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W. H. GRIMDITCH
CATHODE RAY TUBE VESSEL

2,236,708

Filed May 20, 1939

2 Sheets-Sheet 1

Fig. 1.

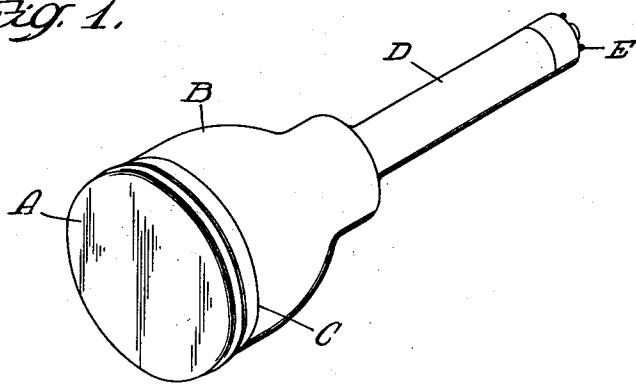
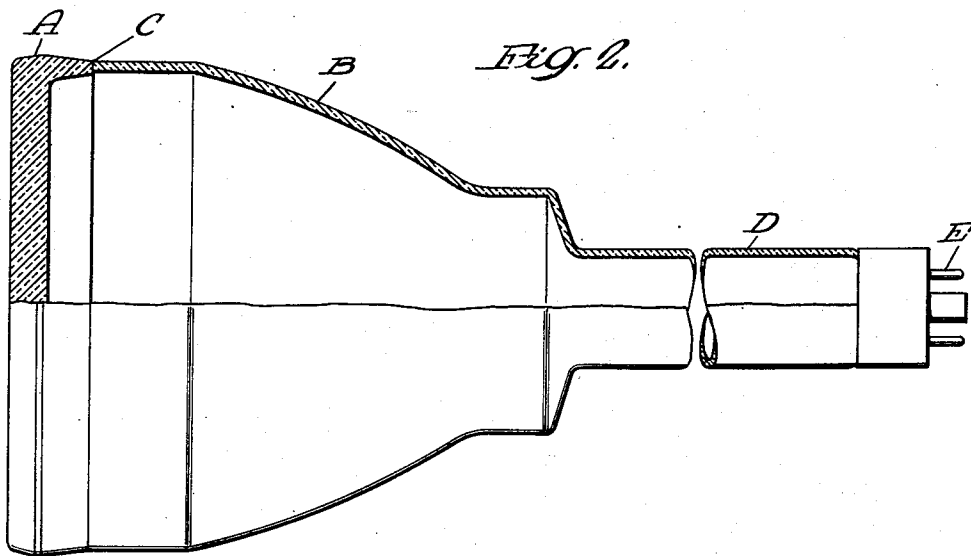


Fig. 2.



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Fig. 3.

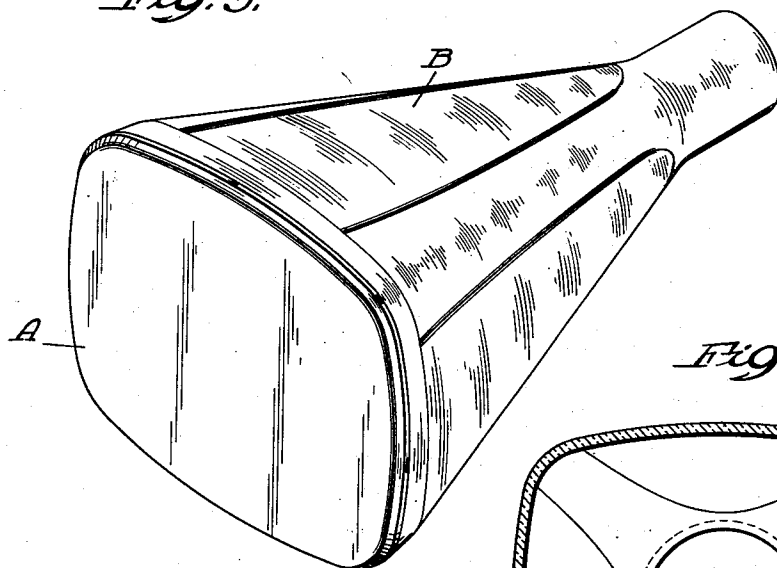


Fig. 5.

