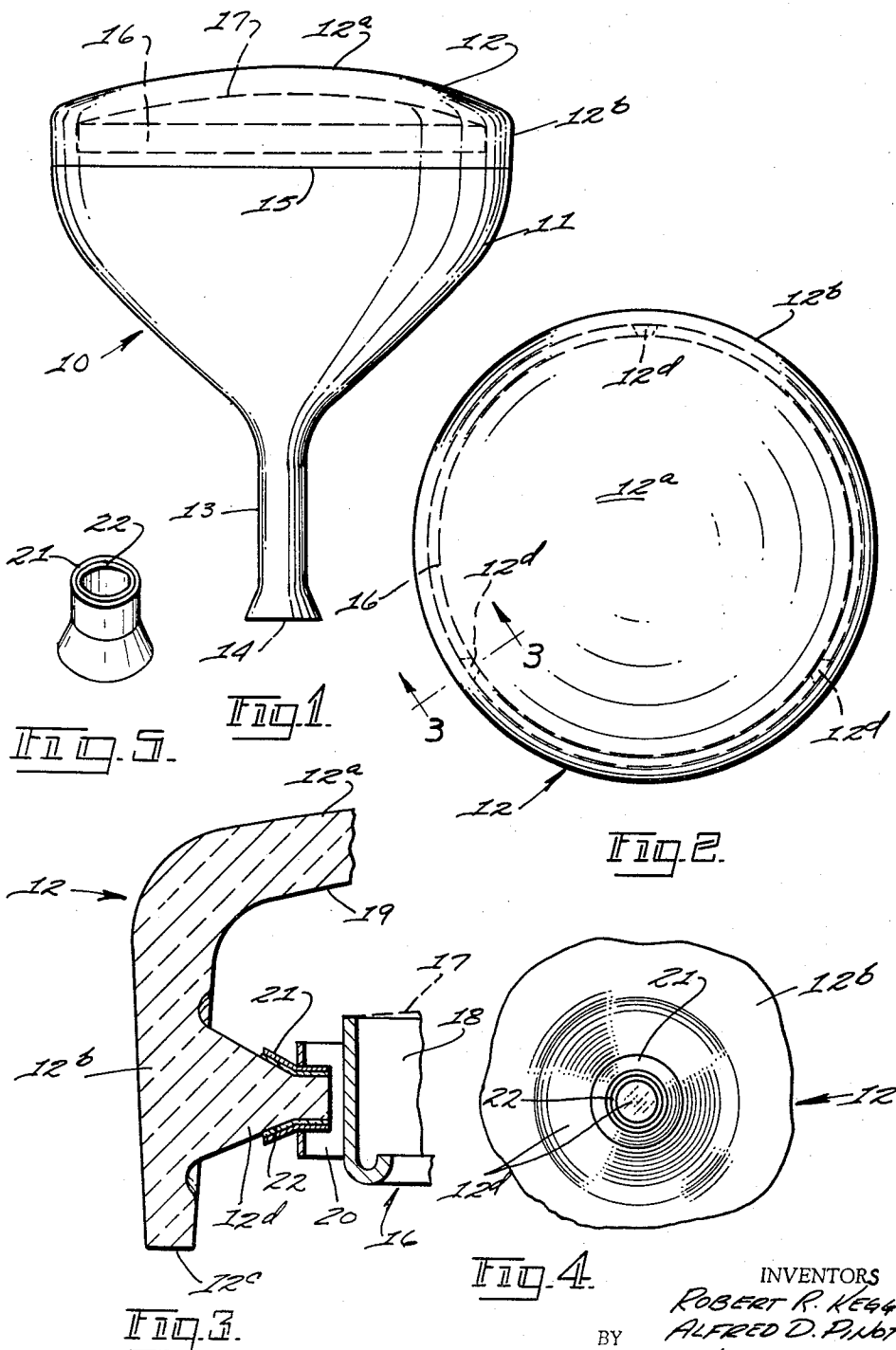


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SUPPORT MEANS FOR MOUNTING COLOR-CONTROL ELEMENT
IN GLASS PORTION OF CATHODE-RAY TUBE ENVELOPE
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SUPPORT MEANS FOR MOUNTING COLOR-CONTROL ELEMENT IN GLASS PORTION OF CATHODE-RAY TUBE ENVELOPE

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The present invention relates to an improved structure for retaining an electronic element within a preformed hollow glass part wherein a portion of the glass is utilized to provide support and mounting areas for the element. The present invention is particularly applicable to hollow glass face plates utilizable as the viewing panel of a cathode-ray tube envelope in the production of color television picture tubes.

