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54 **Color picture tube having a box-like mask-reinforcing assembly.**

57 An improved color picture tube (8) includes an evacuated envelope (10) having a rectangular faceplate panel (12). The panel includes a viewing screen (22) on an inner surface thereof and a shadow mask (24) mounted therein. The shadow mask includes an apertured contoured portion (26) and a reinforcing structure (42) peripherally attached to the apertured portion. The reinforcing structure and a portion (30) of the mask form a box-like enclosure (43) around the periphery of the mask. The reinforcing structure is constructed of a material that has approximately the same thickness as does the material of the apertured contoured portion of the shadow mask.

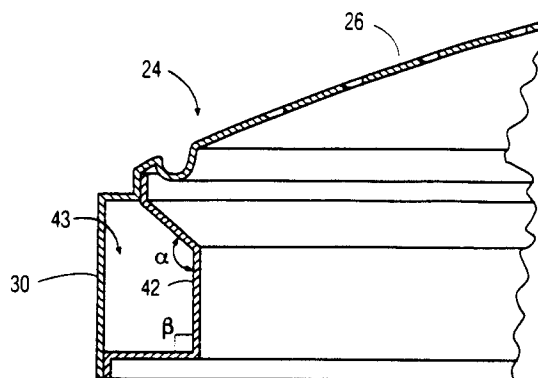


FIG. 3

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This invention relates to color picture tubes of the type having shadow masks that are suspended in relation to cathodoluminescent screens, and particularly to an improved lighter-weight shadow mask.

As the sizes of color picture tubes have increased, there has been a corresponding increase in the sizes and weights of tube components. One of these components is a mask-frame assembly. Present color picture tubes use steel frames to support shadow masks within faceplate panels of the tubes. One type of frame is made from a continuous piece of L-shaped steel that is bent and welded to itself at its ends. Another type of frame is formed by pressing a flat steel sheet into the shape of the frame. Typically, for a 31V tube with a 79 cm diagonal screen, these types of frames are made from materials that are about 1.00 mm (0.039 inch) thick and weigh about 1.63 kg (3.6 lbs). Other frames can be as thick as 1.51 mm (0.062 inch) and are proportionately heavier. The frames are usually rectangularly shaped and supported within faceplate panels by either three or four springs that are attached to the sides of the frames; alternatively, the frames may be supported at their four corners. Embodiments for achieving such corner support are shown in U.S. Patent 4,723,088, issued to Sone et al. on February 2, 1988, and U.S. Patent 4,728,853, issued to Sone et al. on March 1, 1988.

Because of the considerable weight of a conventional mask-frame assembly, there is an opportunity to reduce the overall weight of the tube, if the need for a support frame can be eliminated. The present invention provides a shadow mask that does not utilize a conventional frame.

An improved color picture tube in accordance with the present invention includes an evacuated envelope having a rectangular faceplate panel. The panel includes a viewing screen on an inner surface thereof and a shadow mask mounted therein. The shadow mask includes an apertured contoured portion and a reinforcing structure peripherally attached to the apertured portion. The reinforcing structure and a portion of the mask form a box-like enclosure around the periphery of the mask. The reinforcing structure is constructed of a material that has approximately the same thickness as does the shadow mask material.

In the drawings:

FIGURE 1 is an axially sectioned side view of a color picture tube embodying the present invention.

FIGURE 2 is a bottom view of a quadrant of the faceplate panel and shadow mask of the tube of Figure 1.

FIGURE 3 is a cross-sectional view of the shadow mask taken at line 3-3 of FIGURE 2.

FIGURE 4 is a top view of a corner bracket and spring.

FIGURE 5 is a front view of the corner bracket and spring of FIGURE 4.

5 FIGURE 6 is a cross-sectional view of the shadow mask, corner bracket and spring taken at line 6-6 of FIGURE 2.

FIGURE 7 is a cross-sectional view of a second shadow mask embodiment.

10 FIGURE 8 is a cross-sectional view of a third shadow mask embodiment.

FIGURE 9 is a cross-sectional view of a fourth shadow mask embodiment.

