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CATHODE-RAY TUBE

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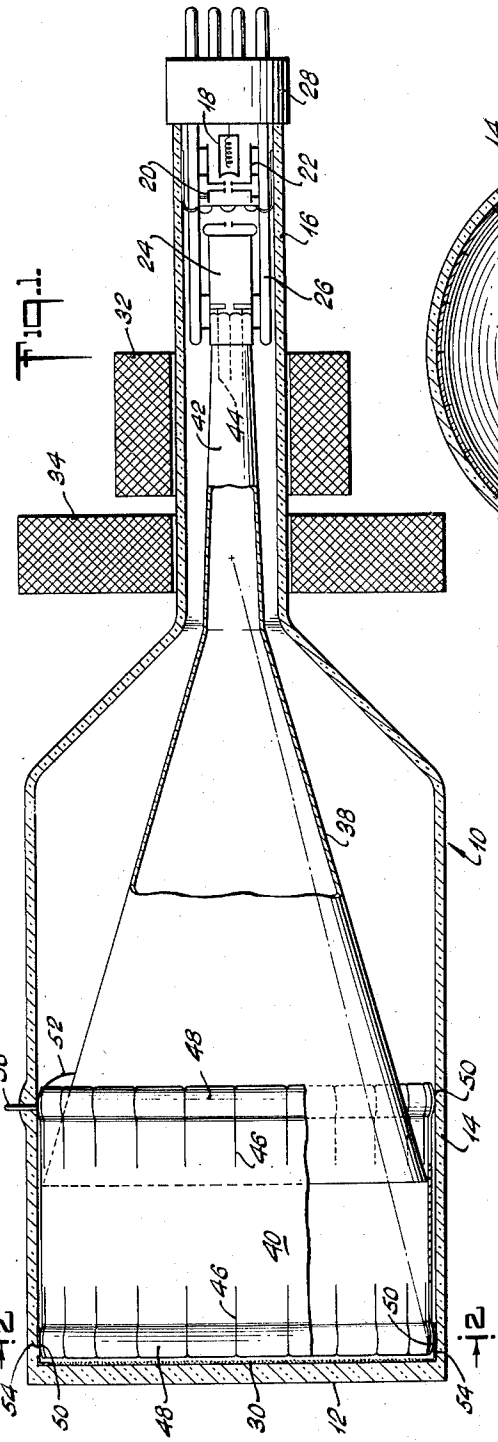


FIG. 1.

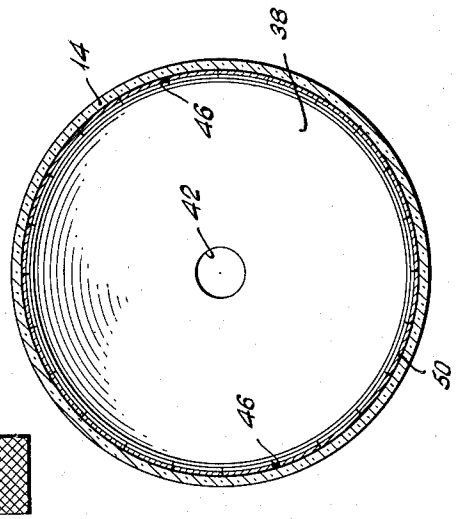


FIG. 2.

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CATHODE-RAY TUBE

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7 Claims. (Cl. 313—76)

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This invention relates to image reproducing tubes and more particularly to projection type tubes for use with a suitable lens to project the images on a screen.

It is well known that second anode accelerating potentials of the order of 30,000 to 50,000 are required to obtain sufficient brightness of the reproduced images on projection tubes to permit satisfactory projection. Higher voltages are of course desirable, but even at the lower voltages it has been found that conventional carbon coatings on the inside of the tube for shielding the electron beam, between the second anode and the screen, break down and produce gas in the tube that greatly impairs its usefulness. Carbon coatings have heretofore been required as the external magnetic deflection and focusing coils for the beam were not materially affected by the carbon because of its high resistance. It has been observed that that part of the carbon or aquadag coating in the field of the deflecting and focusing coils does generate substantial heat which probably results from the action of the high voltage as well as the magnetic fields. Excessive heating of the carbon or aquadag results in the generation of gas in the tube and greatly impairs its operation.

