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(54) Title: ILLUMINATING DEVICE

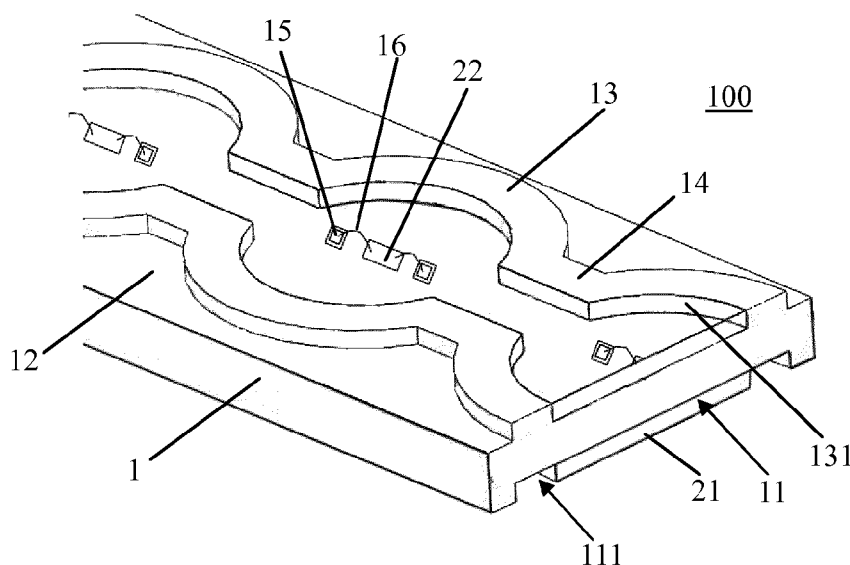


Figure 1

(57) Abstract: An illuminating device (100), comprising a carrier (1) and a light-emitting assembly (2) provided on the carrier (1), the light-emitting assembly (2) comprises a circuit board (21) and at least one light-emitting unit (22), wherein the circuit board (21) is provided on a first side surface (11) of the carrier (1), and the light-emitting unit (22) is provided on a second side surface (12) of the carrier (1) opposite to the first side surface (11), wherein heat from the light-emitting unit (22) is dissipated directly through the carrier (1).



Description

Illuminating device

5 **Technical Field**

The present invention relates to an illuminating device employing LED illumination technology.

Background Art

10 In modern illumination technology, electronic devices, especially illuminating devices relating to illumination technology are increasingly widely used, wherein the LED illumination technology has been widely used in illuminating devices, and the illuminating devices employing the technology have the advantages of good illumination effect, energy saving and
15 high illumination efficiency. With the increase of popularity of such illuminating devices, the users impose higher and higher requirements on the mechanical properties and thermal conductivity of the illuminating devices. For example, the illuminating devices employing the LED illumination technology
20 use the method of COB, i.e. chip on board, so that the LED chip can be simply mounted on the corresponding carrier. With the use of the COB technique, for most illuminating devices, such results as complicated manufacturing process, poor insulating or thermal conducting effects will be produced due to sealing and thermal conduction. Thus, an illuminating device is required which is capable of achieving superior insulating and thermal conducting effects after the
25 employment of a simple manufacturing process, thereby ensuring continuous reliability and effectiveness in complicated
30 application environments.

A solution in the prior art proposes to use MCPCB to manufacture an illuminating device, and on that basis, use the COB technique to mount the LED chip on the circuit board, and then seal it with a package gel, thereby obtaining an illumi-

nating device reaching corresponding industrial level protection. However, the manufacturing process of the illuminating device of this type is complicated, as the manufacturing process requires the use of a package gel, and molding with the package gel is imprecise. In addition, in order to protect the circuit in the illuminating device, the surface treatment on the circuit board will become more difficult, and thermal conducting effect of the illuminating device is also relatively poor.

Another solution in the prior art proposes to use MCPCB to manufacture an illuminating device, and use a plurality of reflector cups on the mounting board. This solution does not require the use of a package gel. Due to the plurality of reflector cups mounted on the MCPCB, the illuminating device is able to achieve good illumination effects. However, the manufacturing process in which reflector cups are used is very difficult and precision cannot be ensured. Moreover, light distribution of the illuminating device is not uniform. Further, the density of the LED chips of the illuminating device is low, thus, the illumination effect is not satisfactory.

