

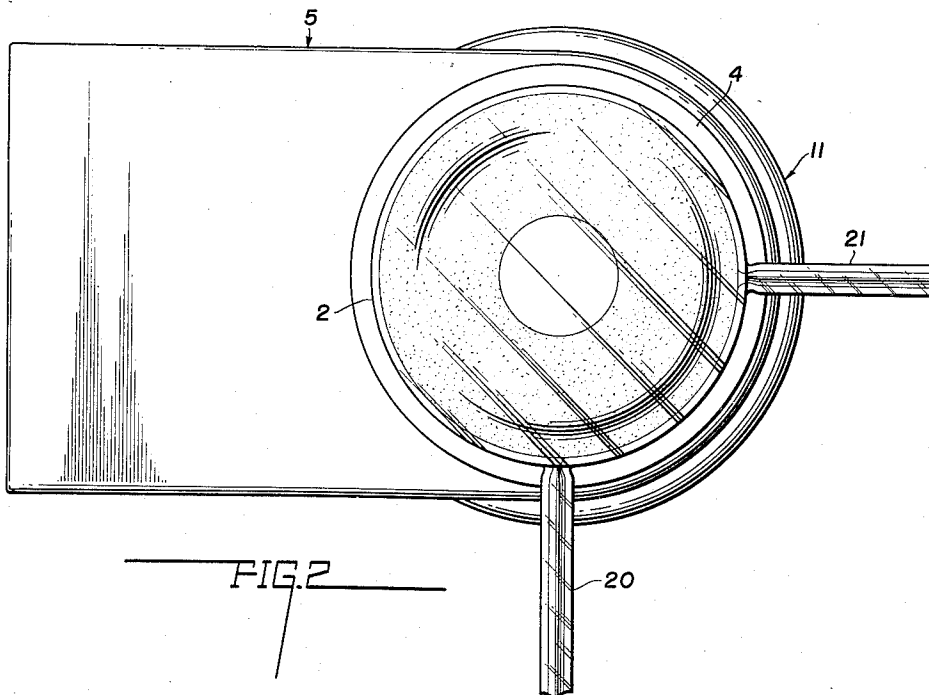
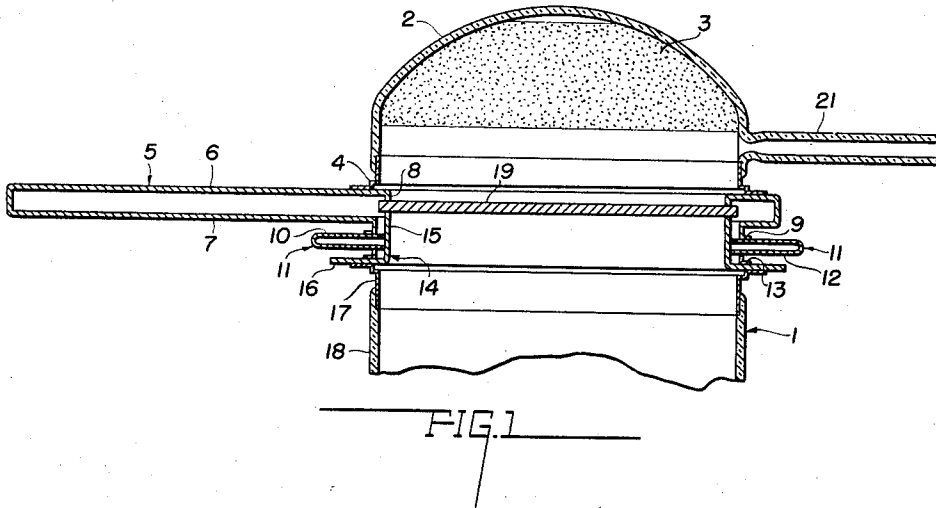
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ELECTRON DISCHARGE DEVICE

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ELECTRON DISCHARGE DEVICE

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1 Claim. (Cl. 313—94)

The present invention relates to an electron discharge device, and more particularly to a unique construction for isolating a photoelectric cathode from other elements in an electron discharge device.

Image tubes of the type disclosed in Day Patent No. 2,708,250, Morton et al. Patent No. 2,487,665 and Flory et al. Patent No. 2,506,018, respectively include a photoelectric cathode, a phosphor screen anode, and suitable electron accelerating elements for projecting an electron image from the cathode onto the anode. In conventional operation, a radiation image, such as an infra-red image, is focused onto the cathode which, in response thereto, emits a corresponding electron image. This electron image is then electron-optically projected onto the phosphor screen which is thereupon excited into luminescence for reproducing visibly the electron image. This particular image tube is well-known in the art and is contained in many different configurations adapted for different purposes. As will appear from the following, this invention is not limited to a particular image tube construction, but instead is adapted for use with any electron discharge device wherein electrons are projected into or onto a particular region or plane.

In general, this invention comprehends isolating the photoelectric cathode during the time of the formation thereof from the other tube elements whereby photoelectric sensitization of the other tube elements may be avoided. In prior art devices, the cathode is rendered photoelectric at the time all of the tube elements are assembled in place in the evacuated envelope, and this process unavoidably contaminates or renders photoelectric such elements which results in unpredictable and undesirable operating characteristics in the finished device. The present invention prevents the contamination of these other elements and thereby conduces to improved performance.

