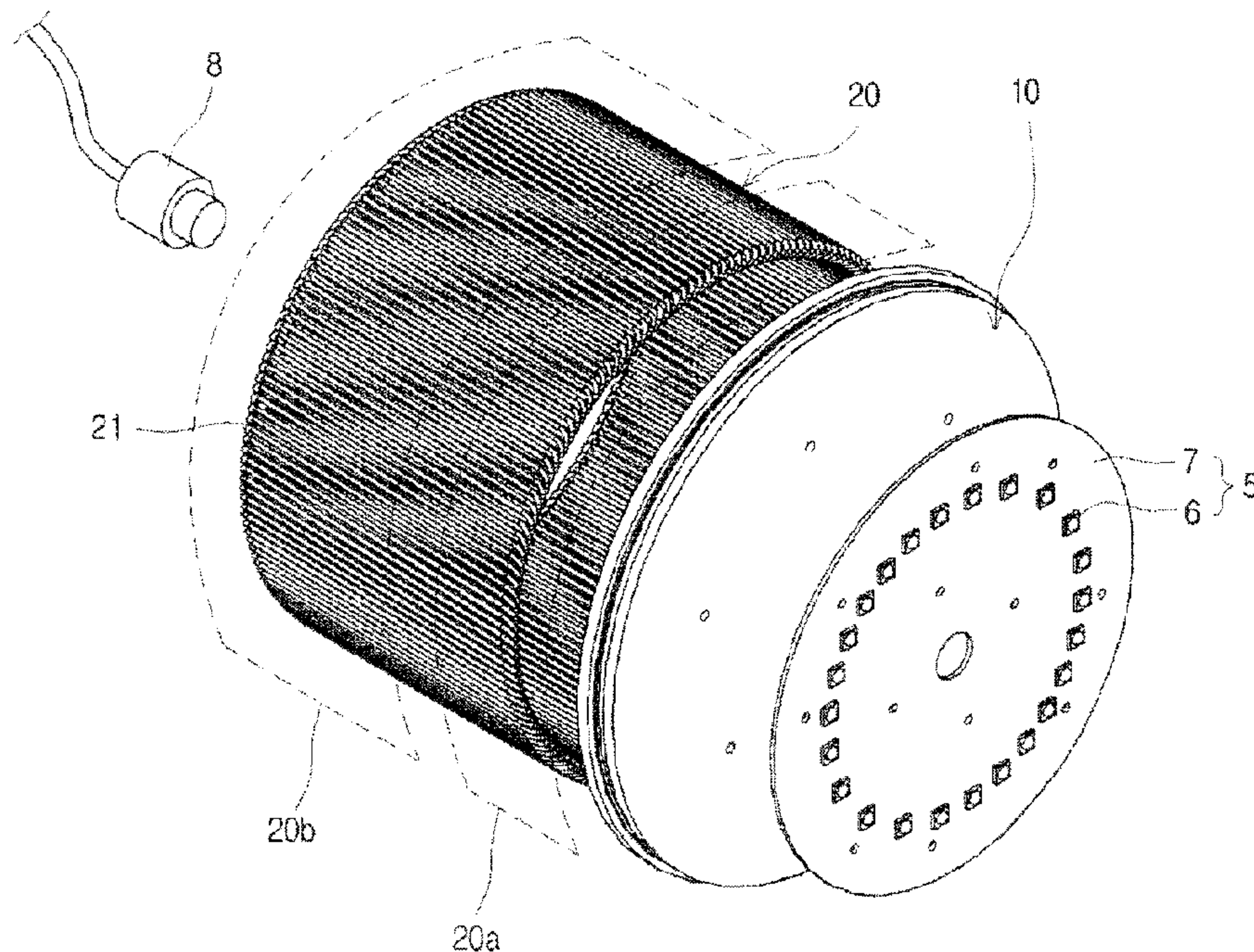




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 (54) Title: LED LIGHTING APPARATUS



(57) Abrégé/Abstract:

Disclosed is a light-emitting diode (LED) lighting apparatus. The LED lighting apparatus comprises: a light source module comprising an LED light source; a thermal base coupled to the light source module so as to receive heat generated by the light source module; and a heat-dissipating member comprising a ventilation unit coupled to an edge region of the thermal base so as to discharge heat transmitted from the thermal base and open a central area of the thermal base so as to facilitate air ventilation to the outside. The LED lighting apparatus can increase heat-dissipating efficiency by maximizing ventilation efficiency and enabling air around the heat-dissipating member to flow smoothly without stagnating.

1 ABSTRACT

2 Disclosed is a light-emitting diode (LED) lighting apparatus. The LED lighting apparatus
3 comprises: a light source module comprising an LED light source; a thermal base coupled to the
4 light source module so as to receive heat generated by the light source module; and a heat-
5 dissipating member comprising a ventilation unit coupled to an edge region of the thermal base
6 so as to discharge heat transmitted from the thermal base and open a central area of the
7 thermal base so as to facilitate air ventilation to the outside. The LED lighting apparatus can
8 increase heat-dissipating efficiency by maximizing ventilation efficiency and enabling air around
9 the heat-dissipating member to flow smoothly without stagnating.

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LED LIGHTING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Patent Application No. 10-2010- 0017149, filed with the Korean Intellectual Property Office on February 25, 2010.

BACKGROUND

1. Technical Field

The present invention relates to an LED lighting apparatus.

2. Background Art

An LED lighting apparatus has a large amount of heat generated due to heat generated by the LED. Generally, when the LED lighting apparatus is overheated, the LED lighting apparatus may malfunction or be damaged, and thus it is essentially required to equip the LED lighting apparatus with a heat-dissipating structure in order to prevent the overheating.

Accordingly, disclosed previously has been an LED lighting apparatus having heat-dissipating fins. In the LED lighting apparatus having heat-dissipating fins therein, the heat-dissipating fins are attached to a cylindrical body that surrounds a light source so as to expand the surface area. However, the heat-dissipating fin structure is limited in expanding the surface area, and the air present in between the heat-dissipating fins is stagnated with heat therein, lowering the heat-dissipating efficiency relative to the surface area.