Summary of the Invention

In order to solve the above technical problem, the present invention proposes a novel illuminating device, which has higher design flexibility and very good heat dissipation property and optical properties. The illuminating device has such structure and design that it can ensure superior heat dissipation performance without the use of a special heat dissipating device. Moreover, the illuminating device also uses the COB technique, so that the cost thereof is reduced.

The object of the present invention is achieved by the illuminating device, comprising a carrier and a light-emitting assembly provided on the carrier, the light-emitting assembly comprises a circuit board and at least one light-emitting

unit, wherein the circuit board is provided on a first side surface of the carrier, and the light-emitting unit is provided on a second side surface of the carrier opposite to the first side surface, wherein heat from the light-emitting unit is transferred to the carrier and then dissipated by the carrier. The different components of the light-emitting assembly generating heat can be directly cooled through an effective thermal conducting path, thereby effectively reducing thermal resistance in the thermal conducting path and improving the heat dissipation performance of the illuminating device.

According to a preferred design solution of the present invention, the circuit board is in thermal contact with the first side of the carrier and the light-emitting unit is in thermal contact with the second side of the carrier, such that the carrier provides a thermal conducting path for the circuit board and the light-emitting unit. As the circuit board and the light-emitting unit are in thermal contact with the carrier, respectively, it is possible to ensure that the light-emitting unit and the circuit board have separate paths to dissipate heat to the outside through the carrier, and in this way, when the carrier carries the light-emitting unit, it can simultaneously absorb heat from the light-emitting unit and the circuit board, and dissipate heat to the outside.

Preferably, the thermal conducting path comprises a first thermal conducting path and a second thermal conducting path, heat from the circuit board is dissipated through the first thermal conducting path and heat from the light-emitting unit is dissipated through the second thermal conducting path. The two thermal conducting paths provide an individual thermal conducting path for the light-emitting unit and the circuit board, respectively. In this way, it is possible to use the same carrier to simultaneously dissipate heat for the members mounted in different regions. Preferably, the first thermal conducting path starts from the circuit board through

the carrier to ambient air, and the second thermal conducting path starts from the light-emitting unit through the carrier to ambient air.

5 Preferably, the carrier is a heat sink. The carrier is capable of providing effective heat dissipating channels for the light-emitting unit and the circuit board, while carrying the light-emitting unit, which achieves efficient heat dissipation without using an additional heat dissipating structure.

10 Preferably, the illuminating device comprises a reflecting structure, wherein the reflecting structure is formed on the second side surface of the carrier, and defines a mounting area for mounting the light-emitting unit on the second side surface. With the reflecting structure arranged in such a manner, light emitted by the light-emitting unit can be favorably reflected. Moreover, the reflecting structure is arranged on a different side surface from the circuit board, so that it can be isolated from the conductive region of the circuit board. In addition, the mounting area of the second side surface defined by the reflecting structure provides a possible mounting space for the light-emitting unit.

25 Preferably, the reflecting structure is configured as an annular projection, wherein an inner wall of the annular projection forms a reflecting surface. The annular projection provides the possibility of reflecting light for the light-emitting unit mounted on the same side as the annular projection, and realizes illumination capability in a wide range. Moreover, different illumination effects can be achieved according to different arranging manners of the annular projection.

30 Preferably, the illuminating device comprises a plurality of reflecting structures, wherein adjacent reflecting structures are connected via a connection structure, wherein the connection structure is so configured that the mounting areas of the adjacent reflecting structures are in communication with

each other. Only one light-emitting unit can be arranged in each of the reflecting structures. In addition, the reflecting structure can also be used as a stopping structure of a package gel for packaging the light-emitting unit, so as to prevent the package gel from entering undesirable areas. Further, since the reflecting structures are in communication with each other, at the time of packaging with the package gel, it is not necessary to separately package the light-emitting unit in each reflecting structure.

Preferably, a free end of the reflecting surface is at a height of 0.2-1.2mm from the second side surface. Depending on the side surface of different heights, the illuminating device can achieve illumination for areas in different ranges, thereby enhancing the use capacity of the illuminating device in different application environments.

