

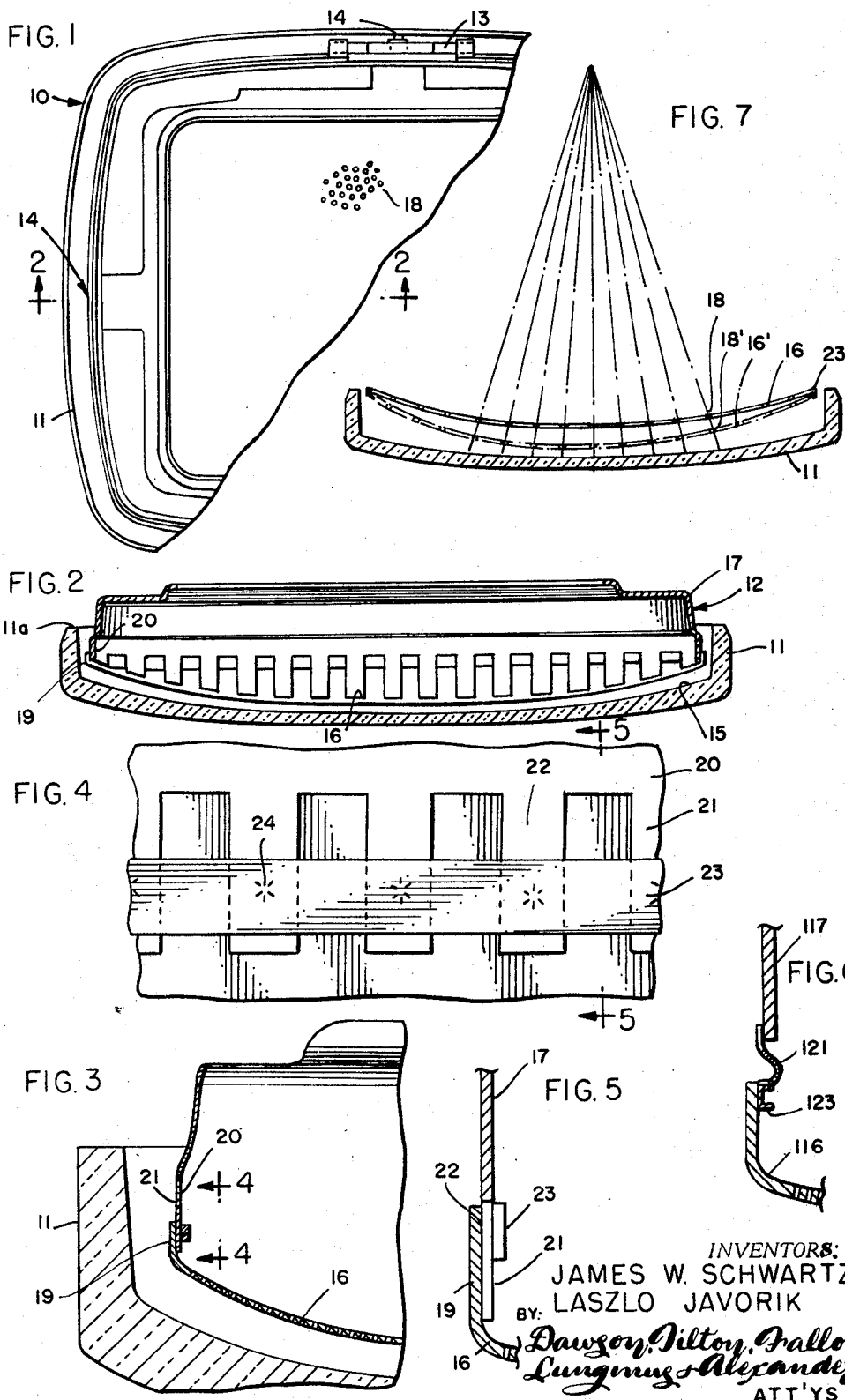
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COLOR TELEVISION TUBE MASK MOUNTING WITH APERTURE ALIGNMENT
MAINTENANCE DURING EXPANSION

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COLOR TELEVISION TUBE MASK MOUNTING WITH APERTURE ALIGNMENT MAINTENANCE DURING EXPANSION

