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(54) **Flat display vacuum tube.**

(57) A flat display vacuum tube having enough strength against the implosion and being able to reduce its thickness and weight. A front edge of a side circumference portion 2 of the vacuum tube is bent to form a panel circumference reinforcing portion 2a. The front panel 1 is coupled to the panel circumference reinforcing portion 2a. The side circumference portion 2 and the rear portion 4 are integrally composed with each other in a metallic material.

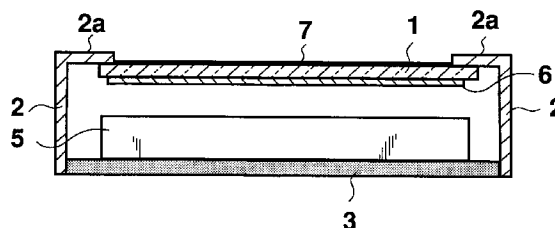


Fig. 1

This invention relates to a flat display vacuum tube for use in a flat plate-type display apparatus in which an image is displayed on a display panel.

As a conventional image display vacuum tube, a Braun tube (CRT) is known, for example.

However, one disadvantage of such a CRT has been that it is very voluminous in its depth. Therefore, recently, an improved display apparatus called a flat display has been developed in accordance with the advance of semiconductor technology. Example of such types of display apparatus are a plasma display panel (PDP) and fluorescent character display tube (VFD).

FIG. 12 of the accompanying drawings shows an example of a cross-sectional view of a conventional flat display vacuum tube. The shown flat display apparatus comprises: a display panel 100 for displaying an image; a rear portion 102 provided with an electrode portion 101 opposed to the display panel 100 for projecting the image; a side portion 103 surrounding the display panel 100 and the rear portion 102 to form a closed vacuum tube. All the tube components are formed of glass.

The electrode portion 101 located on the rear portion 102 projects the image onto the display panel 100 for display, and is composed of, for example, an electron beam generating section, an electron beam convergent section, and an electron beam deflecting section. The electron beam irradiated from the electrode portion 101 is then projected onto a screen 104 formed by coating the inner surface of the display panel 100 with a fluorescent material so as to display the image.

Thus, in the conventional flat display where the image is displayed on the display panel using electron beams irradiated from the electrode portion 101, an internal vacuum glass tube has been used, like the above-mentioned CRT.

In such a conventional flat display vacuum tube, as shown in FIG. 12, the display panel 100, the rear portion 102 and the side portion 103 have all been formed of glass material.

As a result, when the vacuum tube is destroyed due to defects such as micro bubbles present inside the glass material or wounds a so called "implosion" can arise.

Specifically, the "implosion" phenomenon of the vacuum tube can be described as follows: if a part of the vacuum tube is weak, the stress will be concentrated thereon and the tube can be collapsed by atmospheric pressure. Glass fragments generated at the collapse of the vacuum tube are at first absorbed inside the vacuum tube, but immediately thereafter scatter externally with a significant energy (so-called lag demolition), sometimes even toward the viewer of the display.

In order to prevent the danger due to the lag demolition of the implosion, the glass rupture strength

has been set to a value five to seven times larger than that of the stress applied to the vacuum tube, thereby preventing the implosion.

However, the greater the thickness of the glass material to enhance the rupture strength of the glass, the greater the weight thereof.

Also in order to protect the display panel 100 from external damage which could cause an implosion and to prevent danger at the implosion, a shielding plate 105 formed of transparent acrylic material has been disposed in front of the display panel 100, as shown in FIG. 13. In this case, however, since space for installing shielding plate 105 must be provided separately, the display depth is increased and additional cost is incurred. In FIG. 13, the electrode portion and the screen are omitted from the illustration.

Alternatively, Japanese Patent Laid-Open No. Sho 61-118949 and Japanese Patent Laid-Open No. Sho 61-288356 disclose a vacuum tube formed of a metallic material. But in such a type of tube, since even the rear portion thereof must be metallized, an insulating process for inserting an insulating material between the electrode portion and the rear portion has been necessary for the electrode portion. As a result, the manufacturing process becomes complicated, and the flat display itself is thicker.

It is therefore an object of this invention to provide a thin-type flat display vacuum tube having sufficient safety and capable of being lightweight in construction.

According to this invention, a flat-type display vacuum tube comprises: a front display panel for displaying an image and a rear plate, which may be provided with an image projecting apparatus for projecting the image onto the front display panel, and disposed in parallel to the display panel; and is characterized by a side plate comprising a metallic portion, which may be a metallic frame airtightly coupled to the front display panel and the rear plate, in which at least a front edge is bent radially inwardly of the display panel so as to form a front circumference portion.

The rear plate may be composed of a ceramic material, which may have a tensile strength larger than that of glass.

Also, a rear circumference portion may be formed by internally bending an end edge of said side metallic plate at the rear plate side.

The side circumference plate and said rear plate may be integrally formed of a metallic material.

In one embodiment using a side metallic plate airtightly coupling the front display panel and the rear plate, it becomes possible to reduce the weight of the tube, in comparison with a case using a glass material.

With the invention, the end edge of the front display panel is provided with a bent side metallic plate to constitute the front circumference portion. The front

circumference portion and the side portion of the vacuum tube provided with this side metallic plate is a portion being structurally weak due to stress occurring when the inside is made into a vacuum. Therefore, by virtue of using a metallic material having a strength larger than that of the glass conventionally used, the implosion can be certainly prevented and the thickness of the components can be minimized to reduce the weight.