To improve this problem, Korean Patent Publication 2009-0095903 has disclosed a structure that discharges a linear heat radiation member on an external circumferential surface of the body surrounding a light source. However, in this kind of structure also, the air having the heat held therein is stagnated on the exterior of the body in such a way that the problem of

1 lowered heat-dissipating efficiency remains unsolved. Moreover, the heat generated from the
2 light source is confined in the cylindrical body to cause a thermal bottleneck phenomenon, in
3 which the heat confined in the cylindrical body is not transferred to the heat radiation member
4 quickly enough.

5 Korean Patent Publication 2009-0076545 has disclosed an LED lighting apparatus in
6 which open heat radiation passages are formed in a heat sink in order to facilitate air flow.
7 However, this kind of structure also merely improves the air flow limitedly at an end portion of
8 the heat sink and thus is not capable of solving the problem caused by the air having the heat
9 held therein, and the problem of insufficient active heat radiation area for heat dissipation still
10 remains unsolved.

11

12 **SUMMARY**

13 The present invention provides an LED lighting apparatus in which heat-dissipating
14 efficiency is improved by activating air flow around a heat-dissipating member.

15 An aspect of the present invention features an LED lighting apparatus, which includes: a
16 light source module comprising an LED light source; a thermal base coupled to the light source
17 module so as to receive heat generated by the light source module; and a heat-dissipating
18 member comprising a ventilation unit coupled to an edge region of the thermal base so as to
19 discharge heat transferred from the thermal base and open a central area of the thermal base
20 so as to facilitate air ventilation to the outside.

21 The LED light source can be provided in plurality, and the plurality of LED light sources
22 can be arranged to correspond to the edge region of the thermal base.

23 The heat-dissipating member can include a heat-dissipating loop that is constituted with
24 linear members and comprises a spiral structure repeatedly forming a heat-absorbing unit
25 coupled to the edge region of the thermal base to receive heat and a heat-dissipating unit
26 separated from the heat-absorbing unit to dissipate the absorbed heat.

1 The heat-dissipating loop can include a capillary tube type of heat-pipe loop, into which
2 working fluid is injected.

3 The thermal base can be formed with a heat-transfer groove in the shape of a trench,
4 and the heat-dissipating loop can be inserted into and arranged in the heat-transfer groove.

5 The heat-dissipating member can include a hollow-type heat-dissipating fence coupled
6 with the edge region of the thermal base and having a plurality of penetration holes formed
7 therein so as to enable air flow to the inside.

8 The heat-dissipating fence can be provided in plurality and coupled to the thermal base
9 in a multi-layer structure.

10 The heat-dissipating member can include a plurality of linear members, each of which
11 has a heat-absorbing unit coupled with the edge region of the thermal base to receive heat and
12 a heat-dissipating unit separated from the heat-absorbing unit to dissipate the absorbed heat.

13 The thermal base can have a penetration hole formed therein so as to enable air flow.

14 With the present invention, it becomes possible to improve the heat-dissipating efficiency
15 of the LED lighting apparatus by maximizing ventilation efficiency and enabling air around the
16 heat-dissipating member to flow smoothly without stagnating.

17 Moreover, the heat-dissipating efficiency can be improved by preventing heat transfer
18 from slowing down because the heat generated by LED is widely diffused.

19

20 **BRIEF DESCRIPTION OF THE DRAWINGS**

21 FIG. 1 is an exploded perspective view showing an LED lighting apparatus in
22 accordance with an embodiment of the present invention.

23 FIG. 2 is a perspective view showing the LED lighting apparatus in accordance with an
24 embodiment of the present invention.

25 FIG. 3 is a perspective view showing a thermal base of the LED lighting apparatus in
26 accordance with an embodiment of the present invention.

1 FIG. 4 illustrates heat transfer passages in the thermal base of the LED lighting
2 apparatus in accordance with an embodiment of the present invention.

3 FIG. 5 illustrates air flow in the LED lighting apparatus in accordance with an
4 embodiment of the present invention.

5 FIG. 6 is a perspective view showing a heat pipe loop of the LED lighting apparatus in
6 accordance with an embodiment of the present invention.

7 FIG. 7 is an exploded perspective view showing an LED lighting apparatus in
8 accordance with another embodiment of the present invention.

9 FIG. 8 illustrates a heat-dissipating fence structure of the LED lighting apparatus in
10 accordance with another embodiment of the present invention.

11

12 **DETAILED DESCRIPTION**

13 Hereinafter, some embodiments of the present invention will be described with
14 reference to the accompanying drawings.

15 FIG. 1 is an exploded perspective view showing an LED lighting apparatus in
16 accordance with an embodiment of the present invention, and FIG. 2 is a perspective view
17 showing the LED lighting apparatus in accordance with an embodiment of the present invention.

18 The LED lighting apparatus in accordance with an embodiment of the present invention
19 includes a light source module 5, a thermal base 10 and a heat-dissipating member 20, 30.

20 The light source module 5 is a portion that includes an LED light source 6, which can
21 emit light by use of electrical energy, to generate light required for lighting. As illustrated in FIG.
22 1, the light source module 5 in accordance with the present embodiment is constituted with the
23 LED light source 6 and a module board 7, in which the LED light source 7 is mounted.

24 The thermal base 10 is a portion that receives heat generated by the LED light source 6
25 and transfers the heat to a heat-dissipating member. For this, one side of the thermal base 10 is
26 coupled with the LED light source 6 so as to enable heat transfer, and an edge region of the

1 thermal base 10 is coupled with the heat-dissipating member so as to enable heat transfer.
2 Accordingly, the heat absorbed by the thermal base 10 can be readily transferred to the heat-
3 dissipating member.

4 FIG. 3 is a perspective view showing the thermal base of the LED lighting apparatus in
5 accordance with an embodiment of the present invention, and FIG. 4 illustrates heat transfer
6 passages in the thermal base of the LED lighting apparatus in accordance with an embodiment
7 of the present invention.

8 As illustrated in FIG. 4, most of the heat absorbed by the thermal base 10 is dissipated
9 through edge regions where the heat-dissipating member is coupled. Accordingly, the heat
10 transfer passages, in which the cross-sectional areas thereof are increased along the passages,
11 are formed in the thermal base 10. As the heat transfer becomes faster with the increase of the
12 cross-sectional areas, the heat absorbed by the thermal base 10 is not stagnated but quickly
13 transferred to the heat-dissipating member to increase the heat-dissipating efficiency.