Preferably, the free end of the reflecting surface is at a height of 0.6mm from the second side surface. The reflecting surface having such a height can achieve the best reflection effect.

Preferably, viewed in a cross section of the carrier, the reflecting surface and the second side surface form an angle of 90° - 180° . By setting different angles in the manufacturing process, the reflecting surface is able to implement reflection in different directions, so as to achieve illumination in different directions and different ranges.

Preferably, the reflecting structure and the carrier are made in one piece via a hot die casting process. By means of the hot die casting process, the reflecting structure can be made into one piece with the carrier, which ensures stability of the mechanical properties of the illuminating device, and further reduces the manufacturing difficulty of an illuminating device according to the present invention.

Preferably, the carrier comprises a groove formed in the

first side surface, and the circuit board is form-fittingly arranged in the groove. The groove can ensure that the circuit board is firmly fixed on the first side surface. Moreover, the groove also significantly increases the contact area
5 between the circuit board and the carrier, thus improving the heat dissipating performance of the illuminating device.

Preferably, at least one through hole going from the first side surface to the second side surface is formed in the carrier, and an electrical conductor for electrically connecting
10 the circuit board and the light-emitting unit is arranged in the through hole. The through hole provides the possibility of electrical connection with the circuit board for the light-emitting unit, so that even if the light-emitting unit and the circuit board are not on the same side, effective
15 electrical connection can be achieved via the electrical conductor in the through hole.

Preferably, the through hole is filled with a filling material for electrically isolating the electrical conductor from the carrier. The filling material can reliably electrically
20 insulate the electrical conductor from the carrier.

Preferably, the filling material is thermal silica gel. Thermal silica gel can achieve electrical isolation of the electrical conductor in the through hole, while achieving effective thermal conduction.

Preferably, the light-emitting unit is mounted on the second side surface of the carrier through a chip-on-board technique. By using the COB technique, the light-emitting unit can be simply mounted and fixed on the carrier, and can be electrically connected with the circuit board arranged on the
30 other side through the through hole.

Preferably, the carrier is made from a metal, plastic or ceramic. By using these materials, materials and costs can be saved, and the carrier can have superior thermal conducting

effect.

Preferably, the illuminating device further comprises a protective cover provided on the second side surface, the protective cover and the second side surface defining a space enclosing the light-emitting unit. The protective cover, as a device for protecting the circuit structure of the illuminating device, can effectively achieve light transmitting effect, and achieve, to a certain extent, protection of the corresponding industrial level for the illuminating device.

Preferably, the light-emitting unit is configured as an LED light-emitting unit. LED technology is widely used in illumination technology, which not only has a small size, can effectively save energy, but also can achieve efficient illumination effects, and thereby can be integrated with the structure of this design.

Preferably, the circuit board is configured as an FR-4 type circuit board. The circuit board of this type can be easily obtained from the market.

It is to be understood that the features of the various exemplary embodiments described herein may be combined with each other, unless specifically noted otherwise.

Brief Description of the Drawings

The drawings constitute a portion of the Description for further understanding of the present invention. These drawings illustrate the embodiments of the present invention and explain the principle of the present invention together with the Description. In the drawings, the same part is represented by the same reference sign. In the drawings,

Fig. 1 is a local view of the illuminating device according to the present invention;

Fig. 2 is a sectional view of the illuminating device according to the present invention in a transverse direction;

Fig. 3 is a sectional view of the illuminating device according to the present invention in a longitudinal direction;

5 Fig. 4 is a detailed diagram of the illuminating device according to the present invention in the region of the light-emitting unit; and

Fig. 5 is an overall schematic diagram of the illuminating device according to the present invention.

10 Detailed Description of the Embodiments

Fig. 1 is a local view of the illuminating device according to the present invention. As shown in Fig. 1, the illuminating device 100 comprises a carrier 1 and a light-emitting assembly 2 provided on the carrier 1, wherein the light-emitting assembly 2 comprises a circuit board 21 and at least one light-emitting unit 22. The circuit board 21 may use an FR-4 type circuit board, and the light-emitting unit 22 may use an LED light-emitting unit and is mounted on a second side surface 12 of the carrier 1 by means of the COB technique. The circuit board 21 and the light-emitting unit 22 are arranged on different side surfaces of the carrier 1, the circuit board 21 is provided on a first side surface 11 of the carrier 1, while the light-emitting unit 22 is provided on the second side surface 12 of the carrier 1, wherein the second side surface 12 is the other side of the carrier 1 opposite to the first side surface 11. In this design solution, heat from the light-emitting unit 22 is directly transferred to the carrier 1 which is in thermal contact with the light-emitting unit 22, and heat from the circuit board 21 is also directly transferred to the carrier 1 which is in thermal contact with the circuit board 21. That is, on the thermal conducting path from the light-emitting unit 22 to the ambient, there only exists the carrier 1, which significantly

reduces thermal resistance on the thermal conducting path.

