

[54] **SHIELDING MEANS FOR A CATHODE RAY TUBE**

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[58] Field of Search **313/477, 482, 318, 402, 313/479, 449, 450, 325, 352, 364, 470, 407, 429**

[56] **References Cited**

UNITED STATES PATENTS

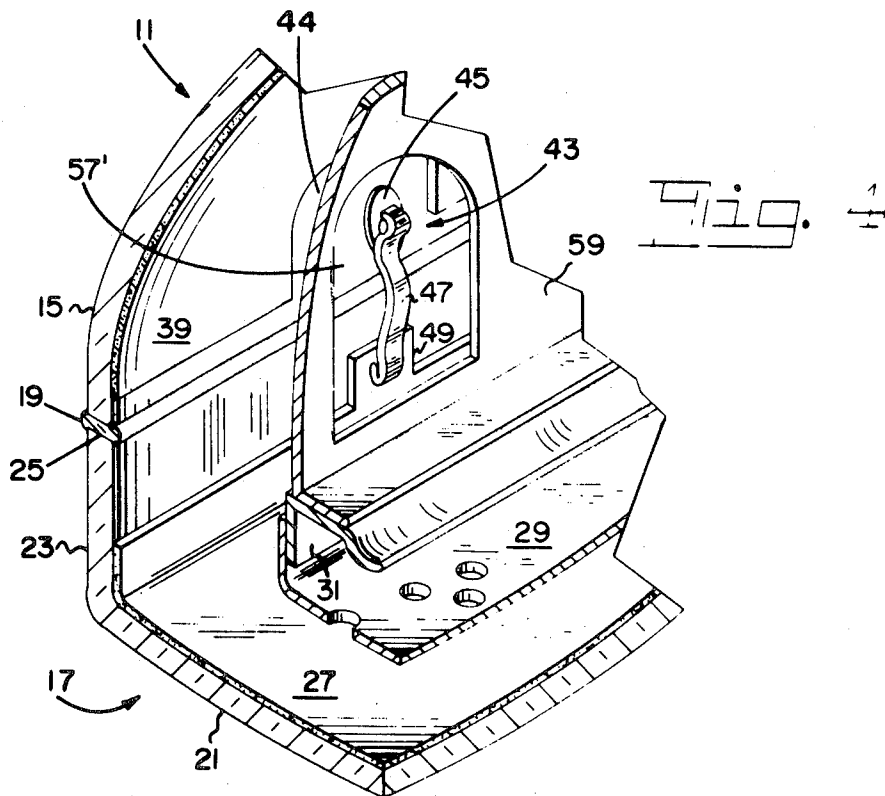
3,176,181	3/1965	Blackler et al.	313/449 X
3,243,645	3/1966	Parnes et al.	313/429 X
3,549,932	12/1970	Lindeman	313/407
3,626,232	12/1971	Ohgoshi et al.	313/428

