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(19) **United States**(12) **Patent Application Publication****Duan**(10) **Pub. No.: US 2006/0185830 A1**(43) **Pub. Date: Aug. 24, 2006**(54) **COOLING PLATE MODULE**

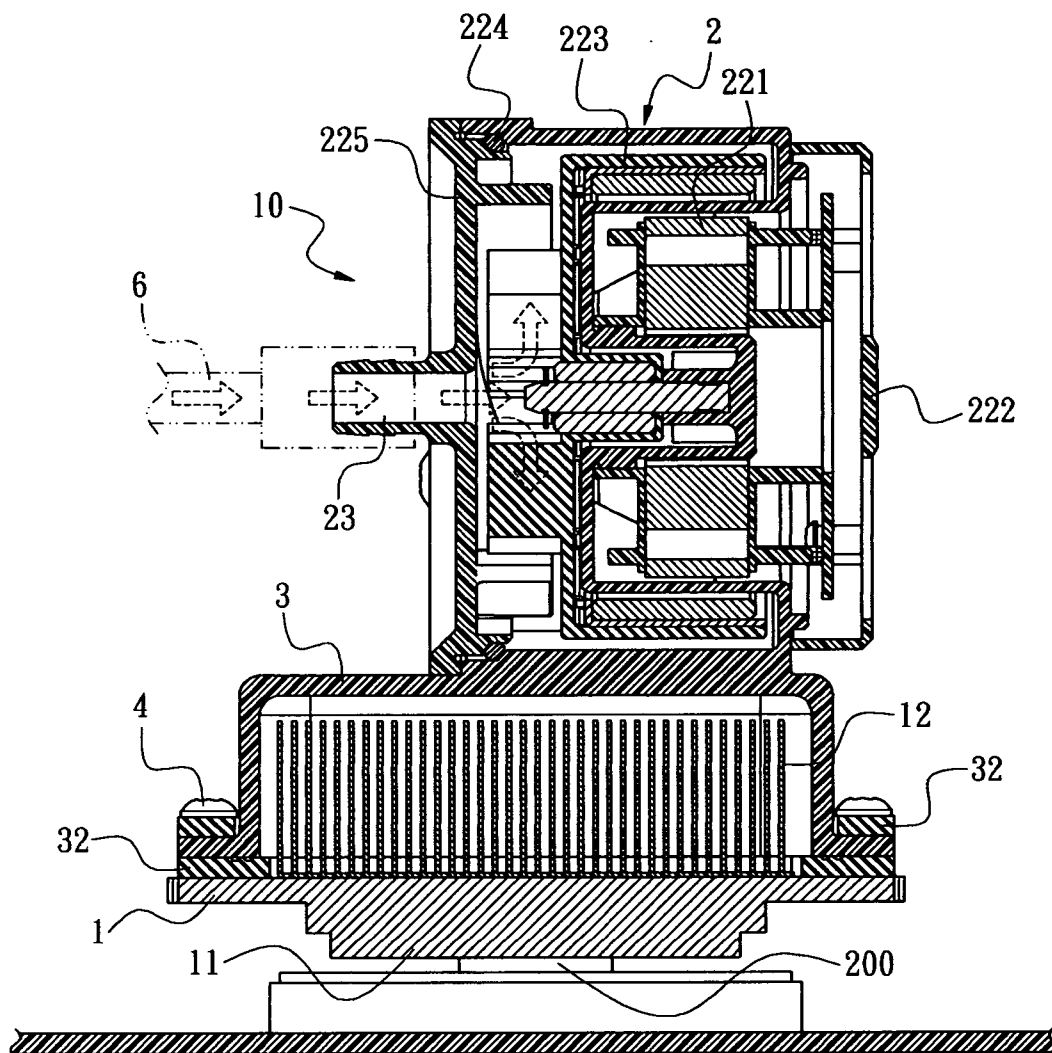
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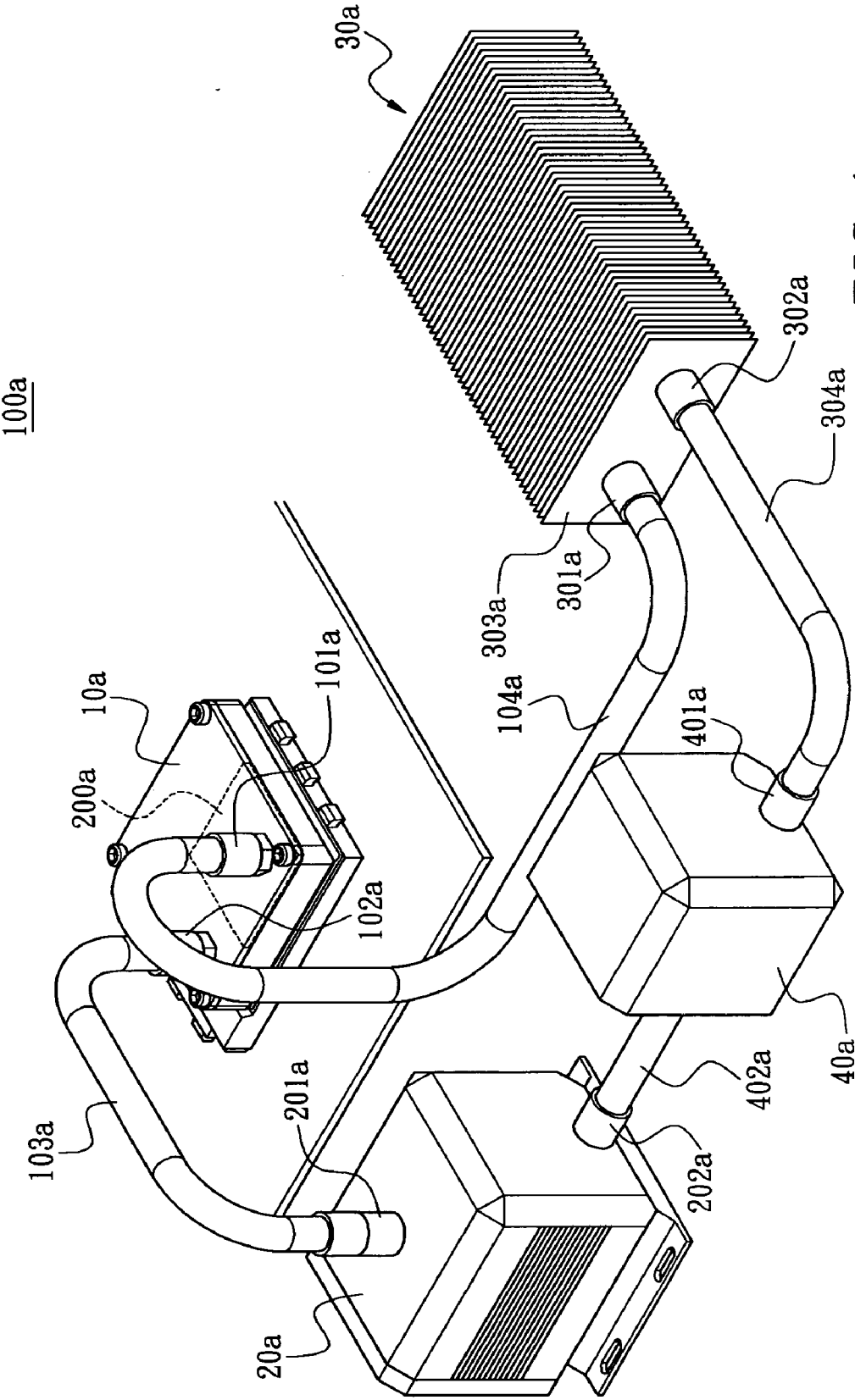
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HDSL**4331 STEVENS BATTLE LANE****FAIRFAX, VA 22033 (US)**(73) Assignee: **Cooler Master Co. Ltd.**(21) Appl. No.: **11/060,442**(22) Filed: **Feb. 18, 2005****Publication Classification**(51) **Int. Cl.****F28D 15/00** (2006.01)(52) **U.S. Cl.** **165/104.33**

