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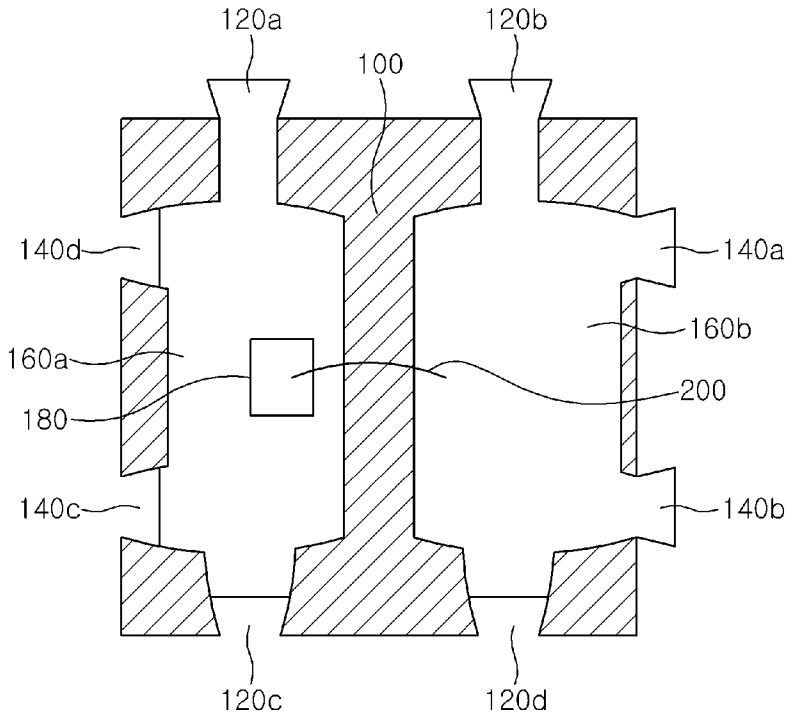
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(54) **Title:** LIGHT EMITTING ELEMENT PROVIDED WITH CONNECTING TERMINALS



(57) **Abstract:** The present invention relates to a light emitting element. The present invention provides a light emitting element, comprising: a substrate; a first electrode formed in one side of the substrate; a second electrode formed in the other side of the substrate; a light emitting chip connected to the first and second electrodes; a first terminal formed in a concave portion and electrically connected to the first electrode, the concave portion being formed in one side surface of the substrate; and a second terminal formed in a convex portion to be fitted into the first terminal and connected to the second electrode, the convex portion being formed in the other side surface of the substrate. According to the present invention, it is possible to provide a light emitting element, which includes connection terminals capable of easily connecting and driving a plurality of the light emitting elements in serial or parallel without an additional printed circuit board.

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Description

LIGHT EMITTING ELEMENT PROVIDED WITH CONNECTING TERMINALS

Technical Field

[1] The present invention relates to a light emitting element, and more particularly, to a connection structure of a light emitting element.

Background Art

[2] In general, a light emitting element has advantages of small size, light weight, and low power consumption enough to save energy as compared to a conventional light emitting apparatus. In spite of such advantages, the light emitting element could not be employed in a display device or a lamp apparatus, since its luminance is lower than that of a conventional element. Thus, recently, a plurality of light emitting elements are connected to each other in order to increase its luminance, whereby the plurality of connected light emitting elements have been employed in an indicator light of a vehicle, a signal lamp or the like.

[3] Fig. 1 is a plan view of a conventional light emitting element.

[4] Referring to Fig. 1, a conventional light emitting element comprises a housing 10, first and second electrodes 20a and 20b formed in the body 10 to be exposed to the outside, a light emitting chip 40 mounted on the first electrode 20a, and a wire 60 for connecting the light emitting chip 40 and the second electrode 20b.

[5] Conventional light emitting elements themselves are provided with no structure for connecting the conventional light emitting elements in serial or parallel. Accordingly, when a plurality of light emitting elements are connected to each other in serial or parallel in order to be used in a display device or light apparatus, the plurality of light emitting elements are mounted to an additional printed circuit board one by one to constitute a circuit. Therefore, there is a problem in that the manufacturing cost and time is wasted.

[6] In addition, when one of the plurality of light emitting elements connected on the printed circuit board in serial or parallel gets out of order, there is cumbersomeness in that the corresponding light emitting element should be replaced after removing a material, such as solder, for attaching the light emitting element to the circuit printed board.

Disclosure of Invention

Technical Problem

[7] In order to solve the aforementioned problems, an object of the present invention is to provide a light emitting element, which is provided with connection terminals to be

directly connected to an adjacent light emitting element and a structure to be coupled to the connection terminals to easily connect a plurality of the light emitting elements.