The development of color television picture tubes has been hindered by stringent requirements of precise alignment of internal components particularly the color-producing electronic elements mounted within the face plate portion of the tube. In present practice an extensive apertured electrode structure such as a shadow mask or line grid is usually disposed adjacent the tube screen to control electron impingement upon luminescent phosphors capable of developing three primary colors. The electrode structure frequently consists of a rather heavy frame and complicated and bulky clamping mechanism all of which add to the difficulty of tube assembly in precise alignment and exhaustion of the tube envelope. The precise location of the apertured electrode with respect to the tube target area which consists of the phosphor screen must be carefully controlled to an extreme degree of tolerance in each individual tube for proper color registry.

Heretofore, in supporting a large mask or grid having a rigid annular frame in proximity to the tube screen or target area, especially contoured areas of the hollow dish-shaped glass face plate surrounding its viewing panel have been used to contact and hold the framing member. Considerable difficulty has been experienced when the tube is subjected to slight physical or thermal shock during which the contoured areas of the glass sometimes tend to become chipped or fractured where hard metals such as stainless steel alloys employed in the fabrication of the frame are permitted to directly contact the glass. As a result, the mask or grid may be displaced or shifted out of alignment with the electron-emitting source or sources and the oppositely-disposed target or screen area of the face plate rendering the tube defective. The metal alloy of the frame being of greater hardness than the glass tends to score the latter both during its fabrication and during handling thereby creating areas of weakness which tend to reduce tube life.

Accordingly, it is an object of this invention to provide an improved supporting structure comprised of glass and metal for retaining an electron beam-controlling element within a hollow glass member of a cathode-ray tube envelope.

Another object of this invention is to provide a novel support bracket for a large electrode element for its positive retention in exactly duplicatable alignment within a cathode-ray picture tube envelope which bracket is adapted to receive a rigid bulky frame of the electrode element without adverse effects upon supporting glass areas therebeneath.

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Another object of this invention is to provide in combination an especially prefabricated hollow glass face plate for retaining a color-control electrode element in a cathode-ray tube in readily detachable and aligned position, the face plate providing a series of spaced-apart supporting brackets comprised of glass lugs or protuberances having metallic sleeves on their free ends for the durable and exactly alignable retention of the color-control element.

A further object of this invention is to furnish a hollow glass cathode-ray tube envelope having an improved supporting structure arranged interiorly of its face plate member for the retention of an extensive apertured electrode structure having a rigid annular metallic frame, which supporting structure is of simple construction having a design applicable to existing and proposed types of television picture tubes.

The specific nature of this invention, as well as other objects and advantages thereof, will become apparent to those skilled in the art from the following detailed description, taken in conjunction with the annexed sheets of drawings on which, by way of preferred example only, are illustrated the preferred embodiments of this invention.

On the accompanying drawings:

Fig. 1 is an elevational view of a cathode-ray tube envelope embodying the present invention.

Fig. 2 is a plan view of the face plate member of the cathode-ray tube envelope.

Fig. 3 is an enlarged vertical sectional view of a peripheral region of the face plate taken along the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary enlarged side view of the supporting structure shown in Fig. 3.

Fig. 5 is a perspective view of a metallic sleeve member adapted to provide the supporting surface of the preferred embodiment of the structure shown in Figs. 4 and 5.

Although this invention will be described as specifically applied to the manufacture of a cathode-ray tube and its glass viewing portion in particular, it will be apparent to those skilled in the art that the principles of the invention are equally applicable to the manufacture of any type or structure of preformed rigid glass article upon or within which it may be desired to mount an independent separable electronic element supported by essentially direct physical contact with the glass.

Referring now to the drawings, a preferred embodiment of this invention consists of a hollow glass electron tube envelope 10 having a frusto-conical shaped funnel member 11, a hollow dish-shaped face plate 12, and a neck tubulation 13 which terminates at an open end 14 into which is normally sealed one or more beam guns (not shown) which furnish an electron source for operation of the finished tube. Face plate 12 has a uniformly curved viewing panel 12a and a surrounding annular flange portion 12b which terminates in an annular sealing surface 12c. Face plate 12 may either be circular or rectangular in shape being shown as the former in Fig. 2. Face plate 12 and funnel 11 are sealed together by a hermetic joint along the planular line 15.