A cooling plate module includes a cooling plate and a liquid driving module. The liquid driving module includes an accommodation chamber and a liquid driving unit used to driving cooling liquid. The liquid driving module includes a liquid inlet communicated to the accommodation chamber and a first liquid outlet is communicated to the bottom of the accommodation chamber. A cap encloses the first liquid outlet and a second liquid outlet is defined on the cap. The cooling plate is assembled with the cap to define a closed space therein and the first liquid outlet is corresponding to the heat-dissipating plates. Therefore, there is no duct connecting between the cooling plate and the liquid driving module, the stagnant problem caused by pressure difference can be prevented and the cool liquid can directly flush the heat-dissipating plates for enhancing heat dissipation efficiency.





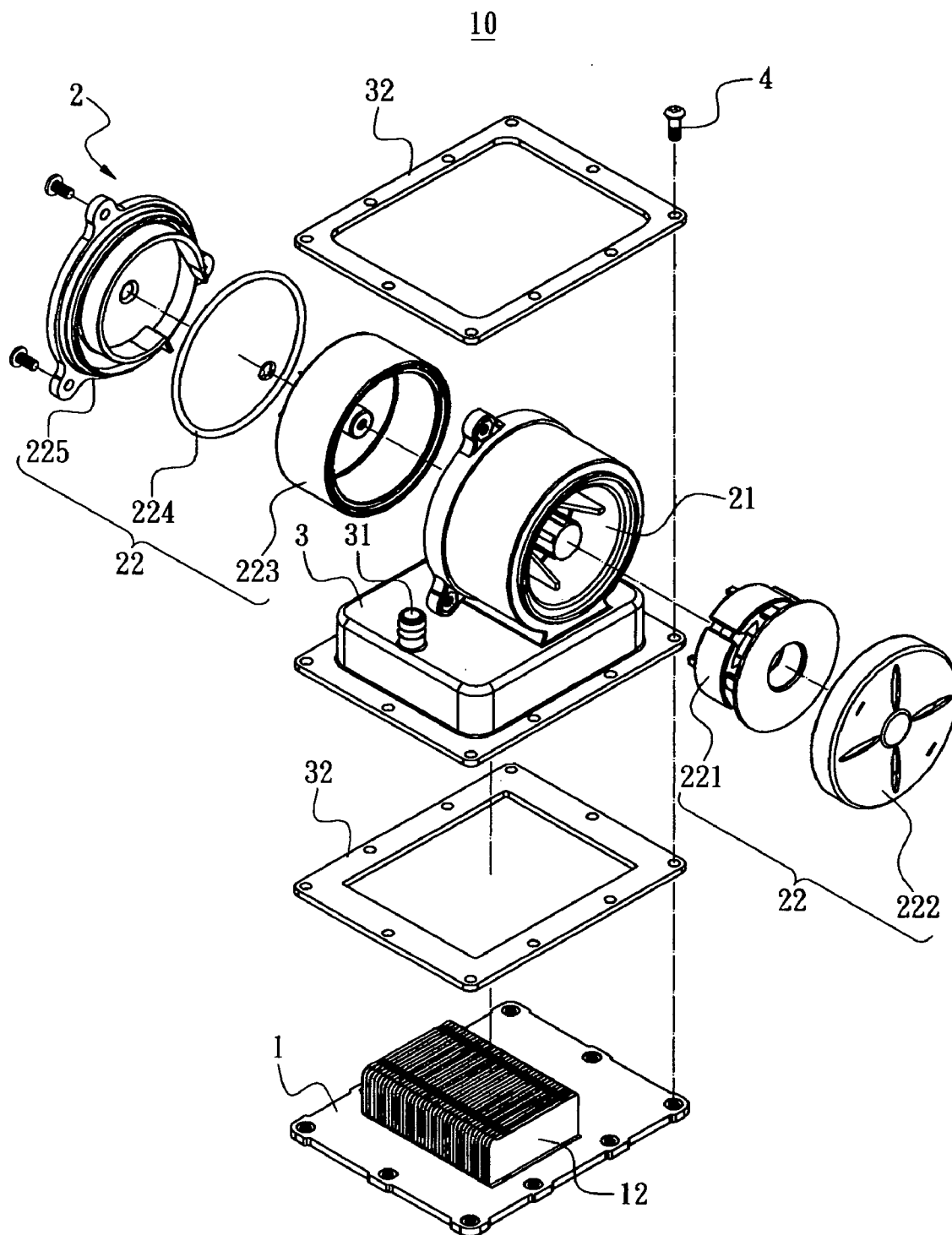
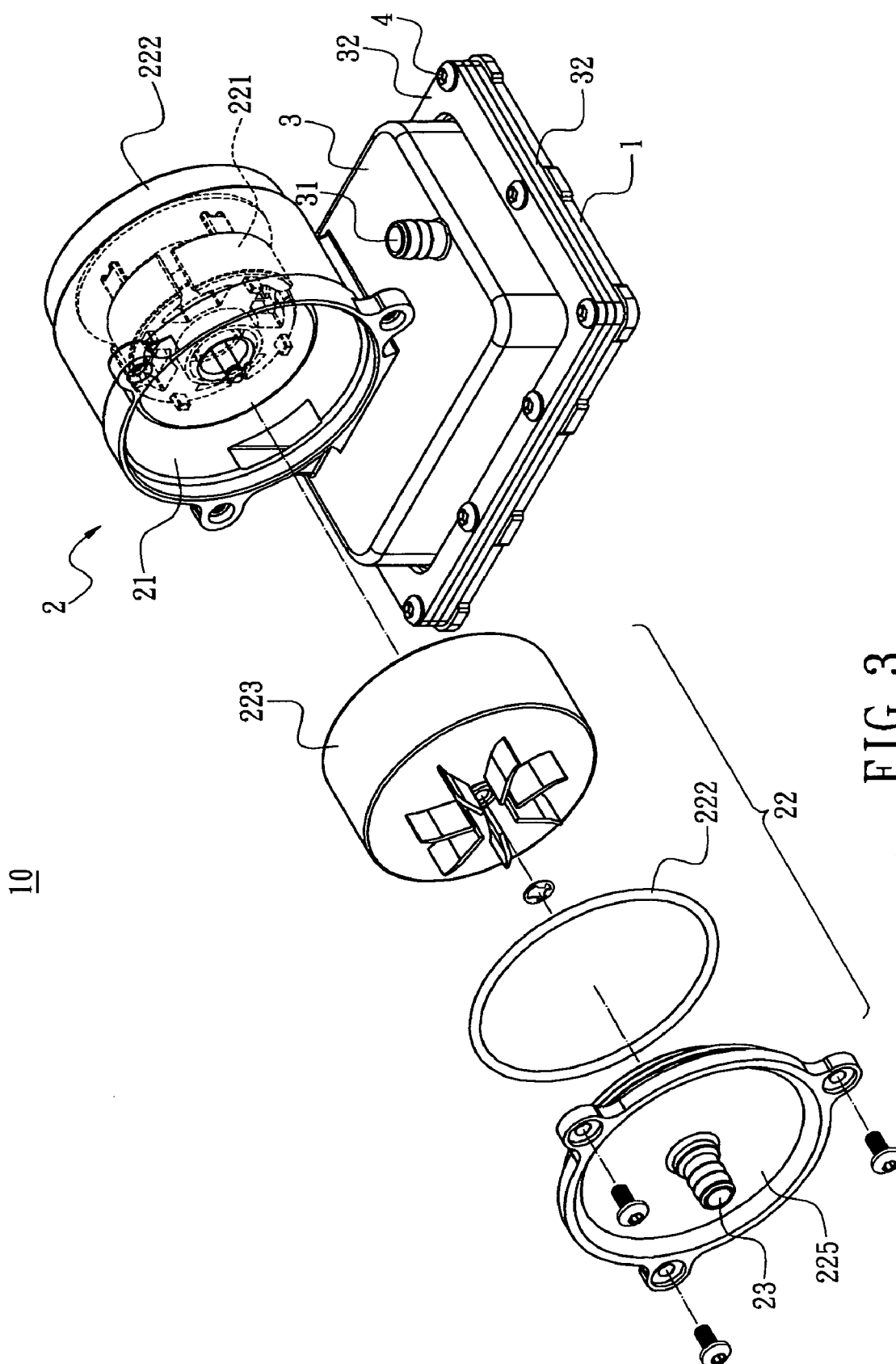