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ABSTRACT OF THE DISCLOSURE

A shadow mask is mounted in the faceplate portion of a color television tube adjacent the phosphor screen by means of spring clips. The shadow mask includes a frame defining a plurality of fingers projecting axially of the tube toward the screen for receiving a foraminous member defining apertures in register with the phosphor pattern of the screen. The foraminous member is mounted at its periphery to the distal ends of the fingers projecting from the frame, and an Invar band having a coefficient of thermal expansion less than the screen and the frame is connected to the periphery of the screen and the distal ends of the frame fingers such that when the frame expands due to heating, the Invar band will restrain the expansion of the periphery of the foraminous member thereby causing an increase curvature of the foraminous member and translating the center thereof axially of the tube toward the screen for correcting for misregistration of the apertures with their associated phosphor pattern.

This invention relates to a color television tube mask construction and, more particularly, to a construction wherein the mask is constructed and arranged so as to minimize the tendency of the mask to expand adversely upon temperature increase thereof.

The invention is directed to unique construction of the perimetric flange portion of the mask whereby the perforated central portion of the shadow mask is maintained in substantial register with the electron beams issuing from the electron guns and the triads of phosphor dots on the tube screen. It will be appreciated that a screen may have 300,000 openings to pass the electron beams during the tracing of a raster. Normally, the beams in landing upon the phosphor dots, occupy all but a 3 mil annulus so that a shift of only a few thousandths of an inch of any given opening can bring about a serious misregister—resulting in poor color emission.

The result of the invention is that the mask is effectively restrained against expansion so that the openings thereof are maintained in substantial register with the phosphor dots on the screen of the cathode ray tube. This results in superior color purity of the picture developed by the electron beams passing through the shadow mask and the provision of the structure for achieving this result constitutes the objective of this invention.

Other objects and advantages of the invention may be seen in the details of construction and operation set down in this specification.

The invention is explained in conjunction with an illustrative embodiment in the accompanying drawing, in which

FIG. 1 is a fragmentary elevational view of the face plate portion of a color television tube and showing a portion of the shadow mask;

FIG. 2 is a sectional view taken along the line 2—2 applied to FIG. 1;

FIG. 3 is an enlarged sectional detailed view of the apparatus seen in FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a sectional view in enlarged scale of a portion of FIG. 3;

FIG. 6 is a sectional view similar to FIG. 5 but of a modified version of the invention; and

FIG. 7 is a schematic picturization of the operation of the mask according to the invention.

In the illustration given and with particular reference to FIG. 1, the numeral 10 designates generally a color television picture tube which includes a glass envelope. In the illustration given, the rear or "gun" portion of the tube is omitted but it will be appreciated that the usual construction may be advantageously employed. For the sake of clarity, the drawing depicts only the face plate portion 11 which is intended to be fused at 11a to the funnel portion of the tube (not shown). Supported adjacent and partially within the face plate 11 is the shadow mask generally designated 12. The support is by means of spring clips 13 provided at least at the sides and top of the mask 12 and which are adapted to couple the mask 12 to posts 14 embedded within the wall of the tube 10. Additionally, the inner surface of the face plate 11 is equipped with a phosphor screen 15 in conventional fashion.

Referring now specifically to the shadow mask 12, it will be seen (particularly in FIGS. 2 and 3) that the mask is made up of two parts—a foraminous or facing portion 16, and a perimetric frame portion 17. The foraminous portion 16 is constructed of relatively lightweight metal and in the 23-inch size includes about 300,000 openings as at 18 (see FIG. 1). The foraminous portion 16 is itself equipped with a perimetric lip or flange, as at 19, in which the perimetric flange portion 20 of the frame 17 is received. The overlapped portions are united by spot welding.