14 In the case that the LED light source 6 is provided in plurality, the plurality of LED light
15 sources 6 can be arranged to correspond to the edge region of the thermal base to shorten the
16 heat transfer passages and further improve the speed of heat transfer to the heat-dissipating
17 member.

18 As illustrated in FIG. 1, in the present embodiment, the light source module 5 having the
19 plurality of circularly-arranged LED light sources 6 is mounted on one surface of the circular
20 thermal base 10, and the cylindrical heat-dissipating member is coupled to the edge region of
21 the other surface of the thermal base 10. As illustrated in FIG. 3, formed in the middle of the
22 thermal base 10 is a penetration hole 14, into which a power cable 8 for supplying electricity to
23 the light source module 5 is inserted.

24 The heat-dissipating member 20, 30 is a portion that is coupled with the edge region of
25 the thermal base to dissipate the heat transferred from the thermal base 10. Particularly, the
26 heat-dissipating member 20, 30 of the present embodiment is formed with a ventilation unit 22,

1 32 that opens a central area of the thermal base 10 and allows the air to flow freely so as to
2 facilitate air ventilation to the outside.

3 FIG. 5 illustrates air flow in the LED lighting apparatus in accordance with an
4 embodiment of the present invention.

5 As illustrated in FIG. 5, the LED lighting apparatus of the present embodiment has an
6 inside that is sufficiently hollow to open the central area of the thermal base 10, and the hollow
7 space inside the thermal base 10 allows for easy ventilation with the outside through the
8 ventilation unit. Accordingly, ventilation efficiency of the LED lighting apparatus is maximized so
9 that the air around the heat-dissipating member is not stagnated but flows freely to improve the
10 heat-dissipating efficiency. That is, by increasing the ventilation efficiency and facilitating
11 continuous air flow around the heat-dissipating member, it becomes possible to prevent the air
12 having the heat held therein from stagnating and lowering the heat-dissipating performance.

13 Moreover, the air ventilated toward the inside works to dissipate not only the heat of the
14 heat-dissipating member but also the heat absorbed by the thermal base 10, further enhancing
15 the heat-dissipating efficiency. In other words, the surface of the thermal base 10 can be also
16 utilized as an active area for heat dissipation. It is also possible that the thermal base 10 is
17 formed with a penetration hole for ventilation, to further enhance the ventilation efficiency of the
18 LED lighting apparatus.

19 Specifically, as illustrated in FIGS. 1 and 2, the heat-dissipating member in accordance
20 with the present embodiment can include a spiral structure of heat-dissipating loop 20 that is
21 constituted with linear members repeatedly forming a heat-absorbing unit 20a, which is coupled
22 to the edge region of the thermal base 10 to receive heat, and a heat-dissipating unit 20b, which
23 is separated from the heat-absorbing unit 20a to discharge the absorbed heat. In other words,
24 the heat-dissipating loop 20 has a spiral structure that reciprocates between a region that is
25 coupled with the thermal base 10 and a region that is apart from the thermal base 10.
26 Accordingly, a gap between spirals of the heat-dissipating loop 20 becomes the ventilation unit

1 22, through which air is freely ventilated to the outside. In addition, by forming the heat-
2 dissipating member in a spiral structure, the surface area required for heat dissipation can be
3 maximized in a limited space.

4 Moreover, as illustrated in FIG. 3, the thermal base 10 is formed with a heat-transfer
5 groove 12 in the shape of a trench, and as illustrated in FIG. 2, the heat-dissipating loop 20 can
6 be successively inserted into and coupled with the heat-transfer groove 12. Accordingly, by
7 filling solder and the like in the heat-transfer groove 12 after inserting the heat-dissipating loop
8 20, the heat-dissipating loop 20 can be readily coupled with the thermal base 10. Moreover,
9 elastic force is at work between spiral-shaped loops of the heat-dissipating loop 20 so that each
10 loop of the heat-dissipating loop 20 inserted into the heat-transfer groove 12 can be separated
11 from adjacent loops and maintain its inserted form by the elastic force.

12 Here, as illustrated in FIG. 4, each loop of the heat-dissipating loop 20 inserted in the
13 heat-transfer groove 12 is arranged at an angle in the heat-transfer groove 12 so as to increase
14 the density of the arranged heat-dissipating loop 200 and the area of contact with the thermal
15 base 10.

16 Moreover, the heat-dissipating loop 20 can include a capillary tube type of heat-pipe loop
17 25, into which working fluid 26 is injected.

18 FIG. 6 is a perspective view showing the heat pipe loop of the LED lighting apparatus in
19 accordance with an embodiment of the present invention.

20 As illustrated in FIG. 5, the heat-pipe loop 25 in accordance with the present
21 embodiment has an oscillating capillary tube type of a heat pipe formed in a spiral structure
22 therein, and the oscillating capillary tube type heat pipe has a structure in which the working
23 fluid 26 and air bubbles 27 are injected in a predetermined ratio into the capillary tube and then
24 the capillary tube is sealed from the outside. Accordingly, the oscillating capillary tube type heat
25 pipe has a heat transfer cycle in which heat is mass transported in the form of latent heat by
26 volume expansion and condensation of the air bubbles 27 and the working fluid 26. As a result,

1 the heat-dissipating efficiency of the heat-dissipating member can be maximized.

2 Here, the heat-pipe loop 25 can be generally formed in the shape of a board. The board-
3 shaped heat-pipe loop 25 can be formed in a cylindrical shape by rolling the heat-pipe loop 25 in
4 an annular shape and having both ends of the heat-pipe loop 25 by a joint 28. The cylindrical-
5 shape heat-pipe loop 25 can be readily inserted in the heat-transfer groove 12 and can have a
6 higher heat-dissipating efficiency because air flow required for heat dissipation becomes freer.

7 The heat-dissipating member constituted with the linear members is not restricted to the
8 spiral loop type but can be embodied in various permutations, for example, a parallel-arranged
9 plurality of linear members, each of which has a heat-absorbing unit coupled with the edge
10 region of the thermal base 10 to receive heat and a heat-dissipating unit separated from the
11 heat-absorbing unit to dissipate the absorbed heat.