FIG. 2



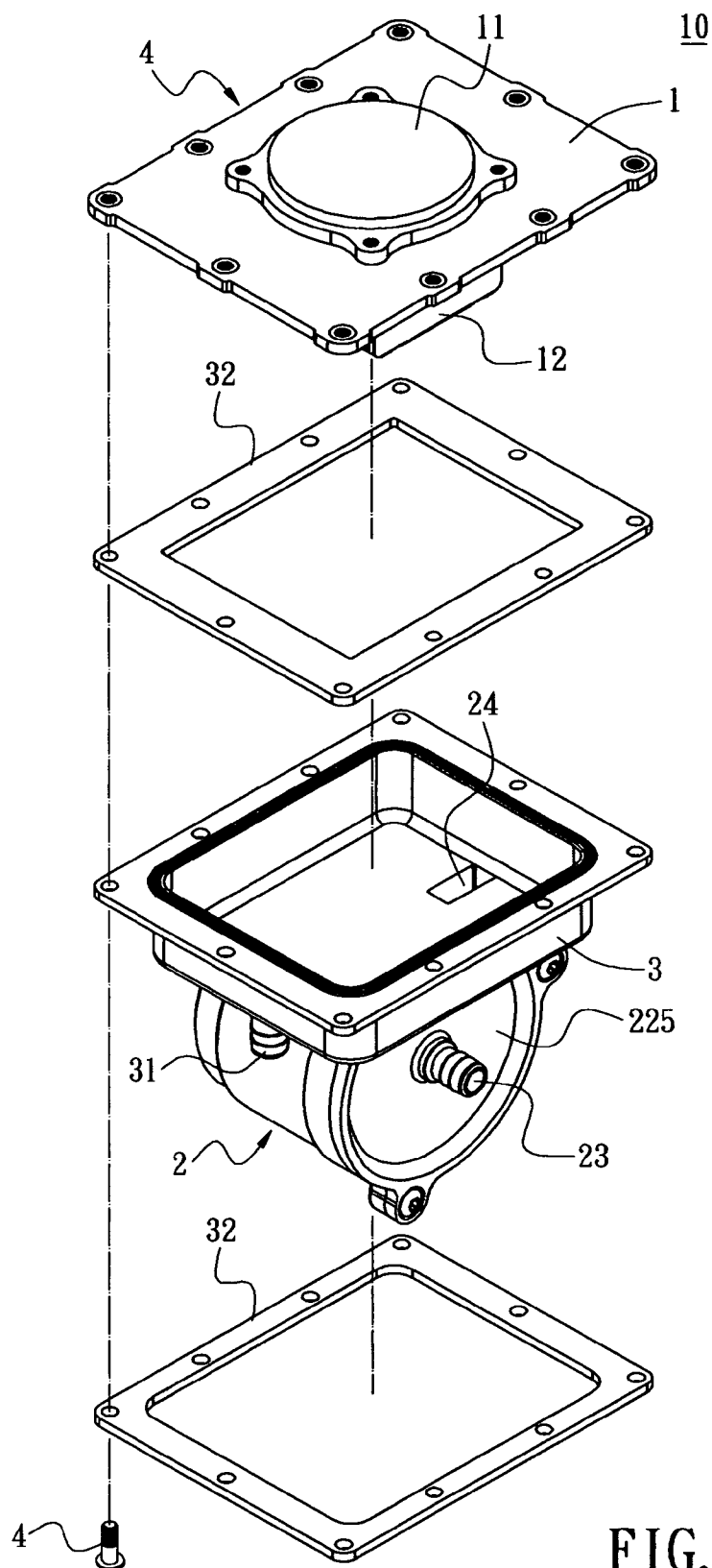


FIG. 4

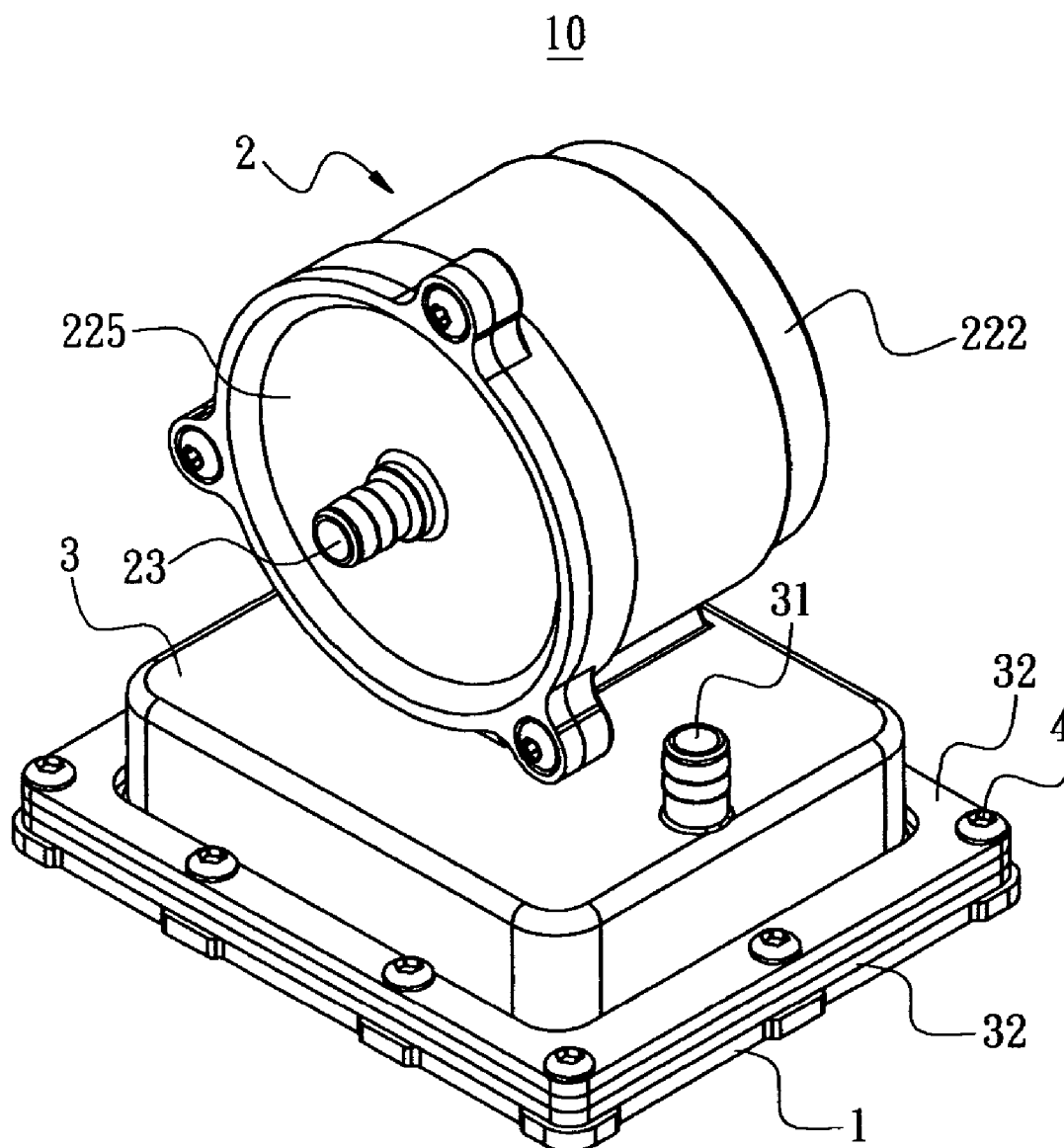


FIG. 5

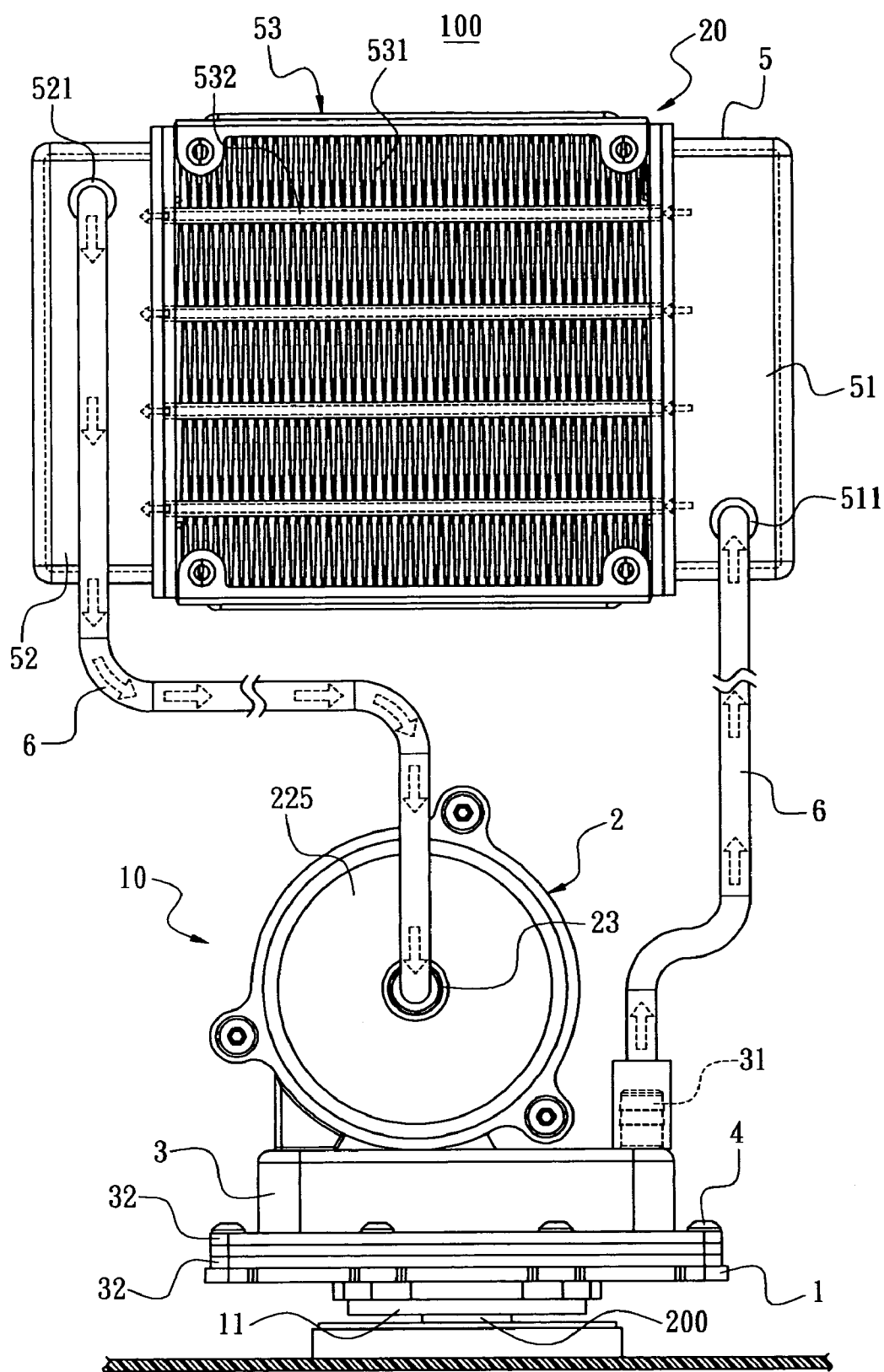


FIG. 6

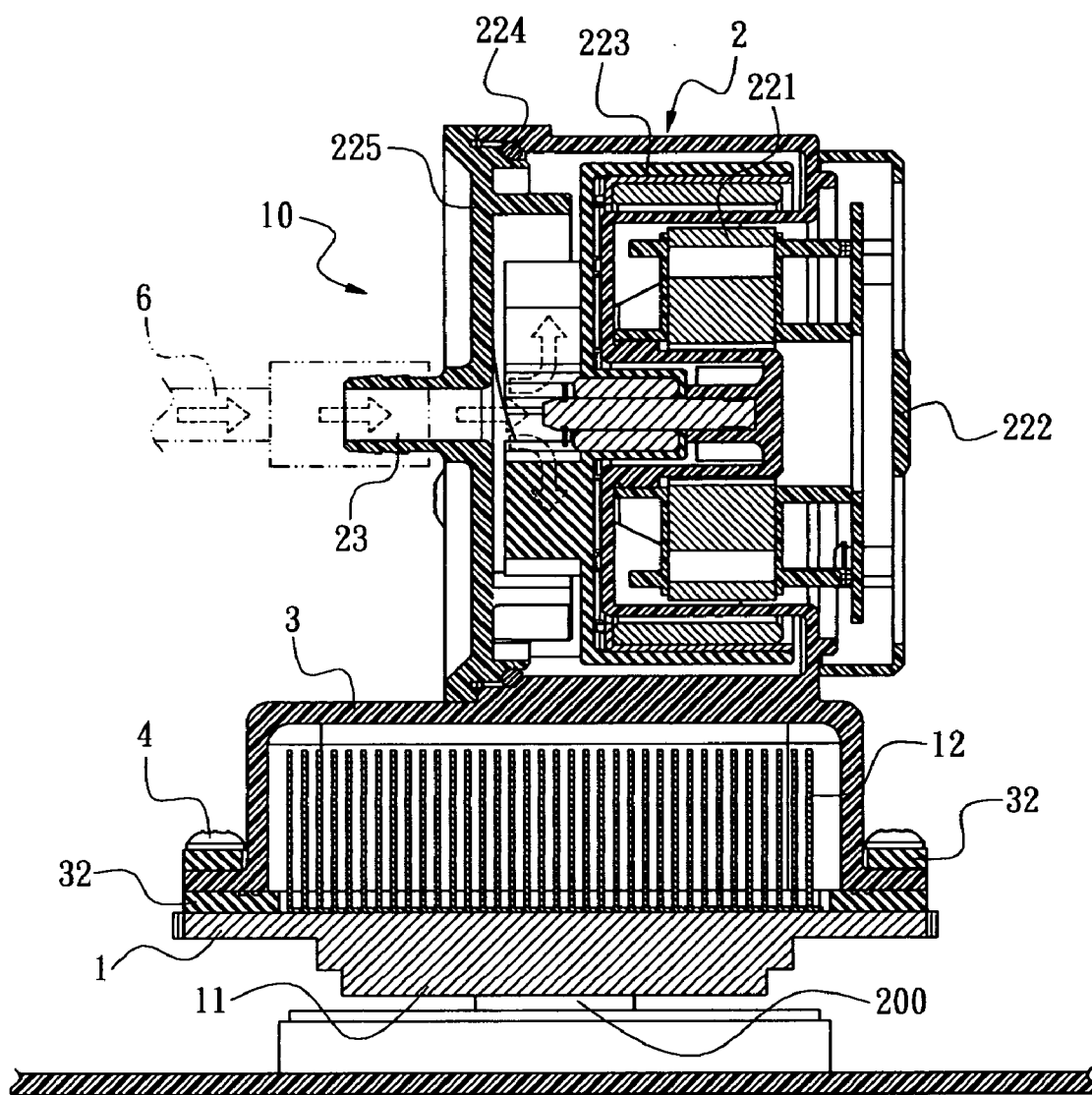


FIG. 7

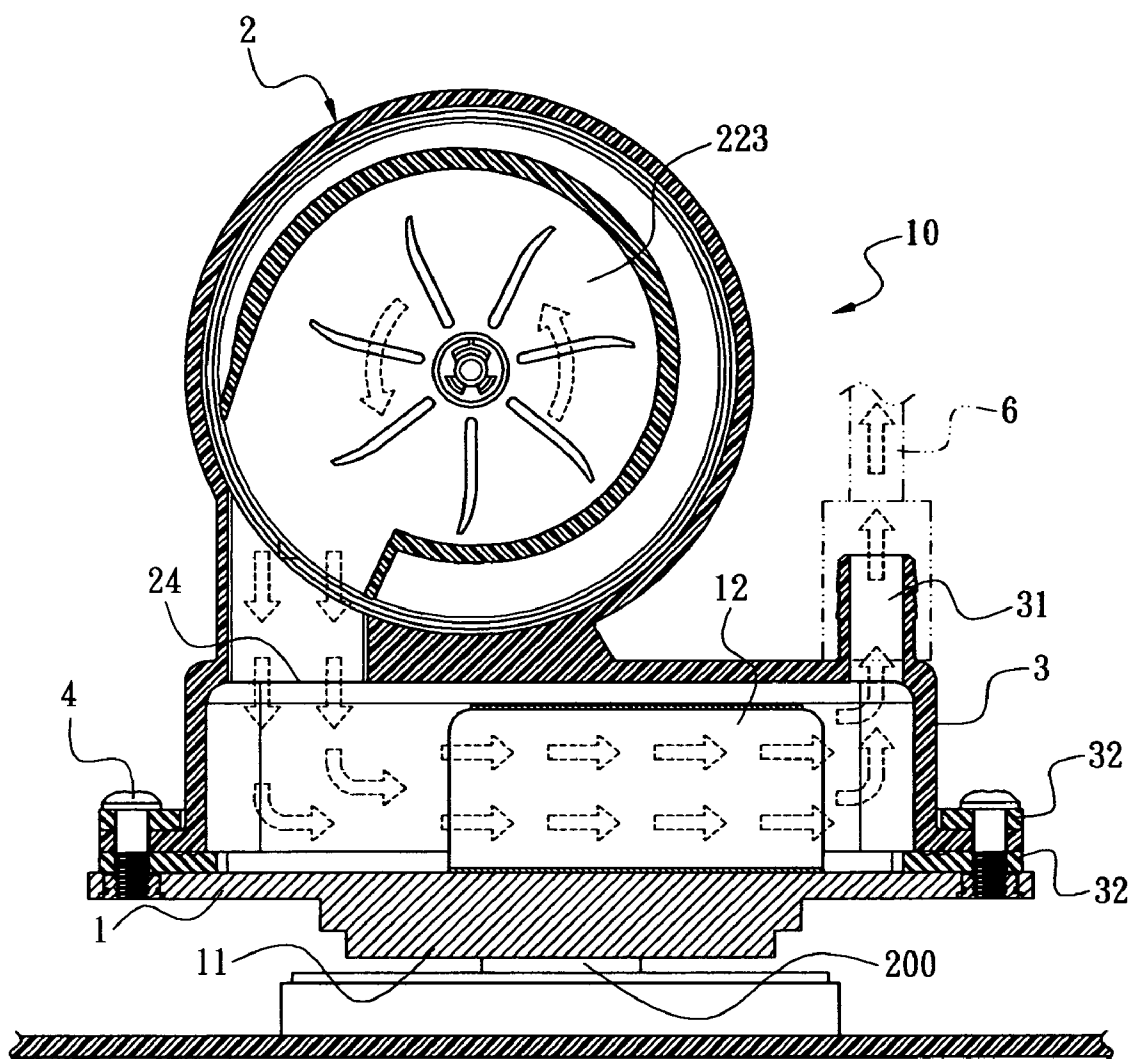


FIG. 8

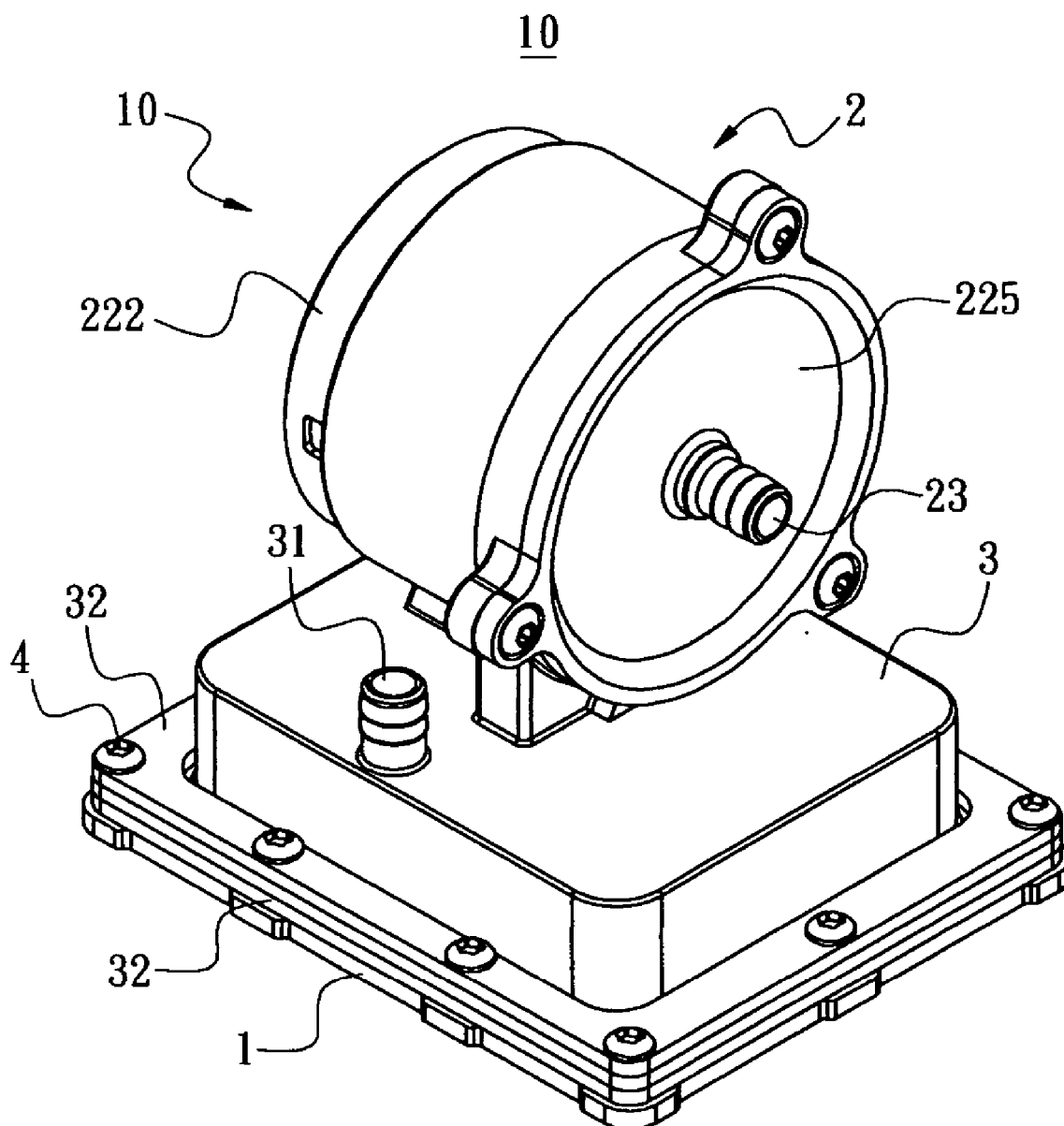


FIG. 9

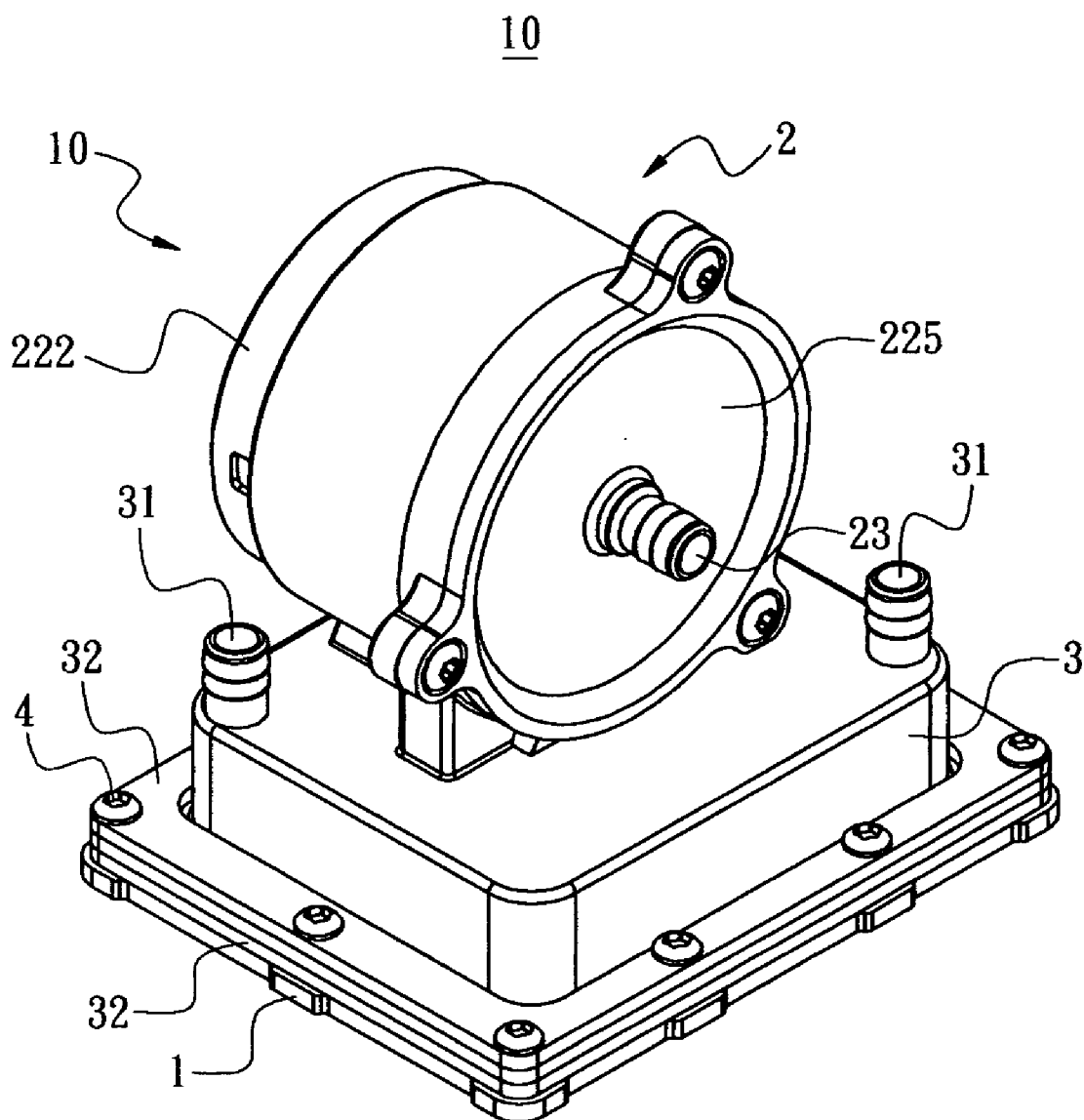


FIG. 10

COOLING PLATE MODULE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a cooling plate module, and more particularly to a cooling plate module used for heat emitting device such as a CPU.

[0003] 2. Description of Prior Art

[0004] The computers are developed with more powerful function and computation speed. Beside performance issue, the product appearance, the construction and motherboard connection ways are also under extensive exploited. As downsize of form factor and increasing of processing speed, the heat dissipation for central processing unit (CPU) is also an important issue to solve.

[0005] FIG. 1 shows a perspective view of a prior art liquid-cooling heat dissipation system 100a. As shown in this figure, the liquid-cooling heat dissipation system 100a comprises a heat dissipation stage 10a, a water outlet 101a and a water inlet 102a on both ends of the heat dissipation system stage 10a, respectively, a duct 103a connected between the water inlet 102a and a water outlet 201a of a water pump 