# United States Patent

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[54] **COLOR TUBE ELECTRON SHIELD HAVING OUTWARDLY BOWED EDGES DIRECTED TOWARD VIEWING SCREEN TO MINIMIZE SEAL EDGE INTERFERENCE**
**9 Claims, 5 Drawing Figs.**


[52] **U.S. Cl.** ..... **313/85,** 313/240

[51] **Int. Cl.** ..... **H01j 1/53,** H01j 29/40

[50] **Field of Search** ..... 313/85 (S), 92, 240, 239



[56] **References Cited**

UNITED STATES PATENTS

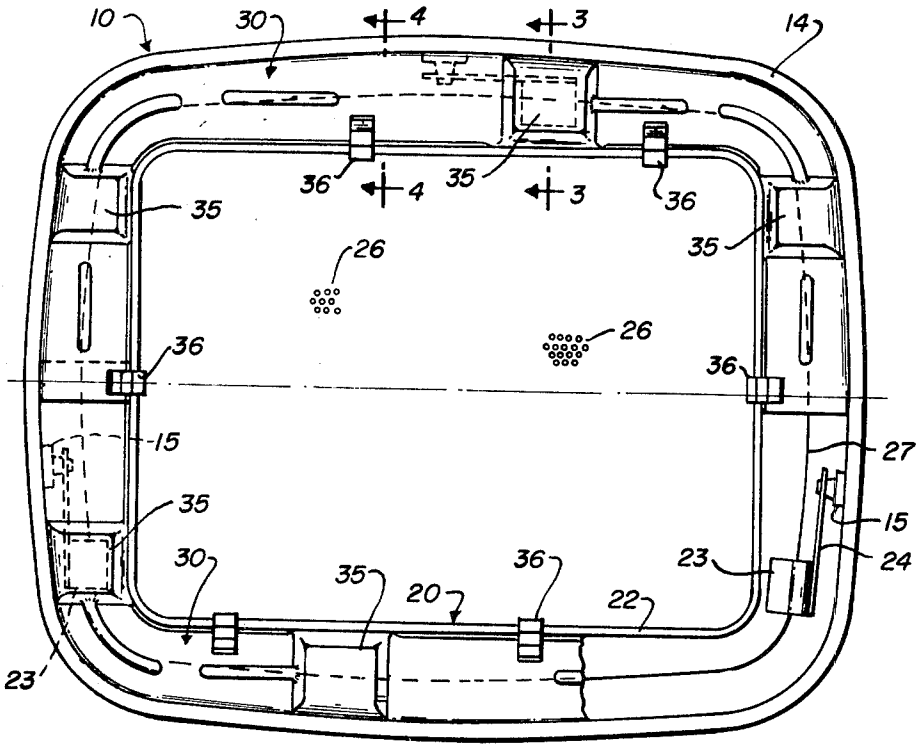
3,377,493 4/1968 Levin et al. ..... 313/85X



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**ABSTRACT:** An electron barrier consisting of two identical shields of semirigid formed aluminum foil having forwardly bowed edges resiliently contacting the inner wall of a color picture tube panel well below frit seal line. The shadow-mask frame includes a lip cooperating with raised portions on the shields to insure flexure of the bowed edges during installation.

