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Lighting system

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(56) Related Art
US 7,918,580

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ABSTRACT OF THE DISCLOSURE

A lighting system of a construction with which for easier heat dissipation is enabled is provided. The lighting system includes a body and a light source which includes a heat sink in an upper portion and an LED module in a lower portion. The light sources and the body are attached to each other so that the heat sink is exposed from a top end of the body. The heat sink includes a planar portion and convex parts protruding from one surface of the planar portion and is in a hill-like shape so that a central portion protrudes.

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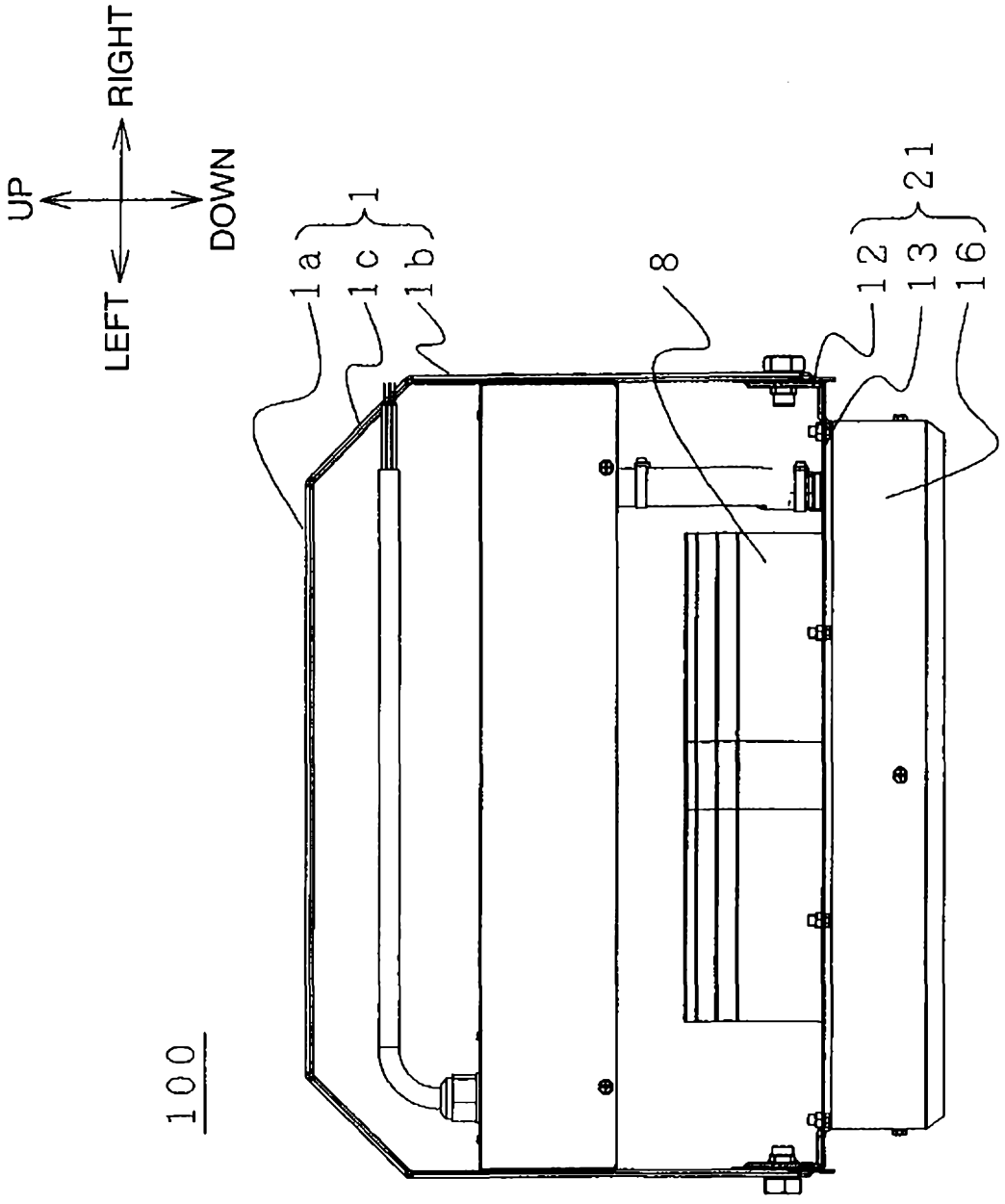
FIG. 1



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Australian Patents Act 1990 – Regulation 3.2

ORIGINAL COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title

Lighting system

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

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TECHNICAL FIELD

The present invention generally relates to a lighting system.

BACKGROUND

There is a trend of energy savings in various products these days. Along with this trend, there is a growing demand in the lighting industry for those using power-saving LEDs of high luminance efficiency as light sources. In the domestic lighting, replacement of incandescent lamps with self-ballasted LED lamps is in progress.

In lightings in factories or the like, mercury lamps which last longer and provide brighter illumination than incandescent lamps have been heretofore used. Because LED lighting systems last longer than mercury lamps, can irradiate objects as bright as mercury lamps, have better startability than mercury lamps, and can consume less wattage than mercury lamps, there is a demand for lighting systems in factories or the like which use LEDs as light sources.

There is a structure as disclosed in JP-A-2013-4168 as for one with LEDs as its light sources for lighting in factories or the like.

It is desired to address or ameliorate one or more disadvantages or limitations associated with the prior art, or to at least provide a useful alternative.

SUMMARY

In accordance with the present invention there is provided a lighting system comprising:

a body, a glow starter, and a mounting bracket rotatably connected to the body; and

a light source which comprises:

a heat sink in an upper portion, and

an LED module in a lower portion,

wherein the light source and the body are attached to each other so that the heat sink is exposed from a top end of the body,

wherein the glow starter is connected with arm portions of the mounting bracket above the heat sink, the heat sink being in a hill-like shape so that a central portion protrudes and comprises a planar portion and a plurality of convex parts protruding from one surface of the planar portion,

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wherein the heat sink is in the hill-like shape to accommodate rotation of the mounting bracket, and

wherein a plurality of convex parts located in a central portion of the heat sink are higher than a plurality of convex parts at the sides of the heat sink in a rotational direction of the mounting bracket, in order to allow the rotatability of the mounting bracket.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention are hereinafter described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

FIG. 1 is a side view of a lighting system according to the present invention.

