode having at least a portion of the cylindrical surface thereof apertured so as to be electron permeable, the electron permeable portion having substantially the same external diameter as the immediately adjacent portions of the first anode member, and means to position said second anode so that the cylindrical portion thereof extends beyond the electron permeable portion of the first anode and coaxial therewith, whereby stray electrons may pass through the electron permeable portion of said first anode and be collected by said second anode.

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