Technical Solution

[8] According to the present invention for achieving the object, there is provided a light emitting element, comprising: a substrate; a first electrode formed in one side of the substrate; a second electrode formed in the other side of the substrate; a light emitting chip connected to the first and second electrodes; a first terminal formed in a concave portion and electrically connected to the first electrode, the concave portion being formed in one side surface of the substrate; and a second terminal formed in a convex portion to be fitted into the first terminal and connected to the second electrode, the convex portion being formed in the other side surface of the substrate.

[9] At this time, a third terminal may be formed in a concave or convex portion and electrically connected to the first electrode, the concave or convex portion being formed in one side surface of the substrate between the first and second electrodes; a fourth terminal may be formed in a convex or concave portion to be fitted into or around the third terminal and electrically connected to the first electrode, the convex or concave portion being formed in the opposite side surface of the substrate to the third terminal; a fifth terminal may be formed in a concave or convex portion and electrically connected to the second electrode, the concave or convex portion being formed in one side surface of the substrate between the first and second electrodes; and a sixth terminal may be formed in a convex or concave portion to be fitted into or around the fifth terminal and electrically connected to the second electrode, the convex or concave portion being formed in the opposite side surface of the substrate to the fifth terminal.

[10] In addition, according to the present invention, there is provided a light emitting element, comprising: a substrate; a first electrode formed in one side of the substrate; a second electrode formed in the other side of the substrate; a light emitting chip connected to the first and second electrodes; a first terminal formed in a concave or convex portion and electrically connected to the first electrode, the concave or convex portion being formed in one side surface of the substrate; a second terminal formed in a convex or concave portion to be fitted into or around the first terminal and electrically connected to the first electrode, the convex or concave portion being formed in the other side surface of the substrate opposite to the first terminal; a third terminal formed in a concave or convex portion and electrically connected to the second electrode, the concave or convex portion being formed in one side surface of the substrate; and a fourth terminal formed in a convex or concave portion to be fitted into or around the third terminal and electrically connected to the second electrode, the

convex or concave portion being formed in the other side surface of the substrate opposite to the third terminal.

[11] At this time, the first and second electrodes may be formed to extend to an innermost side in the concave portion of the substrate and a distal end side of the convex portion thereof.

[12] In addition, convex portions may be formed in the substrate corresponding to the convex portions of the first and second electrodes.

[13] An inside of the concave portion may be wider than an entrance thereof, and the convex portion may correspond thereto.

[14] In the meantime, the substrate may have a horizontal cross section of a rectangle, and the concave and convex portions may be formed to be mated with each other.

[15] In addition, the convex and concave portions in a left and right side surfaces of the substrate may not be fitted into and around the concave and convex portions in an upper and lower side surface of the substrate.

Advantageous Effects

[16] According to the present invention as mentioned above, it is possible to provide a light emitting element, which includes connection terminals capable of easily connecting and driving a plurality of the light emitting elements in serial or parallel without an additional printed circuit board.

Brief Description of the Drawings

[17] Fig. 1 is a plan view of a conventional light emitting element;

[18] Fig. 2 is a horizontal sectional view of a light emitting element according to the present invention;

[19] Fig 3 is a plan view of the light emitting element according to the present invention;

[20] Fig. 4 is a sectional view taken along line A-A' of Fig. 3;

[21] Fig. 5 is a horizontal sectional view of the plurality of light emitting elements connected in parallel according to the present invention;

[22] Fig. 6 is a horizontal sectional view of the plurality of light emitting elements connected in serial according to the present invention;

[23] Figs. 7 and 8 are horizontal sectional views of light emitting elements according to other embodiments of the present invention;

[24] Fig. 9 is a horizontal sectional view of the plurality of light emitting elements connected in parallel according to the other embodiment of the present invention; and

[25] Fig. 10 is a horizontal sectional view of the plurality of light emitting elements connected in serial according to the other embodiment of the present invention.

Best Mode for Carrying Out the Invention

[26] Hereinafter, embodiments of the present invention will be described in detail with

reference to the accompanying drawings.

[27] However, the present invention is not limited to the embodiments disclosed below but may be implemented into different forms. These embodiments are provided only for illustrative purposes and for full understanding of the scope of the present invention by those skilled in the art. Throughout the drawings, like reference numerals are used to designate like elements.

[28] Fig. 2 is a horizontal sectional view of a light emitting element according to an embodiment of the present invention, and Fig 3 is a plan view of Fig. 2.

[29] Referring to Figs. 2 and 3, a light emitting element according to the embodiment of the present invention comprises a quadrangle-shaped substrate 100 having convex and concave portions formed in side surfaces thereof, a first electrode 160a formed on one side of the substrate 100, a second electrode 160b formed on the other side of the substrate 100, a light emitting chip 180 mounted on the first electrode 160a, a wire 200 connecting the light emitting chip 180 and the second electrode 160b, and a hollow housing 110 on the substrate 100 not to shield the light from the light emitting chip 180. Furthermore, the light emitting element may further comprise a molding portion (not shown) for encapsulating the light emitting chip 180 and the wire 200 in the hollow portion of the housing 110.