FIG. 2 is a perspective view of the whole lighting system as viewed from the direction of the floor.

FIG. 3 is a perspective view of the whole lighting system as viewed from the direction of the ceiling.

FIG. 4 is another side view of the lighting system.

FIG. 5 is a lateral cross-sectional view of the lighting system with a mounting bracket rotated by 30 degrees.

FIG. 6 is a perspective view of the lighting system with the mounting bracket cut off.

FIG. 7 is a side view of the heat sink.

FIG. 8 is another perspective view of the lighting system with the mounting bracket cut off.

FIG. 9 is an exploded perspective view of the lighting system.

DETAILED DESCRIPTION

In order to provide a long-lasting LED lighting system, heat dissipation of a light source portion is needed to be improved; therefore, heat dissipation of a light source portion, where heat generation is concentrated, is an issue.

In the structure set forth in JP-A-2013-4168, portions of heat-dissipating fins are raised compared with the other parts to strive for improvement of heat dissipation;

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however, there is a demand for further improvement of heat dissipation.

Embodiments of the present invention provide a lighting system of a construction with which heat dissipation can be made easier.

In embodiments, there is provided a lighting system including a body and a light source which includes a heat sink in an upper portion and an LED module in a lower portion wherein the light source and the body are attached to each other so that the heat sink is exposed from a top end of the body; and wherein the heat sink has a planar portion and convex parts protruding from one surface of the planar portion and is in a hill-like shape so that a central portion protrudes.

It is possible to provide a lighting system having convexly shaped heat sinks, thus enabling to provide for easier heat dissipation.

Described herein is a lighting system of the following configuration. The lighting system includes a body 21 and a light source 19; the light source 19 has a heat sink 8 in an upper portion and an LED module in a lower portion; the light source 19 and the body 21 are attached to each other so that the heat sink 8 is exposed from the top end of the body 21; in such the lighting system, the tip of the heat sink 8 is formed in a hill-like shape, thereby making heat dissipation from the LED lighting system easier.

Hereinafter, a configuration of a lighting system 100 according to an embodiment of the present invention is described by referring to the accompanying drawings of FIGs. 1-9. For convenience of illustration of the embodiment, it is assumed that the ceiling side (not shown) is the upper side, while the floor side is the lower side. The present lighting system 100 is mounted in a building, principally on the ceiling surface of the interior of a factory, and is connected with an indoor wiring instrument provided in a building to be connected with an

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external power supply, thereby being used while being held in position.

FIG. 1 is a side view of the lighting system 100. As described in further detail later, the lighting system 100 is configured including a mounting bracket 1, a glow starter 20, light sources 19, and a body 21. FIG. 2 is a perspective view of the whole lighting system 100, as viewed from the direction of the floor when the lighting system 100 is installed on the ceiling surface (not shown). FIG. 3 is a perspective view of the whole lighting system 100, as viewed from the direction of the ceiling. FIG. 4 is another side view of the lighting system 100. FIG. 5 is a lateral cross-sectional view of the lighting system 100 with the mounting bracket 1 rotated by 30 degrees. FIG. 6 is a perspective view of the lighting system 100 as viewed from the direction of the ceiling with the mounting bracket 1 cut off. FIG. 7 is a side view of the heat sink shown in FIG. 4; in the side view, a cross section including the vicinities is enlarged. FIG. 8 is another perspective view of the lighting system 100 as viewed from the direction of the ceiling with the mounting bracket 1 cut off. FIG. 9 is an exploded perspective view of the lighting system 100.

As shown in FIGs. 1, 4, and 9, the mounting bracket 1 is a member formed to be in a concave shape when viewed laterally from inside of the lighting system 100. It is sufficient as long as the mounting bracket 1 can bear the weight of the whole lighting system 100, and the thickness, the length, or the shape is not specifically restricted. Preferably, the mounting bracket 1 is made of a material capable of withstanding the weight, in order to support the weight of the whole lighting system 100. The mounting bracket 1 comprises a ceiling portion 1a in a plate-like form, arm portions 1b each in a plate-like form and mounted substantially perpendicular to the ceiling portion 1a, and tilted portions 1c connecting the ceiling portion 1a and the arm portions 1b together. The ceiling portion 1a, the arm portions 1b, and the tilted portions 1c together provide a substantially concave form. In the lighting system 100, only the ceiling portion 1a of the mounting bracket 1 is in contact with the ceiling (or the building). Heat generated from the lighting system 100 is transferred to the building via the mounting bracket 1. Therefore, the mounting bracket 1 is preferably made of a material of good thermal conductivity. As a material of good thermal conductivity which can withstand the weight, the mounting bracket 1 is preferably made of iron or the like, which allows continuous electrical grounding for the glow starter 20, the light sources 19, and the body 21.

As shown in FIG. 9, the glow starter 20 includes an upper plate 2, a starting circuit 4, and a lower plate 5. The glow starter 20 exhibits a boxlike appearance. The upper plate 2 is a member that is formed concave when viewed laterally from inside of the glow starter 20 and is composed of a rectangular plate portion A and plate portions B provided perpendicularly at the

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longer sides of the plate portion A. The lower plate 5 is also a concavely shaped member when viewed from inside of the glow starter 20 and is made of a rectangular plate portion C and plate portions D provided perpendicularly at the shorter sides of the plate portion C. The upper plate 2 and the lower plate 5 are connected together to form a substantially boxlike shape. However, as long as it is in the shape of accommodating the starting circuit 4 therein, it is not limited thereto.

As shown in FIGs. 1 and 3-9, each heat sink 8 is hill-shaped with a protruding central portion. In order to make the heat sink 8 in a hill shape as seen in FIG. 7, it has a construction in which the substantially plate-like protruding portions (convex portions) at the center where generated heat is concentrated are made to protrude more and the protruding portions (convex portions) decrease in height from the central, plate-like protruding portion toward the substantially plate-like protruding portions at both ends. Alternatively, in order to make the heat sink 8 in a hill shape, a construction in which each of the substantially plate-like protruding portions of the heat sink 8 is made constant in the maximum height and, for the respective protruding portions (convex portions), the protrusions of the central part is made high and the protruding portions become shorter gradually toward the both ends may be adopted. When this structure is adopted, there is an advantage that the heat sink 8 can be easily formed by extrusion molding.