As can be further seen from the figure, the carrier 1 comprises a groove 111 formed in the first side surface 11, and the circuit board 21 can be form-fittingly arranged in the groove 111, such that the circuit board 21 can be inserted into the groove 111, or connected with the groove 111 in a bonding manner, wherein, after the circuit board 21 is arranged in the groove 111, gaps can be left on both sides of the circuit board 21, and air can circulate in order to enhance heat dissipation smoothly. In this way, the circuit board 21 is in thermal contact with the carrier 1 on the first side surface 11, while the light-emitting unit 22 is in thermal contact with the carrier on the other side surface, so that the carrier 1 can provide an individual thermal conducting path for the circuit board 21 and the light-emitting unit 22, respectively.

According to the design solution of the present invention, the thermal conducting path comprises a first thermal conducting path and a second thermal conducting path, the circuit board 21 is cooled through the first thermal conducting path, viz. the circuit board 21---the carrier 1---the ambient, while the light-emitting unit 22 is cooled through the second thermal conducting path, viz. the light-emitting unit 22---the carrier 1---the ambient. In the design solution of the present invention, the carrier 1 can be configured as a heat sink having efficient heat dissipation function, and the heat sink can be made from a material having high thermal conductivity, e.g., the carrier 1 can be made from a metal, plastic or ceramic, preferably aluminum. In operation, the heat of the light-emitting unit 22 can be directly dissipated from the carrier 1 by making use of the high thermal conductivity of the carrier 1, without passing through the circuit board 21.

As can be further seen from Fig. 1, the illuminating device further comprises a reflecting structure 13, which is

formed in one piece with the carrier 1 on the second side surface 12 of the carrier 1 via a hot die casting process. In this embodiment, the reflecting structure 13 is configured as an annular projection. The reflecting structure 13 not only can favorably reflect light from the light-emitting unit 22 so as to obtain expected light distribution effect, but also defines, on the second side surface 12, a mounting area for mounting the light-emitting unit 22. In this embodiment, a plurality of reflecting structures 13 are arranged on the carrier 1. Referring to Fig. 5, a plurality of reflecting structures 13 are arranged on the second side surface 12, adjacent reflecting structures 13 are connected via a connection structure 14, such that communication among the reflecting structures 13 can be achieved via the connection structure 14, and in this way, the mounting areas defined by the reflecting structures 13 can be in communication with each other. This brings forth a significant advantage, i.e., the reflecting structure 13 can also be used as a stopping structure of a package gel for packaging the light-emitting unit 22, so as to prevent the package gel from entering undesirable areas. Further, since the reflecting structures 13 are in communication with each other, at the time of packaging with the package gel, it is not necessary to separately package the light-emitting unit 22 in each reflecting structure 13. In addition, as shown in Figure, only one light-emitting unit 22 is arranged in each of the reflecting structures 13.

In addition, as shown in Fig. 1, an inner wall of the annular projection forms a reflecting surface 131 which reflects light from the light-emitting unit 22 in a predetermined direction, so as to achieve expected illumination effects. In addition, a free end of the reflecting surface 131 can be at a height of 0.2-1.0mm, preferably 0.6mm, from the second side surface 12.

Fig. 2 is a sectional view of the illuminating device according to the present invention in a transverse direction. As shown in Fig. 2, besides the fact that the height can be de-

signed to be different according to the requirements, the reflecting surface 131 and the second side surface 12 can be designed to have different angles according to the requirements. The angle can be designed between 90° and 180°.

