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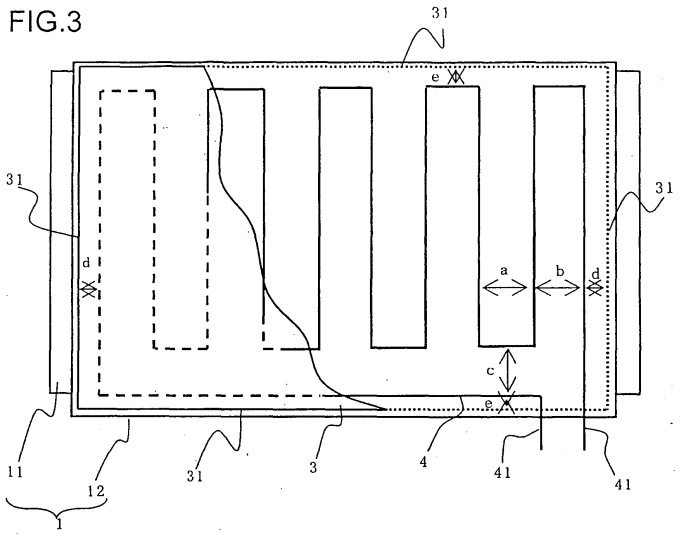
(54) DISPLAY DEVICE PROVIDED WITH GLASS PANEL AND METHOD FOR SEPARATING SAME

(57) A planar display device is provided by adhering a glass panel on a metal plate, in which a display panel main body can be easily separated from a metal material without using large equipment and a special tool, with an adhesive. In the display device, the PDP panel (1) is adhered to the metal plate, not shown in the drawing, through the adhesive layer (3). A wire-like heat generating body (4) is continuously arranged at equal intervals on the adhesive layer (3) with both end sections (41) brought close and protruding from the adhesive layer (3). The adhesive layer (3) is heated to reduce adhesive force by permitting a current to flow in the wire-like heat generating body (4), and the panel is separated from the metal plate.

FIG.3



EP 1 903 540 A1

Description

Technical Field

[0001] The present invention relates to a planar display device which makes it easy to separate a display panel (planar display device) composed mainly of glass and a metal plate (holding mechanism) to which this display panel is adhered, from each other, and a method for the separation.

Background Art

[0002] Development of various planar display devices have been advanced, such as a PDP display device, a liquid crystal display device, an EL display device and an FED (field emission device) display device. The display section (display panel) of these planar display devices is composed mainly of glass. Therefore, the planar display device composed of glass is firmly fixed on a chassis member (holding mechanism) constituted by a metal plate such as aluminum and iron plates with the use of double-sided adhesive tape, for the purpose of security of strength and heat radiation. Fixation of the display panel composed of glass on the chassis member generally requires strength to make separation difficult, and the display panel is firmly adhered and fixed.

[0003] Recently, from the viewpoint of environmental protection, it is compulsorily required to, when these planar display devices are disposed of, classify the materials and recycle reusable materials. In such a situation, there has been required a technique for separating the display panel and the metal plate from each other when such a large-sized planar display device that one side is more than 1 m is disposed of. That is, though the chassis member can be easily recycled because its main components are aluminum and iron, special processing is required for the main body of the PDP panel because it includes lead and other chemical substances.

[0004] To separate the display panel and the chassis member from each other, the double-sided adhesive tape is cut or taken off by some method. However, the double-sided adhesive tape has strong sticking force (adhesive force), it is difficult to separate the PDP panel main body and the chassis member from each other in an ordinary method.

[0005] As an example of this technique, a technique is proposed in which there are provided a display panel main body and a metallic chassis member which holds the display panel main body by the display panel main body being adhered thereto with adhesive; a heat generating member is arranged in the adhesive; and, when the display panel main body and the chassis member are separated from each other, the adhesive is melted or deteriorated by the heat of the heat generating member to reduce the adhesive force (Patent Document 1).