12 Moreover, the heat-dissipating member can be embodied in various other forms than the
13 linear members.

14 FIG. 7 is an exploded perspective view showing an LED lighting apparatus in
15 accordance with another embodiment of the present invention, and FIG. 8 illustrates a heat-
16 dissipating fence structure of the LED lighting apparatus in accordance with another
17 embodiment of the present invention.

18 As illustrated in FIG. 7, the heat-dissipating member in accordance with the present
19 embodiment includes a hollow-type heat-dissipating fence 30, which is coupled with the edge
20 region of the thermal base 10 and has a plurality of penetration holes formed therein so as to
21 enable air flow to the inside. Accordingly, the plurality of penetration holes formed in the heat-
22 dissipating fence 30 become the ventilation unit 32, and the inside of the LED lighting apparatus
23 in accordance with the present embodiment can have free air ventilation with the outside
24 through the penetration holes.

25 The heat-dissipating fence 30 in accordance with the present embodiment is very easy
26 to manufacture and be coupled with the thermal base 10. Moreover, as illustrated in FIG. 8, the

1 heat-dissipating efficiency can be further improved by coupling a plurality of multi-layer heat-
2 dissipating fences 30 to the thermal base.

3 While the present invention has been described with reference to certain embodiments,
4 the embodiments are for illustrative purposes only and shall not limit the invention. It is to be
5 appreciated that those skilled in the art can change or modify the embodiments. It shall be
6 also appreciated that a very large number of embodiments other than those described herein
7 are possible. The scope of the claims appended hereto should not be limited by the specific
8 embodiments set forth in the present description, but should be given the broadest interpretation
9 consistent with the description as a whole.

WHAT IS CLAIMED IS:

1. An LED lighting apparatus comprising:
 - a light source module comprising an LED light source;
 - a thermal base coupled to the light source module so as to receive heat generated by the light source module; and
 - a heat-dissipating member coupled to an edge region of the thermal base so as to discharge heat transferred from the thermal base, wherein the heat-dissipating member comprises a ventilation unit that opens a hollow space of the heat-dissipating member so as to facilitate air ventilation to the outside,
 - characterized in that
 - the heat-dissipating member comprises a heat-dissipating loop that is constituted with linear members and comprises a spiral structure repeatedly forming a heat-absorbing unit coupled to the edge region of the thermal base to receive heat and a heat-dissipating unit separated from the heat absorbing unit to dissipate the absorbed heat,
 - the ventilation unit is a gap between spirals of the heat-dissipating loop,
 - the heat-dissipating member is formed in a cylindrical shape by forming the heat-pipe loop in the shape of a board, then rolling the heat-pipe loop in an annular shape such that the hollow space is formed inside the heat-dissipating member,
 - the heat-dissipating loop comprises a capillary tube type of heat-pipe loop, into which working fluid is injected, and
 - a heat transfer passage is formed in the thermal base and a cross-sectional area of the heat transfer passage increases from a center region to the edge region of the thermal base such that heat absorbed by the thermal base is transferred to the edge region of the thermal base.
2. The LED lighting apparatus of claim 1, wherein the LED light source is provided in plurality, and
 - wherein the plurality of LED light sources are arranged to correspond to the edge region of the thermal base.
3. The LED lighting apparatus of claim 1 or 2, wherein the thermal base is formed with a heat-transfer groove in the shape of a trench, and

wherein the heat-dissipating loop is inserted into and arranged in the heat transfer groove.

4. The LED lighting apparatus of claim 1 or 2, wherein the thermal base has a penetration hole formed therein so as to enable air flow.