5 Fig. 3 is a sectional view of the illuminating device according to the present invention in a longitudinal direction. In order to mount the light-emitting unit 22 on the carrier 1 using the COB technique, at least one through hole 17 is formed in the carrier 1, which goes from the first side surface 11 to the second side surface 12 of the carrier 1. In
10 addition, an electrical conductor 15 is arranged in the through hole 17, for providing electrical connection between the LED chip, serving as the light-emitting unit 22, and the circuit board 21. In this way, the LED chip can be cooled by
15 means of the carrier 1 which serves as a heat dissipating body, and at the same time, can be electrically connected with the circuit board 21 via the electrical conductor 15. More specifically, the through hole 17 is filled with a filling material, e.g. thermal silica gel. The filling material
20 is used for electrically isolating the electrical conductor 15 from the carrier 1, and can also transfer heat of the LED chip to the carrier.

Fig. 4 is a detailed diagram of the illuminating device 100 according to the present invention in the region of the
25 light-emitting unit 22. The figure schematically shows the LED chip serving as the light-emitting unit 22, a through hole 17, and the electrical conductor 15 arranged in the through hole 17. The LED chip is mounted on the carrier 1 via the COB technique, and is electrically connected with the
30 electrical conductor 15 via a gold wire which is used as a bonding wire 16. After the mounting is completed, it is further necessary to fill an insulating filling material, for example, insulating thermal silica gel (not shown in the figure), between the electrical conductor 15 and the through
35 hole 17.

According to the design solution of the present invention, the illuminating device 100 can further comprise a protective cover (for the sake of conciseness, the protective cover is not shown in the figure), wherein the protective cover can be
5 provided on the second side surface 12 of the carrier 1, and the protective cover and the second side surface 12 define a space enclosing the light-emitting unit 22, which thereby achieves corresponding industrial level protection for the LED chip and the circuit enclosed therein.

10 The above is merely preferred embodiments of the present invention but not to limit the present invention. For the person skilled in the art, the present invention may have various alterations and changes. Any alterations, equivalent substitutions, improvements, within the spirit and principle
15 of the present invention, should be covered in the protection scope of the present invention.

List of reference signs

	1	carrier
	2	light-emitting assembly
	11	first side surface
5	12	second side surface
	13	reflecting structure
	14	connection structure
	15	electrical conductor
	16	bonding wire
10	17	through hole
	21	circuit board
	22	light-emitting unit
	100	illuminating device
	111	groove
15	131	reflecting surface

Patent claims

1. An illuminating device (100), comprising a carrier (1) and a light-emitting assembly (2) provided on the carrier (1), the light-emitting assembly (2) comprises a circuit board (21) and at least one light-emitting unit (22), characterized in that, the circuit board (21) is provided on a first side surface (11) of the carrier (1), and the light-emitting unit (22) is provided on a second side surface (12) of the carrier (1) opposite to the first side surface (11), wherein heat from the light-emitting unit (22) is transferred to the carrier through the second side surface (12) and then dissipated by the carrier (1).
2. The illuminating device (100) according to Claim 1, characterized in that, the circuit board (21) is in thermal contact with the first side surface (11) and the light-emitting unit (22) is in thermal contact with the second side surface (12), such that the carrier (1) provides a thermal conducting path for the circuit board (21) and the light-emitting unit (22).
3. The illuminating device (100) according to Claim 2, characterized in that, the thermal conducting path comprises a first thermal conducting path and a second thermal conducting path, heat from the circuit board (21) is dissipated through the first thermal conducting path and heat from the light-emitting unit (22) is dissipated through the second thermal conducting path.
4. The illuminating device (100) according to Claim 3, characterized in that, the first thermal conducting path starts from the circuit board (21) through the carrier (1) to ambient air, and the second thermal conducting path starts from the light-emitting unit (22) through the carrier (1) to ambient air.

