May 23, 1950

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2,508,856

METHOD AND STRUCTURE FOR PROCESSING AN ELECTRON DISCHARGE DEVICE

Filed Sept. 7, 1946

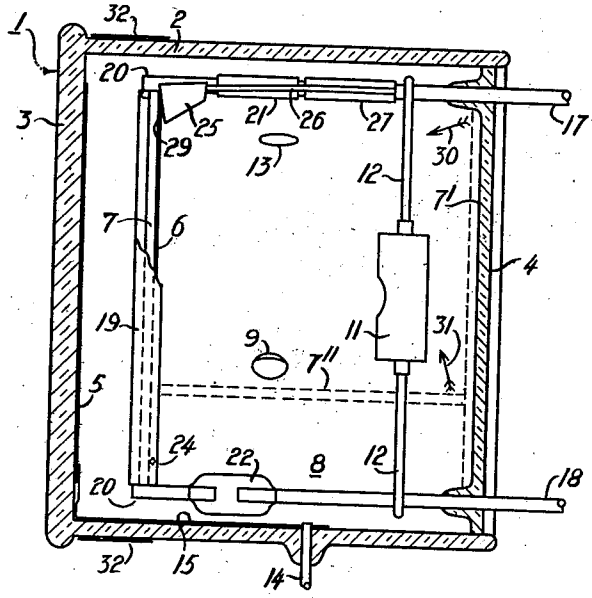


Fig. 1.

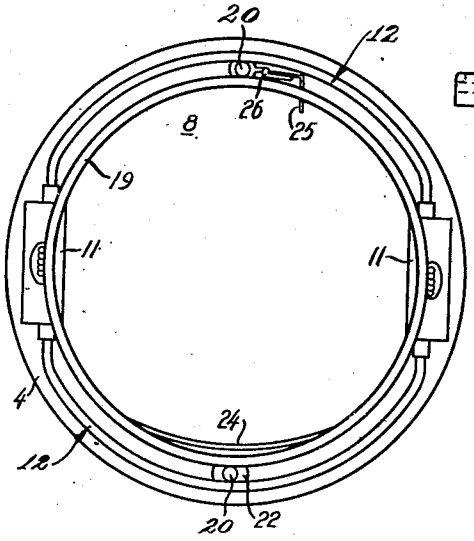


Fig. 2.

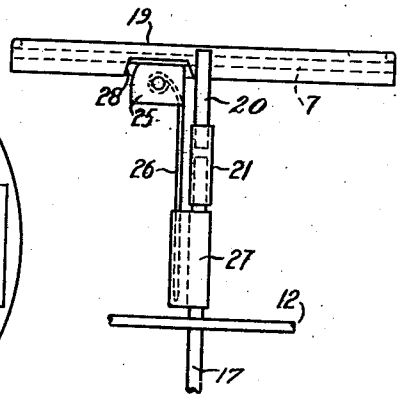


Fig. 3.

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Patented May 23, 1950 2,508,856

UNITED STATES PATENT OFFICE

2,508,856

METHOD AND STRUCTURE FOR PROCESSING AN ELECTRON DISCHARGE DEVICE

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Application September 7, 1946, Serial No. 695,510
In Great Britain September 12, 1941

Section 1, Public Law 690, August 8, 1946
Patent expires September 12, 1961

14 Claims. (Cl. 250—165)

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The present invention relates to electron discharge devices of the kind having a screen and in which at some stage during the manufacture or life of the device it is desired to carry out a treatment with a gas or vapour which is released in the presence of said screen and becomes distributed through the envelope of the device, said gas or vapour being noxious in respect of said screen.