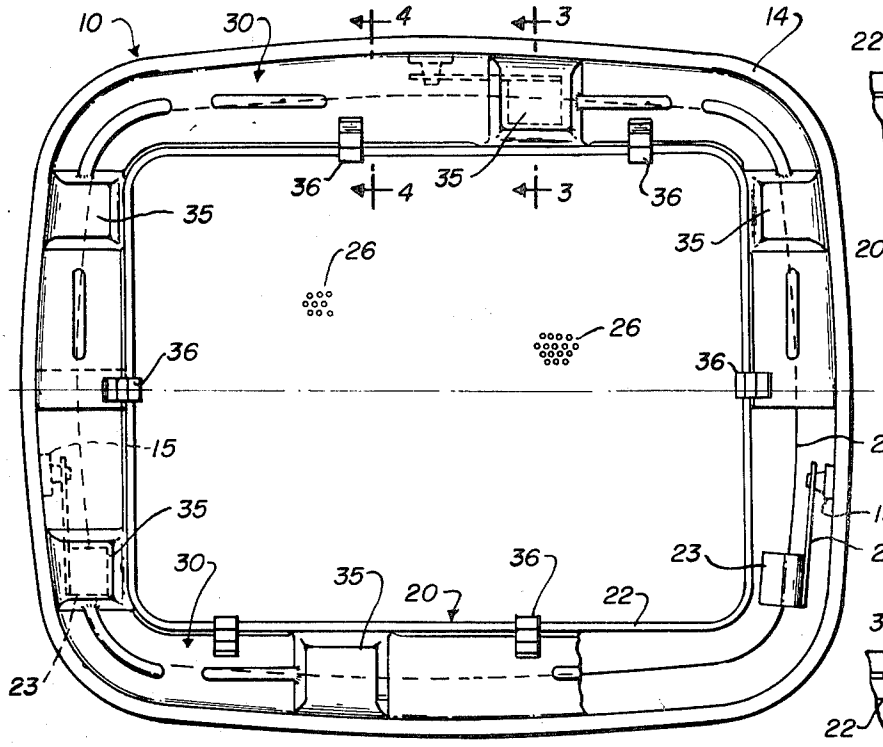



FIG. 1

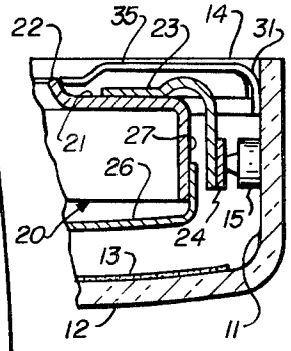



FIG. 3

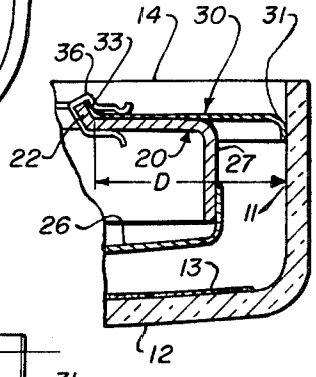



FIG. 4

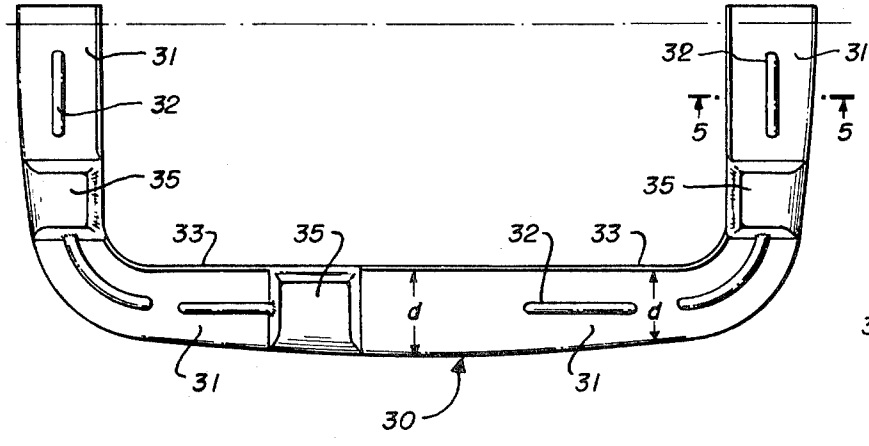



FIG. 2

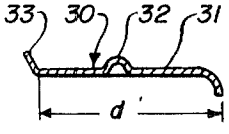



FIG. 5

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# COLOR TUBE ELECTRON SHIELD HAVING OUTWARDLY BOWED EDGES DIRECTED TOWARD VIEWING SCREEN TO MINIMIZE SEAL EDGE INTERFERENCE

This invention relates to electron barrier or shielding apparatus used in color picture tubes for preventing overscanned electrons from directly or indirectly exciting the phosphor screen. In particular, the invention is directed to shields of the type fabricated from semirigid metallic foil which are attached by means of clips to the shadow-mask support frame of the color tube.