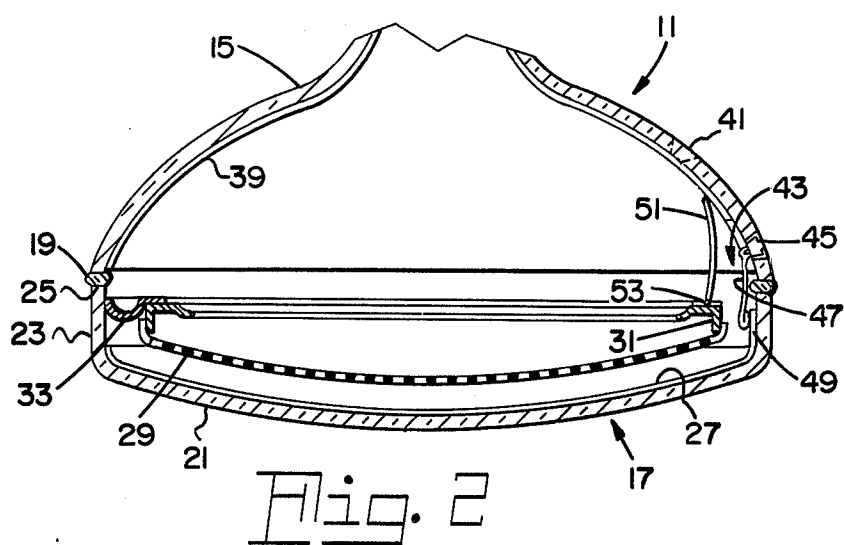
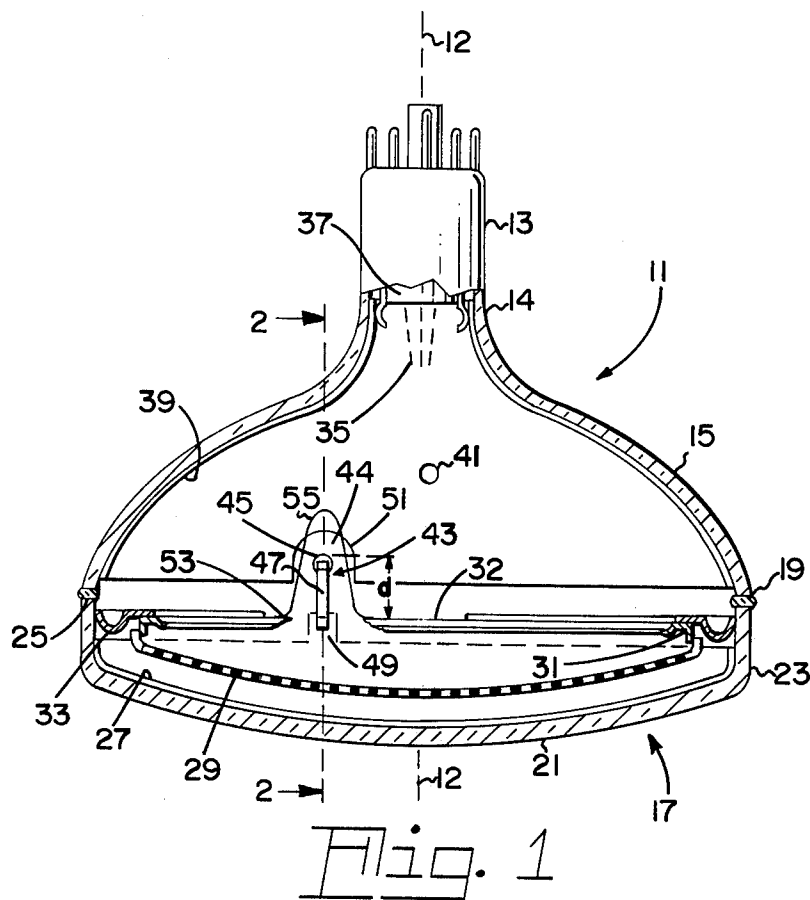
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