15 FIGURE 1 shows a rectangular color picture tube 8 having a glass envelope 10, comprising a rectangular faceplate panel 12 and a tubular neck 14 connected by a rectangular funnel 16. The panel 12 comprises a viewing faceplate 18 and a peripheral flange or sidewall 20, which is sealed to the funnel 16. A mosaic three-color phosphor screen 22 is located on the inner surface of the faceplate 18. The screen preferably is a line screen, with vertically extending parallel phosphor lines. Alternatively, the screen may be a dot screen. A multiapertured color selection electrode or shadow mask 24 is removably mounted in predetermined spaced relation to the screen 22. An electron gun 25 is centrally mounted within the neck 14, to generate and direct three electron beams along convergent paths through the mask 24 to the screen 22.

20 The tube of FIGURE 1 is designed to be used with an external magnetic deflection yoke 28 located in the vicinity of the funnel-to-neck junction. When activated, the yoke 28 subjects the three electron beams to magnetic fields which cause the beams to scan horizontally and vertically in a rectangular raster over the screen 22.

25 The shadow mask 24, shown in greater detail in FIGURES 2 and 3, includes an apertured contoured portion 26 and a peripheral skirt 30 that surrounds the apertured portion 26. The shadow mask is mounted within the faceplate panel 12 by four support means 34 positioned at the four corners of the shadow mask. One such support means 34 is shown in FIGURE 2. Each support means 34 includes a stud 36 embedded in the panel sidewall 20, a spring 38 which engages the stud, and a bracket 40 that is attached to the skirt 30 of the shadow mask. Alternatively, the mask 24 may be suspended by support means located along the sides of the mask.

30 The shadow mask 24 does not use a thick peripheral reinforcing frame, as taught by the prior art. Instead, the skirt 30 of the shadow mask 24 is reinforced by use of a generally C-shaped reinforcing structure 42 that is peripherally attached to the inside surface of the skirt 30. The C-shape is

formed by an obtuse angle α and a right angle β in cross-section in the structure 42. The reinforcing structure 42 and the skirt 30 form a rigid box-like enclosure 43 around the periphery of the mask, with the reinforcing structure forming three sides of the enclosure. The material of the reinforcing structure 42 has approximately the same thickness as does the mask material, e.g., 0.229 mm (0.009 inch). This is considerably thinner than a prior art frame which can be as thick as 1.51 mm (0.062 inch) thick. Therefore, because the reinforcing structure 42 weighs considerably less than a conventional prior art frame, the mask assembly with the box-like enclosure is considerably lighter than the prior art mask-frame assemblies that use heavy peripheral frames.

The spring 38 and bracket 40 are shown in greater detail in FIGURES 4, 5 and 6. One end of the spring 38 is welded to the bracket 40, and the other end of the spring includes an aperture 44 which engages the stud 36. The bracket 40 includes a center section 46, to which the spring 38 is welded, and two legs 48 and 50. The legs 48 and 50 extend along adjacent sides of the mask and are welded to the outside surface of the mask skirt 30.

Although the first embodiment of the present invention has been shown using a C-shaped reinforcing structure, the peripheral box-like structure of the mask can be formed from differently shaped parts. For example, a minor modification to the preferred embodiment is shown in FIGURE 7. In FIGURE 7, a mask 60 is shown having a box-like enclosure 61 formed by a C-shaped reinforcing structure 62 having two right angles in cross-section. In FIGURE 8, an iron-nickel mask 70 has a U-shaped skirt 72 which forms a side of a box-like enclosure 73. The remainder of the enclosure 73 is formed by a C-shaped structure 74 that is attached to the outside surface of the skirt 72 at peripheral points 76 and to the bottom of the U-shape of the skirt at peripheral points 78. A flange 79 of the structure 74 extends toward the center of the mask, to serve as an electron beam overscan shield. A mask 80, shown in FIGURE 9, is similar to the embodiment of FIGURE 8, in that it has a U-shaped skirt 82 and a C-shaped structure 84 forming a box-like enclosure 86, except that the structure 84 touches the outside portion of the U of the skirt 82.

A mask and mask support means constructed in accordance with the present invention uses a minimum amount of material and is lighter than one which uses a frame. This results in cost reduction, better thermal performance and reduced warpage during long-term operation. The thinner material of the reinforcing structure is easier to machine, and the completed mask assembly and support are still

sufficiently sturdy to withstand mechanical shocks and vibrations.