It is therefore an object of this invention to provide an electron discharge device wherein cathode sensitization is restricted only to the vicinity of the cathode and is isolated from the remaining portions of the device.

It is still another object of this invention to provide a shutter type structure in an electron tube, which may be operated for isolating the photocathode from the remaining portions of the tube incorporating the cathode.

In the accomplishment of this invention there is provided an electron discharge device comprising an evacuated envelope, a photoelectric cathode in the envelope, a shutter device for sealing off that portion of the envelope containing the photoelectric element, and means for selectively opening the shutter without breaking the vacuum in the envelope.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

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Fig. 1 is a fragmentary cross-sectional illustration of an embodiment of this invention; and

Fig. 2 is a top plan view thereof.

Referring to the drawings, an evacuated envelope indicated generally by the reference numeral 1 contains the usual image tube elements (not shown) which may include a cathode, a phosphor screen anode, and suitable electron-accelerating and focusing elements. Since the invention is primarily concerned with isolating the cathode from the remaining electrodes, it is necessary to illustrate only the means by which this isolation may be achieved.

The envelope 1 comprises a cup-shaped section or blank 2 which has deposited or otherwise adhered to the inner surface thereof a base coating 3 of antimony or silver onto which caesium may be deposited for achieving the finished photoelectric cathode. On the rim of the blank 2 is sealed a mounting ring 4 of the usual metal used in the fabrication of image tubes.

A laterally offset compartment or chamber indicated generally by the reference numeral 5 is hermetically sealed into the envelope and is composed of spaced apart top and bottom plates 6 and 7. The top plate is provided with an opening having a downwardly turned perimetral flange 8. The bottom plate 7 is also provided with an opening of somewhat larger size which is provided with a downwardly turned ring flange 9 which is sealed to one side 10 of an expansible bellows 11. The other side 12 of the bellows is sealed to a ring 13 which in turn is sealed to a much larger clamping ring 14. This clamping ring 14 is composed of right angle portions 15 and 16, the ring 13 being sealed to the portion 16.

Sealed to the underside of the ring portion 16 is still another metallic ring 17 which is suitably fused or sealed to the remaining section 18 of the envelope 1.

The annular flanges 8 and 15 in combination with the bellows 11 are preformed to grip only lightly, if at all, a metallic shutter plate 19 which provides a partition between the photocathode portion of the tube from the remaining tube portions. This shutter 19 is forcefully clamped between these two flanges 8 and 15 by the use of C-clamps or the like which are fitted over the top plate 6 adjacent the ring 4 and the ring flange 16. By forcing the top plate 6 and ring flange 16 together, the shutter-plate 19 will be securely gripped and sealed between the two flanges 8 and 15. As many C-clamps may be used around the tube as is necessary in order securely to clamp and seal the shutter 19 in place.

The compartment 5 is made to such size that the shutter 19 may be withdrawn completely from the envelope.

In the fabrication of the image tube, silver or antimony as the cathode base material is applied to the inner surface of the end face 2 in the usual manner. The remaining elements in the tube are assembled in place and the shutter 19 is clamped in the position shown. Caesium vapor for sensitizing the cathode base is introduced into the envelope on the cathode side of the shutter 19 by means of suitable tubulations 20 and 21. The usual techniques employed in sensitizing the cathode are used in the present instance, after which the tubulations are sealed off in the usual manner. By reason of the fact, that the cathode region is completely isolated from the remaining portions of the tube by means of the shutter 19, it necessarily follows that the cathode sensitization process will not contaminate nor sensitize the other tube portions or elements. That portion of the tube beneath the shutter 19 may be evacuated either before or after the cathode sensitization step, this depending on whether or not a hermetic seal is provided between the shutter 19 and the two clamping rings 8 and 15.

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Preferably, however, the lower portion is evacuated at the same time as the upper.

When it is desired to operate the tube, the external clamps which force the two rings 8 and 15 onto the shutter 19 are removed whereupon the expansible resilience in the bellows 11 serves to spread the rings 8 and 15, thereby releasing the shutter 19 for dropping into the compartment 5. The cathode is thereupon fully exposed to the remaining portions and elements of the tube.

If it is desired to again isolate the cathode, it is only necessary to invert the tube, permitting the shutter 19 to gravitate into registry with the clamping rings 8 and 15.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What is claimed is:

In an electron discharge tube: an evacuated envelope having first and second spaced apart sections, one of said envelope sections having a photoelectric cathode therein; first and second spaced apart clamping ring members secured respectively to the adjacent ends of said envelope sections; an annular bellows connecting said first and second clamping ring members whereby said first and second envelope sections normally communicate; a laterally extending compartment communicating with the interior of said envelope intermediate

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said clamping ring members; and a thin flat shutter member transversely slidable between a first position in said compartment in which said first and second envelope sections are in communication and a second position in which said shutter extends across said envelope between said clamping ring members thereby isolating said first and second envelope sections; said clamping ring members respectively having first and second annular portions, said first clamping ring portions extending outwardly from the exterior of the respective envelope section, said second clamping ring portions being respectively arranged annularly to engage the opposite faces of said shutter member in its second position responsive to clamping of said first clamping ring portions around their peripheries thereby clamping said shutter member in its second position and sealing said envelope sections from each other to permit activation of said photo-cathode without contaminating elements in the other envelope section.

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