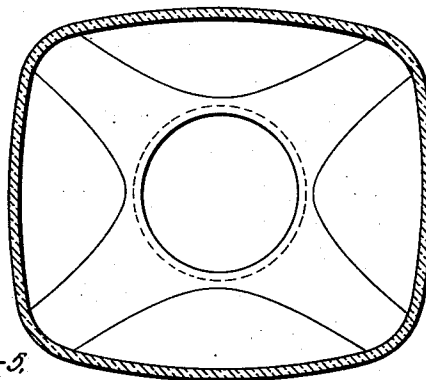
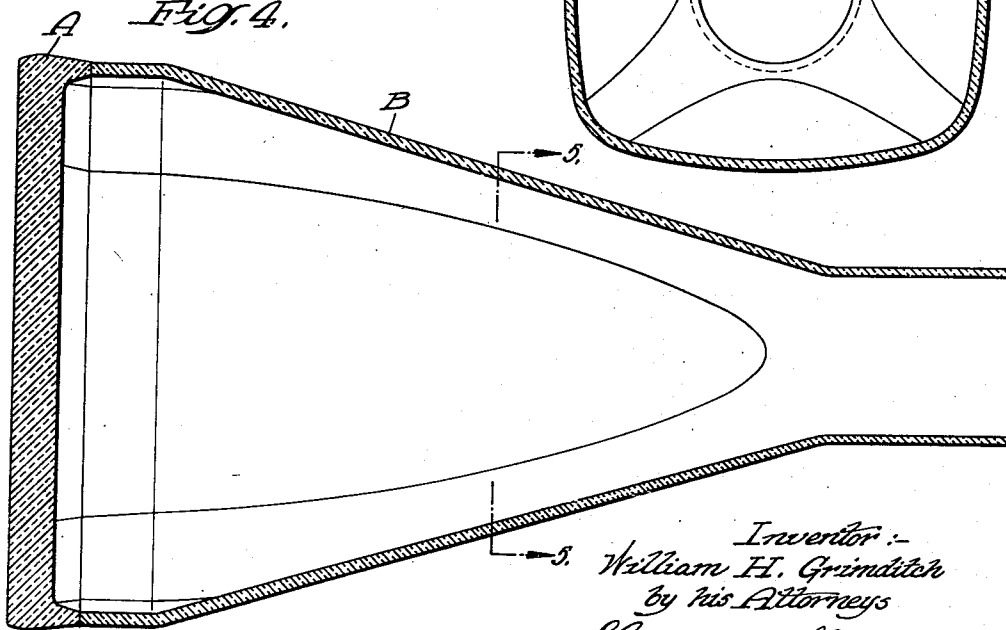


Fig. 4.



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UNITED STATES PATENT OFFICE

2,236,708

CATHODE RAY TUBE VESSEL

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mesne assignments, to Philco Radio and Tele-
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Application May 20, 1939, Serial No. 274,795

2 Claims. (Cl. 250-164)

This invention relates to a novel vessel or envelope structure which is particularly adapted for use in cathode ray tubes or the like. More particularly, the invention relates to a vessel or envelope structure adapted to be used as a picture tube in electronic television for the reproduction of a televised scene upon a screen of fluorescent material.

The principal object of the present invention, therefore, is to provide a novel vessel or envelope structure for use in cathode ray tubes and the like and particularly for use as a picture tube in television, which structure possesses certain advantages over those previously used, as described hereinafter.

A more specific object of the invention is to provide a novel vessel or envelope for the above-mentioned purposes, which has a flat end constituting the viewing screen and which, by virtue of this construction, eliminates the distortion inherent in prior dome end vessels employed heretofore in television picture tubes, and has other advantages to be enumerated later.

A still further object of the invention is to provide a relatively thick blank of vitreous material having substantially plane parallel surfaces for forming the viewing screen of a television picture tube vessel, and which is capable of being sealed to the main portion of the vessel which consists of relatively thin vitreous material.

The invention may be clearly understood from the following description and accompanying drawings in which:

Fig. 1 is a perspective view of a vessel or envelope constructed according to the invention;

Fig. 2 is a part elevation and part sectional view of the same device;

Fig. 3 is a perspective view showing one end of a vessel which represents a preferred form of the invention;

Fig. 4 is a sectional view of the same portion of the vessel or envelope taken longitudinally thereof; and

Fig. 5 is a sectional view taken along line 5-5 of Fig. 4.