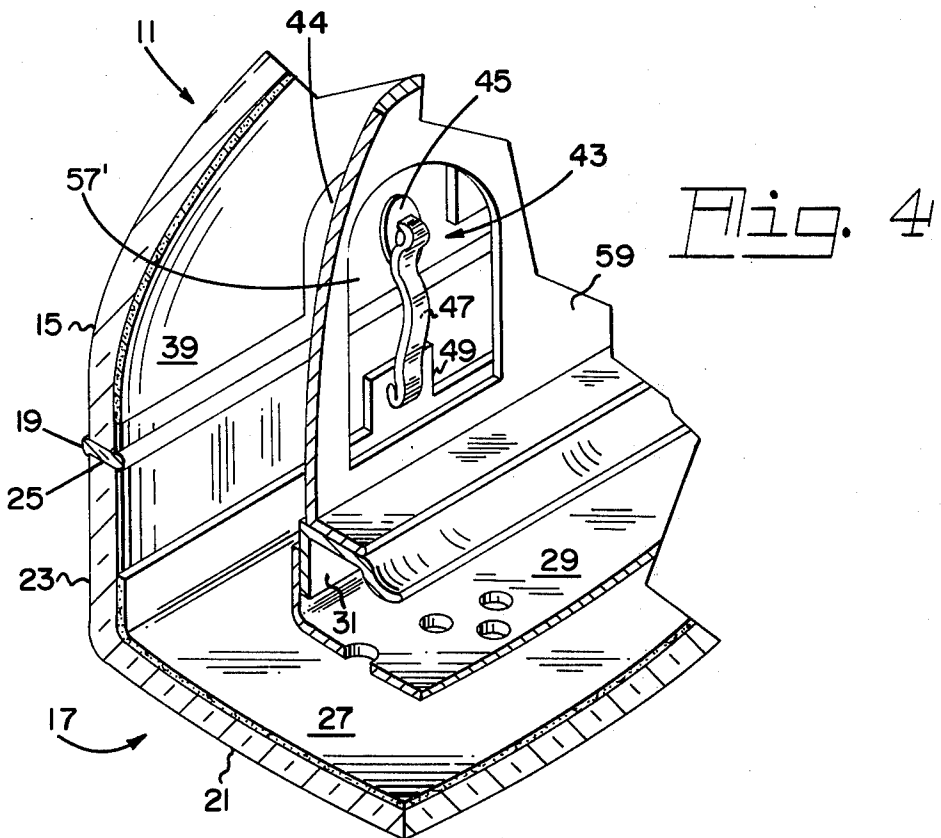
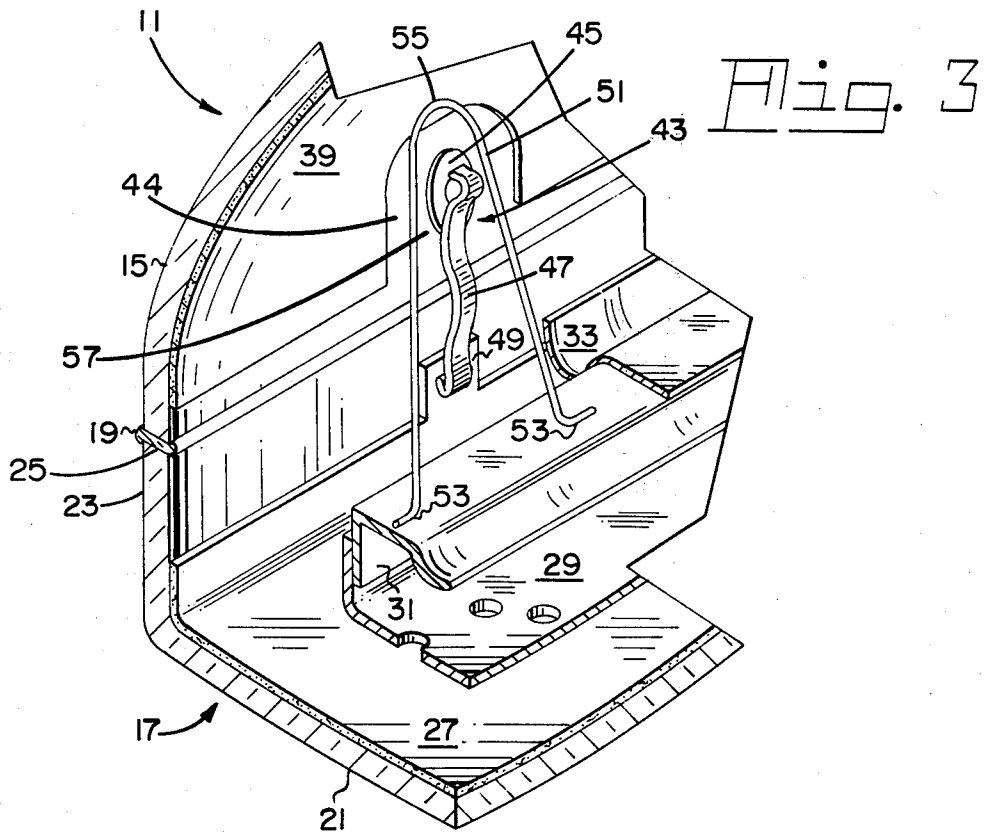
[57] **ABSTRACT**