Most color television picture tubes of the shadow-mask type have a deposited mosaic of color phosphors on the inner surface of the picture tube front panel. An apertured or foraminous mask is supported in predetermined relationship with the panel and effectively "shadows" the color phosphors such that each color is responsive only to electrons with predetermined directivity characteristics. The principles of operation of the shadow-mask color picture tube are well known, and further elaboration is believed unnecessary.

Generally, the foraminous shadow-mask is supported on a rigid, relatively heavy frame structure which in turn is removably mounted within the picture tube panel. In accordance with conventional manufacturing techniques for color picture tubes, the mask serves as a negative in exposing the phosphor mosaic one color at a time and must, therefore, be positioned at least four times during screening. Consequently, it is essential that the frame structure be removable yet readily reinsertable in the same position. The art includes tubes with both three and four stud mounted frames. The mounting studs comprise metallic cone elements embedded about the peripheral wall of the picture tube panel and the frame is resiliently attached thereto with flat springs. The springs are deflectable to permit disengagement from the studs and removal of the frame.

Of necessity, the frame must be smaller than the panel. Since the mounting springs must be deflected to remove the the frame, space must be allowed between the frame and panel walls. It will thus be obvious that a gap will exist between the walls of the panel and the perimeter of the shadow-mask frame. During picture tube operation, many electrons overscan the window formed in the frame and bombard the frame and walls of the panel. These stray electrons often give rise to the emission of secondary electrons which may find their way to the electron sensitive phosphor mosaic without being subjected to the registration effect of the shadow mask. Consequently, highly objectionable random lighting of the edges of the picture tube screen may result.

During tube manufacture, each panel is affixed to a funnel in a frit-sealing operation. This is accomplished by forming a glass-to-glass seal between the panel and funnel, generally consisting of applying a vitrifiable sealing glass called frit between the panel and funnel seal edges and heating. The seal edges are carefully surfaced to insure a good frit joint. For a number of reasons not directly concerned with the instant invention, it is desirable to maintain the entire frame structure within the confines of the panel seal edge, that is below the frit seal line. For example, handling the the panel and frame assembly is materially simplified if the panel can be rested on its seal edge without disturbing the frame structure.

During the frit-sealing process, it is essential to keep foreign material away from the seal edge. Otherwise, an imperfect seal may be formed and result in a defective tube.

A popular type of picture tube electron barrier consists of a plurality of formed aluminum foil shields, attached by clips to the back of the frame, which include substantially parabolically formed edges adapted to fit into the gap between the frame and panel walls. The shields are semirigid in nature and designed such that the walls of the parabola are flexed during insertion to provide a positive seal between the panel walls and the frame. The seal is maintained by the frictional forces exerted by the panel wall and the edges of the frame. The clips, of course, hold the shields in position.



Generally speaking, these electron shields have proven useful and contribute greatly to the quality of display obtainable with the picture tube. There are, of course, a number of deficiencies—some intrinsic to the shield design and others due to the frame and mounting spring arrangement of different tube types. As to the former, the shield pieces (usually four) have a tendency to separate at the corners where they are overlapped, and stray electrons often find passage through these separations. The shield apparatus also requires an operator to separately position and attach four shields to each tube panel. For rectangular tubes, at least two different shaped shields must be stocked, which increases inventory problems. MOst importantly, if the shields aren't positioned properly, the edges thereof tend to ride up the panel wall and interfere with the seal edge area during the frit seal operation, a condition not readily detectable as the funnel must be in place during frit sealing. This latter problem is intensified in tubes incorporating certain types of thermal compensation.