5. The illuminating device (100) according to any of Claims 1-4, characterized in that, the carrier (1) is a heat sink.
- 5 6. The illuminating device (100) according to any of Claims 1-4, characterized in that, the illuminating device (100) comprises a reflecting structure (13), wherein the reflecting structure (13) is formed on the second side surface (12) of the carrier (1), and defines a mounting area for mounting the light-emitting unit (22) on the
10 second side surface (12),.
7. The illuminating device (100) according to Claim 6, characterized in that, the reflecting structure (13) is configured as an annular projection, wherein an inner wall of the annular projection forms a reflecting surface (131).
15
8. The illuminating device (100) according to Claim 6, characterized in that, the illuminating device (100) comprises a plurality of reflecting structures (13), wherein adjacent reflecting structures (13) are connect-
20 ed via a connection structure (14), wherein the connection structure (14) is so configured that the mounting areas of the adjacent reflecting structures (13) are in communication with each other.
9. The illuminating device (100) according to Claim 7, characterized in that, a free end of the reflecting surface (131) is at a height of 0.2-1.2mm from the second side surface (12).
25
10. The illuminating device (100) according to Claim 7, characterized in that, the free end of the reflecting surface (131) is at a height of 0.6mm from the second side surface (12).
30
11. The illuminating device (100) according to Claim 7,

characterized in that, viewed in a cross section of the carrier (1), the reflecting surface (131) and the second side surface (12) form an angle of 90° - 180° .

12. The illuminating device (100) according to Claim 6,
5 characterized in that, the reflecting structure (13) and the carrier (1) are made in one piece via a hot die casting process.

13. The illuminating device (100) according to any of Claims
1-4, characterized in that, the carrier (1) comprises a
10 groove (111) formed in the first side surface (11), and the circuit board (21) is form-fittingly arranged in the groove (111).

14. The illuminating device (100) according to any of Claims
1-4, characterized in that, at least one through hole
15 (17) going from the first side surface (11) to the second side surface (12) is formed in the carrier (1), and an electrical conductor (15) for electrically connecting the circuit board (21) and the light-emitting unit (22) is arranged in the through hole (17).

20 15. The illuminating device (100) according to Claim 14, characterized in that, the through hole (17) is filled with a filling material for electrically isolating the electrical conductor (15) from the carrier (1).

25 16. The illuminating device (100) according to Claim 15, characterized in that, the filling material is thermal silica gel.

17. The illuminating device (100) according to any of Claims
1-4, characterized in that, the light-emitting unit (22)
is mounted on the second side surface (12) of the carrier
30 (1) by a chip-on-board technique.

18. The illuminating device (100) according to any of Claims 1-4, characterized in that, the carrier (1) is made from a metal, plastic or ceramic.
- 5 19. The illuminating device (100) according to any of Claims 1-4, characterized in that, the illuminating device (100) further comprises a protective cover provided on the second side surface (12), the protective cover and the second side surface (12) defining a space enclosing the light-emitting unit (22).
- 10 20. The illuminating device (100) according to any of Claims 1-4, characterized in that, the light-emitting unit (22) is configured as an LED light-emitting unit.
- 15 21. The illuminating device (100) according to any of Claims 1-4, characterized in that, the circuit board (21) is configured as an FR-4 type circuit board.