This invention eliminates carbon coatings altogether and in its place employs a low resistance shield of metal or the like that will not only withstand the high voltages without deterioration but, because of its structure and relationship to the magnetic fields, permits magnetic deflection and focusing means to be used with substantially the same efficiency attained with conventional carbon coatings. Thus very high accelerating voltages can be used without the danger of generating harmful gases and therefore enables the attainment of very much brighter pictures.

Another object of the invention is a new and improved cathode ray tube structure.

The above and other objects will become more apparent in the following description and accompanying drawings forming part of the application.

In the drawings—

Fig. 1 is a cross-sectional view of a tube in accordance with the invention; and

Fig. 2 is a cross-sectional view taken along the line 2—2 of Fig. 1.

In the figures, 10 denotes the envelope of a projection tube having a front face 12, an enlarged cylindrical part 14 and a narrow neck-like extension 16. In the end of the neck 16 is a conventional electron gun having a filament 18,

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control elements 20 and 22, and a second anode 24. These elements are supported by at least three insulating members 26 fastened to the envelope at a point within the base part 28. The front face 12 of the tube carries a luminescent screen 30 and may have a metallic coating thereon to protect the luminescent screen from ion burns. Surrounding the neck 16 are the focusing and deflecting coils 32 and 34 respectively. These coils are disposed at a point forwardly of the second anode 24.

The structure of the tube thus far described is conventional. Conventional tubes, however, employ a carbon coating on the inner wall of the large envelope section 14 and that part of the neck 16 forward of the anode 24. High voltage is fed to the anode 24 and screen 30 by means of the terminal 36 and the carbon coating. It is this coating that has been found to seriously limit the voltage that may be applied to a tube.

In the illustrated structure, however, the carbon coating is replaced with a solid metal shield 38 and 40 of low resistance material. The shield 38 has a narrow somewhat conical part 42 that extends beneath the deflection and focusing coils and engages and electrically contacts the second anode 24. Notwithstanding the presence of this tubular metallic member 42 in the magnetic fields, negligible losses are entailed over those that may be normally experienced with carbon coatings applied directly to the wall of the neck 16. This is attained by properly proportioning the external diameter of the shield 42 with the internal diameter of the coils 32 and 34. For instance, good results can be obtained with some loss when the outside diameter of the shield part 42 does not exceed one-half the internal diameter of the coils 32 and 34, while negligible loss is encountered if the shield does not exceed one-third the internal diameter of the coils. With the latter proportion, the structure will permit sufficient deflection angle of the beam to be obtained for screens of the general size used in projection tubes and conventional deflection and focusing coils may be used; that is, coils of an internal diameter of the order of 1¾". It is apparent, however, that this shield could also be used for direct view tubes and, if desired, the coils could be modified by increasing the internal diameter to enable the attainment of very wide deflection angles and still employ the optimum ratio of shield diameter to coil diameter.

The shield 38 and its conical part 42 is held rigidly within the tube envelope 10 by the metallic ring or collar 40 on one end and the second

anode 24 on the other. In this embodiment the collar 40 forms part of the beam shield. For ease in assembly, the conical part 42 may be slotted as shown at 44 to form a plurality of spring-like fingers for gripping the inside of the anode 24. The supporting ring or collar 40 is also formed with slots 46 formed in each edge thereof and the individual fingers 48 thus formed are curved as shown at 50 so that they will slide relative to the glass envelope without damaging or scratching the inner surface.