Claims

1. A color picture tube (8) including an evacuated envelope (10) having a rectangular faceplate panel (12), said panel including a viewing screen (22) on an inner surface thereof and a shadow mask mounted therein by support means (34), characterized in that

said shadow mask includes an apertured contoured portion (26) and a reinforcing structure (42,62) peripherally attached to said apertured contoured portion, said reinforcing structure and a portion (30, 64, 72, 82) of said mask forming a box-like enclosure (43, 61, 73, 86) around the periphery of said mask, and said reinforcing structure being constructed from material that has approximately the same thickness as does the material of said apertured contoured portion of said mask.

2. The tube as defined in Claim 1, characterized in that said support means (34) are located at each corner of said panel (12) and include a bracket (40) and a spring (38), said bracket including a center section (46) and two legs (48, 50) that extend along adjacent sides of said mask (24), said legs being welded to said mask, and said spring being welded to said center section.

3. A color picture tube (8) including an evacuated envelope (10) having a rectangular faceplate panel (12), said panel including a viewing screen (22) on an inner surface thereof and a shadow mask (24, 60, 70, 80) mounted therein by support means (34) located at the four corners of said panel, said shadow mask including an apertured contoured portion (26) and a peripheral skirt (30, 64, 72, 82), characterized in that

said shadow mask includes a C-shaped reinforcing structure (42, 62, 74, 84) peripherally attached to said skirt, said reinforcing structure and said skirt forming a box-like enclosure (43, 61, 73, 86) around the periphery of said mask, and said reinforcing structure being constructed of a material having approximately the same thickness as does the material of said apertured contoured portion of said shadow mask.

4. The tube as defined in Claim 3, characterized in that said support means (34) at each of said corners includes a bracket (40) and a spring (38), said bracket including a center portion

(46) and two legs (48, 50) that extend along adjacent sides of said mask, said legs being welded to said skirt portion (30), and said spring being welded to said center portion.

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- 5. A color picture tube (8) including an evacuated envelope (10) having a rectangular faceplate panel (12), said panel including a viewing screen (22) on an inner surface thereof and a shadow mask (24, 60, 70, 80) mounted therein by support means (34) located at the four corners of said panel, said shadow mask including an apertured contoured portion (26) and a peripheral skirt (30, 64, 72, 82), characterized in that

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said shadow mask includes a C-shaped reinforcing structure (42, 62, 72, 82) peripherally attached to an inside surface of said skirt, said reinforcing structure and said skirt forming a box-like enclosure (43, 61, 73, 86) with said skirt around the periphery of said mask, said reinforcing structure being constructed of a material that has approximately the same thickness as does the material of said apertured contoured portion of said shadow mask.

