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A. V. BEDFORD

2,293,529

IMAGE TUBE

Filed June 29, 1940

FIG. 1.

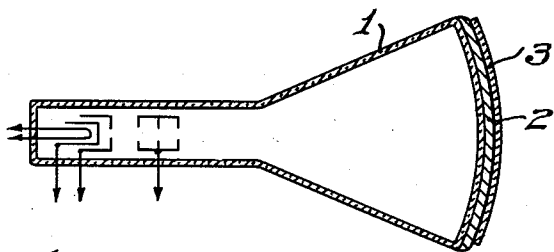


FIG. 2.

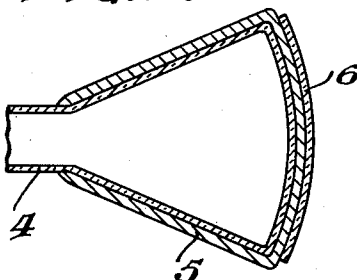


FIG. 3.

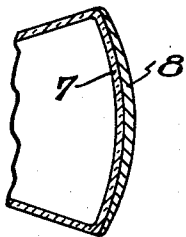


FIG. 4.

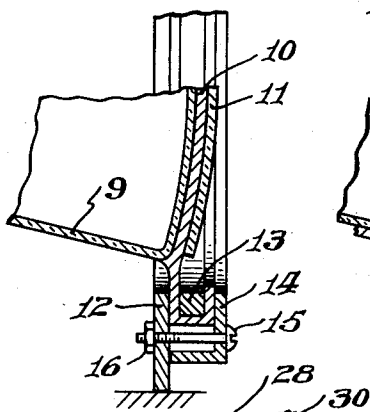


FIG. 5.

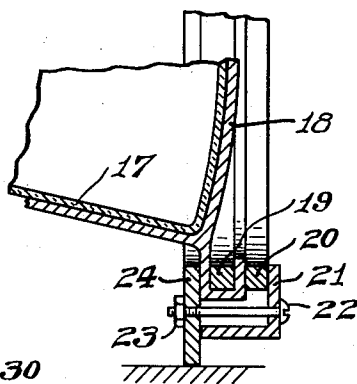


FIG. 6.

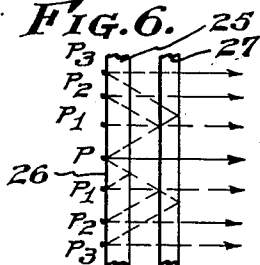


FIG. 7.

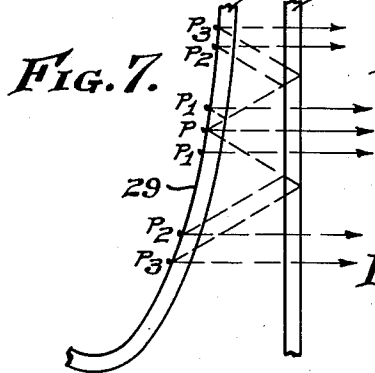


FIG. 10.

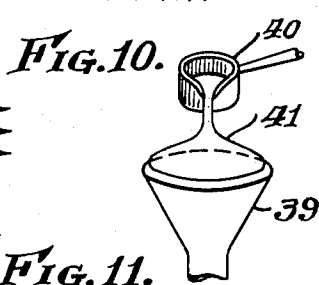


FIG. 8.

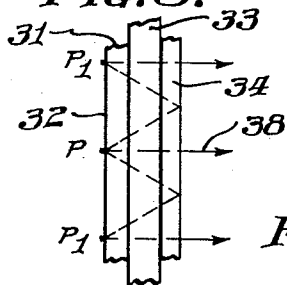


FIG. 9.

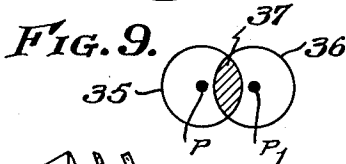


FIG. 11.