As is also well known, the shadow mask in a color picture tube absorbs most of the electron beam energy and experiences substantial temperature increases. This causes thermal movement of the mask structure which, unless compensated for, results in severe color misregistration. This problem was not as prevalent or as serious in "round" type color tubes and also, viewers were much less exacting during the early days of color television. However, with the introduction of rectangular color tubes, the mask shift problem became much more severe, and with the concomitant desire on the part of the viewing public for higher quality color presentations, numerous thermal compensation techniques were developed. ONe well-known type utilizes a plurality of L-shaped bimetallic thermal hinges between the frame and mounting springs for moving the mask closer to the screen as the mask temperature rises. These L-shaped hinges are mounted on the rear of the frame and extend into the gap between the frame and panel wall, thus introducing further complications in providing adequate electron shielding. In particular, the thermal hinges protrude into the gap and reduce the available space for the parabolic end of the electron shield with the result that many defects, traceable to electron shield interference with the frit seal, arose.

The electron shield apparatus of the invention is fabricated of only two pieces, each with an outer bowed edge directed toward the screen. This construction results in shield apparatus which solves all the problems enumerated above and does so in a simple, economical manner.

Accordingly, the primary object of this invention is to provide a novel electron barrier for color picture tubes.

Another object of this invention is to provide a semirigid foil-type electron shield having a configuration which precludes the possibility of interference with the panel-funnel seal edge.

A further object of this invention is to provide electron shield apparatus which consists of two identical pieces of semirigid metallic foil.

Further objects and advantages of this invention will become apparent upon reading the following specification in conjunction with the drawing in which:

FIG. 1 represents an "inside the tube" view of a picture tube panel with mask-frame structure and electron barrier apparatus in accordance with the invention with one of the shields partially cutaway:

FIG. 2 is a view of one of the two identical shields forming the electron barrier of FIG. 1;

FIG. 3 is an enlarged partial view taken along line 3–3 of FIG. 1 showing constructional details of a thermal of and mounting stud; frame;

FIG. 4 is an enlarged partial view taken along line 4–4 of FIG. 1 showing the clip means for attachment of the shield to the frame; and

FIG. 5 is an enlarged view of the shield of FIG. 2 taken along line 5–5.

Referring now to FIG. 1, there is shown a picture tube panel 10 having an inner peripheral wall 11 with a plurality of conical mounting studs 15 embedded therein. This "inside the tube" view is taken from the neck of the picture tube looking forward. A shadow-mask frame 20 is attached to mounting studs 15 via L-shaped termal hinges 23 and mounting springs 24. For a complete exposition on this type of thermal hinge and spring assembly, see the copending application of Cowles et al., Ser. No. 742,651 filed on July 5, 1968.

Frame 20 includes a flat rear portion 21 terminating in an inner raised lip 22 defining a windowlike opening, and a continuous side portion 27 extending parallel to the peripheral wall of the picture tube panel. As best seen in FIGS. 3 and 4, an aperture mask 26 is attached to side portion 27 of the frame. This is generally accomplished by tack welding the mask rim to the frame. Mask 26 effectively "shadows" a mosaic of color phosphors deposited on the inner surface of panel 10 in a manner well known in the art. Frame 20 is fabricated of heavy guage metal and its sole purpose is to support the very lightweight aperture mask in a predetermined position behind the phosphor mosaic. Raised lip 22 not only adds structural rigidity to the frame, but also provides a convenient structure for attaching the shield holding clips and for assuring proper engagement between the shields and peripheral wall 11.