FIG. 1

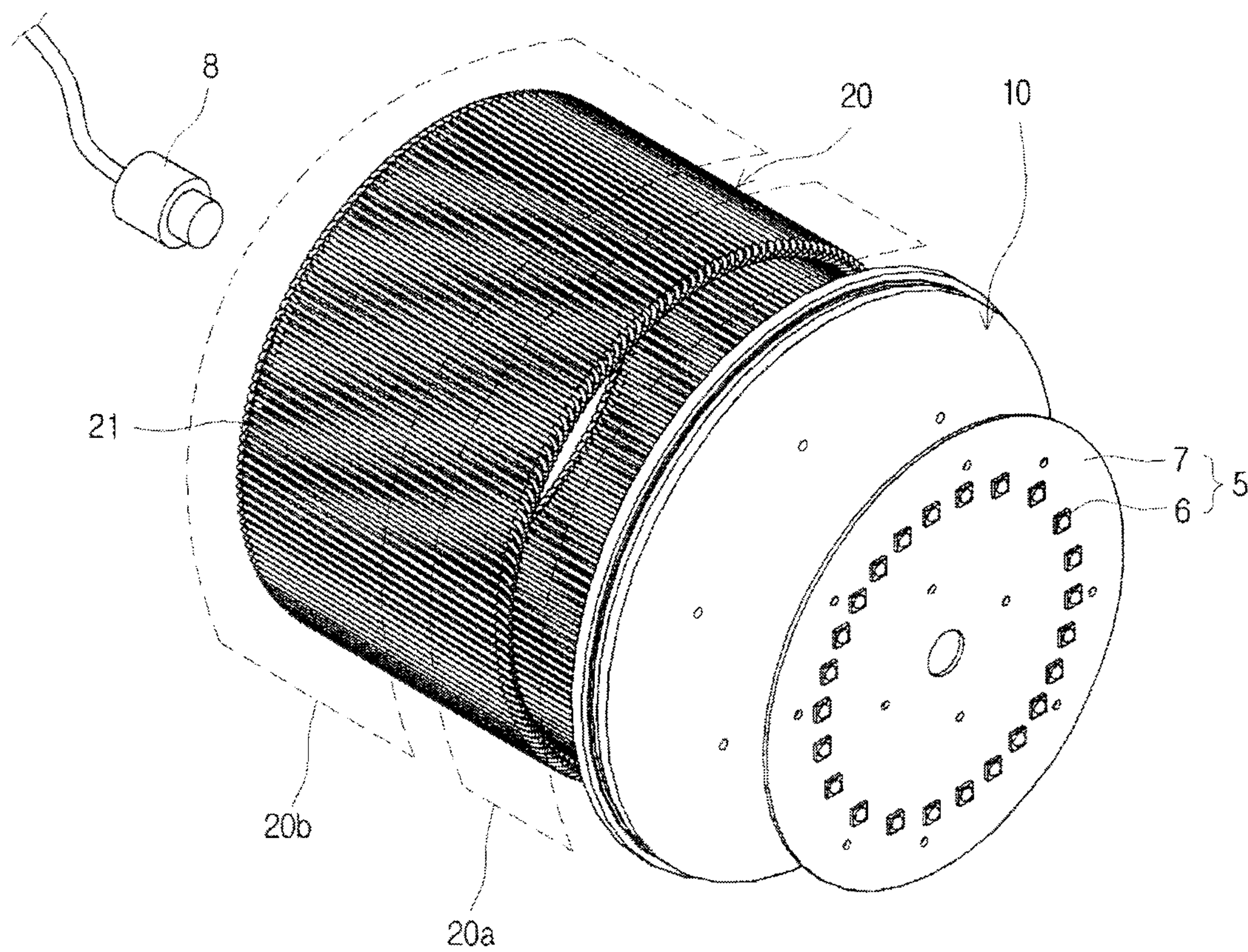


FIG. 2

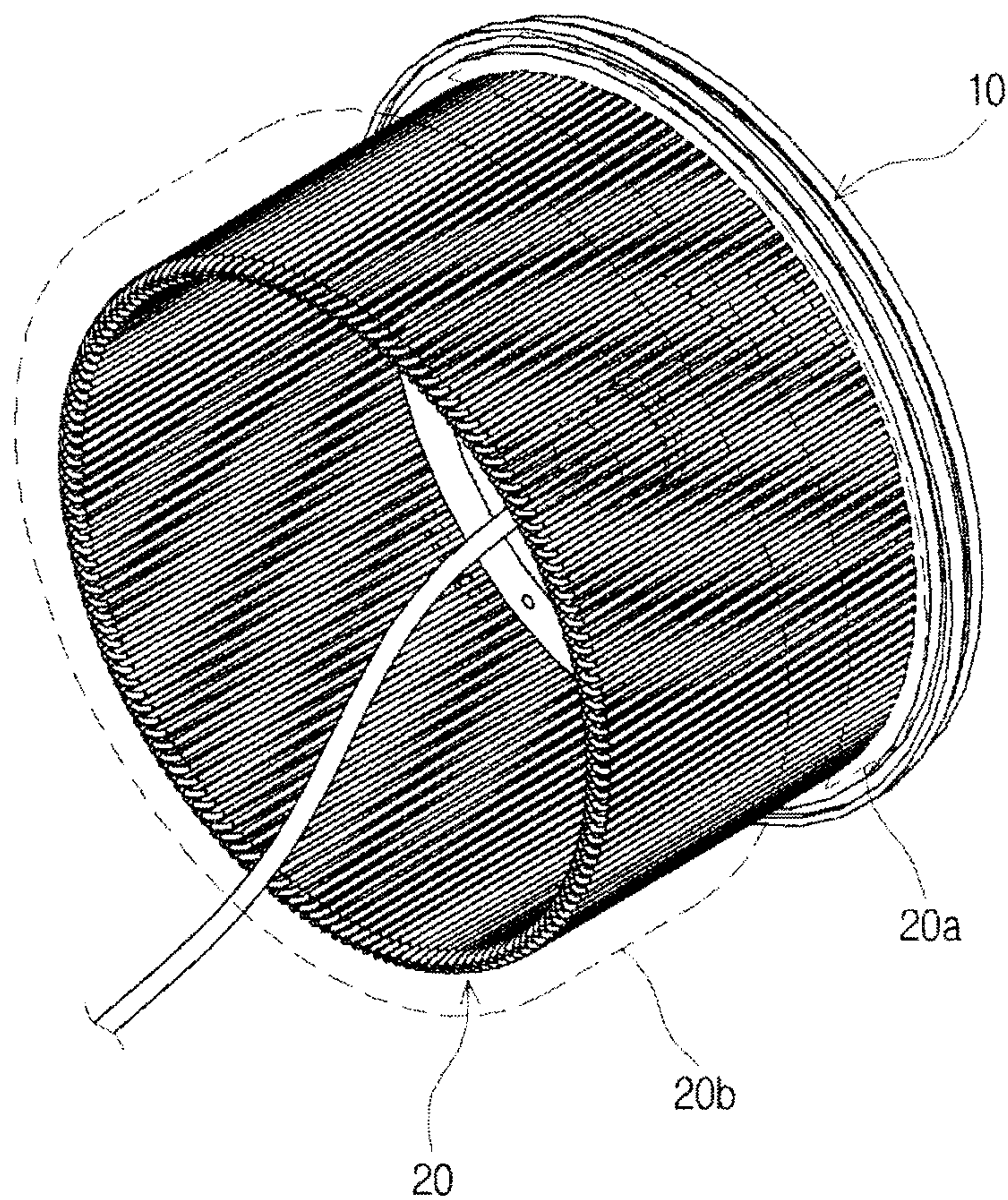