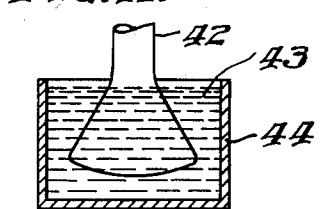
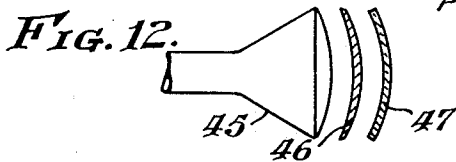
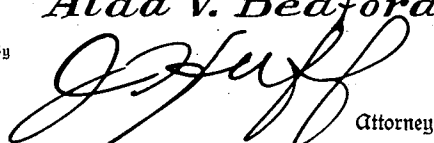


FIG. 12.



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UNITED STATES PATENT OFFICE

2,293,529

IMAGE TUBE

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Application June 29, 1940, Serial No. 343,103

11 Claims. (Cl. 250—141)

This invention relates to television and more particularly to shatter-proof screens for image tubes. It has been found to be desirable to provide a protective guard for image tubes since they have been known to implode and cause injury to the user from flying fragments. Because of the high vacuum employed, and the relatively large size of image tubes, a rupture of the tube causes the elements and fragments of glass to fly in all directions with great force.

Attempts have been made to eliminate this danger by providing an auxiliary shield consisting of a flat circular disc of safety glass mounted in front of the tube. This method has proved unsatisfactory because it offers no protection when the tube is being handled and, in addition, there is a great amount of light diffusion caused by reflection of light from each of the glass surfaces. It has also been found that the use of a plurality of free glass surfaces increases the optical fog caused by dust and moisture collecting on their surfaces.

It has been proposed to mount a picture tube in a cardboard case to be left on at all times. Obviously, this is not always satisfactory because it does not offer any protection to the viewer from the viewing end where protection is, of course, most necessary.

According to this invention, adequate protection to both the handler and the operator or viewer is afforded by the use of a transparent plastic covering which prevents the shattering of the glass in case of rupture and eliminates the objectionable diffusion caused by a plurality of separate glass elements. In addition, an extended plastic coating provides a satisfactory means for supporting the image tube, thus reducing the probability of rupture of the envelope while in a receiver cabinet.

The principal object of this invention is to provide an image tube free from the dangers of implosion.

Another object of this invention is to provide a shatter-proof envelope.

Still another object of this invention is to provide a means for supporting an image tube.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawing, in which

Figure 1 is a cross-sectional view of one form of this invention,

Figure 2 is a cross-sectional view showing another form of this invention,

Figure 3 shows still another form of this invention,

Figure 4 is a cross-sectional view of one form of image tube support,

Figure 5 is a cross-sectional view of another form of tube support,

Figures 6 and 7 show the diffusion caused by using a plurality of glass surfaces,

Figure 8 shows the reduction in diffusion resulting from the use of this invention,

Figure 9 illustrates image distortion caused by diffusion, and

Figures 10, 11 and 12 show several methods of applying a guard layer to the envelope of the image tube.

Referring to Fig. 1, the image tube 1 has a coating of plastic material 2, such as, for example, lucite or styrol, over the viewing end of the envelope. A circular transparent disc 3 shaped to fit the curvature of the envelope 1 is secured to place by the plastic coating 2. Such a combination provides a shatter-proof shield because, if the envelope should implode, the pliable plastic coating will not shatter but will crumple and substantially all the broken pieces of glass will adhere to the surface of the plastic layer.

When a beam of light strikes a surface which separates two mediums having different refractive indexes, a portion of the light is reflected from the surface. The percentage of light reflected for a given angle of incidence increases with an increase in the difference in refractive index of the two mediums.

It is therefore desirable to provide a plastic material and transparent disc material which have substantially the same refractive index as that of the material contained in the envelope of the image tube 1. The plastic lucite suggested above has a refractive index of approximately 1.48, and the nonex or pyrex of the image tube in general used today ranges from 1.47 to 1.49. If such materials are used, very little reflection occurs at the surfaces where the different mediums are joined. According to Fig. 1, the plastic 2 and glass disc 3 cover only the viewing end of the image tube.