As shown in FIG. 9, each of the light sources 19 comprises the heat sink 8, an LED module 10, and an LED module locking plate 11. The heat sink 8 includes a flat plate portion and an uneven portion formed on one surface of the flat plate portion. Convex parts in the uneven portion are in a substantially plate-like shape and a plurality of the convex parts stick out substantially vertically from the flat plate portion. The plurality of the convex parts increase in height above the flat plate portion from the convex part at one end to the convex part in the center and decrease in height above the flat plate portion from the convex part in the center to the convex part at the other end to form in a hill-like shape as a whole. The plural convex parts are formed in the same direction. Therefore, the convex parts are directed in the same direction. The LED module 10 is mounted on the other surface of the flat plate portion. The LED module 10 and the heat sink 8 are connected together via an insulating material and the LED module 10 is secured to the heat sink 8 by the LED module locking plate 11. The LED module 10 comprises a base plate and light-emitting elements mounted on the base plate. Heat generated by the light-emitting elements is transmitted via the base plate and an insulating sheet 9 to the heat sink 8. The heat generated by the light-emitting elements is, then, dissipated away as the uneven portion of the heat sink 8 touches the outside air. As long as heat dissipation

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effect from the heat sink 8 is assured, it is not limited to this shape. Preferably, the heat sink 8 is made of a material providing good heat dissipation because of its role. Furthermore, with the overall weight to be taken into consideration, it is desirable to form it with the lightest material available. Consequently, the heat sink 8 is preferably made of a material such as aluminum.

As shown in FIG. 9, the body 21 is composed of a body support member 12, a body bottom plate, reflecting cylinders 14, cylindrical members 15, a body side plate 16, and a translucent cover 17. The body support member 12 comprises a body bottom plate portion 13 and body support portions. The body bottom plate portion 13 is a substantially plate-like portion. The body bottom plate portion 13 is provided with openings to which the cylindrical members 15 are attached. The openings of the same number as the light sources 19 are provided. Each of the body support portions is a plate-like portion provided in an end portion of the body bottom plate portion 13 so as to extend substantially vertically from the body bottom plate portion 13. In the present embodiment, two body support portions are provided to be identical in number to the arm portions 1b. Each of the reflecting cylinders 14 is a member of a substantially cylindrical shape whose cross-sectional area gradually increases from its top surface toward its bottom surface. In addition, each reflecting cylinder 14 has a mirror-like inner surface to reflect and guide downwardly (in the direction toward the floor surface) light coming from the light source 19. Each of the cylindrical members 15 is a member of a substantially cylindrical shape. The inside diameter of the cylindrical members 15 is nearly equal to the outside diameter of the reflecting cylinders 14, and they are so shaped that the reflecting cylinders 14 can be engaged to lock inside.

While the reflecting cylinders 14 are included inside, the cylindrical members 15 and the body bottom plate portion 13 are connected together. The positions where the cylindrical members 15 are connected are where the openings in the body bottom plate portion 13 face the openings in the cylindrical members 15.

The body side plate 16 is a member of a substantially cylindrical shape having both bottom surfaces open. As a material for the translucent cover 17, a translucent material such as glass or plastic works.

As shown in FIG. 9, the glow starter 20 is connected with the arm portions 1b of the mounting bracket 1. In the present embodiment, the glow starter 20 is in a boxlike shape and the plate portions D on the shorter sides are connected with the arm portions 1b. By connecting the glow starter 20 and the mounting bracket 1 together, heat from the starting circuit 4 can be transmitted to the arm portions 1b via the upper plate 2 and the lower plate 5.

As shown in FIGs. 1-4, 6, and 9, the arm portions 1b of the mounting bracket 1

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and the body support portions of the body support member 12 are connected together with screws. Thus, the body 21 and the mounting bracket 1 are connected together. In the present embodiment, the ceiling portion 1a of the mounting bracket 1 and the body bottom surface portion of the body support member 12 are connected to be substantially parallel to each other when viewed from a side of the arm portions 1b.

As shown in FIGs. 1 and 9, the light sources 19 and the body 21 are connected together by screwing down the heat sinks 8 to the body bottom plate portion 13 of the body support member 12. When the light sources 19 and the body 21 are connected, they are connected so that the openings in the body support member 12 face the LED module 10 and that the heat sinks 8 are located over the body 21.

Here, in the lighting system 100, the hottest portions excluding the LED module 10 are the heat sinks 8. Therefore, the temperature of the whole lighting system 100 can be lowered by dissipating or transferring heat from the heat sink 8. There is a correlation between temperature and efficiency; decreases in the efficiency can be suppressed by lowering the temperature.

By forming the heat sinks 8 in a hill-like shape as described above, the advantageous effect that the central convex portions can more easily come into contact with air than the other portions arises. Air warmed up by heat dissipation from the heat sinks 8 ascends and can produce thermal convection. With the thermal convection, the air around the heat sinks 8 can be cooled down and cooling of the heat sinks 8 can be promoted.

As shown in FIG. 3, in the present embodiment, the light sources 19 are attached to the body 21 such that the direction of the plate of the support portion for the body 21 of the mounting bracket 1 is different from the direction to which the convex parts of the uneven portion are provided. While three light sources 19 are mounted in the present embodiment, they are attached to the body 21 to be in the same orientation.

Furthermore, although in the present embodiment the top surface of the body 21 is perpendicular to the direction in which the arm portions 1b of the mounting bracket 1 extend, it is not restricted thereto. Alternatively, the top surface of the body 21 may make a non-normal angle with respect to the direction in which the arm portions 1b extend. For example, it is possible to arrange that the top surface of the body 21 may make an angle of 60 degrees with respect to the direction in which the arm portions 1b extend. With this arrangement, the direction in which light is emitted from the light sources 19 can be tilted at an angle of 30 degrees with respect to the ceiling surface of the mounting bracket 1, thereby enabling to achieve a desired angle.