The interior surface of viewing panel 12a constitutes a target or screen area 19 (Fig. 3) which has deposited thereon at least one layer of phosphor materials (not shown) which comprises the image-producing area of the cathode-ray picture tube. The particular phosphor materials which comprise the screen 19 may be varied widely as known in the art and do not constitute a part of this invention. Face plate 12 fabricated in accordance with the illustrated embodiment may conveniently be employed in the manufacture of a present-day picture tube

for color television reception having either glass or metal funnel members.

Flange portion 12b of the face plate has a series of preferably three internally extending glass lugs or protuberances 12d. The studs 12d are integrally formed with the flange and may be subsequently formed after the face plate molding operation of glass drawn from the flange area in heat-softening localized areas thereof. The glass studs 12d are basically frusto-conical in shape and have a change of contour near their free cantilevered ends which are either slightly tapered or essentially right-cylindrical in shape.

Each glass lug 12d has a metallic sleeve 21 affixed to the load-supporting region of its free end by an interposed layer 22 of low-melting glass sealing composition for carrying the color-controlling electrode 16. Elements 21 which also may be called "thimbles" comprise inserts which are mounted between the apertured mask support members 20 and the glass surfaces to furnish metal bearing surfaces capable of resisting scratching and thus offering full protection to the glass. The metal thimbles 21 may be fabricated of stainless steel alloy such as No. 430 and may be initially provided with an interior vitreous coating of a low-melting sealing glass for its mounting in precise relationship on the glass studs.

The metallic sleeve members 21 having their interior surfaces covered by soft glass coating 22 may be fitted into a forming tool for molding the glass lugs 12d and the heat-softened glass drawn thereinto, the exterior surfaces of the metal sleeves being maintained in accurate disposition with respect to the screen area of the face plate viewing panel 12a. This method of forming glass lugs 12d is fully disclosed in the pending patent application of Chapman, entitled "Method and Apparatus for Forming Projections on Glass Surfaces," Serial No. 535,451, filed September 20, 1955, and assigned to a common assignee.

The soft glass 22 employed within sleeve members 21 may be comprised of vitreous or devitrifiable sealing compositions commonly referred to as solder glasses which have unusually low softening temperatures and precisely controlled thermal expansion coefficients suitable for uniting glass-to-metal or two distinct "hard" glasses having both similar or slightly dissimilar expansion characteristics. Such sealing compositions are basically referred to as those which are lead-borate containing and have softening point temperatures in the range of from 330° to 400° C. being fully capable of sealing to hard glass parts at temperatures not in excess of 500° C. Examples of such sealing compositions have been fully disclosed in the copending patent application of Billian and Hagedorn, entitled "Devitrifiable Glass Sealing Composition," Serial No. 658,015, filed May 9, 1957, and assigned to a common assignee.

These sealing compositions consist essentially of lead oxide (PbO), boric oxide (B₂O₃), zinc oxide (ZnO) and a small amount of silicon dioxide (SiO₂) in which the lead oxide is the major component comprising more than 70% of the composition. Also the compositions may alternatively contain small amounts of barium and/or copper oxides. The sealing compositions have thermal expansions ranging from 89 to 119×10⁻⁷ per degree C. measured over the range from 0 to 300° C. One example of a preferred solder glass is one containing 74.7% PbO; 12.8% ZnO, 8.4% B₂O₃; 2.0% SiO₂ and 2.0% BaO. The sealing compositions are fully capable of sealing to the parent glass of the face plate 12, for example, without distortion, deformation or the introduction of any thermal stresses therein.

As stated, in many types of commercially produced cathode-ray color picture tubes it is necessary to mount and extensive electronic structure such as a shadow mask 16 in extremely precise alignment between the screen area 19 of viewing panel 12a and the one or more beam guns disposed within end 14 of the neck tubulation.