[0006] It is also proposed that there are provided a display panel having multiple discharge cells and a chassis member which holds the display panel by the backside of the display panel being adhered thereto with a thermal conductive sheet; the thermal conductive sheet is configured by forming adhesive layers on both sides of a porous insulating sheet having thermal conductivity; in the case of adhering the display panel to the chassis member via the thermal conductive sheet, the display panel and the chassis member are adhered with the thermal conductivity sheet by adhering the thermal conductive sheet to the front of the chassis member first, and then overlapping the backside of the display panel on the thermal conductivity sheet of the chassis member; and, in the case of separating the display panel from the chassis member, a cutting member is inserted into the porous insulating sheet part of the adhesive sheet to cut it (for example, see Patent Document 2).

[0007] Additionally, there are proposed a method in which the adhesive layer between the display panel main body and the chassis member is cut with the use of a saw (band saw) or a wire (for example, see Patent Documents 3 and 4), a method in which the display panel main body and the chassis member are separated from each other by heating and melting the adhesive layer with power from a radio-frequency power source to (for example, see Patent Document 5), and a method in which a pyroconductive member composed of stretch release adhesive article is meanderingly arranged to adhere the display panel main body and the chassis member to each other, and, at the time of separation, the end section of the stretch release tape is pulled to reduce the adhesive force for separation (for example, see Patent Document 6).

Patent Document 1: Japanese Patent Laid-Open Publication No. 2002-123187

Patent Document 2: Japanese Patent Laid-Open Publication No. 2004-4075

Patent Document 3: Japanese Patent Laid-Open Publication No. 2004-29630

Patent Document 3: Japanese Patent Laid-Open Publication No. 2004-184677

Patent Document 5: Japanese Patent Laid-Open Publication No. 2004-111092

Patent Document 6: Japanese Patent Laid-Open Publication No. 2004-309547

Disclosure of the Invention

[0008] In the method described in Patent Document 1 described above, since the heat generating member is exposed at the end part of the panel, it is necessary to process this part. In the method of Patent Document 2, it is necessary to insert the cutting member into the insulating sheet at the time of cutting. In the methods described in Patent Documents 3 to 5, it is necessary to provide a sawing device and a special tool, or equipment such as a radio-frequency power source for the disposal processing place. Furthermore, in the method of Patent Document 6, since a large amount of special tape is used,

the manufacturing cost increases. Furthermore, unevenness is caused in the heat transmission between the PDP panel main body and the chassis member, and the screen is affected thereby. There is also a possibility that the stretch-separation type adhesive is cut at the time of separation and separation becomes impossible.

[0009] The present invention solves the above problems of the prior-art techniques, and an object of the present invention is to provide a planar display device which makes it possible to, at the time of disposal processing, easily separate a display panel main body and a chassis member without preparing large-sized equipment or special tools. Furthermore, another object of the present invention is to provide a planar display device using not special double-sided adhesive tape but inexpensive wire, the manufacturing cost of which is low.

[0010] In the present invention, in order to cope with the above problems, a heat generating body is arranged within a plane at predetermined intervals, in contact with an adhesive layer for adhering the metal section and the glass section to each other, and, by heating the adhesive layer to reduce its adhesive force, the glass section and the metal plate are separated from each other.

[0011] In order to cope with the above problems, in the present invention there is provided a display device comprising a display panel composed mainly of glass, an adhesive layer arranged at the back side of the display panel, and a metal plate to which the display panel is adhered with the adhesive layer, wherein one or more wire-like heat generating bodies are arranged between the display panel and the metal plate, in contact with the adhesive layer, and the wire-like heat generating body is continuously arranged on a plane at predetermined intervals.

[0012] According to the present invention, in the above display device, both end sections of the wire-like heat generating body protrude from the display device so that it is possible to cause electricity to flow through the heat generating body from the outside. Furthermore, according to the present invention, in the above display device, the wire-like heat generating body is electrically insulated, except for the vicinity of the end sections, and furthermore, both end sections of the wire-like heat generating body are arranged close to each other, protruding from the adhesive layer.