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By making the top surface of the body 21 have a non-normal angle with respect to the direction in which the arm portions 1b extend, even when it is mounted to a tilted ceiling, the light sources 19 can be directed straight down.

Also, the direction of the plates forming the arm portions 1b of the mounting bracket 1 is arranged identical to the direction in which the convex parts of the uneven portions of the heat sinks 8 are provided. As shown in FIG. 5, when the mounting bracket 1 rotates relative to the body 21, the glow starter 20 secured to the bracket 1 rotates in the same locus. At this time, a risk of interference (contact) between any one of the heat sinks 8 and the glow starter 20 can be reduced by arranging the direction of the plates forming the arm portions 1b of the mounting bracket 1 identical to the direction in which the convex parts of the uneven portions of the heat sinks 8 are provided and making the both ends of each heat sink 8 shorter. Consequently, the arm portions 1b of the mounting bracket 1 can be made shorter than conventional ones and the weight of the mounting bracket 1 is reduced, thereby reducing the weight of the lighting system 100.

The heat sinks 8 can be made so that air can be easily taken from outside of the body 21 by setting the convex parts low at both the ends and gradually increasing the height toward the center as shown in FIGs. 6 and 7.

Besides, the flow of the air from outside of the body is regulated and thus stable heat dissipation can be achieved by flattening the body bottom plate portion 13 located on the front side of each heat sink 8.

Furthermore, as shown in FIG. 8, plural heat sinks 8 can be arranged on the body bottom plate portion 13; by arranging the concave parts, which are parallel to the direction of the plates forming the arm portions 1b of the mounting bracket 1, in a line, air from outside of the body 21 can be uniformly taken in from the both ends and, by causing it to concentrate toward the center, it is circulated by convection toward the above, thereby enabling improvement of the heat dissipation.

It should be further understood by those skilled in the art that although the foregoing description has been made on embodiments of the invention, the invention is not limited thereto and various changes and modifications may be made without departing from the spirit of the invention and the scope of the appended claims.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

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The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavor to which this specification relates.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A lighting system comprising:

a body, a glow starter, and a mounting bracket rotatably connected to the body; and

a light source which comprises:

a heat sink in an upper portion, and

an LED module in a lower portion,

wherein the light source and the body are attached to each other so that the heat sink is exposed from a top end of the body,

wherein the glow starter is connected with arm portions of the mounting bracket above the heat sink, the heat sink being in a hill-like shape so that a central portion protrudes and comprises a planar portion and a plurality of convex parts protruding from one surface of the planar portion,

wherein the heat sink is in the hill-like shape to accommodate rotation of the mounting bracket, and

wherein a plurality of convex parts located in a central portion of the heat sink are higher than a plurality of convex parts at the sides of the heat sink in a rotational direction of the mounting bracket, in order to allow the rotatability of the mounting bracket.