FIG. 3

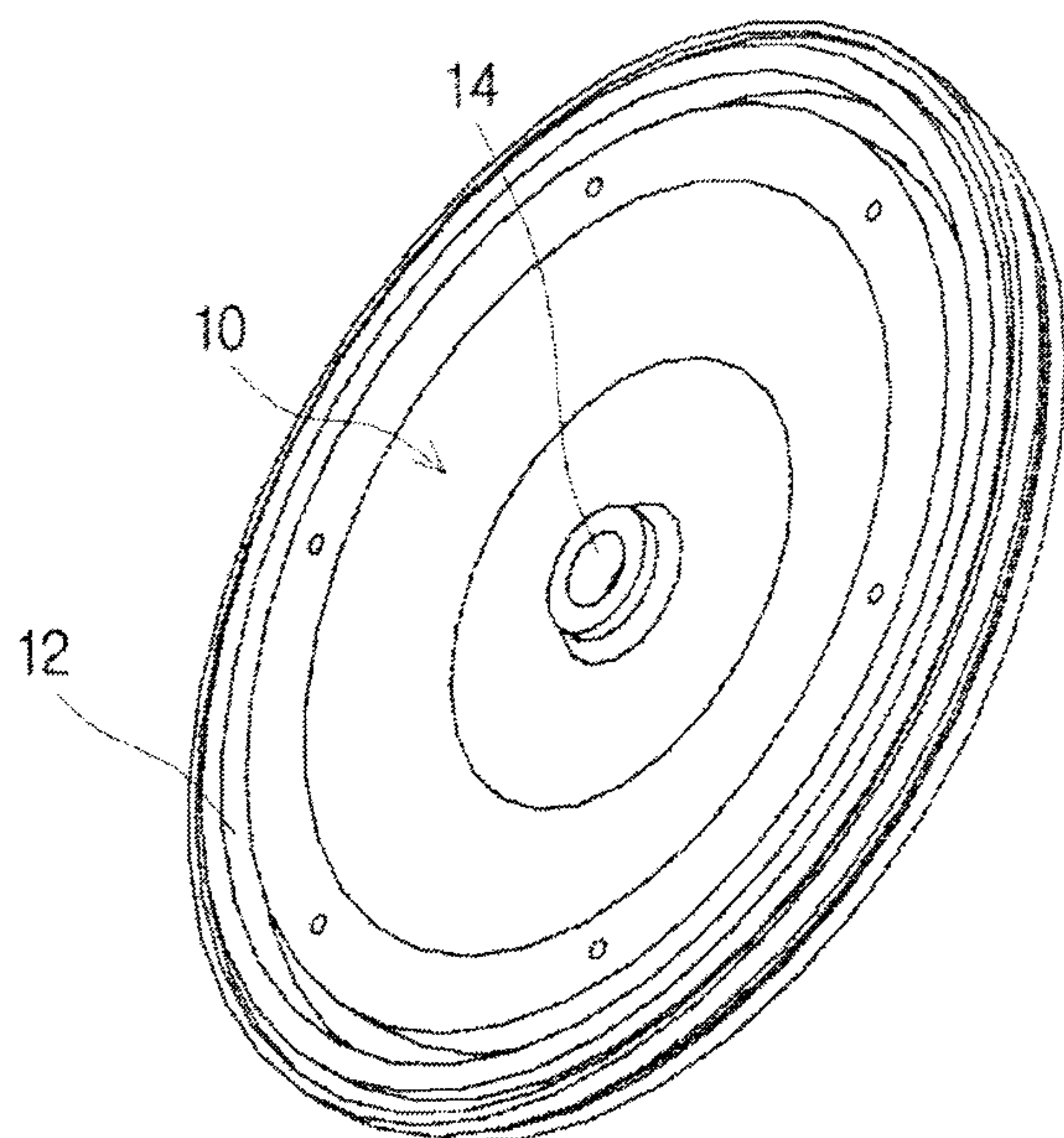


FIG. 4

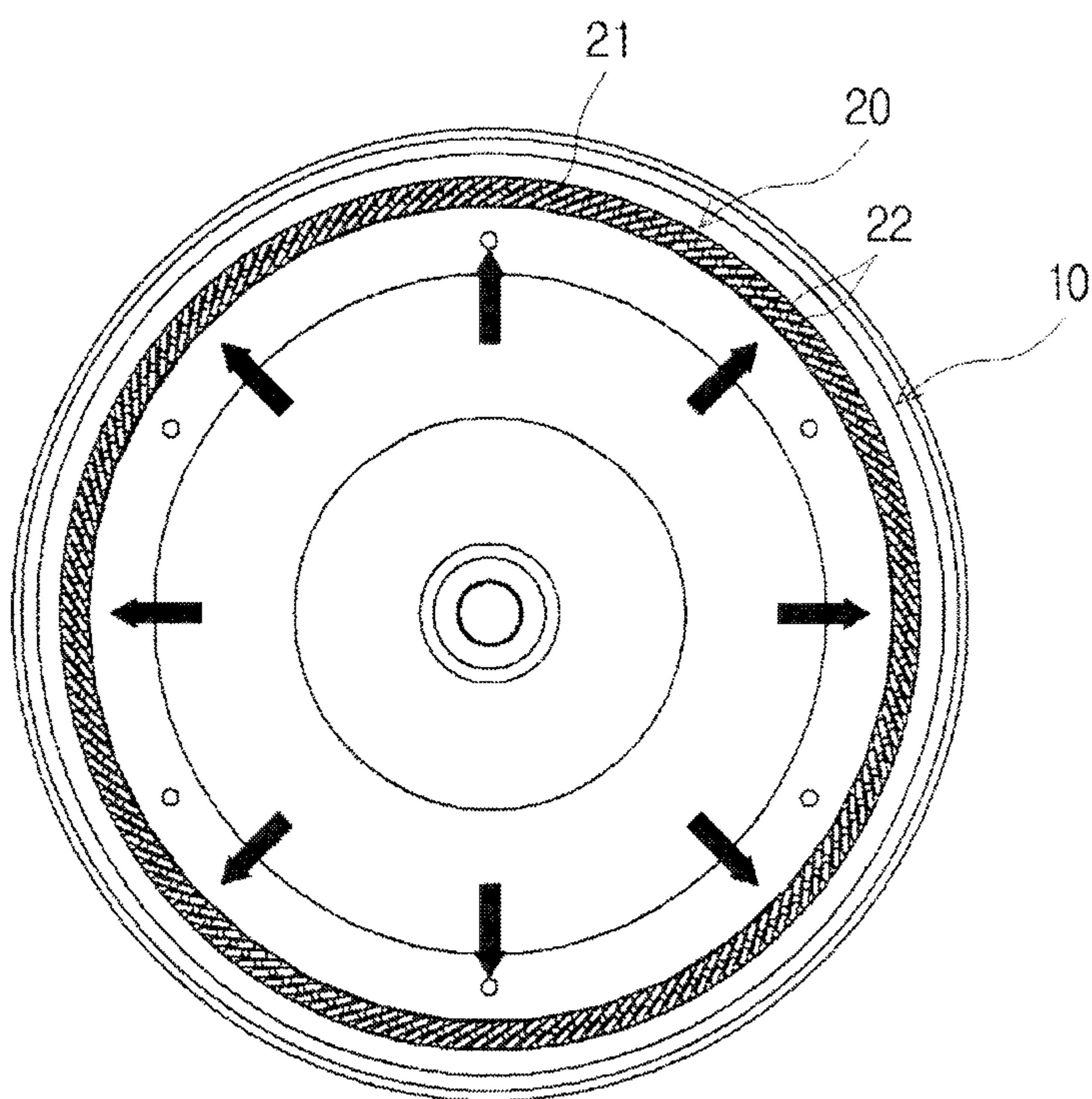