Moreover, by bending the end edge of the rear plate side of the side metallic plate, it is possible to join this plate with the rear plate easily and tightly, and to enhance the safety by reinforcing the structurally weak portion of the rear plate side.

According to this invention, since the side circumference plate is formed of metal and its front edge portion constitutes the panel circumference reinforcing portion, it is possible to effectively reinforce the portion most in need of reinforcement, thereby completely preventing the implosion of the display. At the same time, since the side circumference plate itself is made of metal, even if the implosion occurs, the metallic material can retain its original form so as to minimize the amount of the broken glass and the scattering energy on the implosion. Namely, this invention has enabled the elimination of broken glass pieces conventionally generated on the implosion due to the breakage of the side circumference portion.

Further, in one embodiment, the integral structure of the side circumference plate and the rear plate by means of metallic material has enabled the construction of the flat display in reduced thickness, and the total elimination of broken glass pieces generated by the breakage of the rear plate on the implosion. In particular, by composing all the parts, except the front panel, of metallic material, it is possible to reinforce sufficiently all the portions except the image displaying section. As a result, in comparison with a vacuum tube totally formed of glass material, the weight and the thickness can be reduced, and the anti-implosion property can be enhanced.

Moreover, where the rear plate is composed of ceramic material, the electrode portion for generating electron beams or the like can be directly disposed on this rear plate without any insulating plate.

The term "flat-type display vacuum tube" is intended to encompass tubes with slightly convex front faces as shown in Figures 7 and 8 of the accompanying drawings.

The present invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

FIG. 1 is a cross-sectional view of a vacuum tube according to the first embodiment of this invention;

FIG. 2 is a cross-sectional view of a vacuum tube according to the second embodiment of this invention;

FIG. 3 is a cross-sectional view of a vacuum tube according to the third embodiment of this invention;

FIG. 4 is a cross-sectional view of a vacuum tube according to the fourth embodiment of this invention;

FIG. 5 is a cross-sectional view of a vacuum tube according to the fifth embodiment of this invention;

FIG. 6 is a cross-sectional view of a vacuum tube according to the sixth embodiment of this invention;

FIG. 7 is a cross-sectional view of a vacuum tube according to the seventh embodiment of this invention;

FIG. 8 is cross-sectional view of a vacuum tube according to the eighth embodiment of this invention;

FIG. 9 is a schematic view showing a transforming state of the vacuum tube;

FIG. 10 is a schematic view showing a distribution of stress applied to the surface of the vacuum tube;

FIG. 11 is a schematic view showing a vacuum tube according to an embodiment of this invention;

FIG. 12 is a cross-sectional view of a conventional vacuum tube;

FIG. 13 is a cross-sectional view showing another conventional vacuum tube.

The principles of this invention are particularly useful when embodied in a flat display vacuum tube such as shown in the drawings.

The present inventors have, on making the flat display vacuum tube, analyzed the mechanism of the stress applied to the tube and the implosion.

FIG. 9 of the accompanying drawings shows a transforming state of the vacuum tube, where the tube itself is represented by solid lines while the transforming state thereof when the inside of the tube is made vacuum is shown by the dashed lines. As shown by the dashed lines, when the inside is a vacuum, the atmospheric pressure acts on the vacuum tube to make the front display panel 1 and the rear plate inwardly concave, and the side metallic plate 2 outwardly convex.

Next, FIG. 10 shows a state of stress generated at the surface of the vacuum tube in accordance with the transformation of FIG. 9. The stress caused by this transformation of the vacuum tube must be taken into consideration with regard not only to the surfaces of the components, but also to their insides and rear surfaces. However, it seems that the main cause of the vacuum tube implosion lies in the faults on the glass surface. Therefore, the stress generating on the surface of the vacuum tube will now be mentioned.

In FIG. 10, the vacuum tube is shown by a solid line, while the dashed line located outside the solid

line represents a state where a tension is acting on the surface of the vacuum tube. The dashed line located inside the solid line represents a state where a compression is acting on the surface of the vacuum tube.

Here, when the vacuum tube is totally composed of glass, and if the causes of the implosion are classified into those caused by tension and compression, the number of cases due to tension are approximately ten times larger than those due to compression. Therefore, the portions in a state under tension are particularly to be taken care of.

In FIG. 10, the portions where the tension is especially high are the front circumference portion, the side portion, and the rear circumference portion.

Then, in the flat display vacuum tube according to this embodiment, as shown in FIG. 11, the front display panel 1 is formed of the same glass material as a conventional tube, and a rear plate 3 made of ceramic material is disposed parallel to the front display panel 1. In this case, an insulating ceramic material having a tensile strength reinforced by adding an alumina powder to a conventional glass, for example, is used as the rear plate 3.

Further, the flat display vacuum tube according to this embodiment is provided with a side metallic plate 2 between the front display panel 1 and the rear plate 3, said side metallic plate 2 having a front circumference portion formed by internally bending the end edge of the front display panel side.

Namely, as shown in FIG. 10, at a high-tension portion of the vacuum tube, a metallic material having a high breaking strength (in this case a metal of $B = 15 \text{ Kg/mm}^2$ is used) is employed. In comparison with the conventional glass material, the breaking strength in this present glass material is $B = 4\text{--}5 \text{ Kg/mm}^2$ approximately, but practically it is designed with a maximum stress value of approximately $0.7\text{--}0.8 \text{ Kg/mm}^2$ in order to sufficiently resist the wounds or defects made on the glass.