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FIG. 1

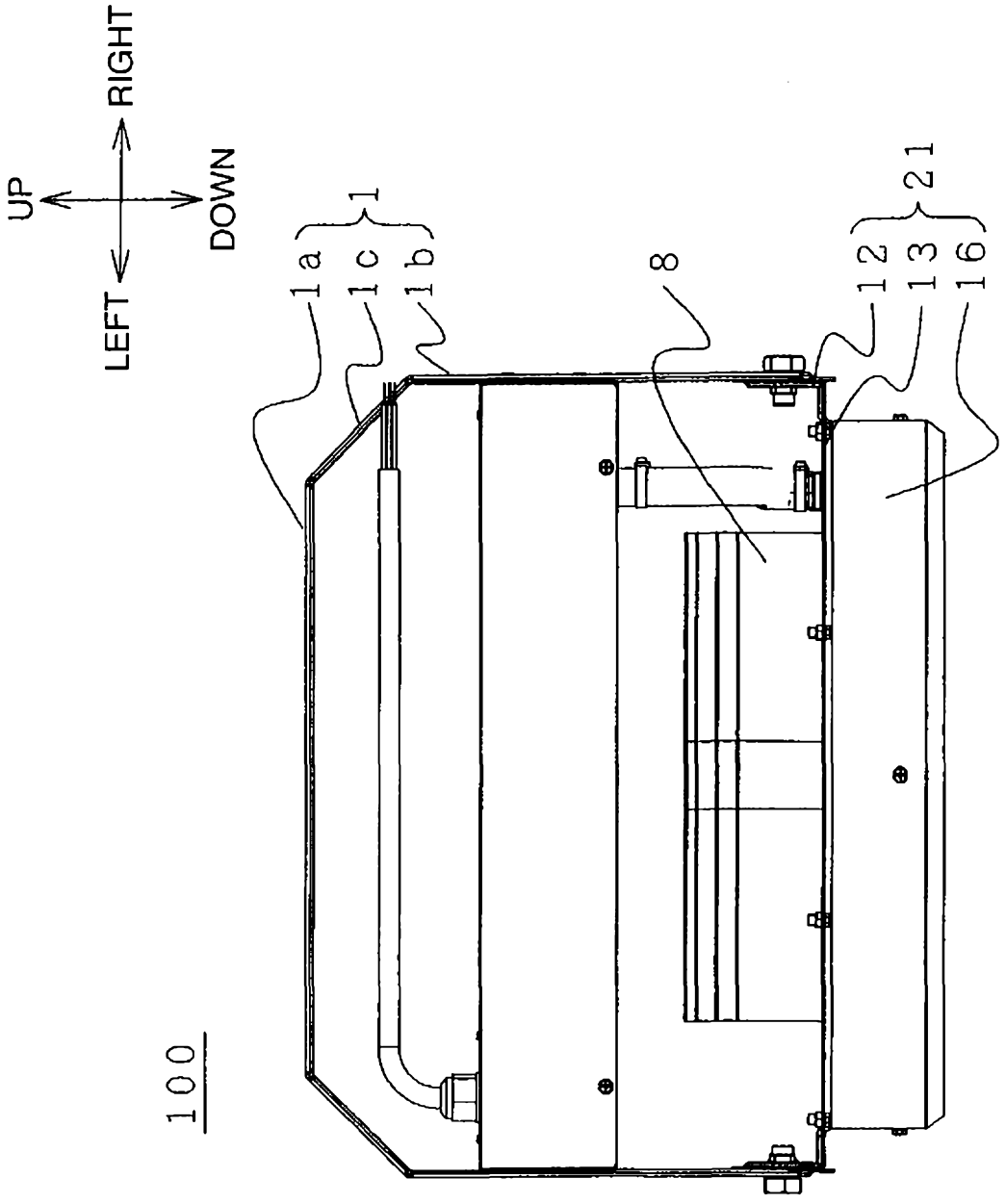

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FIG. 2

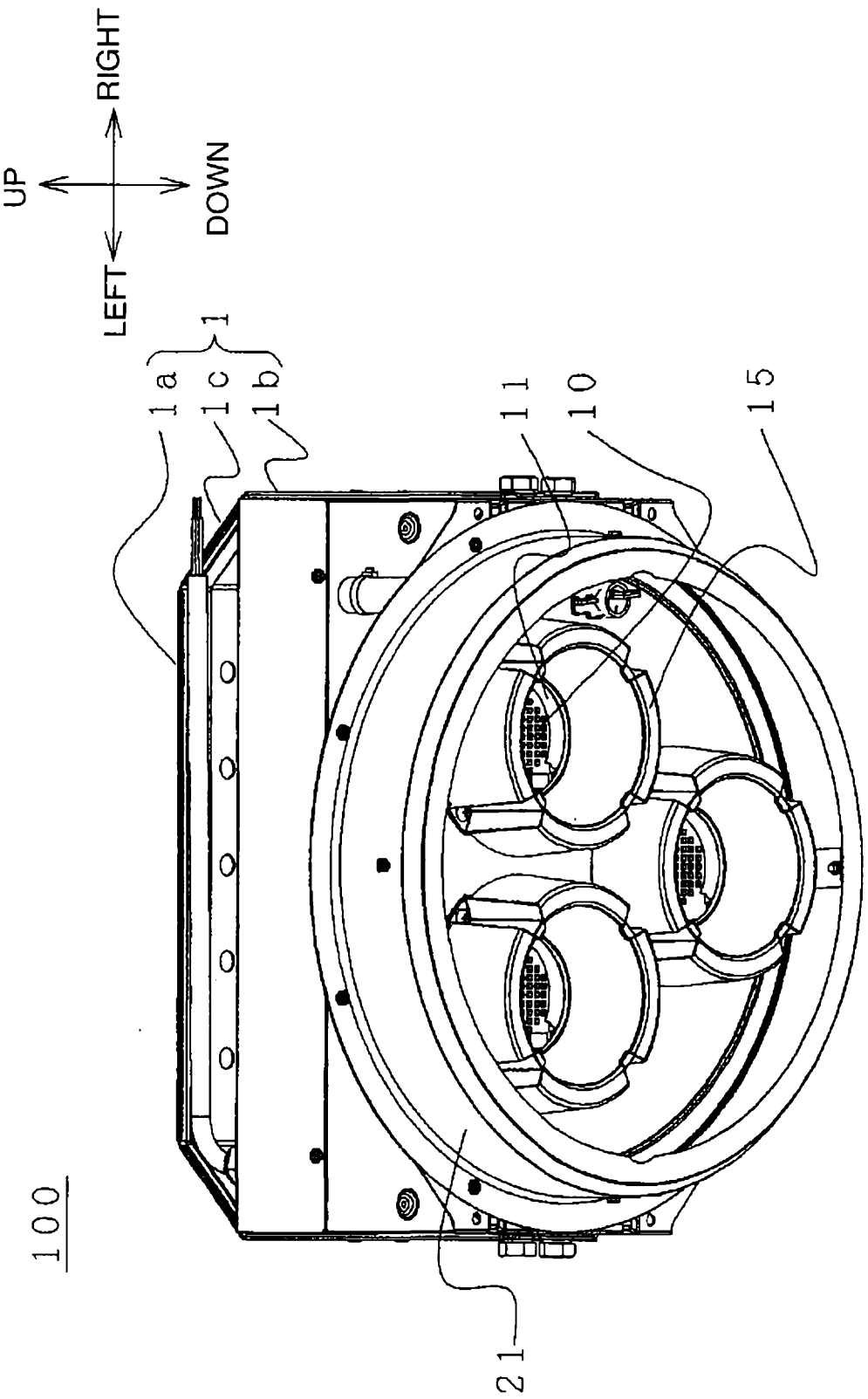