[30] The light emitting chip 180, which is a light source of the light emitting element according to the present embodiment, emits light when electrons and holes are combined in semiconductor P-N junctions by applying an electric current to the light emitting element. The light emitting chip 180 may include first and second semiconductor layers (not shown), and an active layer (not shown) formed between the first and second semiconductor layers. In this embodiment, the first semiconductor layer is a P-type semiconductor layer, and the second semiconductor layer is an N-type semiconductor layer. In addition, a P-type electrode (not shown) is formed on an upper portion of the light emitting chip 140, i.e., on a surface of the P-type semiconductor layer, and an N-type electrode (not shown) is formed on a lower portion of the light emitting chip 140, i.e., on a surface of the N-type semiconductor layer. At this time, the N-type electrode is in contact with the first electrode 160a, and the P-type electrode is electrically connected to the second electrode 160b through the wire 200.

[31] A general printed circuit board (PCB) may be used as the square substrate 100, which serves to support the first and second electrodes 160a and 160b and electrically separate them from each other. Of course, as the substrate 100, it is possible to use a housing made of a polyphthalamid (PPA), liquid crystal polymer (LCP) or the like. At this time, the housing, which is an insulator, supports the first and second electrodes 160a and 160b formed thereon and electrically separates them from each other.

[32] In a prior art, the plurality of light emitting elements are connected in parallel or

serial on an additional printed circuit board, on which a pattern is formed, in order to connect a plurality of light emitting elements. However, in the present invention, at least one convex or concave portion connected to each of the first and second electrodes 160a and 160b is formed in a side surface of the housing 100, so that the plurality of light emitting elements are intended to be easily connected to each other without an additional printed circuit board.

[33] In addition, it is preferred that the first and second electrodes 160a and 160b be formed to cover the convex and concave portions formed in the square substrate 100 in order not to cause a short circuit when the plurality of light emitting elements are connected. That is, as shown in Fig. 4, it is preferred that the first and second electrodes 160a and 160b be formed to be bent by 90 degrees at the innermost side in the concave portion and at the distal end side of the convex portion and to extend downwardly. Accordingly, the first electrode is formed with first and third parallel connection terminals 120a and 120c and third and fourth serial connection terminals 140c and 140d, and the second electrode is formed with second and fourth parallel connection terminals 120b and 120d and first and second serial connection terminals 140a and 140b. In addition, large areas of the first and second electrodes 160a and 160b come in contact with each other when the plurality of light emitting elements are connected in parallel or serial, so that it is possible to prevent the light emitting elements from being short-circuited when connecting them.

[34] Further, in an upper side surface of the substrate 100 with a horizontal cross section to be generally rectangular, the first parallel connection terminal 120a is formed on the convex portion of the first electrode 160a, and the second parallel connection terminal 120b is formed on the convex portion of the second electrode 160b. Furthermore, the first and second serial connection terminals 140a and 140b are formed on the convex portion of the right side surface of the substrate 100. In a lower side surface thereof, the third parallel connection terminal 120c is formed in the concave portion of the first electrode 160a, and the fourth parallel connection terminal 120d is formed in the concave portion of the second electrode 160b. In addition, the third and fourth serial connection terminals 140c and 140d are formed in the left side surface of the substrate 100. At this time, the first and second parallel connection terminals 120a and 120b formed on the upper side surface and the first and second serial terminals 140a and 140b formed on the right side are in a convex shape. Also, the third and fourth parallel connection terminals 120c and 120d formed in the lower side surface and the third and fourth serial terminals 140c and 140d formed in the left side surface adjacent to the lower side surface are in a concave shape.

[35] When the plurality of light emitting elements having the configuration mentioned above are connected in parallel, the first and second parallel connection terminals 120a

and 120b of a convex shape in the side surface of the substrate 100 are coupled to the third and fourth parallel connection terminals 120c and 120d of a concave shape corresponding to the first and second parallel connection terminals 120a and 120b, as shown in Fig. 5. At this time, the first and third parallel connection terminals 120a and 120c cause the first electrodes 160a to be electrically connected to each other, and the second and fourth parallel connection terminals 120b and 120d cause the second electrodes 160b to be electrically connected to each other.

[36] Further, when the plurality of light emitting elements having the configuration mentioned above are connected in serial, the first and second serial connection terminals 140a and 140b of a convex shape in the side of the body are coupled to the third and fourth serial connection terminals 140c and 140d of a concave shape corresponding to the first and second serial connection terminals 140a and 140b, as shown in Fig. 6. At this time, the first and third serial connection terminals 140a and 140c are electrically connected to the second electrodes 160b, and the second and fourth serial connection terminals 140b and 140d are electrically connected to the second electrodes 160b. That is, the first and second electrodes of the adjacent elements are connected to each other.