As a result, assuming that the conventional glass thickness is 10 mm, the corresponding thickness in this invention can be reduced to approximately 2 mm due to the use of metallic material. Even if the glass density is 2.5 g/cm^3 and the metallic material density is 7.8 g/cm^3 , the weight can be sufficiently reduced.

Furthermore, the glass surface of the front display panel 1 is under compression resistive to the implosion as shown in FIG. 10, while the portions having a high tension are metallized as mentioned above. Accordingly, the glass portion of the front display panel 1 can be designed with a lowered resistiveness in comparison with the conventional one. For example, the conventional thickness of 10 mm can be reduced to approximately 6 mm to realize a greater reduction in weight.

The present inventors have repeatedly experimented with a safety standard test in which a conventional flat display composed of only glass was

intentionally damaged and destroyed, and the scattering state of the broken glass fragmentations upon the implosion was observed using high-speed photography etc.. As a result, it has been found that the fragmentations of the side portion and the front circumference portion both having a high tension make up the majority of the glass fragmentation scattering toward the observers with a significant energy.

On the other hand, the vacuum tube according to this invention has been also observed by high-speed photography in the safety standard test. When the glass of the front display panel 1 shown in FIG. 11 is destroyed due to any reason, the glass fragmentations will be once absorbed into the vacuum space, and collide with the rear plate 3 or with an image projecting portion disposed thereon. But the rear plate 3 can not be destroyed by implosion because of being composed of ceramics having a high tensile strength. The majority of the kinetic energy of the implosion will be consumed by the collision of the glass fragmentation of the front display panel 1. Therefore, although small amounts of the glass fragmentation having collided with the rear plate 3 or the image projecting portion would forwardly scatter as a reflecting movement, the energy generating at this time will be significantly weakened so as to cause much less danger.

Also, according to this invention, since the side portion and the front circumference portion of the vacuum tube are composed of metallic plate, the amount of the scattered glass fragmentation will be significantly reduced, thereby assuring safety for the observers if the worst should happen.

Further, according to this embodiment, the rear plate 3 itself is composed of insulating ceramic material, and it is possible to dispose the image projecting portion for projecting the image onto the front display panel 1 directly thereon. As a result, no labor or cost for the insulating process is required, so the thickness of the display can be reduced.

The flat display vacuum tube according to this embodiment is designed as mentioned above, the detailed structure will be now described.

FIRST EMBODIMENT

FIG. 1 is a cross-sectional view showing a flat display vacuum tube according to the first embodiment of this invention.

The front display panel 1 is formed of the same glass material of Japanese electronic machine industry standard H8602 as the conventional one, so as to have a thickness of 6 mm. The inner surface of the glass is provided with a fluorescent screen 6 directly. Of course, it is alternatively possible to provide the screen on another glass plate separately from the front display panel 1, for watching the screen through the front display panel 1.

The side metallic plate 2 is formed of a metal of

SUS410 (13Cr - Fe) having 2 mm of thickness, and the end edge of the front display panel 1 side is internally bent to constitute the front circumference portion 2a. The metallic material used for this side metallic plate 2 is not limited to the above-mentioned metal, but it is desirable to select such metals that match well to the glass material, used for the front display panel 1, to which the metal is attached through a front glass being a solder glass.

Further, the diagonal dimension of the screen of the flat display vacuum tube according to the first embodiment is approximately 340 mm.

The above-mentioned metallic material is divided into a plurality of pieces for facilitating the manufacture, and the brazing or the welding is executed at the junction portion for assuring the vacuum tightness.

In addition, since the rear plate 3 is composed of an insulating ceramic material having a thickness of 8 mm (shown by sand pattern), there is no necessity to apply an insulating process. In this case, an image projecting portion 5 comprising an electron generating section, an electron convergent section and an electron beam deflecting section is directly disposed thereon.

As shown in FIG. 1 in this embodiment, a transparent glass coating film 7 having a thickness of approximately 20 m is baked onto the surface of the display panel 1. Therefore, since the surface of the display panel 1 is protected by this glass coating film 7, damage which may be the cause of the implosion can be prevented, thereby avoiding the scattering of the glass fragmentation.

Further, even if the implosion occurs, since the side metallic plate 2 is composed of metallic material and the rear plate 3 is composed of ceramic material of high tensile strength, the scattering glass fragmentations would only be generated from the display panel 1, and their scattering energy could be significantly weakened by the collision with the rear plate 3 etc., thereby remarkably enhancing the safety.

Moreover, since all the portions except the front display panel 1 are composed of metallic material and ceramic material having a tensile strength higher than that of glass material, the thickness of the components can be reduced, and the entire vacuum tube can be made light-weight.

SECOND EMBODIMENT

FIG. 2 is a cross-sectional view of a flat display vacuum tube according to the second embodiment of this invention.

This vacuum tube has a similar composition to that of the first embodiment, but has a rear circumference portion 2b formed by internally bending the end edge of the side metallic plate 2 around the side of the rear plate 3 to give it a U-shaped cross sectional configuration.

The front display panel 1 and the rear plate formed of ceramics are fixed to the inner side of the U-shaped bent portion so as to constitute an air-tight vacuum tube. As a result, it is possible to construct easily and rigidly a flat type vacuum display tube according to this embodiment.

Also, though not shown in FIG. 2, it is alternatively also possible to compose the entire side metallic plate 2, or the front circumference portion 2a or the rear circumference portion 2b not only with metallic material, but also with another type of material at its inner side taking account of the matching with the glass material of the display panel 1 and the ceramic material of the rear portion 3.

The flat display vacuum tube according to the second embodiment of this invention composed as mentioned above can easily and tightly hold the display panel 1 and the rear portion 3 by virtue of the U-shaped side metallic plate 2.