Improved shielding means are provided in a post-deflection type of color cathode ray tube for effectively removing the cloud of spurious low-velocity secondary electrons from the interior of the tube particularly from the region on the electron gun side of the color-selection electrode. The shielding means is comprised of a defined electrical conductive area of screen potential disposed relative to the interior surface of the tube funnel portion and extended partially therealong in an axially related direction. Associated therewith is a metallic shielding member spaced therefrom and affixed to the framing portion of the color-selection electrode. The shielding member has provisions for defining at least one opening proximally facing the conductive area through which a penetrating potential collects the spurious secondary electrons.

8 Claims, 6 Drawing Figures







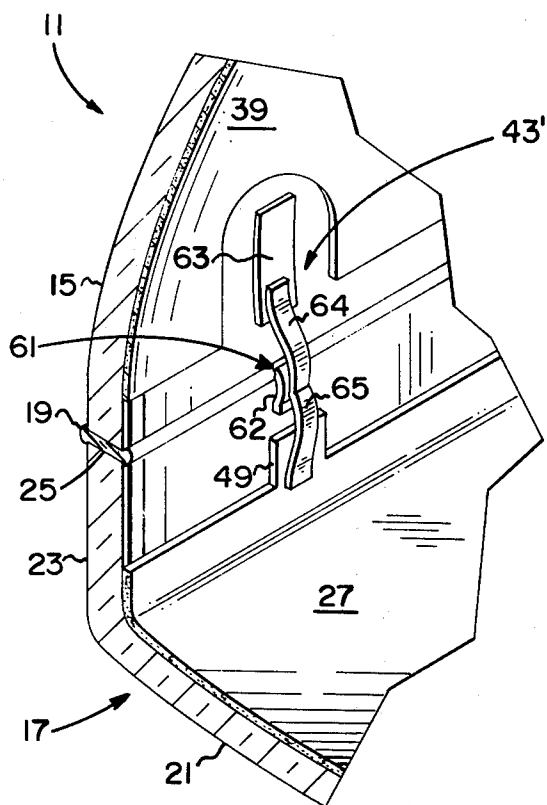


Fig. 5

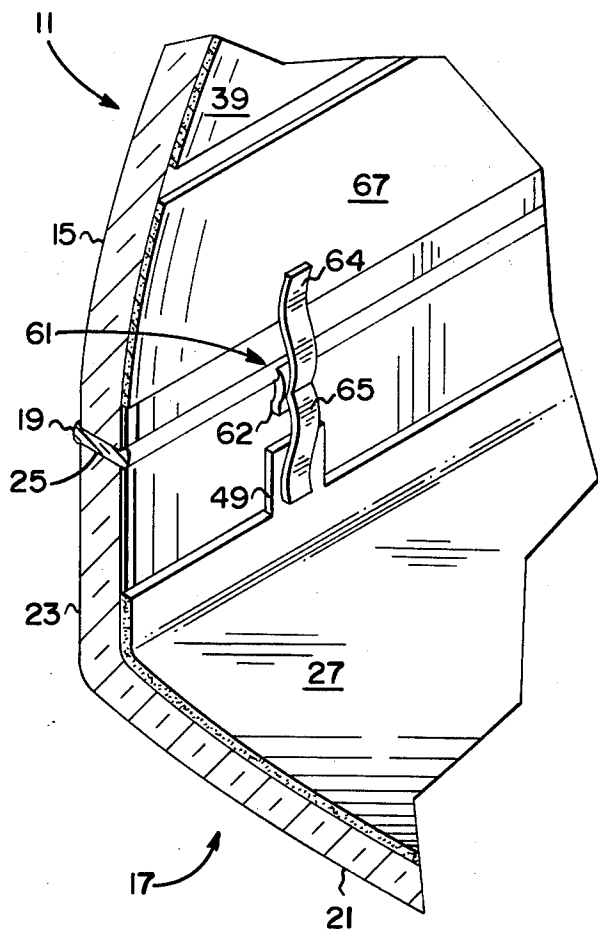


Fig. 6

SHIELDING MEANS FOR A CATHODE RAY TUBE

CROSS REFERENCE TO RELATED APPLICATIONS

This application contains matter disclosed but not claimed in two related applications filed concurrently herewith and assigned to the assignee of the present invention. These related applications are: Ser. No. 483,555, "Cathode Ray Tube Electrical Connective Means", and Ser. No. 483,554, "Electrical Conductive Means For Traversing a CRT Envelope to Effect Multiple Connections Therein."