[0013] According to the present invention, in the above display device, the distance of the wire-like heat generating body from the end section of the adhesive layer is set to 1/2 or less of the interval used for arrangement of the wire-like heat generating body, if there is not any other wire-like heat generating body between the wire-like heat generating body and the end section of the adhesive layer.

[0014] According to the present invention, there is provided a separation method for a display device comprising a display panel composed mainly of glass, an adhesive layer arranged at the back side of the display panel, and a metal plate to which the display panel is adhered with the adhesive layer, in which one or more wire-like heat generating bodies are arranged between the display panel and the metal plate, in contact with the adhesive layer, and the wire-like heat generating body is continuously arranged on a plane at predetermined intervals, wherein, when the display panel and the metal plate are separated from each other, the adhesive layer is heated by causing electricity to flow through the wire-like heat generating body before separating the display panel and the metal plate.

[0015] According to the present invention, it is possible to, when disposing of a display panel device which is composed of glass and which is adhered to a metal plate, easily separate the display panel and the metal plate from each other.

Brief Description of the Drawings

[0016]

Figure 1 is a detailed perspective view illustrating the outline of the structure of a PDP panel main body constituting a PDP display device according to the present invention;

Figure 2 is a plane view illustrating the structure on the metal plate side constituting a PDP panel module according to the present invention;

Figure 3 is a plane view with a part removed, illustrating the structure of the PDP panel module according to the present invention;

Figure 4 is a diagram showing the structure of the PDP panel module according to the present invention when seen from the above; and

Figure 5 is a plane view with a part removed, illustrating the structure of a second embodiment of the PDP panel module according to the present invention.

Description of Symbols

[0017]

1	PDP panel body
11	front glass plate
111	X electrode
112	Y electrode
113	dielectric layer
114	protection layer
12	back glass plate
121	address electrode
122	dielectric layer
123	barrier rib
124	phosphor
2	metal plate
21	X driving circuit
22	Y driving circuit
23	address driving circuit
24	power source circuit

25	control circuit
51, 52	flexible printed circuit-board
3	adhesive layer
4	heat generating body
41	end section

Best Mode for Carrying Out the Invention

[0018] Embodiments of the present invention will be described with the use of Figures 1 to 6, with a plasma display (PDP) as an example.

[0019] An example of the structure of a PDP panel body 1 according to the present invention will be described with the use of the detailed perspective view of Figure 1. On a front glass plate 11 composed of glass, X electrodes 111 and Y electrodes 112 which repeatedly discharge electricity are arranged alternately in parallel. This electrode group is covered with a dielectric layer 113, and the surface of the layer is further covered with a protection layer 114 of MgO or the like. On a back glass plate 12, which is composed of glass similarly to the front glass plate 11, address electrodes 121 are arranged almost vertically to the X electrodes 111 and the Y electrodes 112, and they are further covered with a dielectric layer 122. On both sides of the address electrode 121, bulkheads 123 are arranged to separate the column-direction cells. Furthermore, on the side faces of the dielectric layer 122 over the address electrodes 121 and of the bulkheads 123, fluorescent bodies 124R, 124G, 124B are applied which generate red (R), green (G) and blue (B) visible lights when excited by ultraviolet rays. The panel is configured by attaching the front glass plate 111 and the back glass plate 12 to each other in a manner that the protection layer 114 and the top faces of the bulkheads 123 are in contact with each other, and enclosing discharge gas such as Ne and Xe.

[0020] The configuration of the back of the PDP module will be described with the use of Figure 2. On a metal plate 2 adhered and provided on the back of the back glass plate 12 of the PDP panel body 1, there are provided an X driving circuit 21 for applying voltage to the X electrodes 111, a Y driving circuit 22 for applying voltage to the Y electrodes 112, an address driving circuit 23 for applying voltage to the address electrodes 121, a power source circuit 24 for the driving circuits, and a control circuit 25 for controlling the circuits.