Although not shown in FIG. 2, the image projecting portion 5, the screen 6 and the glass coating film 7 in FIG. 1 are disposed in practically the same manner so as to constitute the display.

THIRD EMBODIMENT

FIG. 3 is a cross-sectional view of a flat display vacuum tube according to the third embodiment of this invention.

The vacuum tube in this third embodiment uses, as shown in FIG. 3, a U-shaped side metallic plate 2 likewise the above-mentioned second embodiment. However, the difference lies in that the rear plate 3 is externally attached to the bent portion. Even if the rear plate 3 is externally attached so, the rear plate can be fixed using the rear circumference portion 2b of the side metallic plate 2, hence the vacuum tube can be easily and tightly formed.

Although not shown in FIG. 3, as shown in FIG. 1, the image projecting portion 5, the screen 6, and the glass coating film 7 are disposed in the same manner so as to constitute the display.

FOURTH EMBODIMENT

FIG. 4 is a cross-sectional view of a flat display vacuum tube according to the fourth embodiment of this invention.

The vacuum tube of this fourth embodiment uses, as shown in FIG. 4, a U-shaped side metallic plate 2. But in contrast to the third embodiment mentioned above, the front display panel 1 side is tightly fixed externally to the front circumference portion 2a through free glass.

In this manner, since the front display panel 1 is fixed also through the front circumference portion 2a, it is possible to compose easily a tight vacuum tube.

Also, as shown in FIG. 4, in the fourth embodi-

ment, it is alternatively possible to provide a insulating film on the side metallic plate 2 including the front circumference portion 2a and the rear circumference portion 2b through a coating means, for the purpose of preventing rusting or of providing a certain potential to the metallic material of the plate 2.

Although not shown in FIG. 4, the image projecting portion 5, the screen 6 and the glass coating film 7 are disposed in the same manner as in FIG. 1 so as to constitute the display.

FIG. 5 shows a flat display vacuum tube according to the fifth embodiment of this invention. This vacuum tube comprises a front panel 1, a side circumference portion 2, and a rear portion 4. Likewise the conventional tube, the front panel 1 is formed of a transparent glass material, which specifically has a thickness of 6 mm and is of Japanese electronic machine industry standard H8602. Further, the side circumference portion 2 and the rear portion 4 are integrally composed of a metallic material, specifically of SUS410 (13Cr - Fe) having a thickness of 2 mm. The screen dimension of this vacuum tube in the diagonal direction is 340 mm. Of course, alternatively, screens of a different size can be used.

At the inner side of the front panel a screen 6 is formed, while at the inner side of the rear portion 4 an electrode portion 4 for emitting an electron beam is disposed. Since the rear portion 4 is composed of a metallic material, an insulating plate etc. must be disposed between the electrode portion and the rear portion 4, but is omitted in the shown embodiment.

The front edge of the side circumference portion 2 is internally bent (in the panel surface direction) to form a panel circumference reinforcing portion 2a. Namely, as shown in FIG. 12, the circumference of the panel is a tension portion where stresses concentrate so it needs to be reinforced. The front panel 1 is joined to this panel circumference reinforcing portion 2 through a flit glass being a solder glass etc..

In this embodiment, the side circumference portion 2 comprises a panel circumference reinforcing portion 2a as its front edge and a side portion 2c coupled thereto. In manufacture, both these portions are integrated by brazing or welding. The same is true for the relationship between the side circumference portion 2 and the rear portion 4. In any case, integrally composing all of the components except the front panel 1 of metallic material has enabled the provision of a flat display vacuum tube which is remarkably light-weight and relatively thin.

On the outside of the front panel 1, there is a glass coating having a thickness of, for example, 20 m to protect the glass surface from external influences and to restrict the scattering of glass fragmentations in case of implosion.

The above composition using metallic material for the portions of quite high tension provides a very high resistiveness against the implosion. As a result, it is

possible to reduce the weight and thickness of the vacuum tube of the flat display. Specifically, if the side circumference portion etc. is composed of metal, the implosion-causing stress will be approximately 15 Kgf/mm². On the contrary, if the vacuum tube is composed of glass, normally the stress is approximately 4 - 5 gf/mm², but taking account of the above lag destruction and defects, it would be necessary in practice to design with 0.7 - 0.8 Kgf/mm² as a maximum stress value.

Under these preconditions, comparing the conventional tube with that of the present embodiment, the thickness of the glass can be reduced in this embodiment to 2 mm approximately from the conventional one of 10 mm approximately, by virtue of using the metallic material. Therefore, it becomes possible to reduce extremely the thickness of the flat display vacuum tube.

Moreover, the density of the glass is approximately 2.5g/cm³, while that of the metallic material is e.g. 7.8g/cm³. Consequently, according to this embodiment, the weight of the vacuum tube can be significantly reduced.

Further, in the case of an implosion occurring, the glass fragmentations generated by the destruction of the front panel would collide with the side circumference portion 2 and the rear portion 4, and thereafter reflect backwardly to scatter in the forward direction. In this embodiment, however, since the metallic material acts to absorb the majority of the scattering energy and the inner side of the panel circumference reinforcing portion 2a can partly retain the scattering glass fragmentations, it is possible to reduce the amount and energy of the glass forwardly scattering fragmentation.

Next, a sixth embodiment of this invention will now be described referring to FIG. 6. In this embodiment and subsequent embodiments hereinafter described, the same numerals as in the first embodiment designate the same or similar components, so the descriptions for such components are omitted.