[37] In this case, only the first and third serial connection terminals 140a and 140c may be formed without the second and fourth serial connection terminals 140b and 140d. However, the present invention is not limited thereto, only first to fourth parallel connection terminals 120a to 120d for parallel connection may be formed as shown in Fig. 7, and therefore, a plurality of light emitting elements can be connected in parallel as shown in Fig. 9.

[38] In addition, only first to fourth serial connection terminals 140a to 140d for serial connection may be formed as shown in Fig. 8, and therefore, a plurality of light emitting elements can be connected in serial as shown in Fig. 10. However, it is preferred that both serial and parallel connection terminals be formed in a light emitting element in order to be connected to each other in both serial and parallel. Furthermore, a number of the first to fourth serial connection terminals 140a to 140d and the first to fourth parallel connection terminals 120a to 120d may be formed according to use of a light emitting element.

[39] In the meantime, it is preferred that the serial connection terminal be formed in a different shape from the parallel connection terminal so as not to connect the serial connection terminal to the parallel connection terminal inadvertently. That is, in order for the parallel connection terminals to be coupled to each other and for the serial connection terminals to be coupled to each other, the first and second parallel connection terminals 120a and 120b have the same shape, and the third and fourth parallel connection terminals 120c and 120d are formed in a shape such that they are

coupled to the first and second parallel connection terminals 120a and 120b. In addition, the first and second serial connection terminals 140a and 140b have the same shape, and the third and fourth serial connection terminals 140c and 140d are formed in a shape such that they are coupled to the first and second serial connection terminals 140a and 140b. At this time, it is preferred that the first and second parallel connection terminals 120a and 120b be formed in a different shape from the first and second serial connection terminals 140a and 140b and the third and fourth parallel connection terminals 120c and 120d be also formed in a different shape from the third and fourth serial connection terminals 140c and 140d.

[40] It is also preferred that the inside of the concave portion in the parallel and serial connection terminals be wider than the entrance thereof, and the convex portion of the parallel and serial connection terminals be formed in a shape corresponding to the concave portion in order to securely fix the parallel connection terminals and the serial connection terminals, respectively, when the light emitting elements are coupled to each other.

[41] According to the light emitting elements having the parallel and serial connection terminals firmed as mentioned above, there are advantages in that it is possible to reduce the cumbersome that light emitting elements should be mounted on an additional printed circuit board to form the circuit and to drive light emitting elements after arranging them in serial or parallel as easily as a jigsaw puzzle is done.

[42] In the meantime, the first and second electrodes 160a and 160b formed on the substrate 100 are those through which power is applied to the light emitting element from the outside, and are generally made of conductive metal. The first and second electrodes 160a and 160b are formed on the substrate 100 and respectively spaced apart from the center of the substrate 100 to prevent a short circuit.

[43] At this time, the vertical type light emitting chip, in which the electrodes are formed on both top and bottom thereof, is mounted on the first electrode 160a, and the light emitting chip 180 is connected to the second electrode 160b through the wire 200. However, the present invention is not limited thereto, but a horizontal type light emitting chip, in which electrodes are formed on the surfaces facing the same direction, may be mounted on the first electrode 160a. At this time, the connection between the light emitting chip and the first and second electrodes 160a and 160b for applying power from the outside to the light emitting chip may be performed by means of a two-tap wire structure using two wires. However, for the manufacturing cost and convenience in the process, it is preferred that the light emitting element be manufactured using a one-tap wire structure in which the vertical type light emitting chip is connected to the first electrode 160a through a wire.

[44] The molding portion (not shown), which is to protect the light emitting chip 180

and the wire 200, is mad of epoxy resin and silicon resin. In addition, a lens section of a convex shape is formed in an upper portion of the molding portion to get an effect of focusing light. However, the present invention is not limited thereto, but the molding portion may be formed in a variety of shape according to the convenience and purpose in the process.

[45] In the meantime, the housing 110 is formed on the substrate 100. At this time, it is preferred that the housing 110 be not formed over the light emitting chip 200 in order not to shield the light emitted from the light emitting chip 200. In addition, a reflection portion is formed by providing the housing 110 with an inclined portion in the circumference of the light emitting chip 200. However, the present invention is not limited thereto, but the housing 110 may not be formed.

[46] Meanwhile, the light emitting element according to the present invention may further include at least a phosphor (not shown) which absorbs the light emitted from the light emitting chip 180 and then convert the wavelength of the light. That is, the light emitting chip 180 may include a light emitting chip for emitting blue light, and the phosphor may include a yellow excited phosphor. In addition, the light emitting chip 180 may include a light emitting chip for emitting ultra violet light, and the phosphor may include a mixture of a red excited phosphor, a green excited phosphor and a blue excited phosphor at a predetermined ratio. At this time, the molding portion may be formed with the phosphor added thereto.

[47] Hereinafter, a manufacturing method of the light emitting element according to the present invention will be described in brief.