BACKGROUND OF THE INVENTION

This invention relates to internal shielding for a cathode ray tube and more particularly to shielding means for controlling secondary electrons in a post-deflection color cathode ray tube.

Color cathode ray tubes of the post-deflection type conventionally utilize at least one electrode member oriented between the electron gun assembly and the spatially related patterned screen. In its simplest form, a post-deflection type of color tube is structured to have a color-selection or focusing electrode that is oriented in spaced adjacency with the screen. This type of tube construction permits the use of larger openings or apertures in the color-selection electrode than those used in the conventional shadow mask type of tube. Thus, a screen display of increased brightness is possible in the post-deflection type of tube. Unfortunately, the achievement of brightness is not without problems. In the post-deflection-type tube, the color-selection or focusing electrode is usually operated at an electrical potential lower than that of the screen, the difference in potential determining whether the action in the tube is post-deflection focusing or post-deflection acceleration. As the electron beams scan across the color-selection electrode during operation of the tube, the primary beams striking the solid portion of the electrode structure effect the generation of a cloud of secondary electrons. Since these low-velocity secondary electrons are present in a critical region, they are readily attracted through the large apertures in the neighboring color-selection electrode by the higher screen potential, and as a result, are allowed to randomly impinge the patterned screen. The resultant luminescent haze or lightened background, caused by the undesired excitation of adjacent phosphors, markedly degrades the contrast of the screen display. Attempts have been made in the art to remedy this kind of degradation of contrast by adding one or more related electrode structures in the proximity of the color-selection electrode. Varying degrees of success have been achieved, but in general, most results have been less than desired.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of this invention to reduce and obviate the aforementioned disadvantages evidenced in the prior art. Another object of the invention is to provide discrete shielding means to collect low-velocity secondary electrons that are present on the gun side of the color selection electrode. A further object of the invention is to provide discrete shielding means in a post-deflection color cathode ray tube for effecting enhanced contrast in a screen display.

These and other objects and advantages are achieved in one aspect of the invention wherein at least one defined electrical conductive area of screen potential is disposed relative to the interior surface of the funnel portion of the cathode ray tube in the region adjacent to the hermetic seal joining the funnel and panel portions thereof. This defined electrical conductive area of screen potential has a dimension extending partially along the funnel in an axially-related direction, such as being defined from the seal line of the funnel toward the neck portion of the tube. Related to this conductive area is a metallic shielding member which is interiorly spaced from the funnel-related screen potential conductive area and positionally affixed to the framing portion of the color-selection electrode. This shielding member, being of color-selection electrode potential is oriented in a manner to extend a partial distance into the funnel portion and has provisions for defining at least one opening approximately facing the conductive area of screen potential and distally facing the longitudinal axis of the tube. The height of the opening defined by the shielding member is greater than the extending dimension of the related conductive area associated with the funnel portion of the tube.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a post-deflection color cathode ray tube wherein one embodiment of the invention is illustrated;

FIG. 2 is another view in partial section taken along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged perspective showing a portion of the tube incorporating one embodiment of the improved shielding means of the invention; and

FIGS. 4, 5, and 6 are partial perspectives illustrating componential embodiments of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following specification and appended claims in connection with the aforescribed drawings.

With particular reference to FIGS. 1, 2, and 3, a color cathode ray tube 11 of post-deflection construction is shown as having a longitudinal axis 12 therethrough and an envelope comprised of an integration of neck, funnel, and face panel portions, 13, 15 and 17, respectively. The panel portion 17 thereof is hermetically joined to the funnel portion 15 along the congruent seal 19, such being effected by a fritting procedure during tube fabrication. The face panel 17 has a viewing area 21 and a substantially perimetrical sidewall portion 23 which is terminated by the sealing seat 25. Formed on the interior surface of the viewing panel is a patterned cathodoluminescent screen 27 formed of discrete areas of color-emitting phosphor materials definitively disposed as stripes or dots in keeping with the state of the art. A discretely apertured structure 29, in this instance referenced as a color-selection electrode, is spatially related to the patterned screen, being preterminately positioned within the face panel 17 by usual means in the art, such as supporting stud-like members embedded in the sidewall 23 of the panel and projecting therefrom to mate with locators integral with the electrode member. For purposes of clarity,