While in the first embodiment the front panel 1 was coupled to the inside of the panel circumference reinforcing portion 2a, this sixth embodiment features the coupling of the front panel 1 to the outside of the panel circumference reinforcing portion 2a so as to render the same effect as in the first embodiment. In this shown embodiment, the components such as the electrode portion 5 are omitted from the illustration.

FIG. 7 shows a seventh embodiment of this invention. This embodiment features composing the central portion of the front panel in a forwardly projected fashion so as to form a slightly convex configuration. Corresponding to this convexity, the panel circumference reinforcing portion 2a also has a certain curvature.

FIG. 8 shows a front panel 1 composed to have a slightly convex configuration likewise the seventh

embodiment. Differing from the seventh embodiment, the front panel 1 is disposed inside of the panel circumference reinforcing portion 2a. In this manner, providing a slight curvature to the front panel 1 as shown in FIGS. 7 and 8 enables a reduction in the stress generated in the front panel 1 relatively easily, and likewise a reduction in the thickness of the front panel 1. Of course, the front panel 1 can alternatively be composed with concave configuration, if necessary.

As mentioned above, according to this invention, since the side circumference portion 2 has been composed of metallic material or ceramics and its front edge has been bent to form the panel circumference reinforcing portion 2a, the panel circumference to which the stress concentrates can be effectively reinforced so as to realize a flat display vacuum tube which is quite strong against the implosion. Further, such a composition can reduce the thickness and the weight of the vacuum tube itself. Moreover, these effects can be enhanced further by integrally composing the side circumference portion and the rear portion in a metallic material. Also, it is possible to coat the outer circumference of the metallic material with an insulating film to prevent oxidation.

Claims

1. A flat-type display vacuum tube including: a front panel (1) for displaying an image; a side plate (2) having a front edge coupled to the front panel (1); a rear plate (31) coupled to the rear edge of the side plate (2);
characterized in that said side plate (2) comprises a portion of metallic material and has a front edge (2a) bent radially inwardly of the panel to form a panel circumference reinforcing portion (2a).
2. A flat-type display vacuum tube according to claim 1 wherein said front panel (1) is coupled to the front panel circumference reinforcing portion (2a).
3. A flat-type display vacuum tube according to claim 1 or 2, wherein said side circumference plate (2) and said rear plate (3) are integrally composed of metallic material.
4. A flat-type display vacuum tube according to claim 1 or 2, wherein said rear plate (3) is composed of ceramic material.
5. A flat-type display vacuum tube according to claim 1 or 2 wherein the rear plate (3) comprises an insulating ceramic material for mounting an image projecting device (5) projecting the image

onto the front display panel (1); and

said side plate is a side metallic plate formed of a metallic frame airtightly coupled to both the front display panel (1) and the rear plate (3).

6. A flat-type display vacuum tube according to claim 4 or 5, wherein said rear plate (3) is composed of a ceramic material which has a tensile strength higher than that of glass.
7. A flat-type display vacuum tube according to any one of the preceding claims, wherein the rear edge of the side metallic plate is bent radially inwardly to form a rear circumference portion.