Shadow mask 16 comprises an extremely thin perforate metal sheet 17 having as many as 200,000 small openings for a 21 inch round picture tube, for example. The extremely thin and delicate perforated sheet 17 is peripherally attached to a relatively stiff and heavy annular member or frame 18. Frame 18 has an L-shaped cross-section as shown in Fig. 3. Shadow mask 16 is detachably supported within the tube envelope by its frame 18 located adjacent to screen area 19. A series of similar phosphors commonly reside in a distinctive pattern with respect to an individual source of electrons emitted by a single beam gun. As is known three beam guns may be utilized within the tube neck 13 to excite three distinct species and prescribed areas of particular phosphors to obtain desired coloration effects.

Mask 16 commonly has a plurality of leaf-spring elements 20 attached to frame 18 arranged in a triangular pattern exteriorly beyond perforate sheet 17. Each spring 20, as shown in Fig. 3, is attached at one end to a central outer surface of the relatively stiff frame 18 of the mask and carries its free end in cantilevered relation. A series of three spring members 20 are employed in conjunction to retain and positively locate electronic shadow mask 16 within the face plate flange 12b by contacting metal sleeve members 21 disposed on the inner ends of each glass lug or protuberance 12d. Each spring 20 has an opening in its free end which engages and surrounds metal sleeve 21. The mask frame 16 is normally disposed in a single plane normal to the electron beams and tube axis in extremely precise relationship laterally and a prescribed distance from screen area 19.

Each spring 20 may be composed of stainless steel alloy, for example, or other metal alloy suitable for use in an evacuated cathode-ray tube. The spring opening does not physically contact the glass but rests on the shoulder portion of the metal sleeve 21 in exactly duplicatable arrangement. Thus, the glass is not contacted during installation of the mask so that scratching, chipping or fracturing of the glass is eliminated.

A considerable improvement in load distribution has been achieved by the subject invention with the apertured electrode element supported in detachable relationship within the tube face plate. The loading placed on each glass lug 12d is distributed over a wide area of its terminating region by the interior surface of the metal sleeve 21 and the interposed layer of solder glass 22.

Drop tests of tube envelopes incorporating the present construction have indicated the practicality and beneficial results obtainable by the invention. Glass lugs of the type illustrated having the metal sleeves or thimbles on their load-bearing free ends have displayed fully adequate strength under continuous loading as well as under repeated physical and thermal shocks introduced by drop and thermal tests. The subject construction is equally durable when resisting physical and thermal shocks without damage to the glass or misalignment of the tube component parts.

The term "hard" glass as used herein is intended to mean commercial glasses such as those employed to fabricate electron tube devices which are higher melting and have higher working temperatures than the referred to glass sealing compositions.

It will, of course, be understood various details of construction may be modified through a wide range without departing from the principles of this invention, and it is not the purpose to limit the patent granted hereon, otherwise than necessitated by the scope of the appended claims.

We claim:

1. In a cathode-ray picture tube envelope, the combination of a hollow body member, a hollow glass face plate hermetically sealed to said body member, and a color-controlling electronic element mounted within said face plate, said glass face plate having a viewing panel comprising a screen area, an annular glass flange por-

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tion extending from and surrounding the viewing panel of said face plate, and a plurality of inwardly-projecting glass lugs having freely-cantilevered ends formed integral with said flange portion, said glass lugs disposed in spaced-apart relation with their axes essentially normal to the tube axis, said color-controlling electronic element having a plurality of spring-type metallic mounting members affixed to its marginal surfaces each having an aperture therein coincidental with the spaced relation of said glass lugs, a sleeve-like metallic member having a flared shoulder portion mounted on the free end of each glass lug, and a solidified fused layer of low-melting sealing composition interposed between each glass lug and its sleeve-like mounting member for their firm attachment in accurate alignment with the tube screen area.

2. The combination in accordance with claim 1, including each of said glass lugs having a precisely-dimensioned tapered free end portion located a prescribed distance from and normal to the screen area of said viewing panel and each of said sleeve-like metallic members fusedly joined to said tapered portion of said glass lugs with said sealing composition to locate said elec-

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tronic element in a positive duplicatable position a prescribed distance from the screen area.

3. The combination in accordance with claim 1, including three of said glass lugs each having a precisely-dimensioned frusto-conical shoulder portion spaced equidistant from the screen area of said viewing panel in triangular relationship, the said metallic mounting members of said electronic element being in contact with and supported by the said sleeve-like metallic members disposed on each of said glass lugs.

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