[0021] Except for the circuit elements of the PDP module and the metal plate 2, the PDP module according to the present invention is configured to have the PDP panel body 1 provided with the front glass plate 11 and the back glass plate 12, and an adhesive layer 3 composed of, for example, double-sided adhesive tape, for adhering the back glass plate 12 of the PDP panel body 1 and the metal plate 2 which works as the holding section for the PDP panel body 1 to each other, as shown in Figure 3, which is a plane view with a part of the adhesive layer 3 removed. The present invention is characterized in that a wire-like heat generating body 4 is arranged at predetermined intervals in contact with the adhesive layer 3. Both end sections 41 of the wire-like heat generating body 4 are provided close to each other, and they protrude from the end section of the PDP module, that is, an adhesive layer end section 31.

[0022] Acrylic foam agent is used as the base material of the double-sided adhesive tape which forms the adhesive layer 3, and acrylic adhesive is used as the adhesive layer. The temperature required to take off the double-sided adhesive tape is about 200°C as a practical temperature, though the adhesive force almost disappears at about 180°C.

[0023] The cross-sectional structure of the PDP module will be described with the cross-sectional view of Figure 4. The back glass plate 12 is adhered to the metal plate 2 with the adhesive layer 3. Between the back glass plate 12 and the metal plate 2, the heat generating body 4 is provided in contact with the adhesive layer 3. The X driving circuit 21, the Y driving circuit 22, the power source circuit 24 and the like are mounted on the metal plate 2. The X driving circuit 21 and an X electrode connection pad provided for the front glass plate 11 are connected via a flexible substrate 51, and the Y driving circuit 22 and a Y electrode connection pad provided for the front glass plate 11 are connected via a flexible substrate 52. Furthermore, the address driving circuit 23 and an address electrode connection pad provided for the back glass plate 12 are connected via a flexible substrate, though it is not shown in Figure 4.

[0024] The heat generating body 4 shown in Figure 3 is of material which is caused to heat by an electric current being applied, for example, copper or Nichrome wire. Except for the end sections 41, the surface is covered with an electrically insulating substance, especially at the parts in contact with the metal plate. The end sections 41 are drawn out from the end face of the PDP panel module so that a current source not shown in the figure is connected to the end sections 41 when the PDP module is disposed of.

[0025] The wire-like heat generating body 4 is planarly arranged so that the intervals a, b and c between parts of the heat generating body 4 are almost the same. On the other hand, the distances d and e of parts of the heat generating body 4 positioned near the end sections 31 of the adhesive layer 3, from the end sections 31 of the adhesive layer 3 are assumed to be half the intervals a, b and c between parts of the heat generating body 9 or less. Thereby, it is possible to efficiently heat the adhesive layer 3 by the heat generating body 4, reduce the adhesive force of the adhesive layer 3, and easily separate the back glass plate 12 and the metal plate 2 from each other.

[0026] The end sections 41 of the heat generating body 4 protrude from the adhesive layer 3, being close to each other, in order that the heat generating body 4 can be easily connected to an external current source. If the end sections 41 of the wire-like heat generating body 4 are drawn out on both sides of the module, the end

sections 41 are away from each other when the panel size is large. For example, in the case of a 40-type panel, the end sections 41 are away from each other by as much as 1 m, and it is difficult to connect them to an external current source.

[0027] The arrangement of the wire-like heat generating body 4 shown in the above embodiment is only an example. A second embodiment of the present invention will be described with the use of the plane view of Figure 5. In this embodiment, the wire-like heat generating body 4 is arranged symmetrically. By pulling the wire-like heat generating body 4 in the arrow direction after heating, the adhesive layer 3 is cut, and the back glass plate 12 and the metal plate 2 are separated from each other.

[0028] In the above embodiments, one wire-like heat generating body 4 is folded and arranged from the end of the PDP panel module to the other end thereof. However, it is also possible to provide multiple wire-like heat generating bodies 4 and divide the heat generation area horizontally or vertically.

Claims

1. A display device comprising a display panel composed mainly of glass, an adhesive layer arranged at the back side of the display panel, and a metal plate to which the display panel is adhered with the adhesive layer, the display device being **characterized in that**:

   one or more wire-like heat generating bodies are arranged between the display panel and the metal plate, in contact with the adhesive layer, and the wire-like heat generating body is continuously arranged on a plane at predetermined intervals.