Referring first to Figs. 1 and 2, the vessel comprises essentially two parts A and B the line of division between the two being designated C. Both of these parts are preferably made from some vitreous material, such as glass, and part A is preferably either transparent or translucent. In the finished vessel the two parts may be so sealed together at C that practically no evidence of the sealing process remains and the two parts

appear as one except perhaps for a slight bulge produced when the glass is heated.

The part B may be of substantially frusto-conical form or may be of the form illustrated which is more properly termed a surface of revolution. For the purpose of this specification the term "frusto-conical" will be used in a broad sense to designate any surface of revolution with an increasing cross-section perpendicular to its axis of symmetry. The small end of this frusto-conical portion may converge into section D which may comprise a substantially tubular stem portion, to the end of which may be affixed a cap or base provided with means E for making connections to the various electrodes to be contained in the vessel. In general, the size of the cylindrical stem D will be governed by the space requirements for the placing and securing of electron guns and other electrodes.

It will be noted that the thickness of the wall of part B increases slightly as the overall cross-section of the frusto-conical portion increases. This may obtain naturally, when the vessel is formed of glass, as a consequence of blowing the part B with its large end downward, so that the hot glass is urged downward by the force of gravity and thus tends to make the bottom portion of B thicker than the upper portion adjacent the stem. This is frequently desirable since, the surface area of the large portion being greater, the total pressure thereon and consequently the stress to which the glass is subjected, is greater. The thicker glass in this portion makes it better able to withstand the pressure.

The part A of the vessel consists of a disc or blank of vitreous material which is separately cast or molded, and which is later sealed to the frusto-conical portion B. It is this blank which forms the end-viewing screen for the television tube, and on it may be deposited a coating of fluorescent material which, when scanned by an electron beam, effects the formation of a picture or image. This part of the vessel represents an important feature of the invention and presents numerous advantages not found in prior structures. The end viewing-screen A consists essentially of a blank of vitreous material which is flat over the entirety of its useful surface, by which is simply meant the entire portion of its external surface upon which a usable image may be produced by the scanning action of a cathode ray beam within the vessel. The inner surface of this blank is preferably flat and parallel to the outer face, or it may be so formed as to increase the strength of the end portion of the vessel. In

general, however, the principal consideration will be the ability of the screen to permit an image to be viewed which is substantially free from distortion caused by refraction in the medium of which the screen is formed, and for this purpose it has been found that parallel surfaces are quite satisfactory.

In an end viewing screen such as the one herein disclosed, in which the outer surface is entirely flat, it is necessary to thicken the glass considerably by comparison with that in the conventional round-ended or dome-shaped tube of the prior art, in which the thickness of the glass in the end viewing screen was substantially the same as that forming the remainder of the vessel. This increased thickness of the flat end viewing screen is necessary to obtain a degree of strength comparable to that of the prior dome-shaped structure. The necessity for this may be readily seen when it is considered that in a vessel having a screen diameter of nine inches, the pressure on the screen when the vessel is evacuated is equal to atmospheric pressure multiplied by the area of the screen or approximately 900 pounds. The increased thickness of the screen, however, is not objectionable and the results obtained are far superior to those obtained when the conventional tube with a dome-shaped end is used. The reason for this is that with the dome-shaped vessel, unless the eye of the observer is positioned almost on a line with the axis of the vessel the straight lines of the picture televised will be distorted into curves whose radii will be dependent upon the curvature of the tube face. Such distortion is avoided when the present flat viewing screen is employed, and a much more pleasing picture is obtained than has been possible heretofore.

In practice it was found impossible to seal a thick blank of glass to the relatively thin sides of the main portion of the picture tube vessel without the application of heat so intense as to melt the portion of the glass forming the viewing screen, thereby rendering it ineffective in this capacity. In order to obtain a satisfactory seal, it was found necessary to reduce the edges of the blank gradually to substantially the same thickness as the glass of which the frusto-conical portion is made. Hence, in accordance with the invention this is done by forming around the edge of the blank a rim section as shown, which projects substantially at right angles to the main body of the blank, which rim is tapered gradually preferably both internally and externally to approximately the thickness of the main portion of the vessel. Both internal and external tapering are resorted to, as shown in the drawings, as this facilitates the casting of the blank. Further it is desirable for the same reason to slightly chamfer or round the corners formed by the intersection of the rim portion with the main body of the blank. However this chamfering should not be such as to appreciably encroach on the flat surface of the viewing screen and thereby interfere with the picture.