[48] For manufacturing the light emitting element according to the present invention, first, a substrate is prepared. At this time, instead of the substrate, a housing may be used, which is mad of a resin with high thermal conductivity and superior insulating property, such as a poly phthal amid (PPA) or liquid crystal polymer (LCP). Here, the substrate or housing is formed in the shape of a rectangular prism and the parallel and serial connection terminals are formed in the four side surfaces thereof.

[49] That is, the first and second parallel connection terminals are formed on the left and right sides of the upper side surface of the substrate, on which the first and second electrodes will be formed, respectively. In addition, the first and second serial connection terminals are formed on the right side surface of the substrate. The third and fourth parallel connection terminals are formed on the left and right sides of the lower side surface of the substrate, on which the first and second electrodes will be formed, respectively. In addition, the third and fourth serial connection terminals are formed on the left side surface of the substrate. At this time, the first and second parallel connection terminals formed on the upper side surface of the substrate and the first and second serial connection terminals formed on the right side surface of the

substrate are formed in a convex shape. Further, the third and fourth parallel connection terminals formed on the lower side surface of the substrate and the third and fourth serial connection terminals formed on the left side surface of the substrate are formed in a concave shape.

[50] Next, the first and second electrodes are formed of conductive metal, such as copper (Cu) or aluminum (Al), on the substrate. At this time, the first and second electrodes are respectively spaced apart from the upper center of the substrate. The first electrode is formed to be electrically connected to the first and third parallel connection terminals and the third and fourth serial connection terminals, and the second electrode is formed to be electrically connected to the second and fourth parallel connection terminals and the first and second serial connection terminals.

[51] The light emitting chip that is separately manufactured is mounted on the first electrode, and the light emitting chip and the second electrode are then connected through the wire, which is made of metal with high conductivity, such as gold (Au) or aluminum (Al). At this time, if the light emitting chip is not a vertical type but a horizontal type, an insulator may be formed between the light emitting chip and the first electrode, and the light emitting chip and the first and second electrodes are connected through two wires.

[52] Next, the housing is formed of a material, such as poly phthal amid (PPA) or liquid crystal polymer (LCP), to cover a portion of the first and second electrodes. At this time, it is preferred that the housing do not cover the above of the light emitting chip so as not to shield the light emitted therefrom.

[53] Thereafter, the molding portion is formed by encapsulating the wire and light emitting chip exposed to the outside with liquid silicon resin or epoxy resin and curing it at a certain temperature and for a certain time, thereby completing the light emitting element according to the present invention.

[54] The scope of the present invention is not limited to the embodiments described above but is defined by the claims. It will be apparent that those skilled in the art can make various modifications and changes thereto within the scope of the invention defined by the claims.

[55] That is, although in the aforementioned embodiments, the substrate has a horizontal cross section of a rectangle, the present invention is not limited thereto but the substrate may have a shape in which the number of both opposite side surfaces is two or more.

Claims

[1] A light emitting element, comprising:
a substrate;
a first electrode formed in one side of the substrate;
a second electrode formed in the other side of the substrate;
a light emitting chip connected to the first and second electrodes;
a first terminal formed in a concave portion and electrically connected to the first electrode, the concave portion being formed in one side surface of the substrate; and
a second terminal formed in a convex portion to be fitted into the first terminal and connected to the second electrode, the convex portion being formed in the other side surface of the substrate.

[2] The light emitting element as claimed in claim 1, further comprising a third terminal formed in a concave or convex portion and electrically connected to the first electrode, the concave or convex portion being formed in one side surface of the substrate between the first and second electrodes; a fourth terminal formed in a convex or concave portion to be fitted into or around the third terminal and electrically connected to the first electrode, the convex or concave portion being formed in the opposite side surface of the substrate to the third terminal; a fifth terminal formed in a concave or convex portion and electrically connected to the second electrode, the concave or convex portion being formed in one side surface of the substrate between the first and second electrodes; and a sixth terminal formed in a convex or concave portion to be fitted into or around the fifth terminal and electrically connected to the second electrode, the convex or concave portion being formed in the opposite side surface of the substrate to the fifth terminal.

[3] A light emitting element, comprising:
a substrate;
a first electrode formed in one side of the substrate;
a second electrode formed in the other side of the substrate;
a light emitting chip connected to the first and second electrodes;
a first terminal formed in a concave or convex portion and electrically connected to the first electrode, the concave or convex portion being formed in one side surface of the substrate;
a second terminal formed in a convex or concave portion to be fitted into or around the first terminal and electrically connected to the first electrode, the convex or concave portion being formed in the other side surface of the substrate

opposite to the first terminal;

a third terminal formed in a concave or convex portion and electrically connected to the second electrode, the concave or convex portion being formed in one side surface of the substrate; and

