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(54) **HEAT-EXCHANGE TYPE COOLER**

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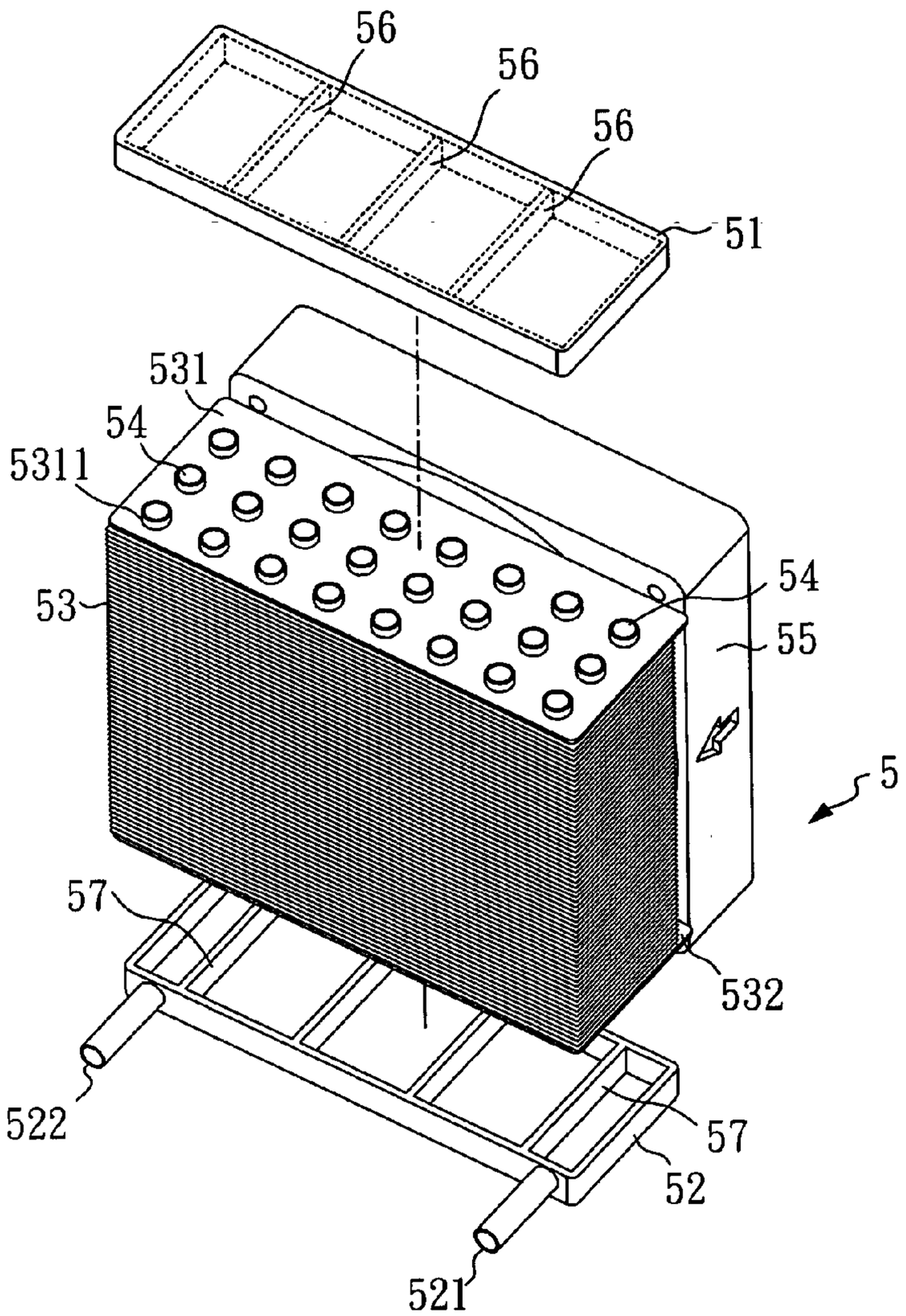
(57) **ABSTRACT**

A heat-exchange type cooler includes a top panel, a bottom panel, radiation fins arranged in parallel between the top panel and the bottom panel, heat exchange tubes vertically inserted through the top and bottom panels and the radiation fins, a top cover and a bottom cover respectively covered on the top panel and the bottom panel and defining with the top panel and the bottom panel a top chamber and a bottom chamber, and partition plates respectively mounted inside the top and bottom chambers and dividing the top and bottom chambers into top sub-chambers and bottom sub-chambers that form with the heat exchange tubes a detoured one-way fluid passage for guiding a heat exchange fluid in one direction in a roundabout way.