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FIG. 3

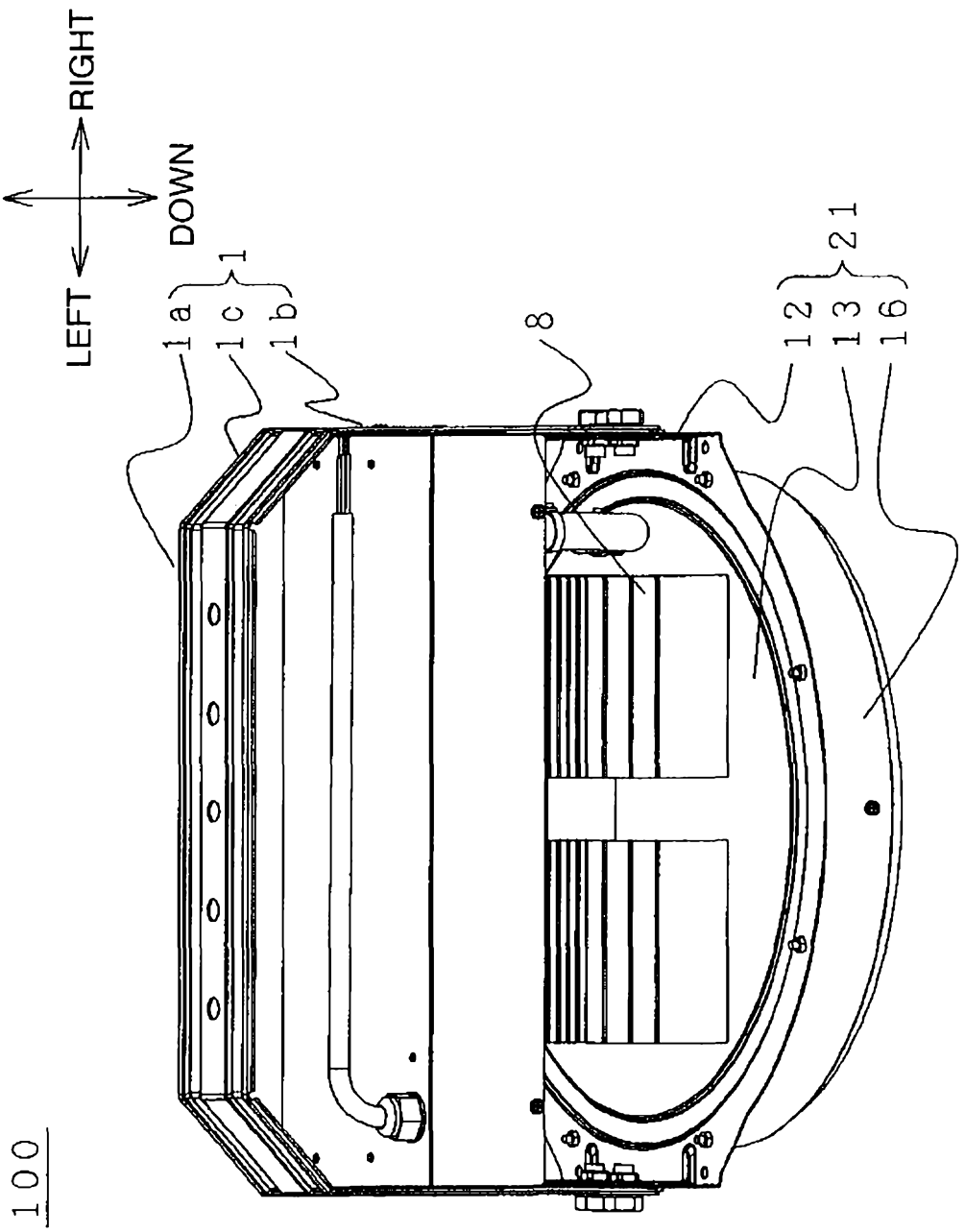

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FIG. 4

