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COLOR TUBE SHIELD

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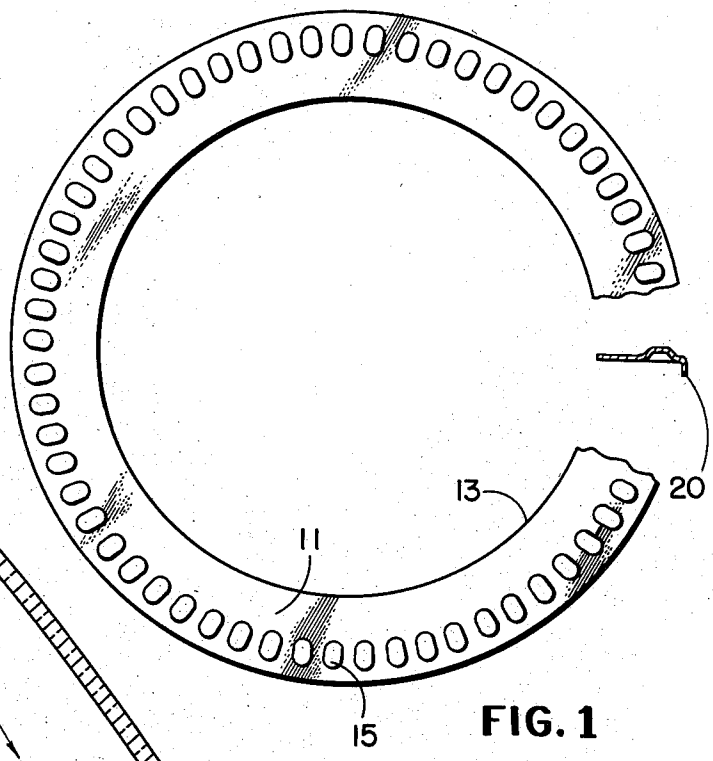


FIG. 1

FIG. 2

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COLOR TUBE SHIELD

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6 Claims. (Cl. 315—13)

This invention relates to cathode ray tubes in general and to tri-color television picture tubes in particular.

One of the problems associated with tri-color picture tubes is the elimination of the effect known as halation. Halation is the false excitation of the fluorescent materials around the edge of the viewing screen. For example, if a portion of the red-producing electron beam falls on the blue-producing fluorescent material, the visible color blue will be produced.

In a shadow mask tube, the foramina in the mask prevent cross-excitation of the fluorescent materials over the greater part of the viewing screen. However, even a practical design such as that shown in United States Patent No. 2,690,518 of Fyler and Rowe, assigned to the same assignee as the present application, exhibits halation around the edge of the viewing screen. In such a tube, halation appears as a bluish fringe with green overtones around the picture. If uncontrolled, such visible evidence of halation may render a tube commercially unacceptable.

The color of the fringe around the picture is a function of the different luminous efficiencies of the presently used luminescent materials and the method of compensating for the different efficiencies. The red-producing material now being used is the least efficient; that used to produce green being next in efficiency and that used to produce blue being the most efficient. The beam currents of the guns are adjusted to keep the ratio of the beam currents inversely proportional to the luminous efficiency of the particular luminescent materials over all useful brightness ranges. This means that at any given brightness level the blue beam is the least intense and the red beam the most intense. Even a small proportion of the red beam reflecting off the funnel of the tube and impinging on the blue and green producing phosphors will excite such phosphors sufficiently to give a visible color.

A positioning structure for a shadow mask adjacent to the viewing screen is shown in detail in a patent application of Fyler Serial No. 506,684, dated May 6, 1955, for "Color Picture Tube." This structure results in an opening being left between the outer edge of the shadow mask and the inner wall of the tube envelope. This opening has proven troublesome because as the raster is scanned, the electron beams are periodically deflected so as to fall on the inner wall of the tube envelope adjacent to the opening. Although the inner wall is coated with a conducting material, some reflection occurs. In addition, some secondary emission undoubtedly occurs. The reflected electrons and a portion of the secondarily emitted electrons are diffused through the opening on to the edges of the viewing screen. No separation of the beams has been accomplished because the beams have not passed through any of the foramina in the shadow mask. Therefore, the three beams remain mixed even after reflection. The ratio of the beam currents energizing each color-producing fluorescent material under these conditions is not inversely proportional to the luminous efficiency of the various phosphors. The result is the bluish green fringe which is so objectionable. The red phosphor is also energized, but since its efficiency is low, the effect is masked by the more intense blue and green.