these conventional stud-like supporting members and mask locators have been eliminated from the drawings. Attached to the framing portion 31 of the color-selection electrode 29 is a peripheral strip-like beam shielding means 33 which is positioned to extend from the frame of the electrode in a bridging manner to make contact with the panel sidewall thereby protecting the patterned cathodoluminescent screen from deleterious electron excitation resultant from the peripheral overscan of the several electron beams 35 emanating from the electron gun assembly 37 positioned in the neck portion 13 of the tube envelope. As shown, the interior of the funnel portion has a skirt-like conductive coating 39 disposed thereon in a manner extending substantially from the neck portion to the forward region adjacent the sealing zone 19. This envelopic coating, which is usually of the potential of the final gun electrode, is formed of a material such as Aquadag, such being electrically connected to the color-selection electrode 29, by means not shown. Electrical potential is usually supplied to this skirt-like coating by a conductive button 41 traversing the wall of the funnel portion 15.

The first embodiment of the invention, as shown in FIGS. 1, 2 and 3, illustrates improved shielding means arranged to collect the secondary low-velocity electrons that are ambiently present within the tube on the electron gun assembly side of the color-selection electrode. In this embodiment, the defined conductive area of screen potential 43 is an integrated longitudinal formation or combination extending from the periphery of the screen into the funnel portion. The extending dimension "d" being referenced from the plane 32 of the framing portion 31 of the color selection electrode into the funnel portion for a distance adequate to accomplish the desired shielding effect. Preferentially, an extending dimension not exceeding about 25 percent of the distance from the seal edge 19 to the neck jointure region 14 of the tube has been found to be appropriate for the construction described, but such dimensioning is not to be considered limiting as greater dimensioning can be employed within the feasibility of structuring, if the associated shielding means is adjusted accordingly.

This integrated conductive formation is comprised of an envelope-traversing electrical conductor in the form of a metallic conductive button 45 that is disposed in the wall of the envelope funnel portion 15 in the region adjacent to the panel-funnel seal 19, and a substantially longitudinal resilient metallic connective member 47 which is affixed to the interior surface of the funnel-disposed button, and extended therefrom to make contact with a peripheral portion of the screen. In this instance, a conductive tab 49 is formed as an extended area of the screen 27, such being disposed on the panel sidewall in a manner to extend toward the seal edge to expedite electrical contact with the connective member 47 of the areal combination 43. While the connective member 47 may have a jointure region formed for affixation directly to the bottom surface of the conductive button 45, such is considered a precarious type of jointure as there is danger of weakening or perforating the bottom of the button. A more preferred embodiment is the type of connective member shown in the referenced figures and separately disclosed and described in patent application Ser. No. 483,555 by Charles A. Davis et al, filed concurrently herewith and assigned to the assignee of the present invention.

The conductive button 45 associated with the screen potential conductive area 43 is isolated from the skirt-like conductive area 39 of color section electrode potential covering most of the interior surface of the funnel portion by the interspatial region 44. If this separation region is retained as unprotected bare glass, it is prone to assume an undesirable negative charge which may build to a magnitude to affect the trajectories of the primary beams as they scan through that region of the raster. Therefore, to avoid the build-up of such a charge, it has been found beneficial to cover the separation region 44 with a coating of a poor conductive material, such as ferric oxide, to efficiently dissipate the charging effect thereon. Immediately in front of the funnel-related screen potential conductive area 43, and oriented in spatial relationship thereto, is a substantially inverted U-shaped wire shielding formation 51 having the ends 53 thereof positionally affixed to the framing portion 31 of the color-selection electrode 29. This U-shaped shield is formed and positioned in a manner to extend a partial distance into the funnel portion, wherein the apex 55 thereof may be in contact with skirt-like coating 39 on the inside of the funnel since that coating is of the same potential as the color-selection electrode 29. The shaped shield proximally faces the related conductive area 43 and distally faces the tube axis 12. It has been found that such discretely oriented shielding, which is configured to encompass a defined opening 57, provides two beneficial results. First, this type of shielding tends to minimize the effect of the negative charge build-up that may be present on the interspatial area surrounding the button and associated connective member assembly. Secondly, this type of defined shielding allows a portion of the high voltage field of the screen potential area 43 to extend through the opening, between the legs thereof, and thereby penetrate into the interior of the funnel region. For instance, in a tube employing a screen potential in the neighborhood of 30 KV and a color-selection-electrode potential of approximately 20 KV, this penetration potential through the shield opening may be, for example, in the order of 100 to 300 volts, which is adequate to collectively remove the low-velocity secondary electrons over the full areal region in back of the color-selection electrode. Such sweeping removal of this deleterious cloud of secondaries markedly upgrades and improves the contrast of the color display on the screen.