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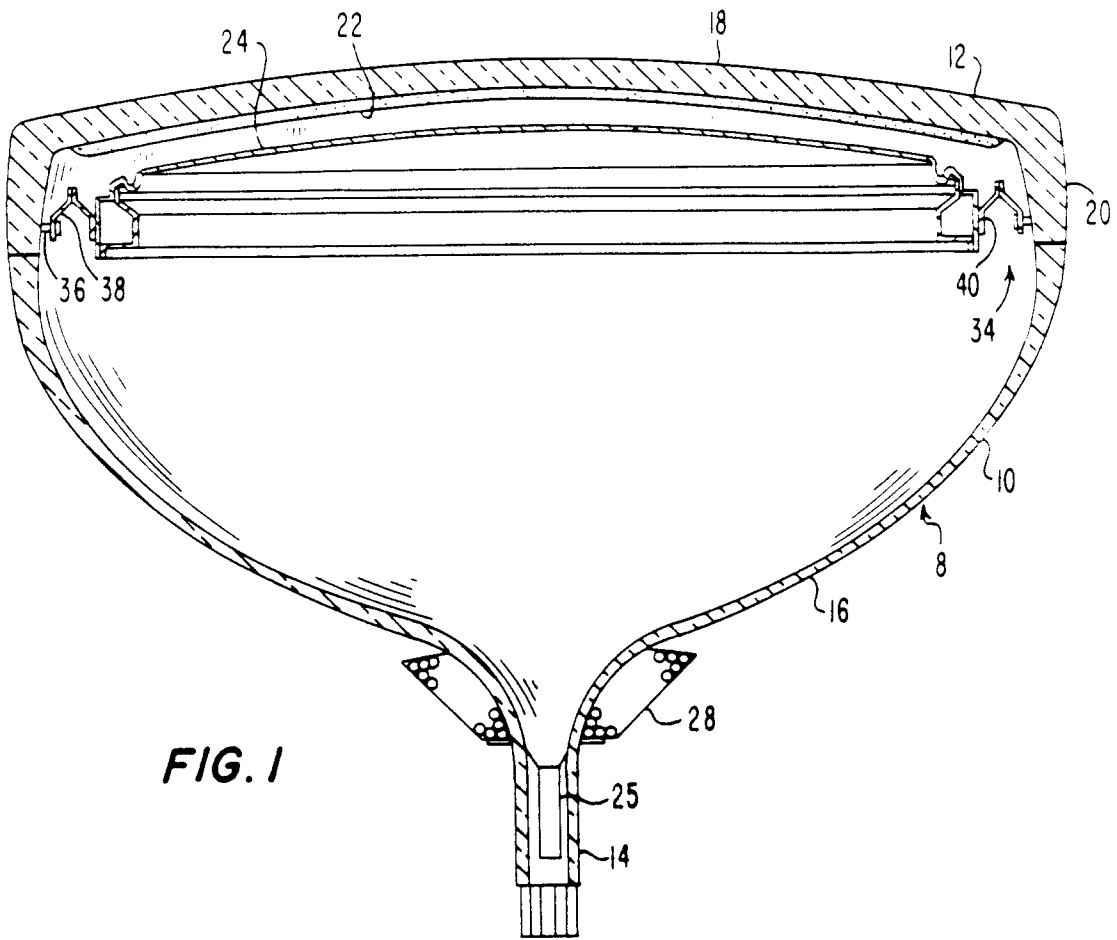
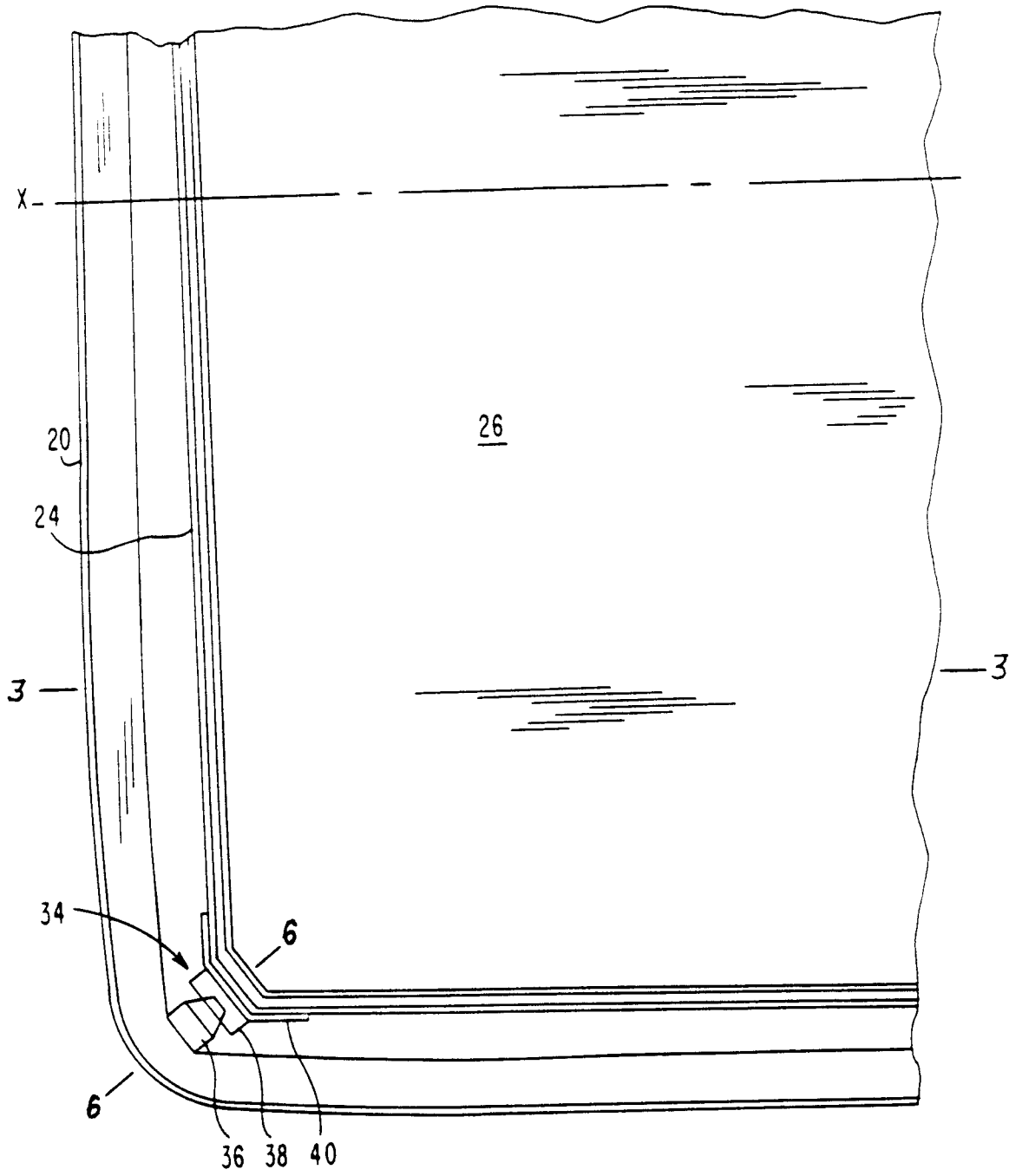