FIG. 5

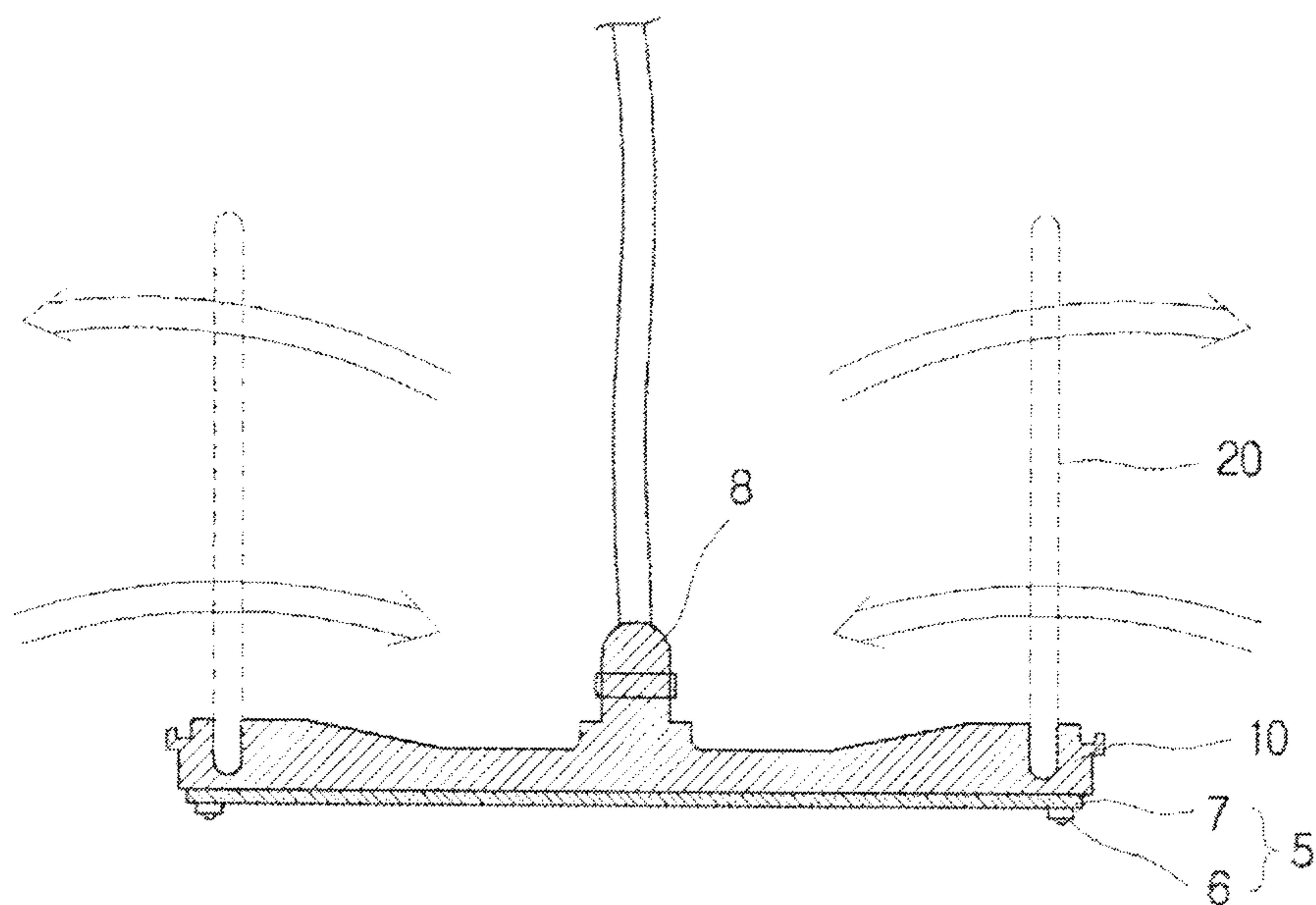


FIG. 6