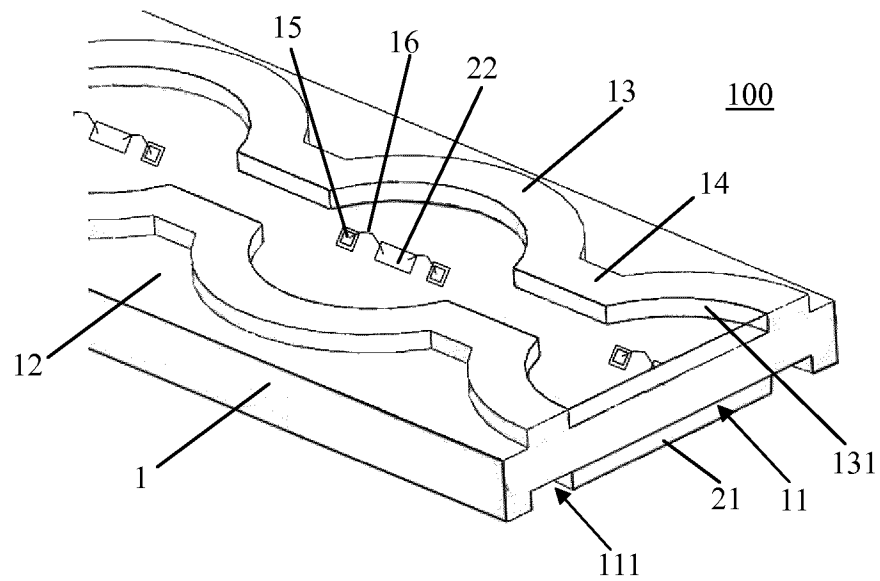


Figure 1

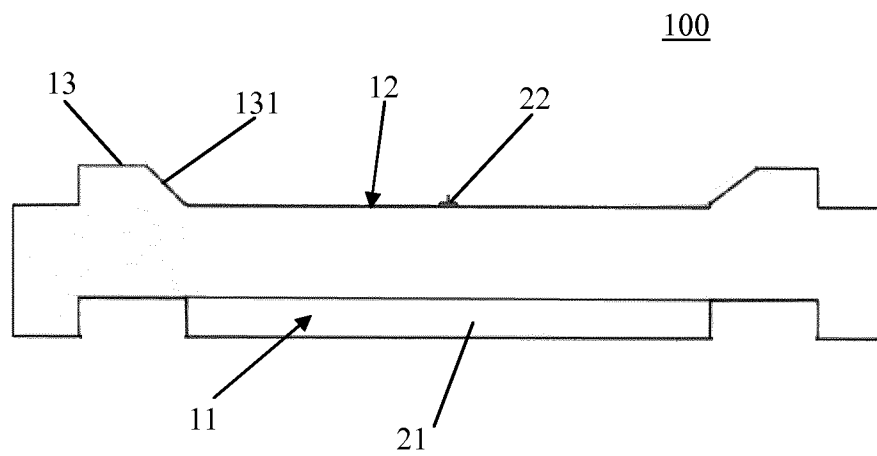


Figure 2

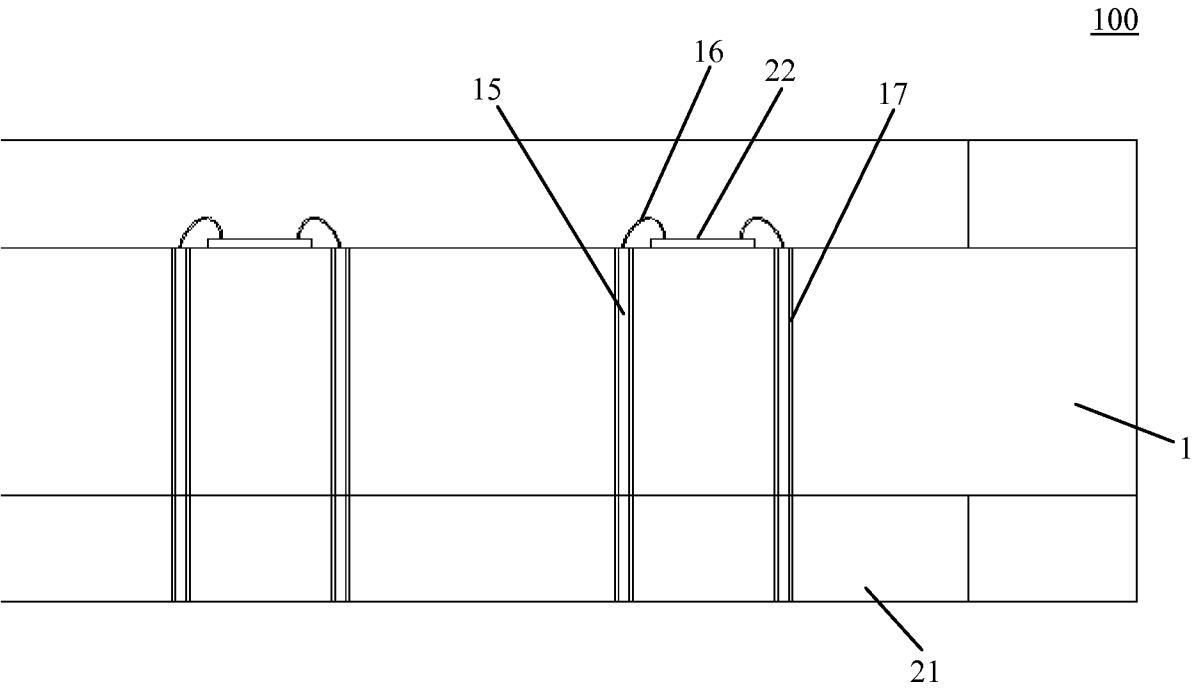


Figure 3

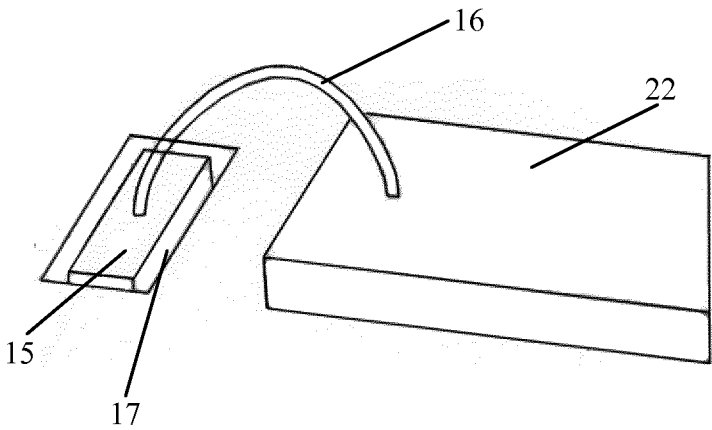


Figure 4

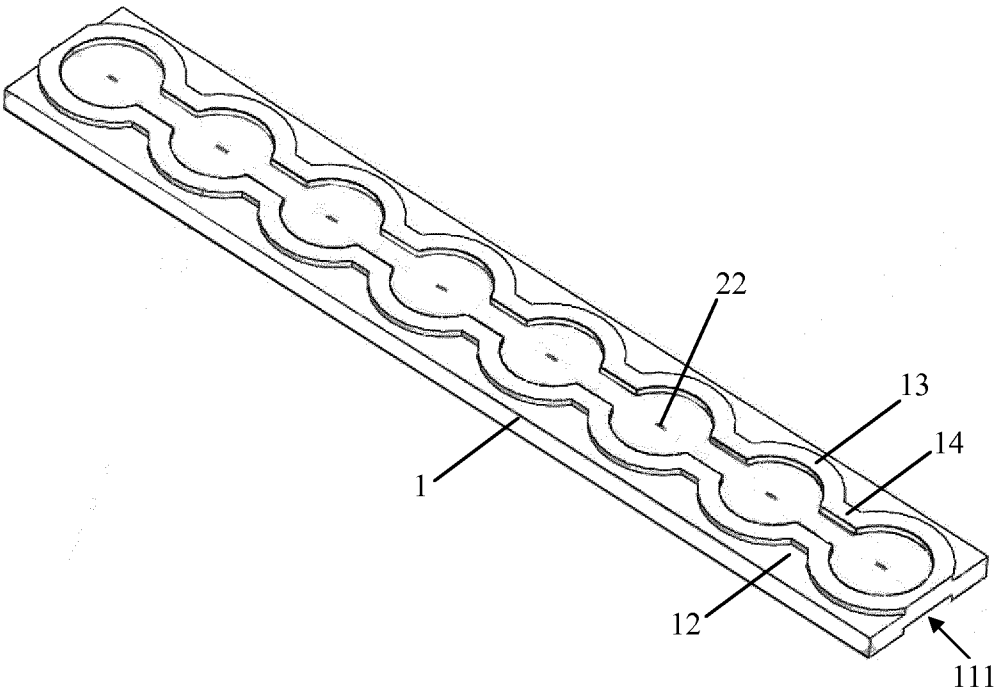


Figure 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055242

A. CLASSIFICATION OF SUBJECT MATTER
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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)
H05K F21K F21V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/211351 A1 (VAN DE VEN ANTONY PAUL [CN] ET AL) 1 September 2011 (2011-09-01)	1-5, 13-16, 18-21 6-12
Y	paragraph [0277] paragraph [0291] paragraph [0502] - paragraph [0514]; figures 20-33 paragraph [0563] - paragraph [0564]; figures 81,81	
X	US 2006/227558 A1 (OSAWA SHIGERU [JP] ET AL) 12 October 2006 (2006-10-12) paragraph [0050] - paragraph [0232]; figures ----- -/-	1-5, 14-21



Further documents are listed in the continuation of Box C.



See patent family annex.

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Name and mailing address of the ISA/

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Geoghegan, C

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055242

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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