20a, a duct 104a connected between the water outlet 101a and a water inlet 301a of a cooling stage 30a, which is composed of a plurality of heat-dissipating fins 303a. The cooling stage 30a comprises a water outlet 302a connected to a water inlet 401a of a water tank 40a through a duct 402a. The water tank 40a comprises a water outlet connected to the water inlet 202a of the water pump 20a, thus forming the liquid-cooling heat dissipation system 100a. During operation, the water pump 20a conveys cool water to the heat dissipation stage 10a for heat exchanging into hot water. Afterward, hot water flows to the cooling stage 30a through the duct 104a for heat exchanging into cool water there and cool water flows back to the water tank 40a through the duct 304a. The above operations are repeated for cyclic heat exchange.

[0006] However, above-described prior art liquid-cooling heat dissipation system 100a is composed of separate heat dissipation stage 10a, water pump 20a, cooling stage 30a and water tank 40a and ducts 103a, 104a, 304a and 402a interconnecting between above devices. The liquid-cooling heat dissipation system 100a thus formed is bulky and hard to assemble. This is adverse to the compact trend of computer.

SUMMARY OF THE INVENTION

[0007] The present invention provides a cooling plate module wherein the cooling plate is integrally formed with the liquid driving module such that the layout of the cooling plate module can be minimized to reduce space.