The invention has been developed in connection with an electron discharge device known as a picture transformer comprising a photo-cathode and a fluorescent screen disposed within an envelope so that if an optical image is focussed on to the cathode it causes the emission therefrom of photo-electrons, and the composite beam of electrons thus obtained is projected on to the fluorescent screen and the image is reproduced thereon. In the construction of such a device it is usual after the fluorescent screen has been inserted within the envelope to form a photo-cathode by evaporating a suitable foundation on to a member, which may, for example, be part of the envelope, and then treating the foundation by admitting oxygen and caesium vapour after evacuation of the envelope. These operations may, however, result in damage to the fluorescent screen if it is not protected. Various expedients have already been proposed for affording protection to the fluorescent screen, involving for example, the use of protective flaps for covering the fluorescent screen during the formation of the cathode, or the making of the cathode reversible. The use of a flap is not entirely satisfactory where the cathode and screen are required to operate in close proximity, as it is difficult to accommodate the flap and to prevent undesired electrical discharges occurring between the cathode and the flap. Also where it is required to form the cathode on an immovable member, such as a window forming part of the wall of the envelope, it is not possible to make the cathode reversible.

The object of the present invention is to afford protection for said screen while the treatment with noxious gas or vapour is being carried out without the necessity of employing a flap to protect the screen and without the necessity of employing a reversible cathode.

According to the present invention there is provided an electron discharge device or a device for use in the manufacture of an electron discharge device, said device comprising a substantially closed envelope, a movable support member carrying a screen, a mounting for said

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support member, holding means for maintaining said support member in said mounting in a predetermined operating position in which said screen is exposed within said envelope, the arrangement being such that said support member can be caused to occupy a safe position within said envelope in which position said screen is sandwiched between said support member and a further member so as to be unexposed whereby damage to said screen by gas or vapour noxious to said screen which may be admitted to said envelope in the presence of said screen during or subsequent to manufacture can be substantially avoided, and said support member can then be caused to fall from said safe position into said mounting and into said operating position by manipulation of said device. Preferably, said holding means are arranged to be operable from without said envelope to allow said support member to be released from said mounting after said support member has been mounted and engaged by said holding means.

The invention further includes the method of manufacturing an electron discharge device, and an electron discharge device manufactured by said method, employing a device in accordance with the invention and comprising manipulating the device to cause the support member for the screen to move to its safe position, admitting or releasing a vapour or gas which is noxious in respect of the screen so as to treat an element of said device within the envelope, and subsequently causing said support member to move to its operating position.

In order that the said invention may be clearly understood and readily carried into effect, it will now be more fully described with reference to the accompanying drawings, in which:

Figure 1 is a side elevational view, partly in section, of an electron discharge device in the form of a picture transformer constructed in accordance with the invention,

Figure 2 is a detail view showing in front elevation the frame by which the fluorescent screen and the silver evaporators for providing the silver base for the photo-cathode are mounted on the header of the device shown in Figure 1, and

Figure 3 is a detail top plan view showing the screen and screen catch in the device of Figure 1 with the front and upper members of the aforesaid frame.

Referring to Figure 1 of the drawing, it will be seen that the device therein shown comprises a glass envelope 1 consisting of a cylinder 2 having one end closed by an end wall 3 and the

other end sealed by a disc-shaped header 4 which is inserted within the end of the cylinder 2. The end wall 3 and the header 4 are each formed so as to provide a window, both faces of each being optically worked. On the inner face of the end wall 3 is formed the photo-cathode 5 which is illuminated through the end wall. The fluorescent screen 6 is formed on a support member constituted by a glass disc 7 carried in a mounting 8 supported on the header 4, the screen 6 being viewed through the header 4. The construction of the mounting 8 is described more in detail below. The screen 6 is shown formed in Figure 1 facing away from the cathode, but in operation the screen 6 is arranged to face the cathode and to extend parallel thereto and separated therefrom by a gap only a few millimetres wide.

The envelope 1 is evacuated through an aperture 9 in the wall of the cylinder 2. The photo-cathode 5 is formed in the manner described in British Patent specification No. 492,036, that is to say, the photo-cathode is formed by depositing a thin layer of silver on the glass wall 3, this layer being oxidised and a relatively thick layer of silver being applied over the oxidised layer to render it conducting and the oxidised layer being rendered light-sensitive by treatment with caesium vapour before or after the deposition of the relatively thick layer. The silver for forming the cathode is furnished from two evaporators 11 each comprising a silver-coated heating filament and a cylindrical shield having an opening through which the silver vapour is ejected. The evaporators 11 are carried on the ends of arms 12 forming part of the mounting 8, while caesium vapour is admitted through the aperture 13 in the wall of the cylinder 2, the aperture 13 being preferably disposed at the end of a diameter at right angles to the corresponding diameter through aperture 9.