The effect of halation has been studied and may be avoided or minimized in any one of the following ways:

(1) Fitting the mask to the panel so that an intimate contact is made completely around the periphery of the mask;

(2) Designing sweep circuits so that no part of the raster is swept over the outer edge of the mask;

(3) Blanking off overswept portions of the raster from the fluorescent screen;

(4) Reducing the active area of the fluorescent screen;

(5) Equalizing the luminous efficiency of each of the fluorescent materials used to make the viewing screen;

(6) Using a perfect conductor with a very high work function as a coating on the inner walls of the tube envelope.

A moment's consideration will serve to show that method 3 above is the best. Each of the other methods involve high cost precision work, complicated external circuitry, sacrifice of efficiency, or development of special materials.

A second problem associated with the manufacture of color tubes arises when the funnel is joined to the panel to complete the tube envelope. All practical methods of fabricating a color tube make it highly desirably that the tube envelope be constructed of at least two major parts. The usual parts are the rear section which includes a neck and funnel, and the viewing screen end, or panel. The electron guns are mounted in the neck and the fluorescent screen and shadow mask in the panel. Metallic flanges are usually sealed to the mating ends of the funnel and flange to permit welding to complete the envelope. Cushioning of some kind is desirable especially during assembly of the panel and funnel. Extreme care then need not be taken to avoid mechanical and thermal strains. At the same time, a firm evenly distributed mechanical contact must be maintained between the parts to ensure proper relative positioning of the electron guns, the shadow mask and the fluorescent screen.

It is an object of this invention to provide a simple device in a color picture tube to eliminate the effects of halation.

It is a further object of this invention to provide self supporting positive means of positioning an anti-halation device or electron shield.

It is also an object of this invention to furnish a cushioning pad between the panel and funnel portions of the tube to prevent injury to either portion during assembly.

In general, the objects of the present invention are attained by placing a conductive element substantially perpendicular to the path of electrons reflected off the funnel or emanating therefrom due to secondary emission, thus intercepting or preventing such electrons from impinging on the luminescent screen. The conductive element is held in position perpendicular to the longitudinal axis of the tube by pressure exerted on either side by the panel and funnel after the two parts are secured together. At the same time, serrations in the conductive element allow the conductive element to deform slightly in response to such pressure, thus prevening excessive strains in the glass of which the panel and funnel are made. Motion of the anti-halation screen in a direction perpendicular to the longitudinal axis of the tube is prevented by a lip on the periphery of the conductive element. This lip is substantially perpendicular to the plane of the main part of the conductive element and is preferably formed as an integral part of the conductive element. During assembly, this lip is matched with an indentation previously fashioned in either the panel or funnel of the completed tube. For a better

understanding of this invention, reference should be made to the drawing in which:

Fig. 1 is an orthogonal view of a practical embodiment of this invention; and

Fig. 2 is a view of the shield of Fig. 1 in place in a color picture tube. Only the electron beam producing red is depicted.

Referring to Fig. 1, the three main parts of a preferred embodiment of an electron shield **13** may be seen. The inner portion **11** of the shield **13**, the central portion **15** and the lip **20** may advantageously be formed from a single electrically conductive sheet. The lip **20** is preferably a flange projecting substantially at right angles to the plane of the remaining portions **11**, **15** of the shield **13**. The central portion **15** of the shield **13** may be serrated or crimped from the inner edge of the lip **20** to provide a resilient surface of any desired dimensions. The type of crimping is not material. The inner portion **11** of the shield **13** projects inwardly from the central portion **15** a predetermined amount to form an aperture of any desired size and shape.

Alternative ways of constructing a shield which will perform some or all the functions performed by the preferred embodiment will suggest themselves to anyone skilled in the art. Among such ways are the extension of either or both the flanges **17**, **18** (shown in Fig. 2) inwardly in place of the shield **13**, shaping a shield from a resilient electrically conductive material such as woven wire, or crimping the inner portion **11** of the shield **13**. However, in order to obtain the required shielding, cushioning and positioning, the embodiment shown is preferred.

The operation of the electron shield **13** may be seen by referring to Fig. 2. The panel **16** has a flange **17** sealed thereto; the funnel **12** has a second flange **18** sealed thereto. The flanges **17** and **18** are similarly shaped for manufacturing economy and convenience of assembly. Each flange **17** and **18** has a groove **21** of sufficient depth and diameter to accommodate the lip **20** of the shield **13**. When the lip **20** is placed in one of the grooves **21**, the crimped central portion covers the flange **17** or **18** inwardly of the groove **21**. The shield **13** is thus restrained from any substantial radial movement. After the lip **20** is inserted in the selected groove **21**, the remaining section of the tube envelope is positioned so that the outer edges of the flanges **17** and **18** are adjacent to each other. A compressive force is exerted on the central portion **15** of the electron shield **13** by so moving the flanges **17**, **18** into juxtaposition. The resiliency of the central portion **15** cushions any shock. While the flanges **17**, **18** are thus held, a weld **19** is formed between the outer peripheries of the flanges **17**, **18**. This weld **19** holds the parts firmly in place.