Figure 2 shows the image tube envelope surface 4 having its plastic coating 5 extended down to the neck of the tube. This extension of the protective plastic coating will prevent the sides of the tube from shattering and it offers complete protection while the tube is being handled. The glass disc 6 need only be applied to the viewing end of the tube as shown in Figure 1.

Figure 3 shows an image tube 7 with a plastic

coating 8. The transparent glass disc shown in the previous figures is omitted in this form of the invention. The flexibility of the plastic 8 is sufficient to prevent shattering of the envelope 7 and under conditions which are likely to exist in the use of this image tube such as enclosed in television receiver cabinets, the surface of the plastic coating is not likely to be scratched so as to make necessary the application of an outside glass surface.

Because it is desirable to produce a large-sized image in the reception of television signals, it is necessary to produce a large envelope, the viewing end of which may have a diameter as great as 20 inches. This large bulky size of a relatively fragile piece of equipment requires support means in addition to its socket and yoke. Unless the image tube is well supported while in its cabinet, any jar or vibration is likely to cause a rupture of the envelope. In addition to providing protection from implosion, a plastic coating provides more safety through its support of the envelope while in the cabinet.

Figure 4 shows the image tube 9 with a plastic coating 10 which is extended beyond the envelope to engage clamp 14. A fastening means, such as a bolt 15 and nut 16, compresses the plastic material between an auxiliary ring 13, the surface of the clamp 14 and a tube support section or cabinet 12. The secure fastening of the plastic material at its edge further reduces danger in case of implosion by retaining the plastic material in its proper location. A glass disc 11 is shown covering the plastic 10 on the viewing end of the tube 9.

Figure 5 shows the picture tube 17 with its plastic coating 18 extending over substantially all the glass area of the picture tube and engaging the clamp indicated by pieces 21 and support 24. Two rings 19 and 20 are used to securely engage the edge of the plastic 18 in a manner similar to that shown in Figure 4. By the use of the additional auxiliary ring 20, the clamp elements 21 may consist of short lengths or toe clamps. The additional auxiliary ring 20 is not necessary when the clamp 14 shown in Figure 4 consists of a continuous circular ring.

Figures 6 and 7 of the accompanying drawing illustrate the diffusion caused by reflection between separated glass surfaces. 25 is the end of the ordinary image tube having luminescent coating 26 on its inside surface. A guard member 27 consisting of a separate piece of glass is positioned adjacent the end of the envelope 25. It follows that all rays of light emanating from point P will be reflected from each of the surfaces of glass 25 and 27. Taking, for example, one ray as shown in Fig. 6, it will be noticed that, at the reflection from each of the surfaces of glass layers 25 and 27, this single light ray produces additional points of light because of optical bombardment of the luminescent screen at points P₁, P₂ and P₃. As a result, we have three sources of light P₁, P₂ and P₃ on the luminescent screen in addition to the main point of light P for each ray.

When the main point of light P gets to a position near the edge of the luminescent screen which is on the curved portion of the end of the envelope as shown in Fig. 7, we find a much greater dispersion of the reflected rays of light and, consequently, a larger area is covered by the diffused light emanating from the original point P on the luminescent screen. As a result of this large area of diffused light, any dark por-

tion of the picture adjacent the edge of the luminescent screen is subject to a large amount of diffused light and, consequently, image brilliance is destroyed.

Figure 8 shows the reason for the relatively insignificant circle of diffusion resulting when this invention is used. We find that there is only one additional point of light on the luminescent screen because the plastic material 33 has substantially the same refractive index as the two transparent elements 31 and 34. This results in the reduction of diffused light by more than one-half and, consequently, results in an image having greater brilliance and less distortion caused by irregular light diffusion such as results from an irregular spacing of the protective shield from the luminescent screen.