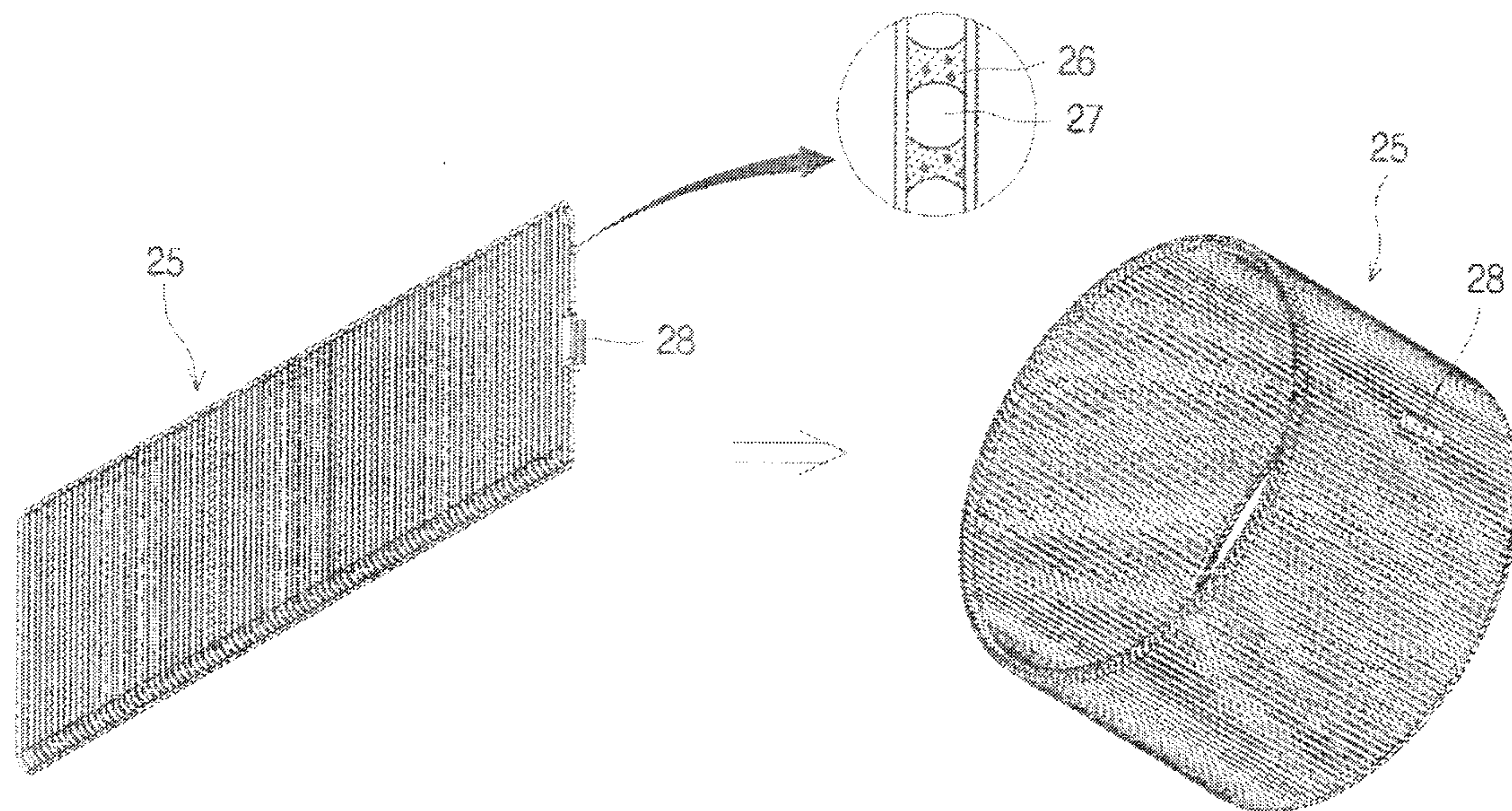


FIG. 7

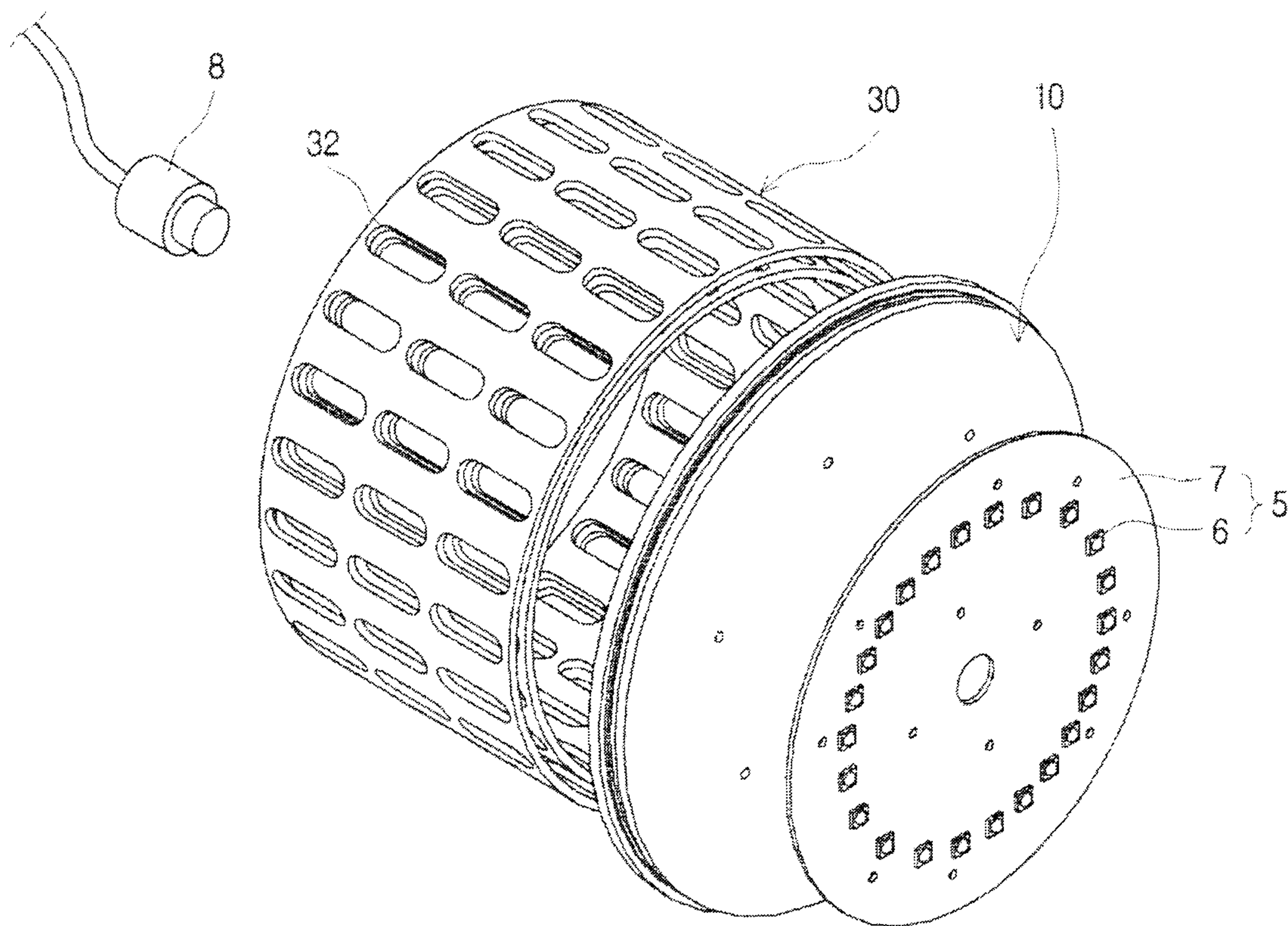


FIG. 8