In addition to the advantage already pointed out, namely that the flat ended vessel gives a considerable reduction in picture distortion, it is also to be noted that any tendency of the picture to creep around the side of the tube due to over-deflection of the electron beam, as is the case with the prior tubes with dome shaped ends, is avoided. This is a psychological phenomenon which may be observed in a person watching a picture on the conventional tube. Because of the gradual round-

ing of the corners, the eye tends to follow the picture as it moves off the sides of the screen, because the picture is still visible though to some extent distorted. This tires the observer and consequently reduces the entertainment value of the picture. In the vessel of the present invention, the possibility of "following the picture off the screen" is precluded by continuing the flat surface of the tube up to the very point at which it changes abruptly in such fashion that the picture image cuts off sharply instead of "squeezing together" at the edges of the screen.

Still another advantage of the present structure is the ease with which the flat surfaces of the viewing screen blank may be ground and polished in large scale production as compared with the prior dome-shaped tubes.

In constructing the vessel, the parts A and B are formed separately and then joined together, as will be understood from the foregoing description. As mentioned above, the part B may be formed by blowing, and the end of the blown part may be removed and discarded to form an open-ended structure adapted to receive the part A.

Referring now to Figs. 3, 4, and 5, there is illustrated a preferred embodiment of the invention which is characterized in that the area of the end viewing screen is substantially the same as that of the picture to be reproduced, is substantially rectangular in form, and has the same aspect ratio as the picture. Only the frusto-conical portion and end viewing screen portion of the vessel are shown, since the stem portion is of the same form as that shown in the vessel of Figs. 1 and 2. It will be noted that the end viewing screen blank A, as shown in Fig. 4, is essentially of the same general form as the one previously described, having faces which are quite flat, a rim portion which tapers to substantially the thickness of the glass in the frusto-conical portion of the vessel, and chamfers at the lines of intersection between the end blank proper and its rim. The only difference resides in the shape of the end area which is generally rectangular with convex sides. This permits the frusto-conical portion B to be appreciably flattened so as to give it a cross section which is generally rectangular. It is to be noted, however, that the sides are made convex (see Fig. 5) in order more readily to withstand the pressure of the atmosphere to which the vessel is subjected upon evacuation.

This form of the vessel presents certain advantages over the one first described in that it will occupy less space in the cabinet in which the television receiver and other associated equipment are installed, and it also presents less volume to be evacuated while still giving a viewing screen of the desired size and shape to accommodate the standard television picture. This latter feature is of considerable importance, of course, from the point of view of increasing commercial production when the vessels are evacuated.

It will, of course, be understood that the invention is not limited to the particular forms illustrated, it being obvious that other specific forms are possible within the scope of the invention as defined by the appended claims.

I claim:

1. A vessel or envelope for a television picture tube, comprising a generally frusto-conical body portion having relatively thin walls terminating at the large end thereof in a substantially annular edge, and a relatively thick disc having substantially parallel plane surfaces attached to said edge and constituting a picture screen on which

an image may be formed, said disc having an integral annular rim of a diameter not exceeding the diameter of said disc and extending from the edge of the disc in a direction normal to the plane of said disc, at least one wall of said rim tapering gradually and uniformly from the edge of the disc toward the outer end of said rim to provide a rim having an appreciable thickness adjacent the disc and a lesser thickness at its outer edge, the outer edge of said rim being substantially equal in extent and in thickness to the annular edge at the large end of the body portion, the edge of said rim abutting and being joined to the edge at the large end of the body portion, whereby said rim merges into the wall of said body portion.

2. A vessel or envelope for a television picture tube, comprising a generally frusto-conical body portion having relatively thin walls terminating at the large end thereof in a substantially annular edge, and a relatively thick disc having sub-

stantially parallel plane surfaces attached to said edge and constituting a picture screen on which an image may be formed, said disc having an integral, tapered, annular rim of a diameter not exceeding the diameter of said disc and extending from the edge of the disc in a direction normal to the plane of said disc, the inner and outer walls of said rim tapering gradually and uniformly toward each other and toward the outer end of said rim to provide a rim having an appreciable thickness adjacent the disc and a lesser thickness at its outer edge, the outer edge of said rim being substantially equal in extent and in thickness to the annular edge at the large end of the body portion, the edge of said rim abutting and being joined to the edge at the large end of the body portion, whereby said rim merges into the wall of said body portion.

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