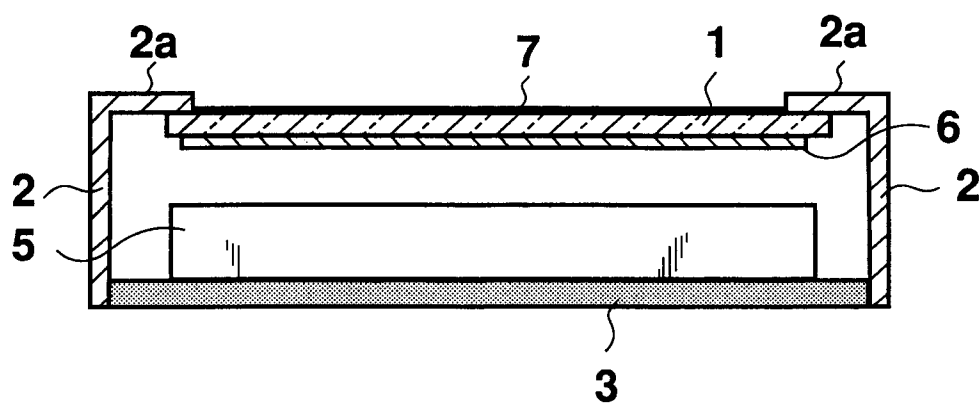


Fig. 1

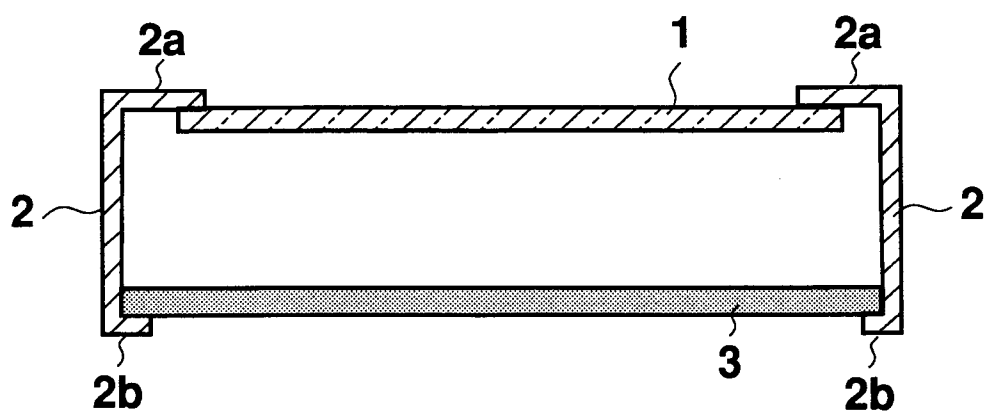


Fig. 2

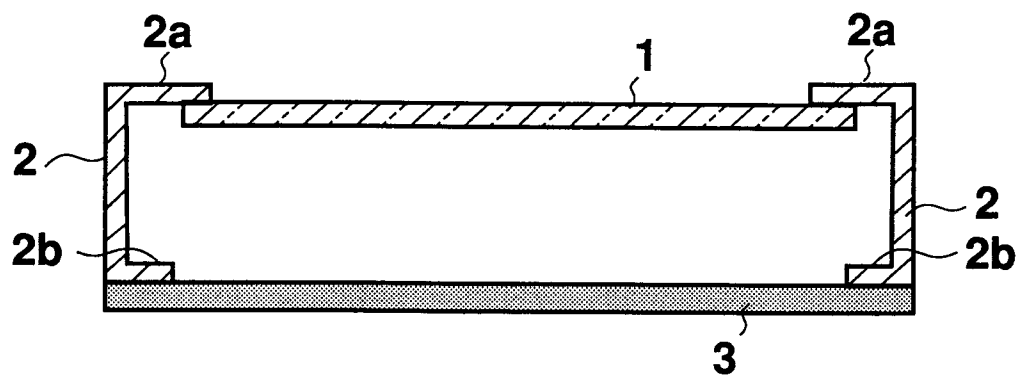


Fig. 3

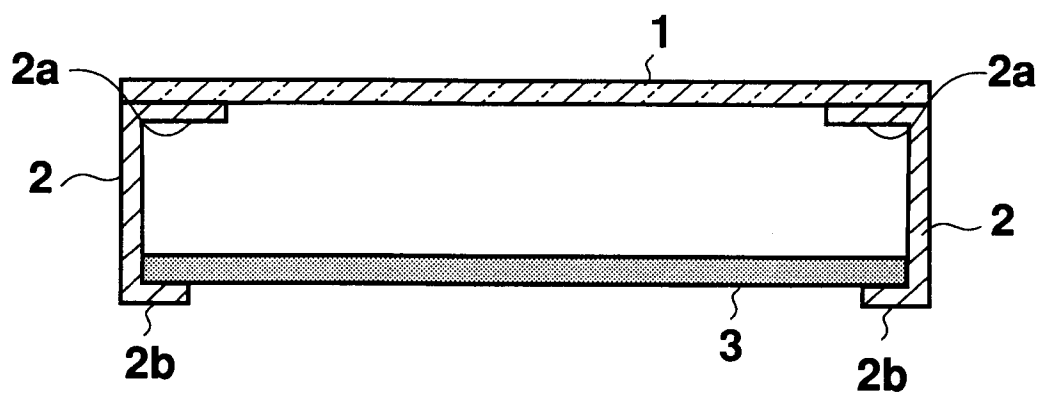


Fig. 4

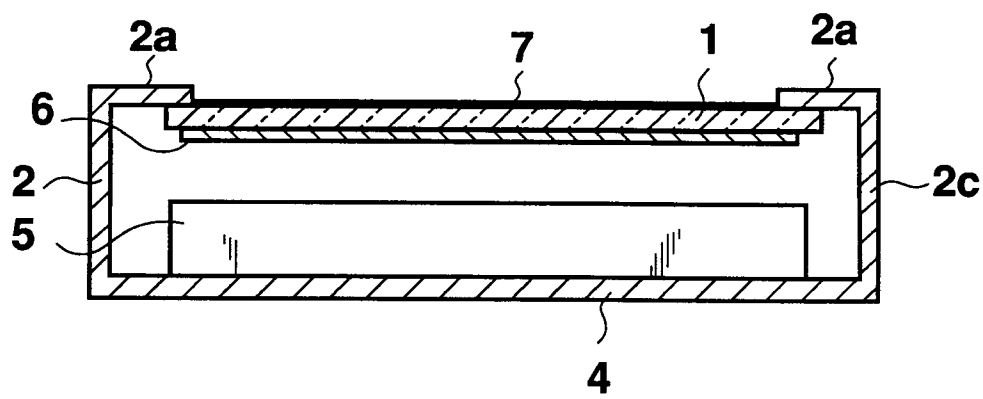


Fig. 5

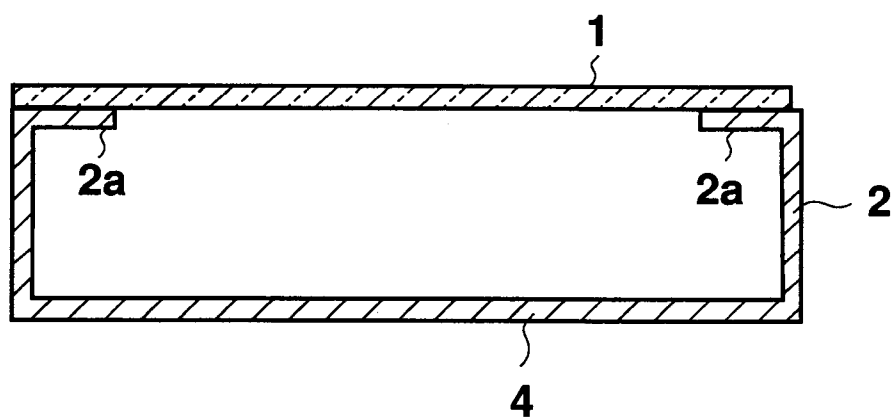


Fig. 6

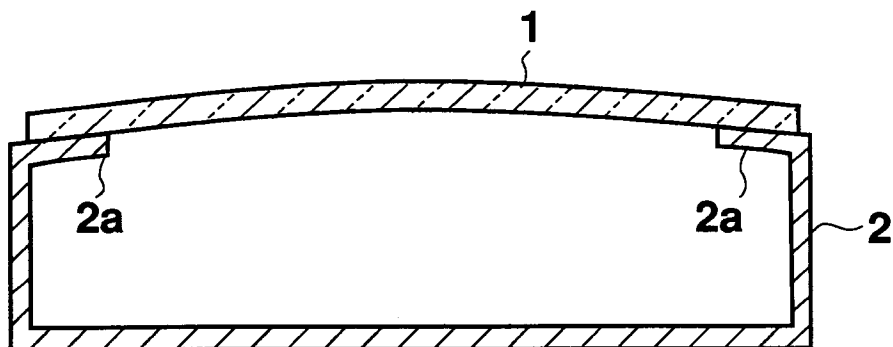


Fig. 7

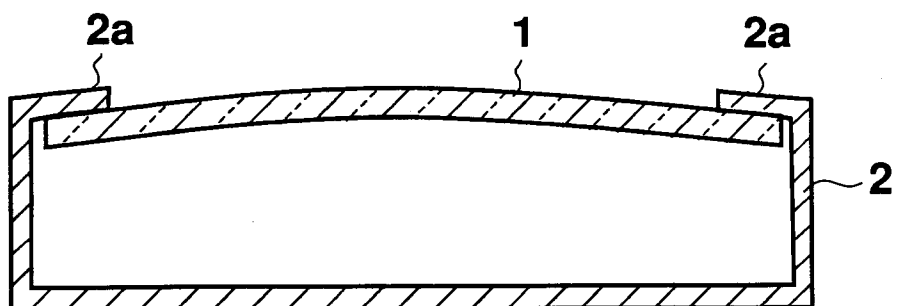


Fig. 8

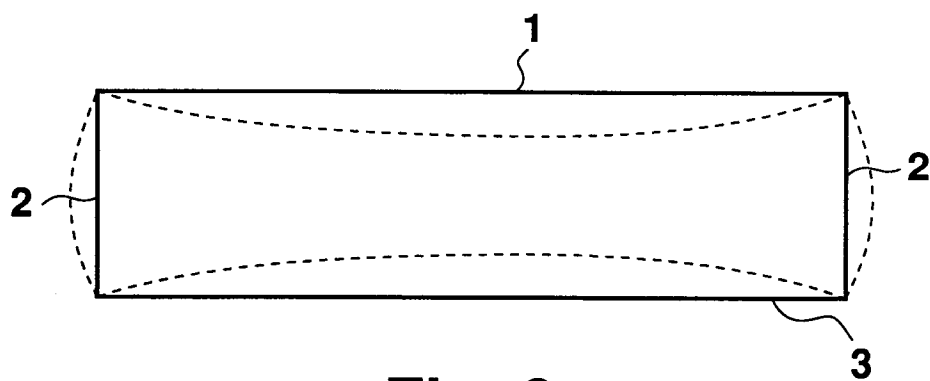


Fig. 9

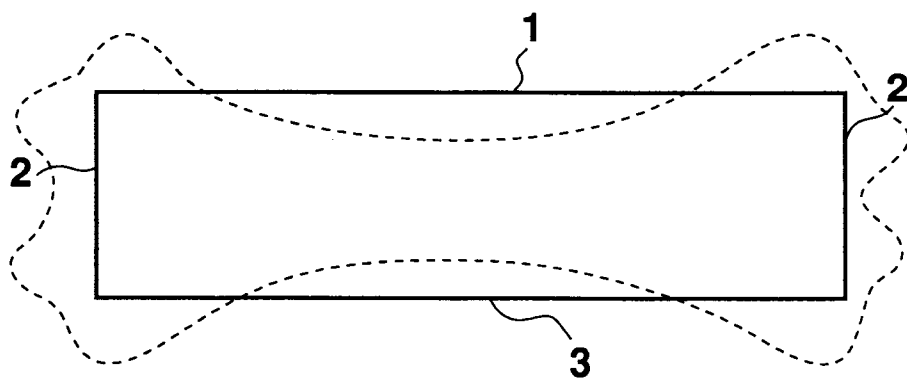


Fig. 10

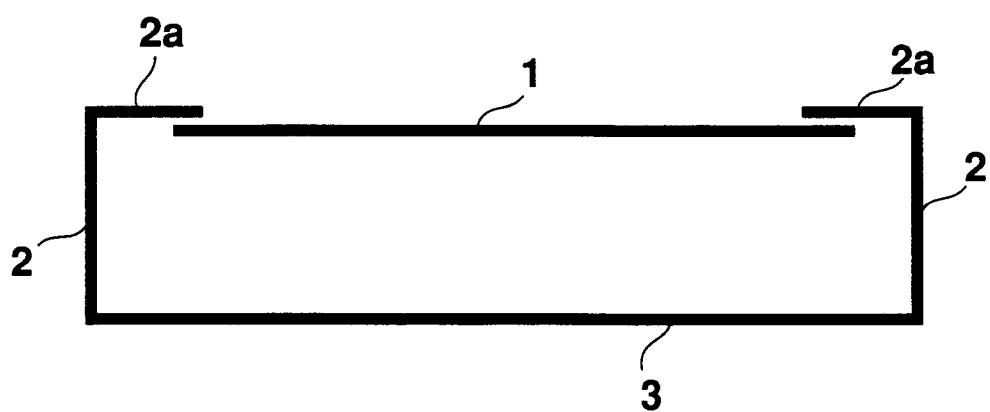


Fig. 11

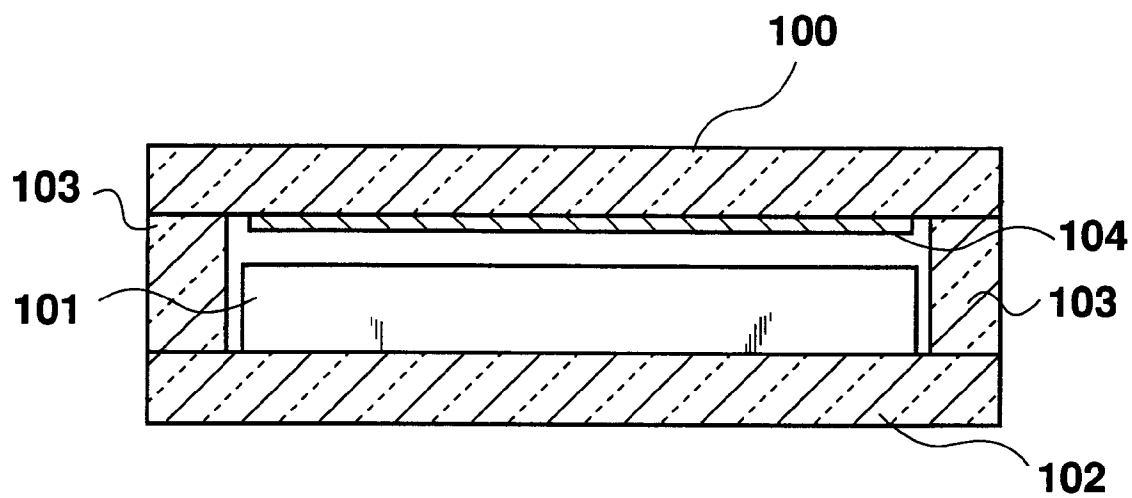


Fig. 12