When the assembled tube is placed in operation the following occurs. The deflected red electron beam originating at electron gun **23** is represented by the fascicled arrows such as those numbered **22**. The spacing between the arrows roughly represents the electron density variations across the beam. The broken arrows such as those numbered **22*a*** represent that portion of the electron beam which is reflected off the inside of the funnel **12**. The broken arrows such as those numbered **22*b*** represent those electrons which are secondarily emitted from the inner wall of the funnel **12**. The dotted arrows such as those numbered **22*c*** represent the path the electrons would take without the electron shield in place.

The inner portion of electron shield **13** is positioned in the path of the reflected portion of the electron beam **22*a*** and in the path of substantially all the secondarily emitted electrons **22*b*** which could impinge on the luminescent screen. The electron shield **13** is substantially normal to the path of the reflected and secondarily emitted electrons **22*a*, 22*b*** so that any electrons reflecting off the shield **13** do not reach the luminescent screen on the panel **16** either through or around the shadow mask **24**. Any electrons such as those represented by the arrow **22*c*** which would, in the absence of the shield **13**, impinge on the luminescent screen after reflection near the edge thereof are intercepted by the shield **13**. If the main part of the beam **22** is deflected to the position of the arrow **22*c***, reflection in the absence of the shield **13** would be intensified. An electrical contact **14** bleeds off any charge which tends to build up on the electron shield **13**, keeping the shield **13** at the same potential as the inner wall of the panel **16** and funnel **12**.

Although the invention has been illustrated and described in connection with one practical color television picture tube in which it has been incorporated, it is believed that the concept of simultaneously providing a simple electron shield and cushioning device which may be positively positioned in the tube to eliminate halation and breakage in manufacturing is such that other embodiments will suggest themselves to those skilled in the art. In particular, it should be noted that the shape of the viewing screen of the picture tube in which an electron shield such as that shown and described is not restricted. A viewing screen of any shape other than the described circular shape may be protected by a shield of appropriate outline. Such other embodiments are believed to be within the spirit and scope of the present invention as defined in the appended claims.

What is claimed is:

1. A tri-color television picture tube having a two-part envelope, a viewing screen disposed on a portion of the inner surface of one part of said envelope and including, a resilient annular ring frictionally positioned between said parts of said envelope and projecting inwardly of said envelope adjacent the viewing screen of said tube, said ring being fabricated from an electrically conductive material, and means for maintaining said ring at the same electric potential as the said part of said envelope which includes said viewing screen.

2. In a cathode ray tube, an annular electron shield comprising, a substantially flat electrically conductive inner portion, a crimped central portion integral with said flat portion and a peripheral fold substantially perpendicular to the plane of said inner portion.

3. In a cathode ray tube having a panel and funnel, an electron shield comprising, an annular electrically conductive ring, a crimped portion outwardly adjoining said annular ring and means for retaining said ring in the interstice between said panel and funnel.

4. An electron shield for cathode ray tubes comprising, an inner portion, a central portion and a peripheral portion, said portions being formed from a single sheet of electrically conductive material, said inner portion having an aperture of predetermined size formed therein, said central portion being crimped, and said peripheral portion being substantially perpendicular to said central portion.

5. In a multi-color cathode ray tube for television picture presentation, an electron shield and positioning apparatus comprising, an annular electrically conductive element, the cross-section of the outer edge of said annular conductive element being shaped to fit a predetermined cross-section of said tube, the inner edge of said annular conductive element being substantially parallel to said outer edge, corrugations being formed in the said annular conductive element, said annular conductive element being disposed in said tube substantially perpendicularly to the longitudinal axis thereof to mask the edges of the viewing screen therein.

6. In a tri-color shadow mask picture tube having a panel and an adjacent funnel portion to form an envelope, a fluorescent viewing screen disposed on a portion of the inner surface of said panel and means for simultaneously deflecting three electron beams originating in said funnel portion, a cushioning and shielding device comprising, a resilient portion frictionally mounted in the interstice between said panel and said funnel, a cir-

cumferentially positioning portion disposed about the outer edge of said panel, and a flat annular portion inwardly adjoining said resilient ring portion and projecting inwardly of said interstice to intercept a predetermined portion of said deflected electron beams, the inner edge of said annular portion having substantially the same shape as the projected periphery of said viewing screen on the plane of said flat annular portion, said annular portion, said resilient portion and said circumferentially positioning portion being electrically conductive.

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