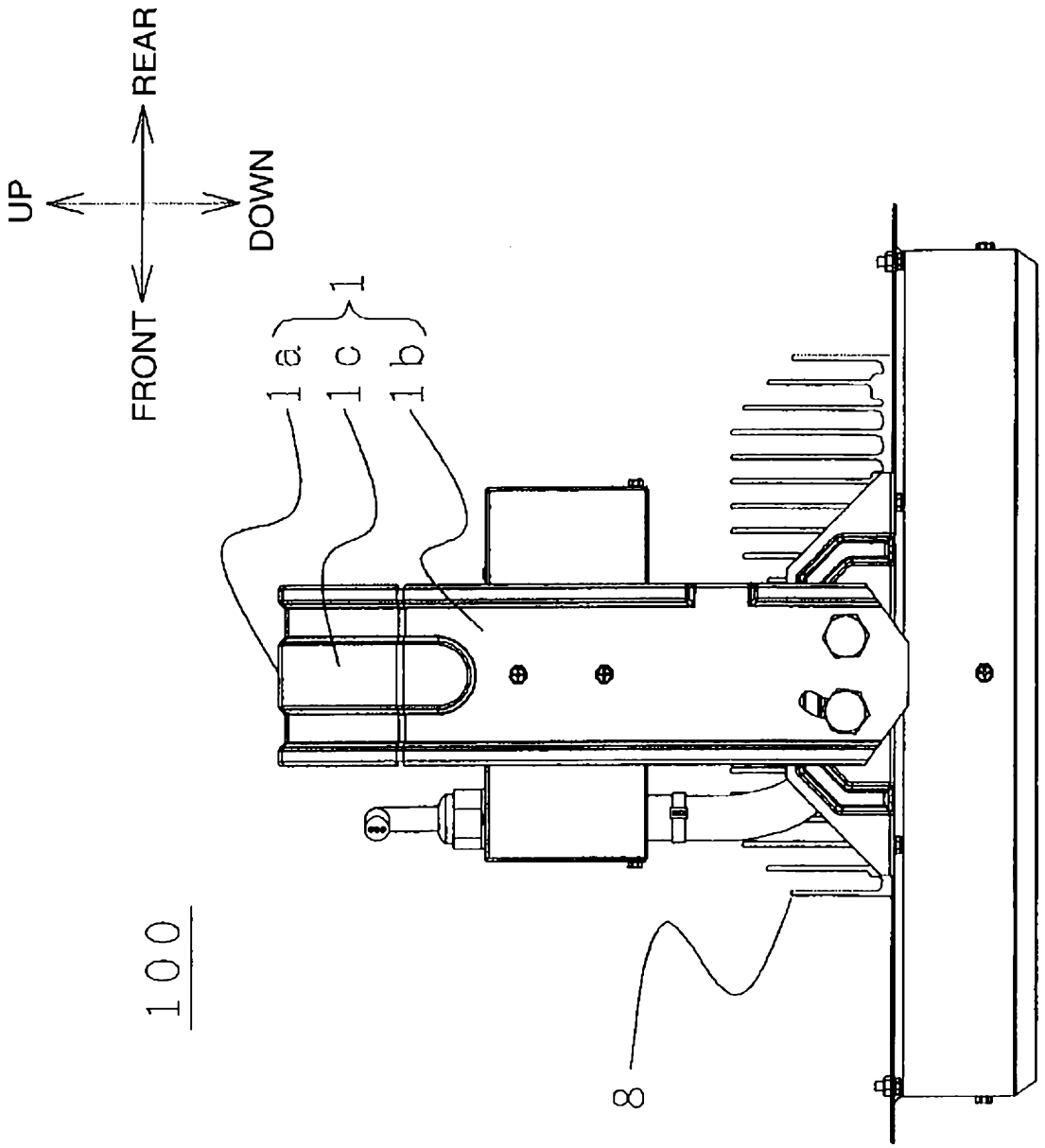

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FIG. 5

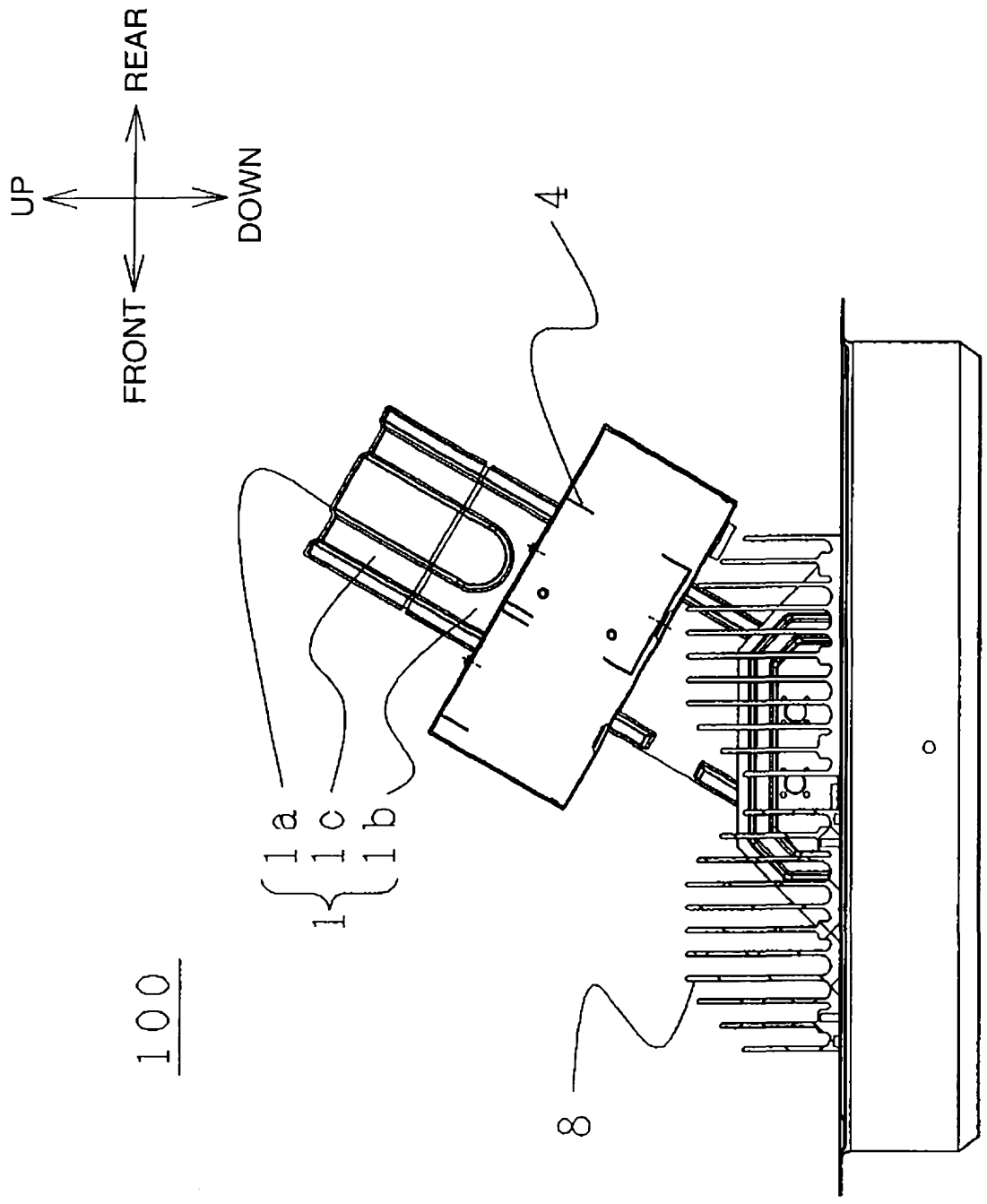

FIG. 6

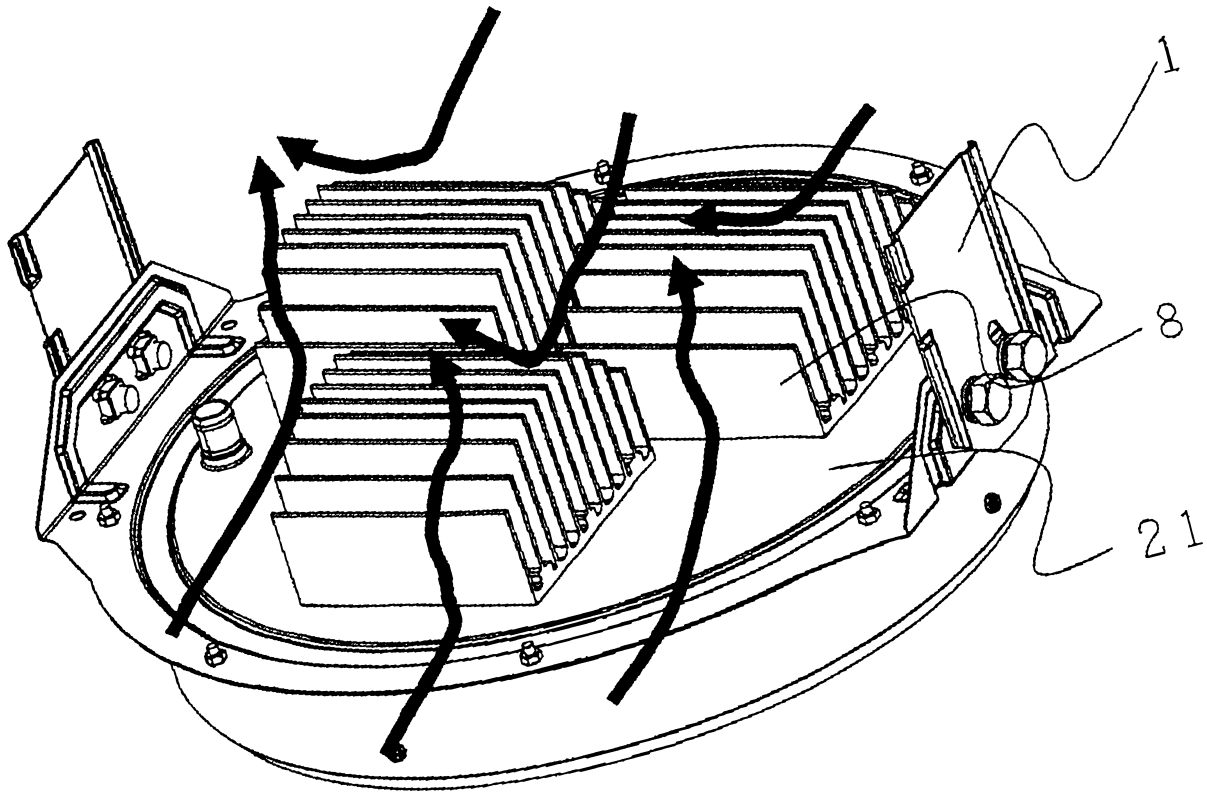