FIG.2



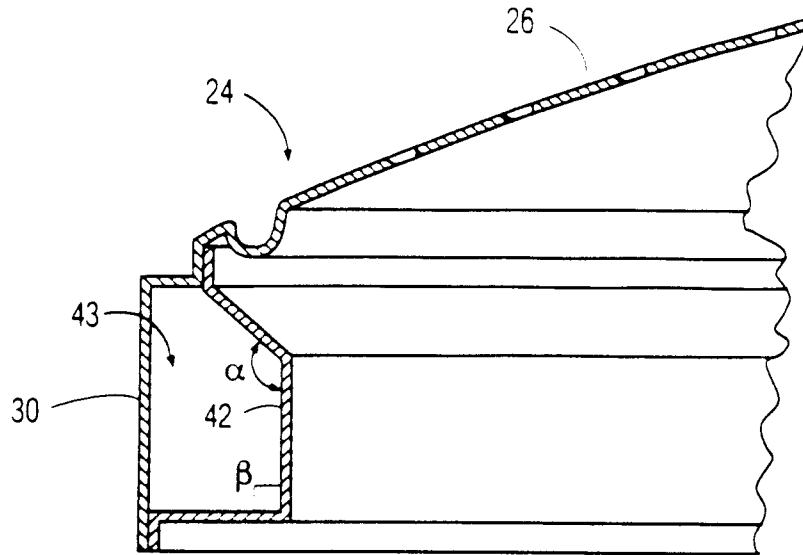


FIG. 3

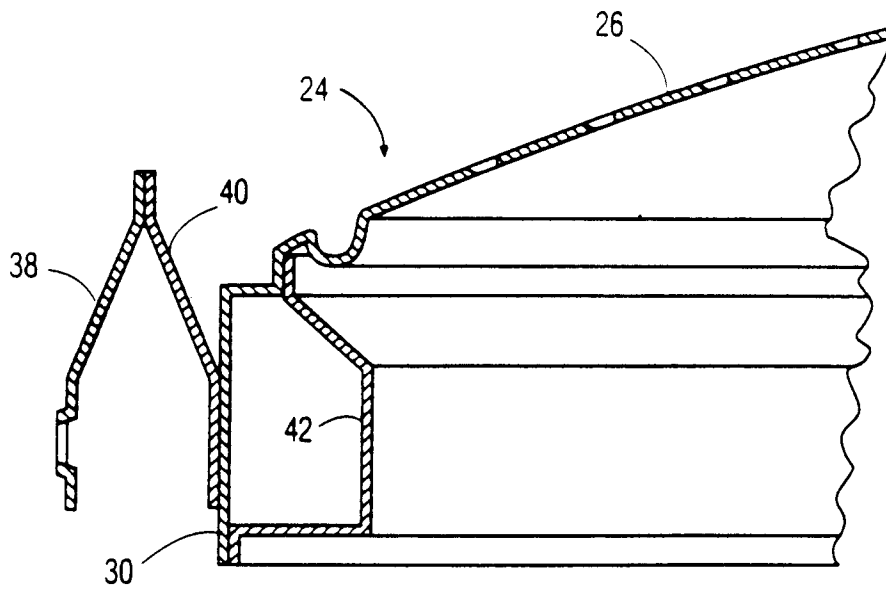


FIG. 6

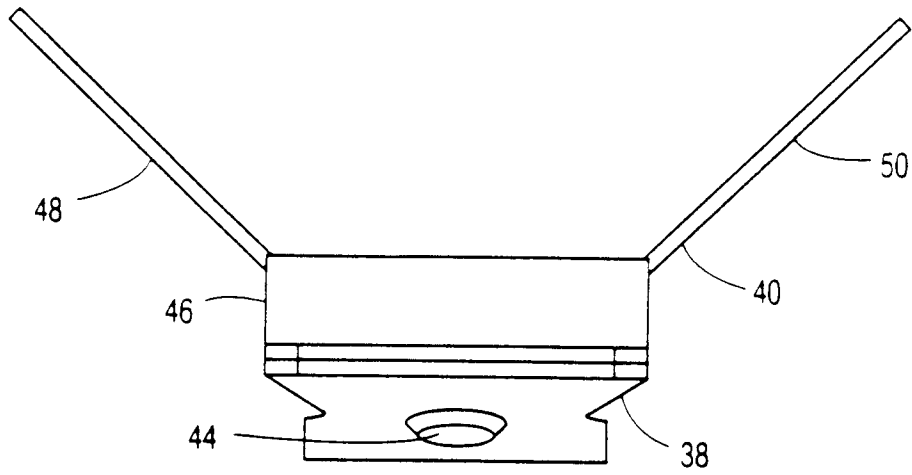


FIG. 4

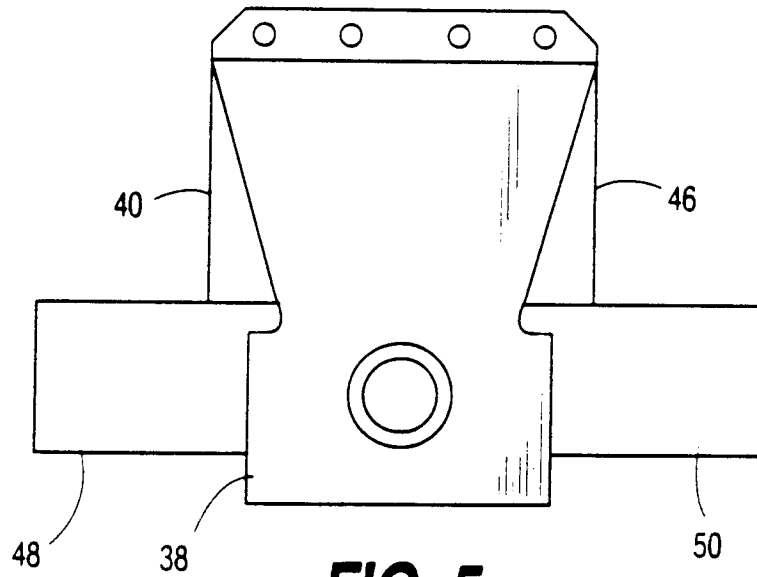


FIG. 5

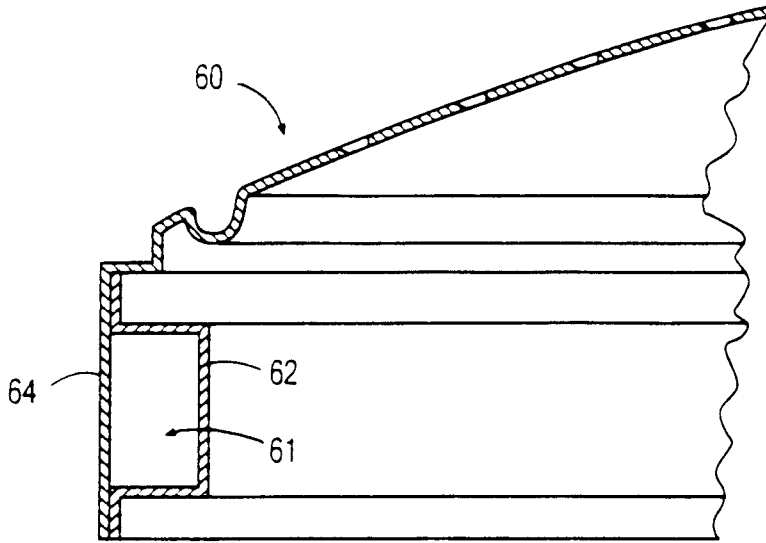


FIG. 7

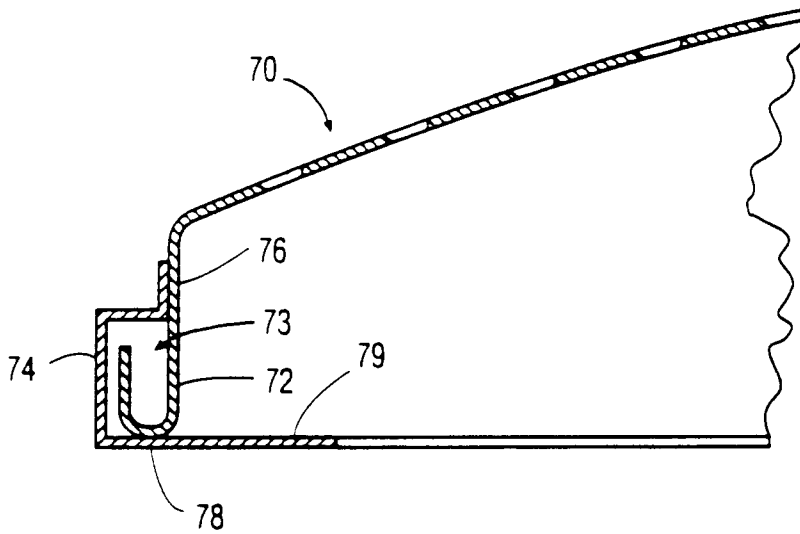


FIG. 8

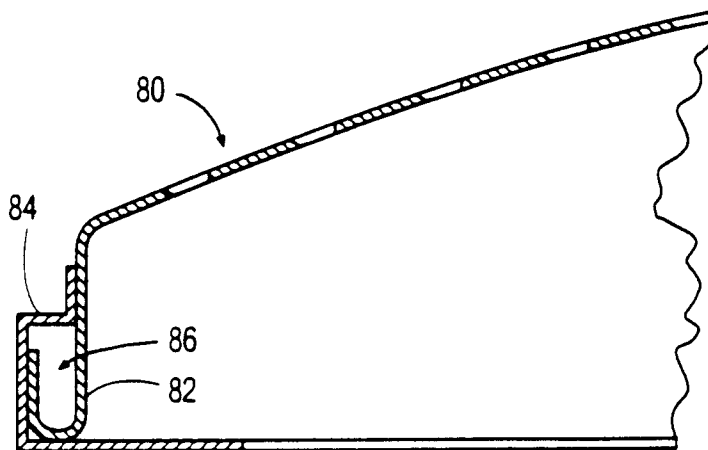


FIG. 9



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	PATENT ABSTRACTS OF JAPAN vol. 5, no. 159 (E-77) (831) 14 October 1981 & JP-A-56 088 239 (HITACHI SEISAKUSHO K.K.) 17 July 1981 * abstract *	1, 3, 5	H01J29/07
Y	US-A-5 072 151 (P.SPINA) * claims 1,2 *	1, 3, 5	
A	US-A-4 700 105 (HIDEYA ITO) * claims 1-7 *	1, 3, 5	
A	US-A-5 021 707 (R.C.BAUDER) * column 3, line 31 - line 41; claim 1; figure 5 *	2, 4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 February 1995	Examiner Van den Bulcke, E
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			