Another embodiment of the improved shielding combination of the invention is illustrated in FIG. 4 wherein a metallic shielding member, which is spaced from the aforescribed funnel related screen potential conductive area 43, is in the form of a standing perimetrically oriented wall 59 that is affixed to the framing portion 31 of the color-selection electrode 29. This wall, which is formed in a manner to spatially extend into the funnel portion, has at least one defined opening 57' therein that is immediately in front of and facing the funnel-related conductive area of the screen potential 43. This defined opening operates functionally as that defined by the previously described substantially U-shaped wire formation 51, by allowing an electrical field to penetrate therethrough from the funnel-related screen potential conductive area 43 to collect the secondary electrons present in the internal region. The size of the opening in the wall 57', and also that aforementioned opening 57 encompassed by the U-shaped

wire configuration, embraces a controlled open area that is sufficient to allow an influencing electrical field from substantially the whole of the funnel-related electrical conductive area 43 to penetrate therethrough. The height of the defined opening is usually greater than the extending dimension of the related conductive area. Accordingly, exemplary dimensions of the controlling opening, 57 or 57', may be in the order of, for example, of about 2 inches in width by about 3 inches in height. It is evident that the dimensionings of such openings may be modified in keeping with the value of the desired field of penetration from the funnel-related conductive area 43.

For another embodiment of the invention, reference is made to FIG. 5 wherein the envelope traversing electrical conductor is in the form of a discretely fashioned seal-related conductive structure 61 disposed through the fritted region of the panel-funnel seal 19. While seal-related electrical connectors are known in the art, an example of a suitable seal-related conductive structure is one such as that disclosed in a related application by Charles A. Davis et al, Attorney's Docket 8062, filed concurrently herewith and assigned to the assignee of the present invention. A through-the-seal conductor of this type is formed to have integral contacting means to make internal pressured electrical connections with a longitudinal strip of funnel-disposed conductive coating 63, such as Aquadag, and a peripheral tab portion 49 extending from the screen 27. Such pressured connections being effected by substantially resilient contacting means such as 64 and 65. This type of construction defines an electrical conductive area of screen potential 43' that is disposed relative to the interior surface of the funnel portion, and such may be utilized with either the wall-defined window 57' or the U-shaped wire 57 shielding configurations.

Still another embodiment of the invention is that shown in FIG. 6 wherein the defined conductive area of screen potential is in the form of a band of conductive coating 67, such as Aquadag, interiorly applied in a peripheral manner about the funnel 15. This band has a height dimensionally extending in an axially related direction from the region adjacent the panel seal and extends back into the funnel region about the same distance as the previous screen potential embodiments 43 and 43'. Associated with this band of conductive material is a through-the-seal type of electrical conductor 61, such as that previously described, which makes connection with the screen tab 49. This band-type area 67 of screen potential is particularly adaptable for use with the previously described shielding wall 59 perimetricaly oriented to and affixed to the framing portion of the color-selection electrode 29. In this embodiment, the shielding wall would contain one or more defined openings such as 57' thereabout.

Another type of envelope-traversing electrical conductive means applicable for usage with the band of conductive coating 67 is that shown in FIGS. 3 and 4, wherein a conductive button 45 disposed in the wall of the funnel portion would make contact with the band 67, wherefrom the integral resilient connective member 47 would, in turn, make contact with the peripheral portion of the screen.