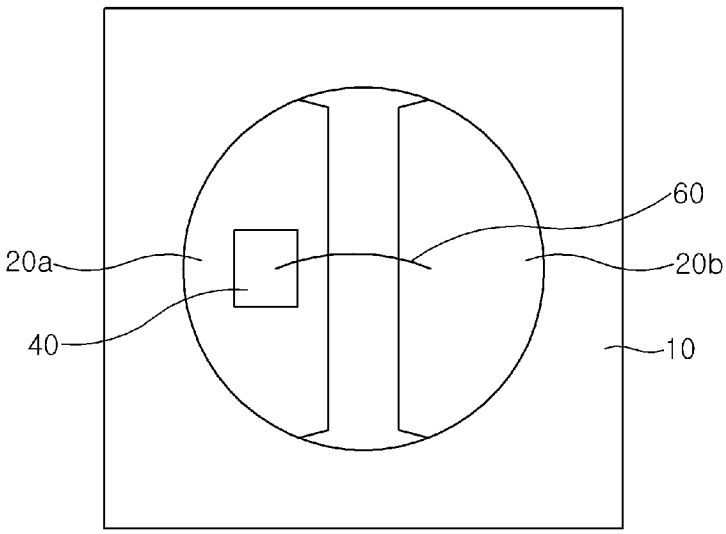
a fourth terminal formed in a convex or concave portion to be fitted into or around the third terminal and electrically connected to the second electrode, the convex or concave portion being formed in the other side surface of the substrate opposite to the third terminal.

[4] The light emitting element as claimed in any one of claims 1 to 3, wherein the first and second electrodes are formed to extend to an innermost side in the concave portion of the substrate and a distal end side of the convex portion thereof.

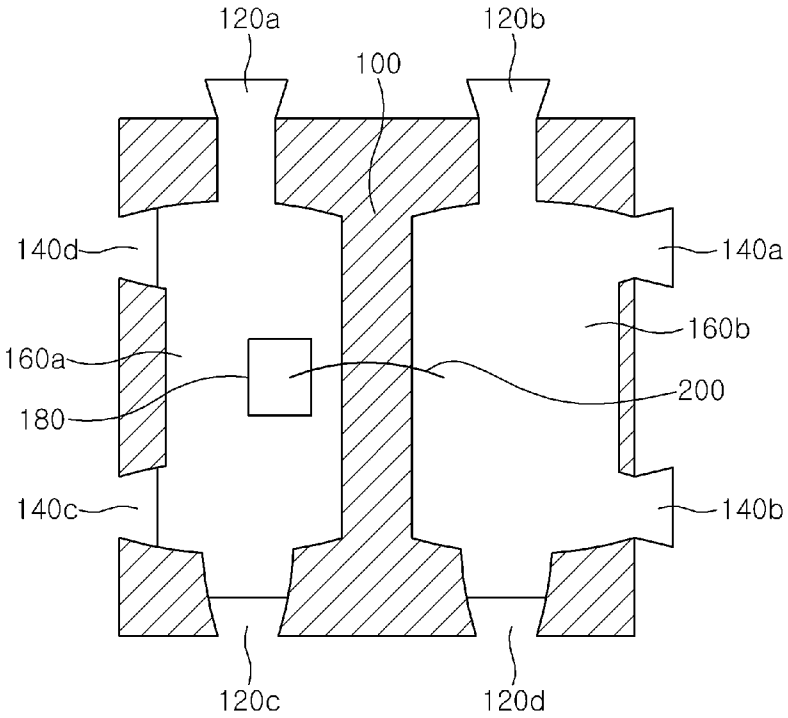
[5] The light emitting element as claimed in any one of claims 1 to 3, wherein an inside of the concave portion is wider than an entrance thereof, and the convex portion corresponds thereto.

[6] The light emitting element as claimed in claim 2, wherein the convex and concave portions in a left and right side surfaces of the substrate are not fitted into and around the concave and convex portions in an upper and lower side surface of the substrate.

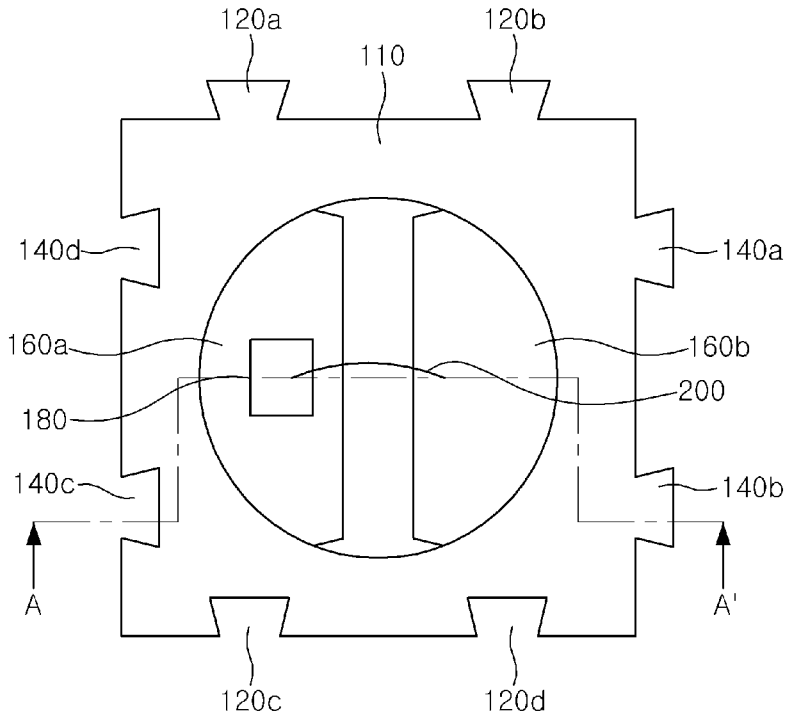
[Fig. 1]