[0008] The present invention further provides a cooling plate module, wherein there is no duct connecting between the cooling plate and the liquid driving module, the stagnant problem caused by pressure difference can be prevented and the cool liquid can directly flush the heat-dissipating plates for enhancing heat dissipation efficiency.

[0009] According to one aspect of the present invention, the cooling plate module is applied to a liquid cooling cyclic mechanism and comprises a cooling plate and a liquid

driving module. The liquid driving module includes an accommodation chamber and a liquid driving unit used to driving cooling liquid. The liquid driving module includes a liquid inlet communicated to the accommodation chamber and a first liquid outlet is communicated to the bottom of the accommodation chamber. A cap encloses the first liquid outlet and a second liquid outlet is defined on the cap. The cooling plate is assembled with the cap to define a closed space therein and the first liquid outlet is corresponding to the heat-dissipating plates.

[0010] According to another aspect of the present invention, the cooling plate module is communicated with the water tank module through ducts. The water tank module comprises a box with a liquid entrance region and a liquid exit region provided on both sides of the water tank, respectively. The box comprises a cooling stage at center thereof and composed of a plurality of stacked heat-dissipating fins arranged in rows. Runners are defined between rows of the heat-dissipating fins; both ends of the runner are communicated with the liquid entrance region and the liquid exit region. When the hot liquid in the liquid entrance region flows to the liquid exit region through the runners, the hot liquid is first heat exchanged with the heat-dissipating fins into cool liquid and then the cool liquid flows to the liquid exit region.

BRIEF DESCRIPTION OF DRAWING

[0011] The features of the invention believed to be novel are set forth with particularity in the appended claims. The invention itself however may be best understood by reference to the following detailed description of the invention, which describes certain exemplary embodiments of the invention, taken in conjunction with the accompanying drawings in which:

[0012] FIG. 1 shows a perspective view of a prior art liquid-cooling heat dissipation system.

[0013] FIG. 2 shows an exploded view of the cooling plate module according to the present invention.

[0014] FIG. 3 shows another exploded view of the cooling plate module according to the present invention.

[0015] FIG. 4 shows an exploded view of the cooling plate before assembling to the box.

[0016] FIG. 5 shows a perspective view of the cooling plate module according to the present invention.

[0017] FIG. 6 shows a sectional view of the liquid cooling cyclic mechanism according to the present invention.

[0018] FIG. 7 shows a sectional view of the cooling plate module according to the present invention.

[0019] FIG. 8 shows another sectional view of the cooling plate module according to the present invention.

[0020] FIG. 9 shows another preferred embodiment of the present invention.

[0021] FIG. 10 shows still another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0022] With reference to FIGS. 2 and 6, the cooling plate module 10 according to the present invention is applied to a

liquid cooling cyclic mechanism 100, which is used for the heat dissipation of a CPU 200 and composed of the cooling plate module 10 and a water tank module 20 connected with the cooling plate module 10 through ducts. The cooling plate module 10 comprises a cooling plate 1 and a liquid driving module 2. The cooling plate 1 comprises a heat absorbing face 11 on bottom thereof and being in contact with a heat source. A plurality of heat-dissipating plates 12 are formed on top face of the cooling plate 1 and can be arranged in longitudinal or transverse manner. A runner is defined between the plurality of heat-dissipating plates 12 and forms a closed loop.