The various embodiments of the invention herein described provide improved shielding means for use in a post-deflection color cathode ray tube for effecting removal of the secondary electrons that have long been

a bothersome factor affecting the operational quality of the tube. By utilizing this efficient means for controlling the cloud of spurious low-velocity electrons within the tube, there has been a noticeably marked improvement in the contrast of the screen display.

While there has been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. Improved shielding means for use in a post-deflection color cathode ray tube having a longitudinal axis therethrough and incorporating an envelope-traversing electrical conductor for applying a separate electrical potential to the screen therein, said tube envelope being formed of an integration of a neck portion having an electron gun assembly positioned therein, a funnel portion joined thereto, with said funnel portion being sequentially sealed to a contiguous panel portion having a patterned cathodoluminescent screen formed on the inner surface thereof, and wherein a frame supported color-selection-electrode is oriented in spatial relationship thereto, said improved shielding means comprising:

at least one defined electrical conductive area of screen potential disposed relative to the interior surface of said funnel portion in the region adjacent to the seal joining said funnel and panel portions, said area having an effective dimension extending into the funnel portion from the plane of the framing member of the color-selection electrode in an axially related direction for a partial distance thereinto relative to said seal; and

a metallic shielding member interiorly spaced from said funnel-related screen potential conductive area and positionally affixed on the framing portion of said color selection electrode in a manner to extend a partial distance into said funnel portion, said shielding member being of color-selection-electrode potential and having provisions for defining at least one opening proximally facing said conductive area of screen potential and distally facing said axis, the height of said defined opening being related to the extending dimension of said related conductive area.

2. The improved shielding means according to claim 1 wherein said defined conductive area of screen potential is a longitudinal formation extending from the periphery of said screen into said funnel portion, said conductive formation comprising an envelope-traversing electrical conductor in the form of a metallic conductive button disposed in the wall of said funnel portion adjacent the panel-funnel seal, and a substantially longitudinal resilient metallic connective member affixed to the interior surface of said funnel-disposed button and extended therefrom to make contact with a peripheral portion of said screen.

3. Improved shielding means according to claim 1 wherein said defined conductive area of screen potential is a longitudinal formation of conductive coating applied to the wall of the funnel portion longitudinally dimensionally extending in an axially related direction therealong from a region adjacent the panel-funnel seal, and wherein said envelope-traversing electrical conductor is disposed through said panel-funnel seal in

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a manner to make internal pressured electrical connections with said strip of said funnel disposed conductive coating and a peripheral portion of said screen.

4. Improved shielding means according to claim 1 wherein said defined conductive area of screen potential is in the form of a band of conductive coating interiorly applied in a peripheral manner about said funnel and having a height dimensionally extending in an axially related direction from the region adjacent the panel seal, and wherein said envelope traversing electrical conductor is disposed through said panel-funnel seal in a manner to make internal pressured electrical connections with said band of funnel disposed conductive coating and a peripheral portion of said screen.

5. Improved shielding means according to claim 1 wherein said metallic shielding member spaced from said funnel related screen potential conductive area is a substantially inverted U-shaped wire having the ends thereof positionally affixed to the framing portion of the color-selection electrode, said U-shaped wire being oriented thereon in a manner to extend into said funnel portion.

6. Improved shielding means according to claim 1 wherein said metallic shielding member spaced from said funnel-related screen potential conductive area is in the form of standing perimetrically oriented wall af-

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fixed to the framing portion of said color-selection electrode in a manner to spatially extend into said funnel portion, said wall-like member having at least one defined opening therein facing said funnel-related conductive area of screen potential.

7. The improved shielding means according to claim 1 wherein said defined electrical conductive area of screen potential has an effective extending dimension not exceeding about twenty-five percent of the funnel distance from the seal edge to the neck-related portion thereof.

8. Improved shielding means according to claim 1 wherein said defined conductive area of screen potential is in the form of a band of conductive coating interiorly applied in a peripheral manner about said funnel and having a height dimensionally extending in an axially related direction from the region adjacent the panel seal, and wherein said envelope-traversing electrical conductor is in the form of a metallic conductive button disposed in the wall of said funnel portion adjacent the panel-funnel seal, making contact with said band of coating and wherefrom a substantially longitudinally resilient metallic connective member affixed to said button extends to make contact with a peripheral portion of said screen.

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