60
20a
20b
40
10

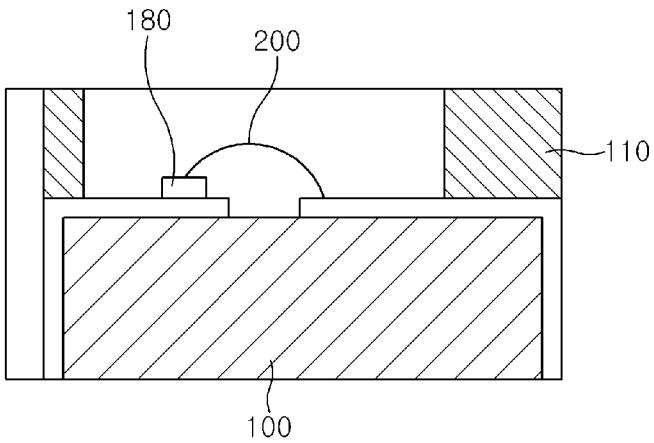
[Fig. 2]


120a
120b
100
140d
140a
160b
160a
200
180
140c
140b
120c
120d

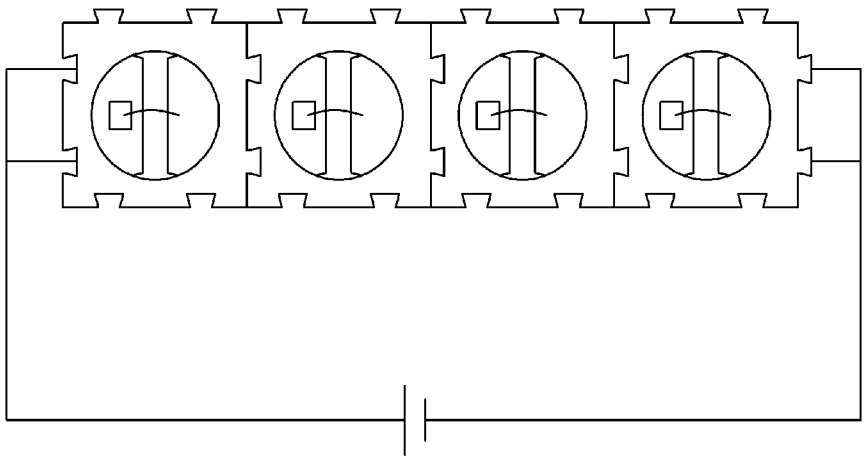
[Fig. 3]



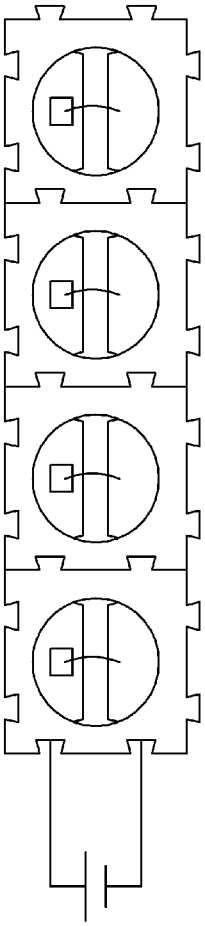
[Fig. 4]