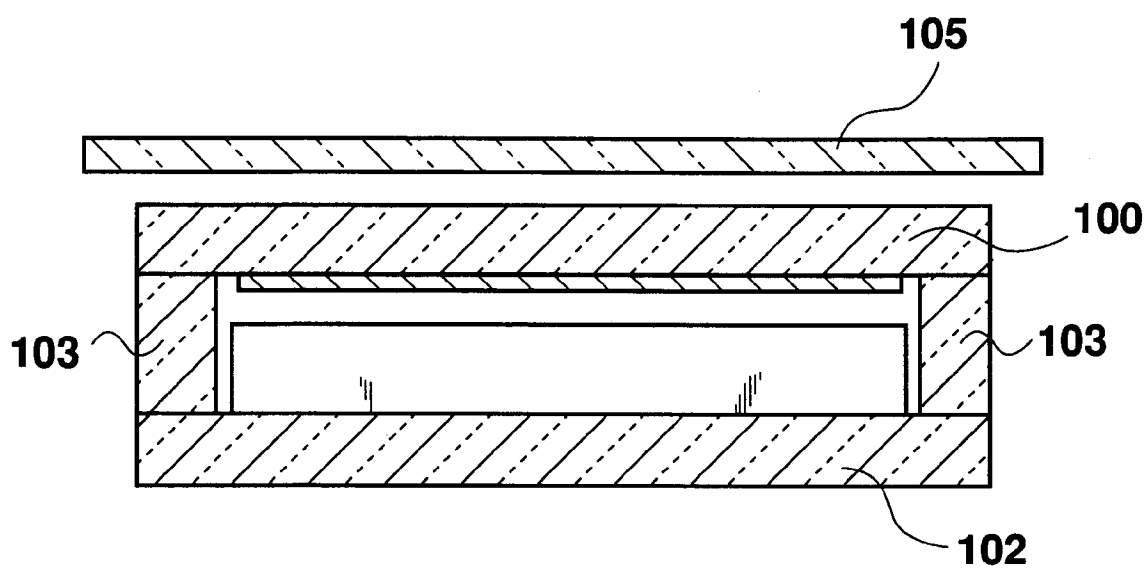


Fig. 13



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 31 0142

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.5)
Y	EP-A-0 233 677 (PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES) * page 1, line 14 - line 21; figures * * page 3, line 5 - line 18 * * page 5, line 3 - line 6 * * page 6, line 7 - line 12 * * page 7, line 11 - line 15 * ---	1-3, 7	H01J29/87
Y	PATENT ABSTRACTS OF JAPAN vol. 10, no. 306 (E-446)(2362) 17 October 1986 & JP-A-61 121 243 (MATSUSHITA ELECTRIC IND.CO.LTD.) 9 June 1986 * abstract * ---	1-3, 7	
A	EP-A-0 257 676 (PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED) * column 2, line 50 - column 3, line 7 * * column 7, line 19 - line 27; figure 3 * ---	1-3, 7	
A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 179 (E-414)(2235) 24 June 1986 & JP-A-61 029 054 (NEC CORP.) 8 February 1986 * abstract * -----	1, 4	TECHNICAL FIELDS SEARCHED (Int. Cl.5) H01J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 MARCH 1992	Examiner COLVIN G. G.
CATEGORY OF CITED DOCUMENTS 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 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			

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