Electrical connection to the cathode 5 is affected through a lead-in wire 14, for example, of tungsten, passing through the wall of the cylinder 2 and a strip of burnished silver 15 painted on the inside of the cylinder 2 and end wall 3.

The mounting 8 carrying the disc 7 on which the fluorescent screen 6 is formed comprises two side rods 17 and 18 which may be formed of tungsten and are sealed through the header 4 at diametrically opposed points. An arm 12 is secured to each of the rods 17 and 18 at a point near to the header 4, the arms 12 and evaporators 11 forming a complete hoop girdling the support rods. The arms 12 are insulated from the shields of the evaporators, but are electrically connected through the heating filaments thereof so that the rods 17 and 18 constitute lead-in wires for the evaporator heater currents. The mounting 8 is completed by bezel ring 19 of J or L-form cross-section which may be formed of nickel, into which the disc 7 fits. The ring 19 has wires 20 welded on to it registering with the rods 17 and 18 respectively, the wire 20 shown uppermost in Figures 1 and 2 being secured to the rod 17 by means of a tight fitting metal sleeve 21 which is welded to wire 20 and rod 17 to provide an electrically conducting connection between the ring 19 and the rod 17, while the lowermost wire 20 is secured to rod 18 by means of a bead 22 of insulating material, such as glass.

The screen 6 is formed of willemite or similar fluorescent material deposited on a platinum graticule which provides an electrically-conducting backing for the screen, the graticule being sintered on the disc 7 and having a continuous edge portion which, in operation, engages the inner edge of ring 19 to provide electrical connection between the screen and the rod 17, which latter thereby constitutes a lead-in wire for the screen.

The disc 7 carrying the screen 6 is maintained in the ring 19 by means of a bracing wire 24, which engages the disc 7 near the edge thereof, and a catch 25 which engages the edge of the disc 7 at a point diametrically opposite the middle of the wire 24. The wire 24 may be formed of nickel and is welded on the ring 19 while the catch 25 is formed of a material, such as Permalloy, and is supported on a spring 26, formed of tungsten, for example, carried by a clip 27 mounted on the rod 17. The spring 26 is biassed inwardly and forces the catch 25 through a cut-out portion 28 (see Figure 3) in ring 19, against the disc 7 which is thereby firmly gripped in position. The front edge 29 of catch 25 is preferably slightly inclined so that the catch 25 exerts a wedging action on the disc 7 and tends to bind more and more tightly if the device is subject to vibration.

As indicated above, the frame 8 is assembled on the header 4 with the disc 7 disposed in the ring 19 with the screen 6 presented to the header 4. The header assembly is then inserted and sealed in the cylindrical portion 2. At this stage the screen 6 must be moved to a position of safety where it will not be subject to action of any vapour or gas released during the formation and treatment of the cathode 5. To cause the screen 6 to move to the aforesaid position of safety the device is supported with its end wall 3 uppermost and the catch 25 is disengaged from the disc 7 by applying a magnet outside the cylinder 2 to cause the catch to move against the action of the spring 26. The disc 7 then drops down and by gentle manipulation of the device the disc may be caused to fall to the position indicated in dotted lines at 7' in Figure 1, where the disc lies flat on the header 4 with the screen 6 sandwiched between the disc and the header, the exposed surface of the screen, that is to say the surface of the screen liable to be attacked by noxious vapour or gas, being covered by the header. The screen 6 is thus completely protected.