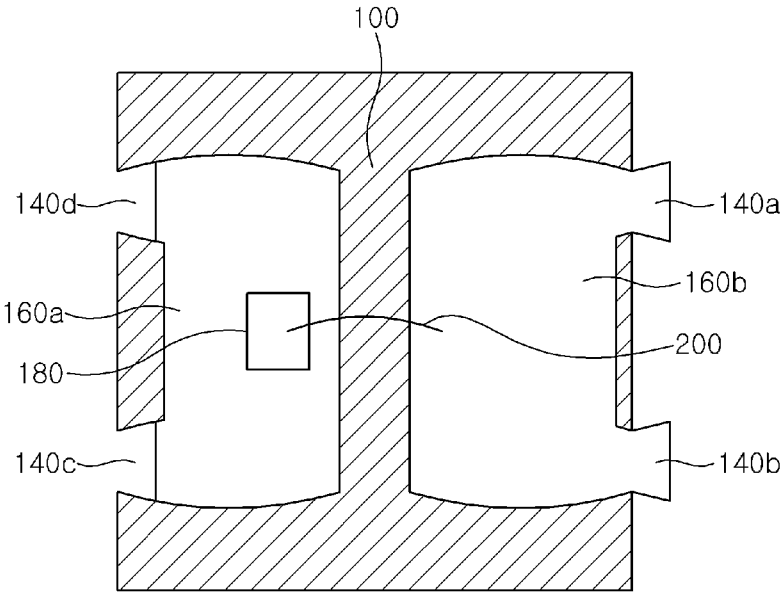
[Fig. 5]



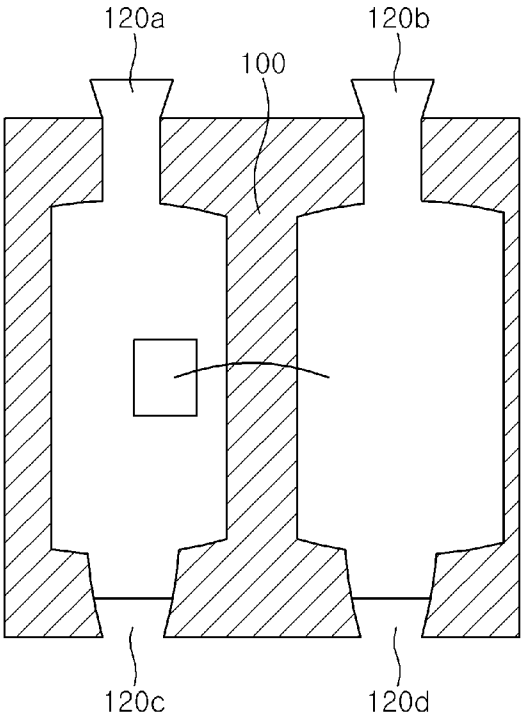
[Fig. 6]



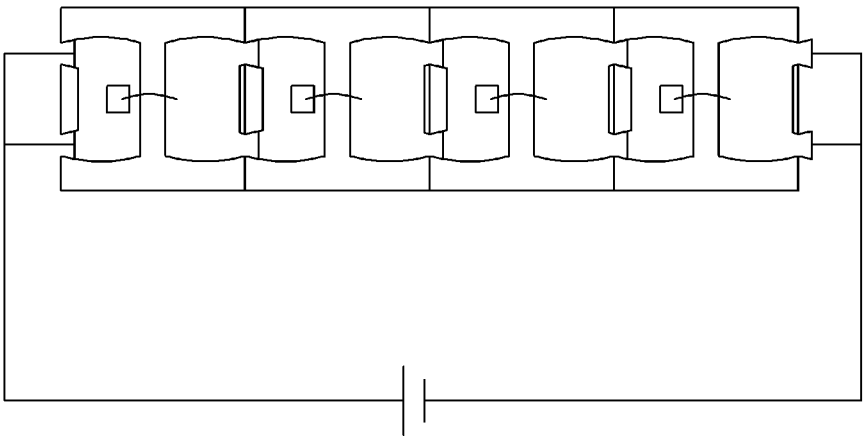
[Fig. 7]



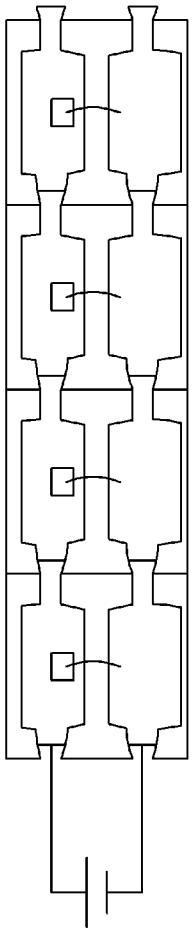
[Fig. 8]



[Fig. 9]



[Fig. 10]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/005826

A. CLASSIFICATION OF SUBJECT MATTER

H01L 33/00(2006.01)i

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)
IPC8 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applictions for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS(KPA, PAJ, FPD, USPATFULL) in KIPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 13-177151 (Sharp Co.) 29 Jun 2001 See Abstract; Figure 1	1
A	KR 10-2005-0048766 (Samsung Electro-Mechanics Co. Ltd.) 25 May 2005 See Abstract; Figure 3	1
A	US 2004/0252501 A1 (Moriyama et al.) 16 Dec 2004 See Abstract; Figure 52	1
A	KR 10-2005-0060479 (LG Electronics Inc.) 22 Jun 2005 See Abstract	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 APRIL 2007 (13.04.2007)	**13 APRIL 2007 (13.04.2007)**

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Telephone No. 82-42-481-8509

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/005826

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