Figure 9 illustrates the loss of detail caused by the overlapping of the diffusion areas 35 and 36 of the light points P and P₁. The overlapping of two such diffusion areas creates a relatively strong light source illustrated by irregular-shaped area 37. Actually, the diffused light from many other points such as P contribute to illuminating the same area. This would cause any desired dark spot between two adjacent light points to show up gray.

Figure 10 illustrates one method of producing such a guard layer by pouring a molten transparent plastic 41 on the upper end of an image tube 39. A uniform amount of molten plastic material applied to the image tube provides a coating of uniform thickness, due to the suitable viscosity and the rate of solidification of the plastic material.

Another method of preparing such a coating is shown in Fig. 11, which illustrates the dipping of image tube 42 in a container 44 having the guard layer in the form of a fluid plastic 43.

Figure 12 illustrates one method of applying the auxiliary glass disc 47 to the end of the image tube 45. The guard layer 46 is in the form of a solid transparent plastic material which is secured between the end of image tube 45 and glass disc 47, with a molten or dissolved plastic material preferably having the same index of refraction as the solidified plastic.

While several systems for carrying this invention into effect have been indicated and described, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organization shown and described, but that many modifications may be made without departing from the scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. In an electron discharge device including a luminescent screen mounted within a container provided with a transparent wall, the combination of a pliable coating on said wall, and a transparent coating on said pliable coating.

2. In an electron discharge device including a luminescent screen mounted within a container provided with a transparent wall, the combination of a pliable adhesive layer on said wall, and a transparent coating on said pliable adhesive layer.

3. In an electron discharge device including a luminescent screen mounted within a container provided with a transparent wall, the combination of an adhesive coating on said wall, and a transparent coating on said adhesive coating.

4. In an electron discharge device including a luminescent screen mounted within a container provided with a transparent wall, the combina-

tion of an adhesive transparent coating having an index of refraction equal to the index of refraction of said wall on said wall, and a transparent coating on said adhesive transparent coating.

5. In an electron discharge device including a luminescent screen mounted within a container provided with a transparent wall, the combination of a pliable coating on said wall, and a transparent coating on said pliable coating and wherein the wall and said coatings have substantially the same refractive indices.

6. In an electron discharge device including a luminescent screen mounted within a container provided with a transparent wall, the combination of an adhesive transparent coating on said wall, a support for said device having a clamp member, and an extension of said coating to be engaged by said clamp member.

7. An image tube comprising an envelope, an electrode structure mounted inside of said envelope, a luminescent screen in one end of said envelope, a pliable coating on said envelope, a support for said image tube, and an extension on said pliable coating for engaging said support.

8. An image tube comprising an envelope, an electrode structure mounted inside of said envelope, a luminescent screen in one end of said envelope, a pliable coating on said end, a support for said image tube, and means for securing said coating to said support comprising a clamp member on said support to engage said coating.

9. An image tube comprising an evacuated envelope, an electrode structure mounted inside of said envelope, a luminescent screen in one end of said envelope, a guard coating of transparent plastic material on said envelope, a support for said image tube, and means for securing said envelope to said support comprising a plurality of rings whose diameter is greater than the diameter of said luminescent screen, and means for clamping an extension of said guard coating between said rings.

10. An image tube comprising an evacuated envelope, an electrode structure mounted inside of said envelope, a luminescent screen in one end of said envelope, a guard coating of transparent plastic material on said envelope, a support for said image tube, and means for securing said envelope to said support comprising a ring whose diameter is greater than the diameter of said luminescent screen, and means for clamping a portion of said guard coating to opposite sides of said ring.

11. An image tube comprising an evacuated envelope, an electrode structure mounted inside of said envelope, a luminescent screen in one end of said envelope, a pliable coating upon said envelope, a guard coating of transparent material adhering to said pliable coating, a support for said tube, and means for securing said pliable coating to said support including a plurality of rings between which is clamped an extension of the guard layer adjacent said screen.

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