After the disc 7 and screen 6 have thus been moved the envelope is sealed on to the pumps and evacuated; heater current is supplied to the evaporators 11, through rods 17 and 18 and arms 12 to liberate silver vapour as required during the formation of the cathode 5, oxygen is admitted to oxidise the cathode and excess pumped off; and then the caesium vapour for sensitising the cathode is introduced through aperture 13. When the formation and sensitising of the cathode is completed, the lead-in tubes connected to apertures 9 and 13 are sealed off and the disc 7 can then be caused to move into the operative position with screen 6 presented to the cathode 5. To bring about this movement the device is rocked so as to cause the disc 7 to fall from the position 7' into the position shown dotted at 7'' in Figure 1, with a swinging movement, as indicated by the arrow 30, and is further rocked to cause the disc to swing in a direction indicated by the arrow 31 so that the disc 7 falls on to the bezel ring 19 again, but with the screen 6 presented towards the cathode 5 and with the bottom of the disc gently engaged by the wire 24 which serves to guide the disc into position in the ring 19 so that

when the catch 25 is withdrawn once again, the disc 7 is permitted to move to its operative position with the screen 6 resting on the inner edge of the bezel. The catch 25 is then released and locks the disc 7 firmly in position.

If, for any reason, it is required to re-treat the cathode 5 it will be seen that the disc 7 and the screen 6 can be moved to a position of safety whenever desired by simply withdrawing catch 25 and suitably manipulating the device.

It will be seen that with the arrangement described in detail above the fluorescent screen 6 can be moved to a position of safety freely and without damage. This enables the screen 6 to be brought, in operation, as close to the cathode 5 as desired, thus simplifying the focussing of electrons from the cathode on to the screen. In cases where the cathode and screen operate in very close proximity it is desirable to provide means for preventing undesired discharges taking place between the screen and the cathode. It is found that a coating of conducting material, for example, a suspension of colloidal graphite applied round the outside of the cylinder 2 in the vicinity of the cathode, as indicated at 32 in Figure 1, and maintained at approximately cathode potential when the device is in operation is effective to prevent these discharges occurring.

What I claim is:

1. An electron discharge device comprising an envelope, a member mounted in position within said envelope, a coating on one face of said member, said envelope having an inner surface conforming with said coated face of said member, releasable means within said envelope for locking said member in mounted position and for releasing said member whereby said member may be positioned with said coated face in contact with said inner envelope surface.

2. An electron discharge device comprising an envelope, a plate member mounted in position within said envelope, an activated material coating one face of said plate member, said envelope having an inner surface conforming with the coated face of said plate member, releasable means within said envelope for locking said plate member in mounted position and for releasing said plate whereby said plate may be positioned with said coated face in contact with said inner envelope surface.

3. An electron discharge device comprising an envelope, a screen mounted in position within said envelope, said screen having a surface portion thereof coated with an activated material, said envelope having an inner surface unobstructedly spaced from said screen, said inner envelope surface conforming with said coated surface portion, means within said envelope for releasably holding said screen in mounted position, said holding means including a movable catch for releasing said screen from the mounted position whereby said screen may be positioned with said coated surface portion in contact with said inner envelope surface.

4. An electron discharge device comprising an envelope, a member mounted in position within said envelope, said member having a sensitized surface thereof, a header element forming a part of the wall of said envelope, said header element unobstructedly spaced from said member, a portion of the inner surface of said header conforming with said sensitized surface of said member, releasable means within said envelope for holding said member in mounted position and for releasing said member whereby said member may

be positioned with said sensitized surface in contact with said conforming inner surface portion of said header.

5. An electron discharge device comprising a tubular envelope, a header element closing one end of said envelope, a screen within said envelope mounted on said header element, said header having a portion of the enclosed surface thereof unobstructedly spaced from said screen, said screen having a sensitized surface, said portion of the enclosed surface of said header conforming with said sensitized surface of said screen, releasable means within said envelope for holding said screen in mounted position and for releasing said screen whereby said screen may be positioned with said sensitized surface in contact with said conforming surface portion of said header.

6. An electron discharge device comprising a tubular envelope, a header disc sealed to one end of said envelope, a screen within said envelope, means fixed to said header disc for supporting said screen in a position unobstructedly spaced from said header disc, said screen having a sensitized surface, a portion of the inner surface of said header disc conforming with said sensitized screen surface, a movable catch mounted on said screen supporting means for holding said screen in said unobstructed position and for releasing said screen whereby said screen may be positioned with said sensitized surface in contact with said conforming inner surface of said header.