The shield 38 joins the collar 40 at a point midway of its edges and may be secured thereto by riveting, welding or other suitable means. As the front or screen edge of the collar 40 is in close proximity to the screen 30 the entire path of the electron beam from the second anode to the screen is completely shielded.

The shielding structure is connected to the high voltage terminal 36 by the lead 52. By reason of the electrical contact between fingers 44 of the conical shield section 42 and the second anode, the latter is also maintained at the same potential and without any resistance losses entailed in the use of high resistance carbon coatings in conventional tubes. The screen 30 is also charged to this high potential and the connection between the screen and the shield member 40 is preferably accomplished by a metallic coating of silver, aluminum or the like extending from the periphery of the screen 36 along the wall of the cylindrical envelope section 14 so that it will be contacted by the spring fingers 50 of the shield part 40.

With this structure all carbon and aquadag coatings within the tube are entirely eliminated, thus enabling higher voltages to be applied to the second anode and screen without the danger of generation of harmful gases and without entailing any losses in the magnetic deflection and focusing of the beam greater than those normally encountered with carbon or aquadag coatings.

This application is a continuation in part of my application Serial No. 60,868, filed November 19, 1948, and issued October 2, 1951, as Patent #2,569,654.

I claim:

1. A cathode ray tube comprising an outer envelope, an electron gun in one end of the envelope, a screen in the other end of the envelope, a solid metallic self-sustaining shield extending from the screen to the electron gun to shield the beam throughout its travel from the gun to the screen, and magnetic beam controlling means about the tube envelope and at a point between the gun and the screen, said shield having that part encircled by the beam controlling means of a diameter less than one-half the inside diameter of the magnetic means.

2. A cathode ray tube of the magnetic deflection type comprising an outer envelope, an electron gun in one end of the envelope for generating an electron beam, a screen in the other end of said envelope, a continuous shield for said beam extending from the gun to the screen and consisting of a stable material of high conductive properties, said shield being spaced from the envelope throughout at least a part of its length.

3. Means for shielding a cathode ray beam in an image reproducing tube of the magnetically deflected and focused type wherein coils are placed about the beam, comprising a continuous metallic self-sustaining shield surrounding the cathode ray beam and having a diameter at that part between the coils and the beam less than one-half the distance between opposing coils.

4. Means for shielding a cathode ray beam in an image reproducing tube of the magnetically deflected and focused type wherein coils are placed about the beam, comprising a continuous metallic self-sustaining shield surrounding the cathode ray beam and having a diameter at that part between the coils and the beam approximately one-third the distance between opposing coils.

5. A cathode ray tube comprising an outer envelope having an enlarged cylindrical part and a small cylindrical part coaxially alined with said enlarged part, a screen in the enlarged part, an electron gun in the small part, including a tubular second anode element, and a cylindrical metallic shield extending from the screen to the second anode comprising a collar having a plurality of spring fingers about each edge thereof to bear against the inner wall of the enlarged cylindrical part, a first conical member fastened at its larger end to said collar with its smaller end terminating adjacent the entrance of the small cylindrical envelope part and a second anode conical member joined to the smaller end of the first conical part and extending to a point within the tubular second anode.

6. In a cathode ray tube having an evacuated envelope, a gun structure therein including a second anode, a magnetic means surrounding the tube forwardly of the gun structure for deflecting the electron beam, means for shielding the electron beam comprising a tubular continuous metallic member within said envelope and spaced from the wall thereof at least in the region of said magnetic means, said member extending forwardly of the gun structure to a point beyond the magnetic deflecting means surrounding said tube and energized at a potential at least as high as that of the second anode.

7. Means for shielding a cathode ray beam in an image reproducing tube of the magnetically deflected type wherein coils are placed about the beam, comprising a continuous metallic shield within the tube envelope and surrounding the cathode ray beam, said shield extending beneath the magnetic deflection coils and spaced from the wall of said tube at least in the region of the magnetic deflection coils.

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