It will be seen that a substantial gap exists between the outer edge of frame 20 and peripheral wall 11. An electron carrier is provided by two identical shields 30 of semirigid metallic foil which fit between peripheral wall 11 and raised lip 22 of frame 20. Shields 30 thus bridge the gap between the frame and panel wall to preclude overscanned electrons from directly or indirectly finding undesired paths to the phosphor mosaic. A plurality of clips 36 fit over raised lip 22 and hold shields 30 in contact with frame 20.

In FIG. 2, one of the shields is shown. Shield 30 is formed of metallic foil of semirigid configuration having a continuous outer bowed edge 31 (best seen in FIGS. 3 and 4) and a plurality of stiffening ribs 32. Shield 30 also includes an inner raised edge 33 adapted for cooperation with the lip on the frame. A plurality of blisterlike raised areas 35 are provided to insure clearance over thermal hinges 23. To enable two identical shields 30 to be used, areas 35 are positioned such that, in either of the two possible positions a shield may occupy on the frame, the thermal hinges on the frame will underlie corresponding raised areas on the shield. In the disclosed embodiment of the invention, a vertical axis of symmetry exists for the lower half of the panel and frame. Consequently, only three raised areas 35 need be formed in each shield as shown in FIGS. 1 and 2.

In FIG. 3, a section through the panel, frame and shield is shown to indicate how the raised areas 35 provide clearance for bimetal hinges 23. Aperture mask 26 is shown attached to side portion 27 of frame 20 and spaced a predetermined distance from phosphor mosaic 13. The viewing side of picture tube panel 10 is designated as 12 and the seal edge as 14. The L-shaped bimetal hinge has one leg mounted to rear portion 21 of the frame and the other leg extends into the gap between frame 20 and peripheral wall 11. It should be particularly noted that even with raised portion 35, the entire frame and shield structure is below seal edge 14. Therefore, the panel may be rested on this edge during tube processing without danger to the parts comprising the frame, mask and electron barrier assembly. It should be further observed that outer bowed portion 31 extends toward phosphor mosaic 13 thus eliminating any possibility of interference between shield 30 and seal edge 14.

In FIG. 4, a shield clip 36 is shown attaching shield 30 to frame 20. The clip fits over lip 22 on the frame and clamps raised edge 33 of the shield against lip 22.

As seen in FIG. 5, which is a cross section of another portion of shield 30 clearly depicting raised edge 33 and the stiffening member 32, the dimension *d* is the distance from the base of edge 33 to the extremity of bowed portion 31 when the shield is undistorted. Distance *d* is slightly larger than the corresponding distance D measured between the base of lip 22 on the frame and peripheral wall 11. Both distances *d* and D vary from point to point about the frame and shield, but at any given point, *d* is greater than D. This assures that the outer bowed edges 31 of shield 30 will be deflected when positioned to cause firm frictional engagement between the shield and panel wall.

In a typical installation, shield 30 is positioned at an acute angle, with outer bowed edge 31 in the gap between frame 20 and peripheral wall 11. The shield is then pivoted into surface engagement with frame 20, and in the process, bowed edge 31 (that portion thereof comprising the bight of U-shappd shield 30) frictionally slides upward along wall 11. Simultaneously, the free ends of shield 30 move downwardly engaging bowed edges 31 along peripheral wall 11. When shield 30 is flat against rear portion 21 of frame 20, contact with wall 11 exists along the entire length of bowed edge 31. Thereafter, the outwardly directed forces exerted on shield 30 by application of clips 36 simultaneously nests raised edge 33 against the lip of the frame and pushes shield 30 against peripheral wall 11. This is accompanied by the deflection of outer bowed edge 31 into firm contact with wall 11 because of the relationship existing between the dimensions *d* and *D* as mentioned above. A similar procedure is followed when installing the other shield. A clip 36 is placed over the areas of overlap between shields 30 to firmly hold them together. This type of overlap and clip arrangement makes for a very positive seal between the shield and overcomes one of the serious problems in using corner overlapped shields.

With the invention, not only is adequate shielding obtained, but it is accomplished with a minimum of parts and complete elimination of seal edge interference.