[0023] With reference to FIGS. 2, 3 and 4, the liquid driving module 2 comprises an accommodation chamber 21 and a liquid driving unit 22 located in the accommodation chamber 21 and used to driving the cool liquid. The liquid driving unit 22 comprises a coil stage 221, an upper cover 222, an impeller stage 223, a sealing washer 224 and a lower cover 225. The lower cover 225 comprises a liquid inlet 23 communicated with the accommodation chamber 21. A first liquid outlet 24 is communicated to the bottom of the accommodation chamber 21 and is enclosed by a cap 3. A second liquid outlet 31 is defined on the cap 3. The cooling plate 1 is assembled with the cap 3 to define a closed space therein and the first liquid outlet 24 is corresponding to the heat-dissipating plates 12. In the present invention, the liquid driving module 2 can be reciprocating pump, centrifugal pump or axial-flow pump.

[0024] To assemble the cooling plate module 10, the coil stage 221, the upper cover 222, the impeller stage 223, the sealing washer 224 and the lower cover 225 are assembled to the accommodation chamber 21 in turn. Thereafter, sealing pads 32 are provided between the cap 3 and the cooling plate 1 and provided atop the cap 3, and are retained by bolt units 4. The cooling plate 1 is fixed to bottom of the cap 3 and the heat-dissipating plates 12 are located in the cap 3 and corresponding to the first liquid outlet 24. The thus assembled cooling plate module 10 is shown in FIG. 5.

[0025] As shown in FIG. 6, the water tank 20 of the liquid cooling cyclic mechanism 100 comprises a box 5 with a liquid entrance region 51 and a liquid exit region 52 provided on both sides of the water tank 20, respectively. The box 5 comprises a cooling stage 53 at center thereof and composed of a plurality of stacked heat-dissipating fins 531 arranged in rows. Runners 532 are defined between rows of the heat-dissipating fins 531; both ends of the runner 532 are communicated with the liquid entrance region 51 and the liquid exit region 52. When the hot liquid in the liquid entrance region 51 flows to the liquid exit region 52 through the runners 532, the hot liquid is first heat exchanged with the heat-dissipating fins 531 into cool liquid and then the cool liquid flows to the liquid exit region 52.

[0026] In the present invention, during the assembling of the liquid cooling cyclic mechanism 100, the liquid inlet 23 of the cooling plate module 10 is communicated to the liquid outlet 521 of the liquid exit region 52 of the water tank 20 through duct 6. Moreover, the second liquid outlet 31 of the cooling plate module 10 is communicated to the liquid inlet 511 of the liquid entrance region 51 of the water tank 20 through duct 6, thus forming the liquid cooling cyclic mechanism 100 with continuous cycles. Thereafter, the liquid cooling cyclic mechanism 100 is assembled to the

CPU 200 with the heat absorbing face 11 being in contact with the CPU 200 for heat dissipating the CPU 200.

[0027] With reference to FIGS. 7 and 8, during operation of the present invention, the cool liquid in the water tank 20 is conveyed to the accommodation chamber 21 through the duct 6 and the liquid inlet 23 of the cooling plate module 10 and driven by the liquid driving unit 22. The cool liquid then flows to the cap 3 through the first liquid outlet 24 for heat dissipating the heat-dissipating plates 12 in the cap 3. More particularly, the cool liquid is heat exchanged with the heat-dissipating plates 12 into hot liquid. The hot liquid then flows to the liquid entrance region 51 of the water tank 20 through the second liquid outlet 31 of the cooling plate module 10 and another duct 6.

[0028] The hot liquid flowing into the liquid entrance region 51 of the water tank 20 will be conveyed to each runner 532 and heat exchanged with the heat-dissipating fins 531 into cool liquid. The cool liquid flows to the liquid exit region 52 of the water tank 20 and then flows to the cooling plate module 10 through the duct 6 connected to the liquid exit region 52, thus performing cyclic heat exchange.

[0029] FIG. 9 shows another preferred embodiment of the present invention, the liquid driving module 2 is integrally formed at center of the cap 3 such that the cool liquid flowing into the accommodation chamber 21 will directly flow out of the first liquid outlet 24 and flush the heat-dissipating plates 12 to heat dissipate the heat-dissipating plates 12 with enhanced efficiency.

[0030] FIG. 10 shows still another preferred embodiment of the present invention, the cap 3 comprises two second liquid outlets 31 thereon. In case of only one water tank 20, one liquid outlet 31 is connected to the liquid inlet 511 of the liquid entrance region 51 of the water tank 20 through a duct 6. The liquid outlet 521 of the liquid exit region 52 of the water tank 20 is connected to the liquid inlet 23 of the cooling plate module 10 through another duct 6. When two water tanks 20 are to be used, the two second liquid outlets 31 are connected to the two water tanks 20 through respective duct 6.

[0031] In the present invention, the cooling plate 1 is integrally formed with the liquid driving module 2 such that the layout of the cooling plate module 10 can be minimized to reduce space. Moreover, there is no duct connecting between the cooling plate 1 and the liquid driving module 2, the stagnant problem caused by pressure difference can be prevented and the cool liquid can directly flush the heat-dissipating plates 12 for enhancing heat dissipation efficiency.

[0032] Although the present invention has been described with reference to the preferred embodiment thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have suggested in the foregoing description, and other will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A cooling plate module used in a liquid cooling cyclic mechanism for removing heat from a heat source, comprising

a cooling plate comprising a heat absorbing face on bottom thereof and being in contact with a heat source, and a plurality of heat-dissipating plates on top face of the cooling plate;

a liquid driving module comprising an accommodation chamber and a liquid driving unit used to driving a cooling liquid, the liquid driving module comprising a liquid inlet communicated to the accommodation chamber and a first liquid outlet communicated to a bottom of the accommodation chamber; a cap enclosing the first liquid outlet and a second liquid outlet being defined on the cap;

wherein the cooling plate is assembled with the cap to define a closed space therein and the first liquid outlet is corresponding to the heat-dissipating plates.

2. The cooling plate module as in claim 1, wherein the heat-dissipating plates are arranged in one of longitudinal manner and transverse manner.

3. The cooling plate module as in claim 1, wherein the heat-dissipating plates are such arranged that a runner is defined between the plurality of heat-dissipating plates and forms a closed loop.

4. The cooling plate module as in claim 1, wherein the liquid driving module is a reciprocating pump.

5. The cooling plate module as in claim 1, wherein the liquid driving module is a centrifugal pump.

6. The cooling plate module as in claim 1, wherein the liquid driving module is an axial-flow pump.

7. The cooling plate module as in claim 1, wherein a sealing pad is provided between the cap and the cooling plate.

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