2. The display device according to claim 1, **characterized in that**:

   both end sections of the wire-like heat generating body protrude from the display device so that it is possible to cause electricity to flow through the heat generating body from the outside.

3. The display device according to claim 1, **characterized in that**:

   the wire-like heat generating body is electrically insulated, except for the vicinity of the end sections.

4. The display device according to claim 1, **characterized in that**:

   both end sections of the wire-like heat generating body are arranged close to each other, protruding from the adhesive layer.

5. The display device according to claim 1, **characterized in that**:

   the distance of the wire-like heat generating body from the end section of the adhesive layer is set to 1/2 or less of the interval used for arrangement of the wire-like heat generating body, if there is not any other wire-like heat generating body between the wire-like heat generating body and the end section of the adhesive layer.

6. A separation method for a display device comprising a display panel composed mainly of glass, an adhesive layer arranged at the back side of the display panel, and a metal plate to which the display panel is adhered with the adhesive layer, in which one or more wire-like heat generating bodies are arranged between the display panel and the metal plate, in contact with the adhesive layer, and the wire-like heat generating body is continuously arranged on a plane at predetermined intervals, the separation method being **characterized in that**:

   when the display panel and the metal plate are separated from each other, the adhesive layer is heated by causing electricity to flow through the wire-like heat generating body before separating the display panel and the metal plate.