The forward portion of the perimetric frame 17—as at 20 in FIG. 4 is seen to be equipped with a plurality of axially forwardly extending fingers or projections 21. These fingers, or projections, are spot-welded as at 22 to the lip 19. Additionally, the projections 21 are integrated or united together by a perimetric band or ring 23, which is spot-welded to the fingers 21 as at 24. In operation, the frame 17 tends to expand, but the portions thereof which support the foraminous member 16 are confined against expansion by means of the band 23 which is constructed of a material having a minimal coefficient of thermal expansion. The frame portion 17 normally is constructed of cold-rolled steel. In one embodiment of the invention, the band 23 is advantageously constructed of Invar which has a negligible coefficient of thermal expansion. The mask for example, is constructed of 0.005 inch thick cold-rolled steel, while the band 23 and frame 17 are constructed of metal having thicknesses of the order of 0.030 inch.

Operation

In the operation of the invention, the mask is constrained against perimetric expansion, i.e., of movement generally perpendicular to the axis or longitudinal dimension of the envelope. This is represented schematically in FIG. 7. The numeral 16 designates the foraminous portion of the screen in its quiescent or "unheated" condition. The numeral 16' designates the foraminous portion of the mask when the same has been heated, as by the absorption of heat from the traversing electron beam. It will be seen that the foraminous portion 16 is arcuate, having somewhat of a substantially spherical configuration so that upon the restricted expansion thereof to the condition designated 16', a given opening 18 moves to a position 18' where it is still in register with a beam travelling from the gun (not shown) to the cylindrically

configured face plate. Thus, the expansion or movement of the mask's foraminous portion 16 is in a generally radial direction i.e., along the beam path and toward the face plate 11 so as not to disturb the initial register provided in the tube.

An alternative construction for limiting perimetric expansion of the foraminous portion of the mask is seen in FIG. 6. There the foraminous portion is designated 116 and is equipped with an annular channel 123 which advantageously can be constructed of Invar—for that matter, the entire frame can be so constructed but such would be economically unfeasible. However, this does serve to restrict mask expansion in the direction causing misregister. In the FIG. 6 embodiment, the frame 117 is again constructed of cold-rolled steel and is equipped with arcuate fingers or tabs 121 coupling the frame 117 to the band 123 at a plurality of perimetrically spaced points. The FIG. 6 construction is advantageous in not stressing the band 123 by virtue of the expansion of the frame 117, this stress being taken up in fingers 121. Additionally, there is a slight bi-metal effect—any expansion of the fingers 121 being directionalized to move the foraminous portion 116 toward its associated screen and thus further compensate for any slight lateral expansion of the portion 116.

A metal such as Invar is particularly suitable for use in the instant invention since there is relatively little expansion of the metal in the range of normal operating temperatures, 20°–40° C. However, the metal does possess a substantial coefficient of thermal expansion, approaching that of steel, at elevated temperatures. Thus, there is no tendency of the tube interior parts to assume serious strains during normal manufacturing operations when the tube is subjected to temperatures to the order of 400° C.

While in the foregoing specification a detailed description of an embodiment of the invention has been set down for the purpose of illustration, many variations of the details herein given may be made by those skilled in the art without departing from the spirit and the scope of the invention.

We claim:

1. A color television tube comprising: an elongated envelope having a faceplate portion defining a phosphor screen at one end; a shadow mask including a peripheral frame of cold rolled steel defining a plurality of fingers projecting axially of said tube toward said screen, a foraminous member of cold rolled steel defining apertures in register with the phosphor pattern of said screen and mounted at its periphery to the distal ends of said fingers, and a band having a coefficient of thermal expansion less than said screen and said frame over normal operating temperatures connected to the periphery of said screen and to the distal ends of said frame fingers; and spring clip means mounting said shadow mask in said faceplate portion of said envelope adjacent said screen whereby upon expansion of said frame due to heating, said band restrains the expansion of said foraminous member and said fingers, thereby increasing the curvature of said foraminous member and translating the center thereof toward said screen axially of said tube for correcting misregistration of said apertures with their associated phosphor pattern.

2. The structure of claim 1 wherein each of said fingers is periodically spaced about the periphery of said frame and each defines an arcuate shape whereby when said frame expands, the distal ends of said fingers will be restrained from expanding and said foraminous member and said band will be translated bodily toward said screen to provide additional compensation for misregistration.

3. The structure of claim 1 wherein said band is Invar steel having a coefficient of thermal expansion which is negligible over the normal operating temperatures of said tube.

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