7. An electron discharge device comprising a tubular envelope, an end wall closing one end of said envelope, a header disc sealed across the other end of said envelope, a plate member within said envelope, one face of said plate member being sensitized means mounted on said header disc for supporting said plate member in a position unobstructedly spaced between said header disc and said end wall, a portion of the inner surface of said header disc conforming with said sensitized face of said plate member, releasable means on said plate member supporting means for holding said plate member in said unobstructed position and for releasing said plate member whereby said plate member may be positioned with said sensitized face in contact with said conforming inner surface of said header.

8. An electron discharge device comprising a tubular envelope, an end wall adapted to be sensitized closing one end of said envelope, a header member sealed to the other end of said envelope, a support plate within said enevelope, an activated material coating one face of said support plate, means fixed to said header member for mounting said support plate in a position unobstructedly spaced between said header member and said end wall, a portion of the inner surface of said header conforming with said coated face of said support plate, releasable means on said support plate mounting means for holding said support plate in said unobstructed position and for releasing said support plate whereby said support plate may be positioned with said sensitized face in contact with said conforming inner surface of said header during formation of a sensitized surface on said end wall.

9. A header assembly for sealing to an electron discharge device, said assembly comprising a flat header disc, supporting means fixed to said header disc, a sensitized screen mounted in position on said supporting means, releasable means fixed to said supporting means for holding said

screen in position and for releasing said screen from said supporting means.

10. A header assembly for an electron discharge device having an envelope, said assembly comprising a flat header member for closing said envelope, supporting means fixed to said header member and extending from one face thereof, a screen mounted on said supporting means and unobstructedly spaced from said header member, a sensitized coating on one portion of said screen, said one face of said header member conforming with said coated portion of said screen, releasable means on said supporting means for holding said screen in said unobstructed position and for releasing said screen whereby said coated portion may be positioned in contact with said conforming face of said header.

11. A header assembly for an electron discharge device having an envelope and a photocathode, said assembly comprising a flat header member for closing said envelope, supporting means fixed to said header member and extending from one face thereof, a screen mounted on said supporting means, said screen having a sensitized surface, means fixed to said supporting means for forming said photocathode, said one face of said header member conforming to said sensitized surface, said supporting means including a releasable catch for holding said screen in mounted position and for releasing said screen whereby said screen may be positioned with said sensitized surface in contact with said conforming face of said header member during formation of said photocathode.

12. A header assembly for an electron discharge device having an envelope, said assembly comprising a header member for closing said envelope, a supporting frame fixed to said header member and extending from one face thereof, a screen mounted on said frame and unobstructedly spaced from said header member, a fluorescent coating on one surface of said screen, said one face of said header member conforming to said fluorescent coated screen surface, means fixed on said supporting frame for evaporating a metal photocathode layer on the inner surface of said envelope, said supporting frame including releasable means for holding said screen in mounted position and for releasing said screen whereby said fluorescent coated surface may be positioned in contact with said conforming face of said header during formation of said photocathode.

13. An electron discharge device comprising an envelope, a header member forming part of said envelope wall, a screen within said envelope, supporting means fixed to said header and enclosed within said envelope for mounting said screen in position adjacent the inner surface of a portion of said envelope wall, said screen having a sensitized surface, a metal evaporator fixed to said supporting means for forming a photocathode layer on said inner envelope surface portion, said header having an enclosed surface conforming with said sensitized screen surface, said supporting means including a releasable catch for holding said screen in position adjacent said wall portion and to release said screen whereby said sensitized surface may be positioned in contact with said conforming header surface during formation of said photocathode layer.

14. An electron discharge device comprising an envelope, a header member forming part of said envelope wall, a screen within said envelope, said screen having a sensitized surface, a metal evaporator mounted within said envelope for forming a photocathode layer within said envelope, said header having a surface enclosed within said envelope conforming with said sensitized screen surface, releasable means within said envelope for maintaining said screen in one position and for releasing said screen from said position whereby said sensitized surface may be positioned in contact with said conforming header surface during formation of said photocathode layer.

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