FIG.1

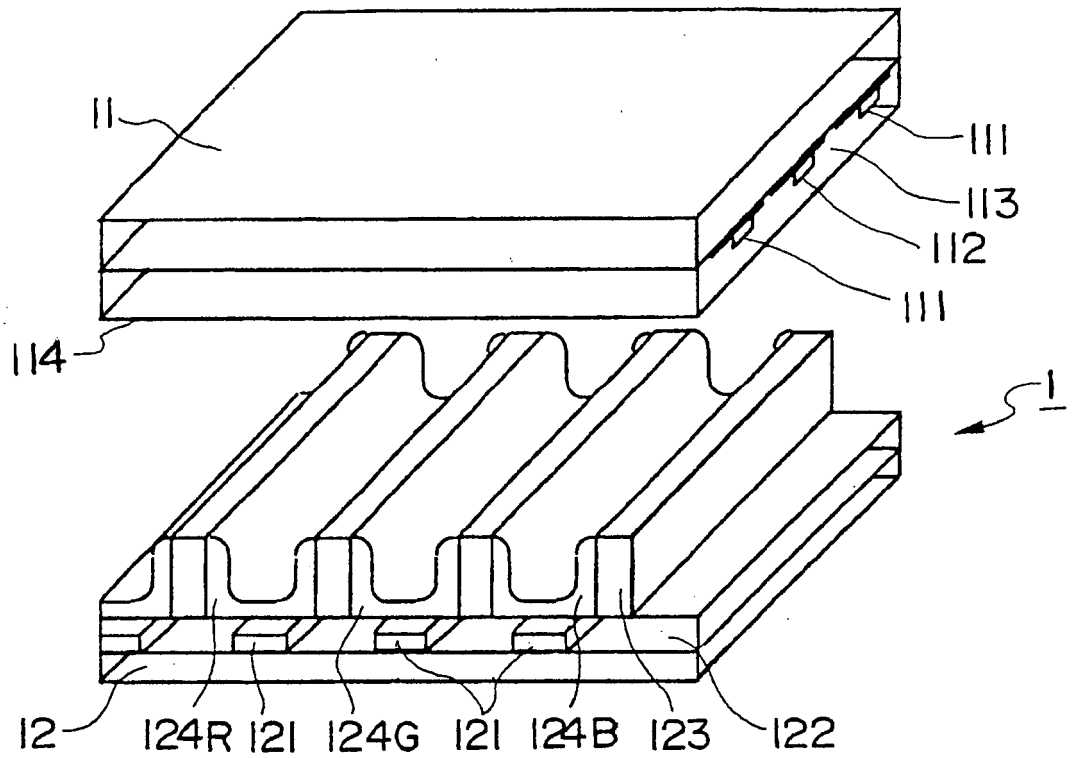


FIG.2

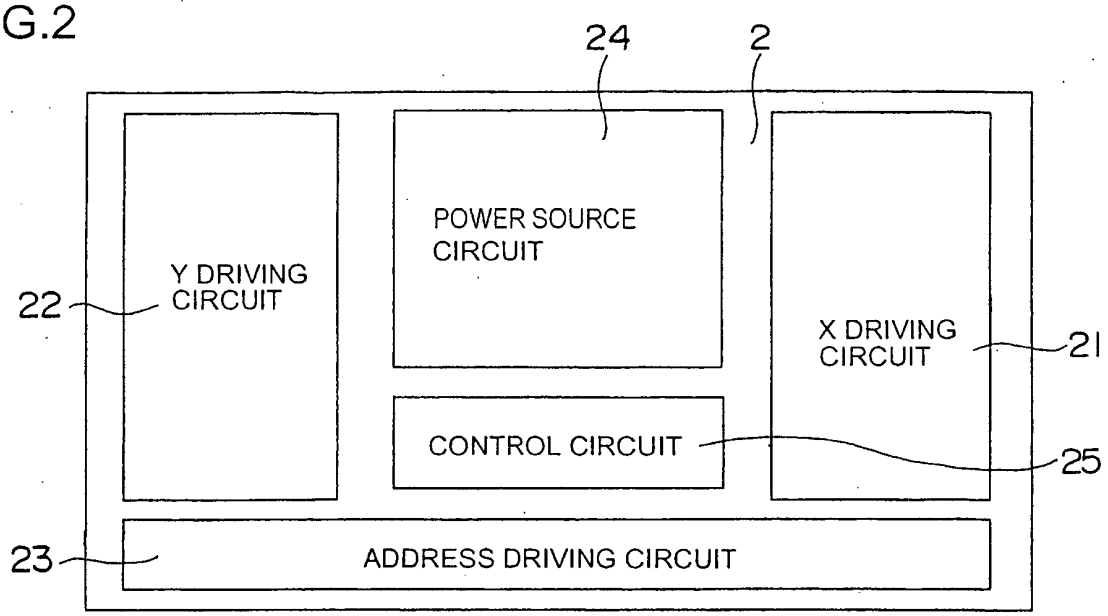

24
2
POWER SOURCE CIRCUIT
Y DRIVING CIRCUIT
22
X DRIVING CIRCUIT
21
CONTROL CIRCUIT