The embodiments of the invention in which an exclusive property of privilege is claimed are defined as follows:

We claim:

1. A color television picture tube comprising an evacuated envelope having a front panel including a curved viewing surface and a peripheral wall terminating in a seal edge; a viewing screen consisting of a color phosphor mosaic deposited on the inside of said viewing surface; a foraminous mask spaced a predetermined distance from said mosaic; a rigid windowlike frame supporting said mask; a plurality of mounting studs arranged about the interior of said peripheral wall; spring means for removably attaching said frame to said mounting studs; said frame necessarily being smaller than said panel to allow ready insertion and removal therefrom during tube fabrication and creating a peripheral gap between the edge of said frame and said panel through which overscanned electrons may travel resulting in spurious edge bombardment of said mosaic; said frame being mounted to said panel such that no portion thereof extends beyond said seal edge; and electron foil shield including a bowed outer portion extending toward said viewing surface for snugly bridging said gap without danger of interference with said seal edge.

2. A color television picture tube as set forth in claim 1 wherein said electron foil shield is fabricated to rigid metal having a raised inner portion opposite said bowed outer portion; said windowlike frame having a upstanding peripheral lip about the opening therein; said rigid foil being compressed between said peripheral lip and said peripheral wall to slightly flex said bowed outer portion and insure closure of said gap; and means securing said foil to said frame.

3. A color television picture tube as set forth in claim 2 wherein said windowlike frame has a flat surface, in parallel with said viewing screen, to which said foil is mounted; and wherein said spring means include; a plurality of L-shaped mounting brackets each having a first leg secured to said surface and a second leg extending toward said screen and parallel to said peripheral wall, and a spring secured to each said second leg for resiliently supporting said frame on said mounting studs; said mounting brackets extending a substantial distance into said gap; said shield overlying said mounting

brackets and said bowed outer portion extending toward said viewing surface in a converging path with said peripheral wall to enable flexible contact therebetween well below said seal edge without interference with said mounting brackets.

4. A color television picture tube as set forth in claim 3 wherein said mounting brackets extend above said surface and wherein said foil is fabricated with salient areas overlying said mounting brackets, to insure good engagement between said foil and said frame.

5. A color television picture tube as set forth in claim 4 wherein said means securing said foil to said frame include a plurality of clips cooperating with said peripheral lip to maintain said inner portion against said lip.

6. A color television picture tube including a front panel having a peripheral wall terminating in a seal edge; a shadow mask; a windowlike frame supporting said shadow mask; a number of mounting studs symmetrically disposed about said peripheral wall; mounting means removably attaching said frame to said mounting studs; said frame being substantially similar in shape, but smaller than said panel and positioned below said seal edge; and an electron shield closing the gap between said frame and said peripheral wall comprising two identical semirigid formed sheets of metallic foil, each having an outer bowed portion said shield being of similar shape, but of greater size than the area defined by the perimeter of said peripheral wall and the opening in said frame; and means maintaining said shield in position on said frame with said outer bowed portion contacting said peripheral wall a substantial distance below said seal edge.

7. A color television picture tube as set forth in claim 6 wherein said windowlike frame includes a lip about the opening therein and wherein said sheets of metallic foil include an upturned edge portion for cooperation with said lip, the distance between said lip and said peripheral wall being slightly less than the corresponding dimension on said metallic foil whereby said outer bowed portion is flexed slightly in positioning said shield to insure a good fit with said peripheral wall.

8. A color television picture tube as set forth in claim 7 wherein said means maintaining said shield in position comprise spring clips adapted to fit over said lip of said frame and urge said upturned edge portions into close engagement with said lip.

9. A color television picture tube as set forth in claim 8 wherein said mounting means include L-shaped mounting brackets secured to the surface of said frame and wherein each foil sheet has raised areas formed therein corresponding to the locations of said L-brackets when positioned in either of its two positions.