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FIG. 7

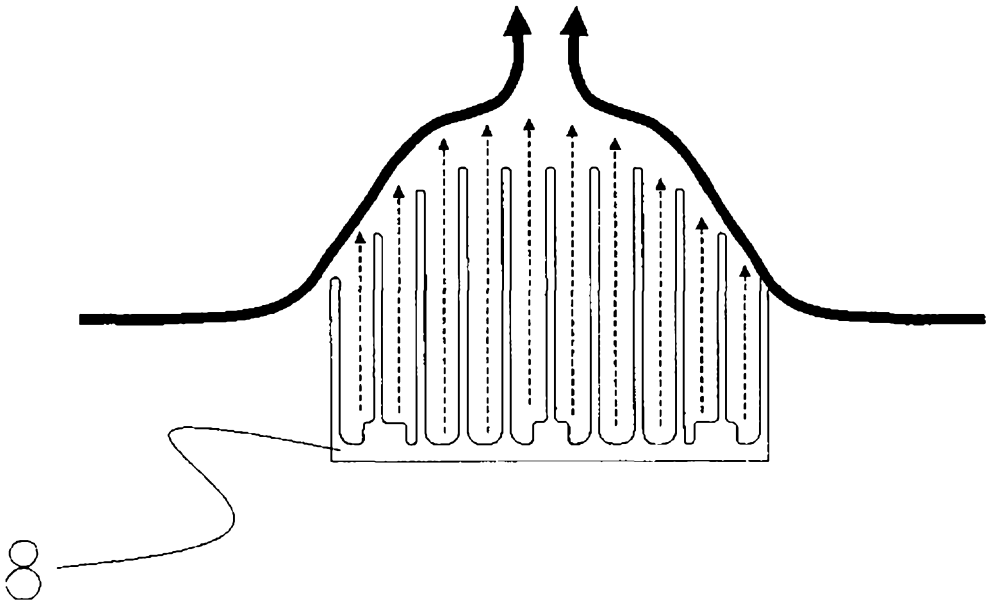

FIG. 8

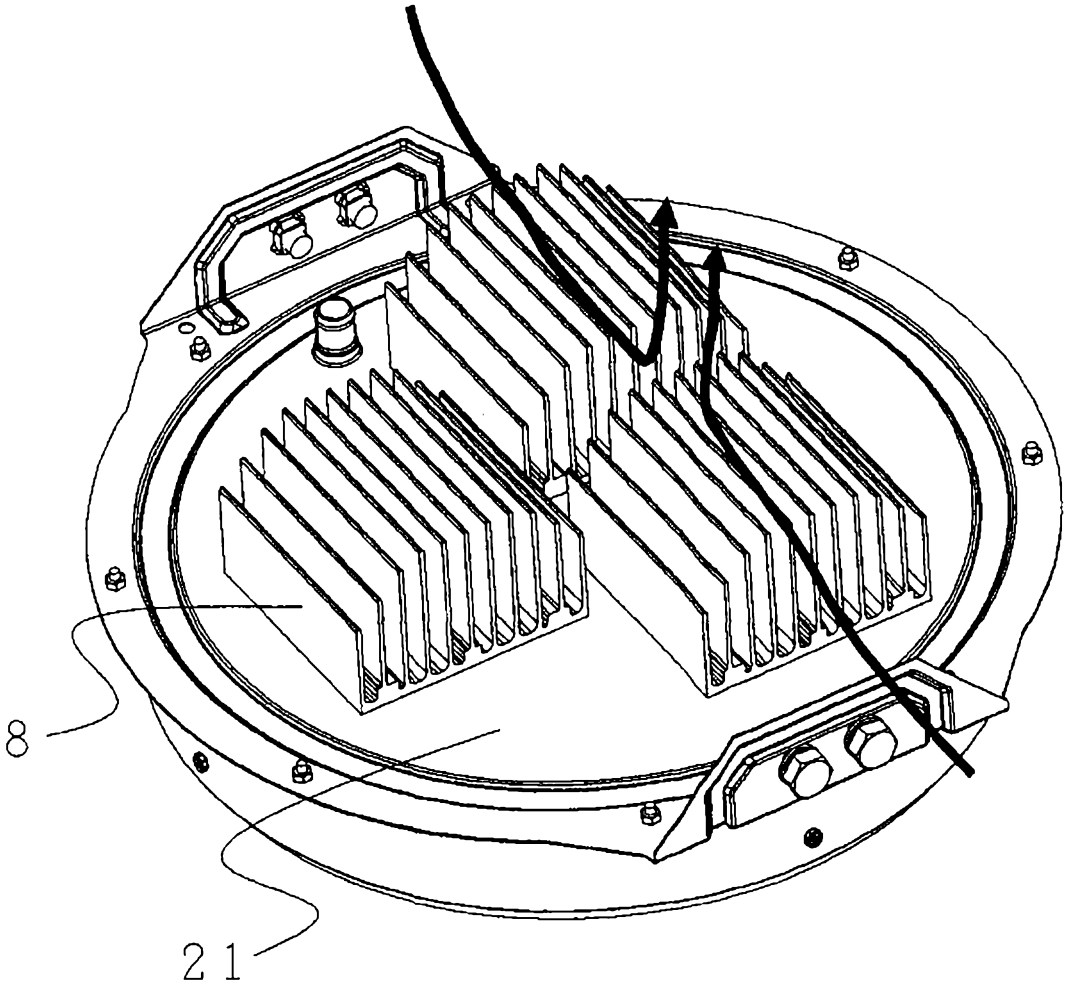

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FIG. 9