25
23
ADDRESS DRIVING CIRCUIT

FIG.3

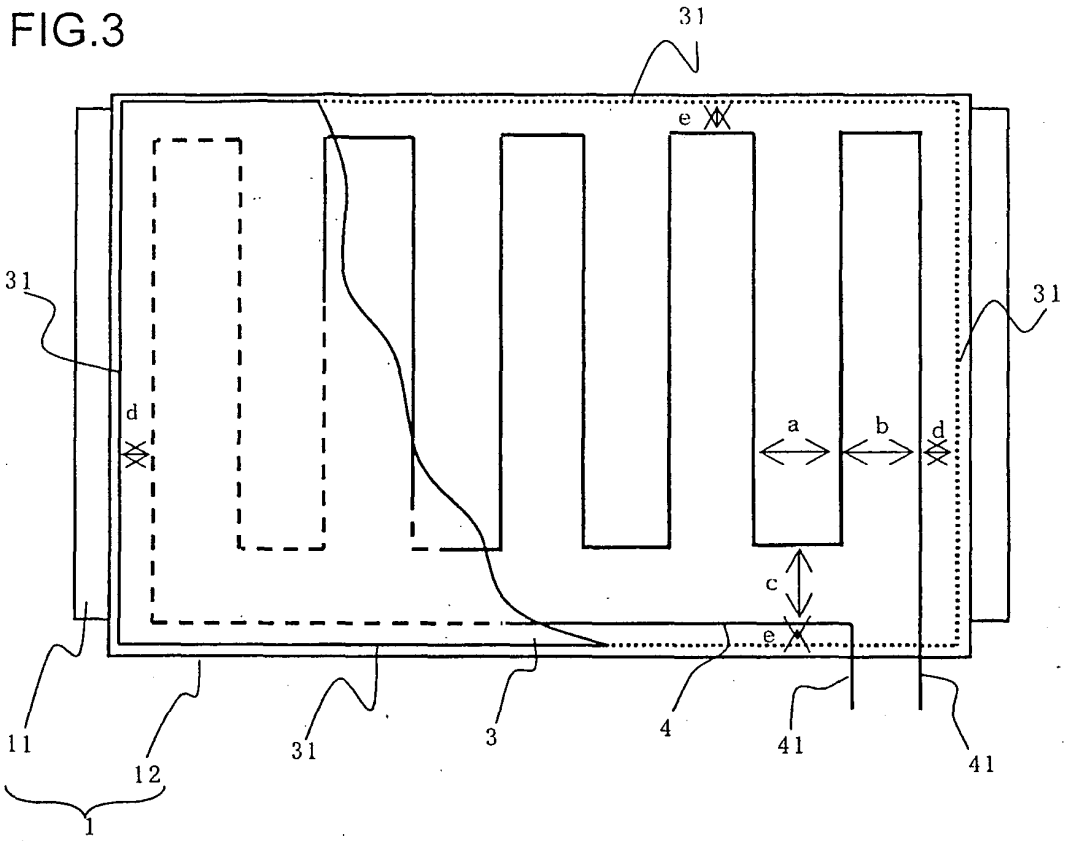


FIG.4

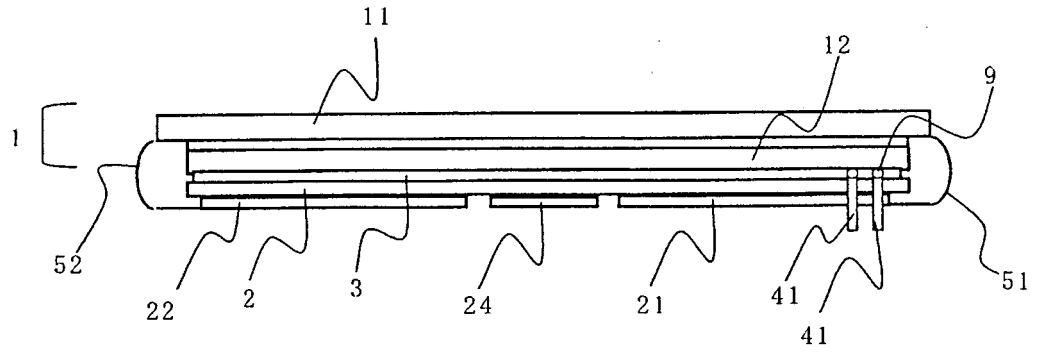
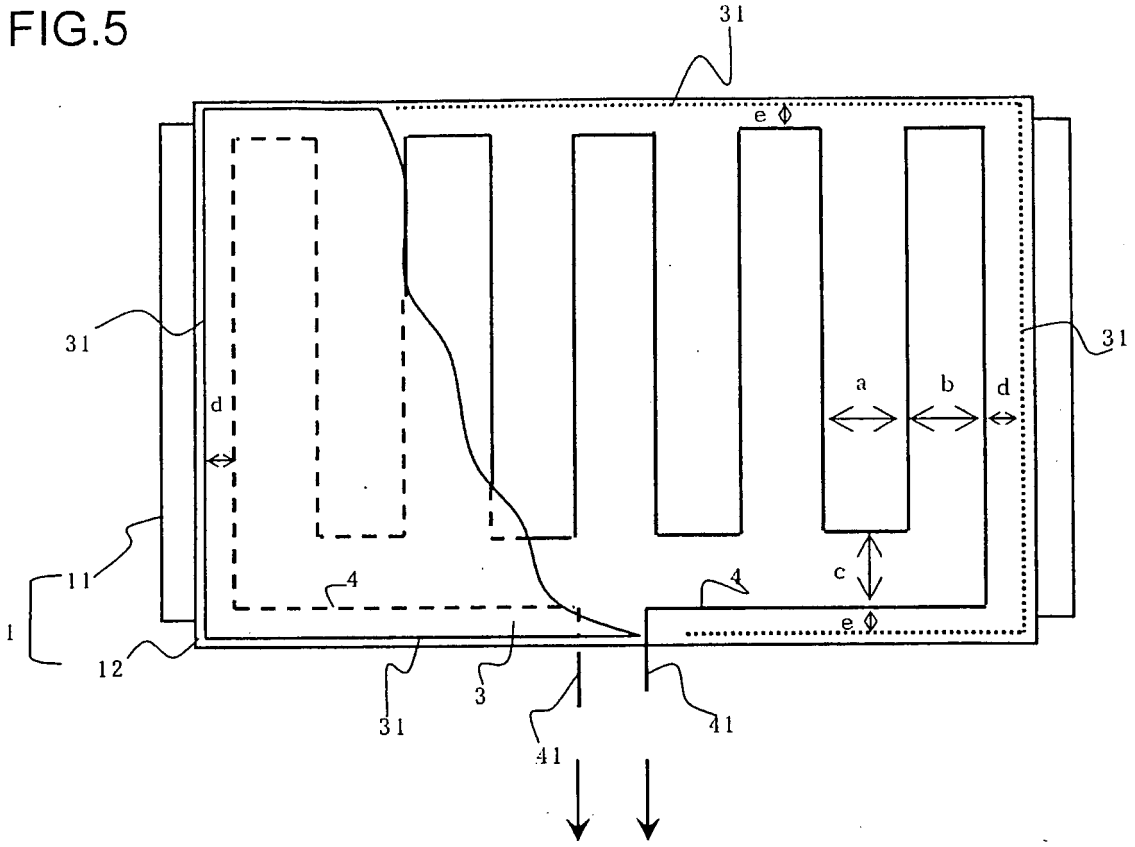


FIG.5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/012829

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] G09F9/00, B26D1/46, C09J5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] G09F9/00-9/46, B26D1/25-11/00, C09J1/00-5/10, H01J29/86-29/98

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2005
Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2002-123187 A (Matsushita Electric Industrial Co., Ltd.), 26 April, 2002 (26.04.02), Par. Nos. [0029] to [0033]; Figs. 7 to 9 (Family: none)	1-6
Y	JP 2001-282114 A (Hitachi, Ltd.), 12 October, 2001 (12.10.01), Par. Nos. [0019] to [0021]; Figs. 1 to 4 (Family: none)	1-6
Y	JP 11-329302 A (Director General, Agency of Industrial Science and Technology), 30 November, 1999 (30.11.99), Par. Nos. [0006] to [0016]; Figs. 1 to 6 (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
27 July, 2005 (27.07.05)	16 August, 2005 (16.08.05)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/012829

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 2004-152691 A (Kawai Musical Instruments Mfg. Co., Ltd.), 27 May, 2004 (27.05.04), Full text; all drawings (Family: none)	1-6
A	JP 2004-309549 A (Matsushita Electric Industrial Co., Ltd.), 04 November, 2004 (04.11.04), Full text; all drawings & WO 2004/090848 A1	1-6
A	JP 2004-309547 A (Matsushita Electric Industrial Co., Ltd.), 04 November, 2004 (04.11.04), Full text; all drawings (Family: none)	1-6
A	JP 2004-002548 A (Sekisui Chemical Co., Ltd.), 08 January, 2004 (08.01.04), Full text; all drawings (Family: none)	1-6
A	JP 2002-123186 A (Matsushita Electric Industrial Co., Ltd.), 26 April, 2002 (26.04.02), Full text; all drawings (Family: none)	1-6

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

REFERENCES CITED IN THE DESCRIPTION

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- JP 2004004075 A **[0007]**
- JP 2004029630 A **[0007]**
- JP 2004184677 A **[0007]**
- JP 2004111092 A **[0007]**
- JP 2004309547 A **[0007]**