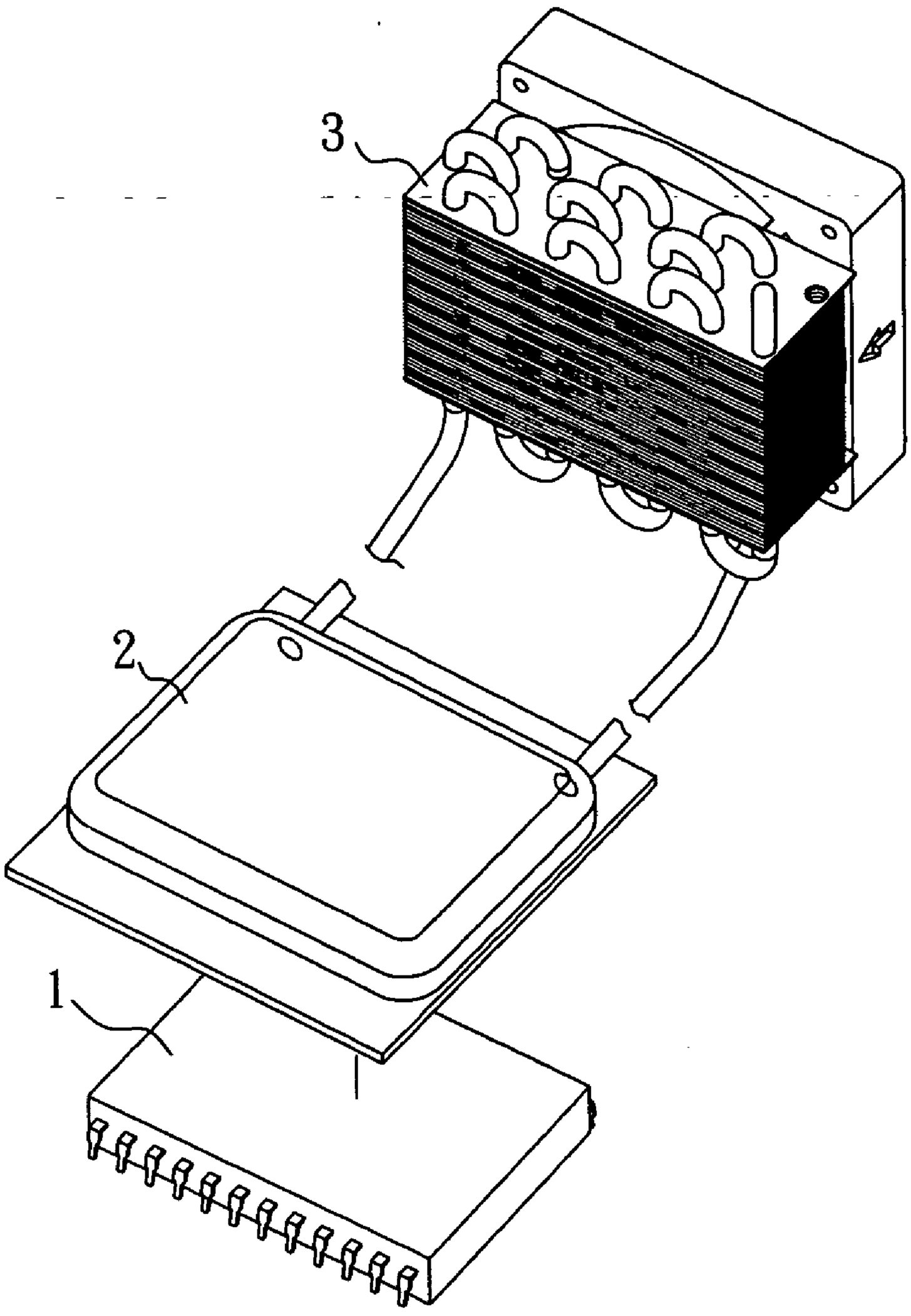


FIG. 1(Prior Art)

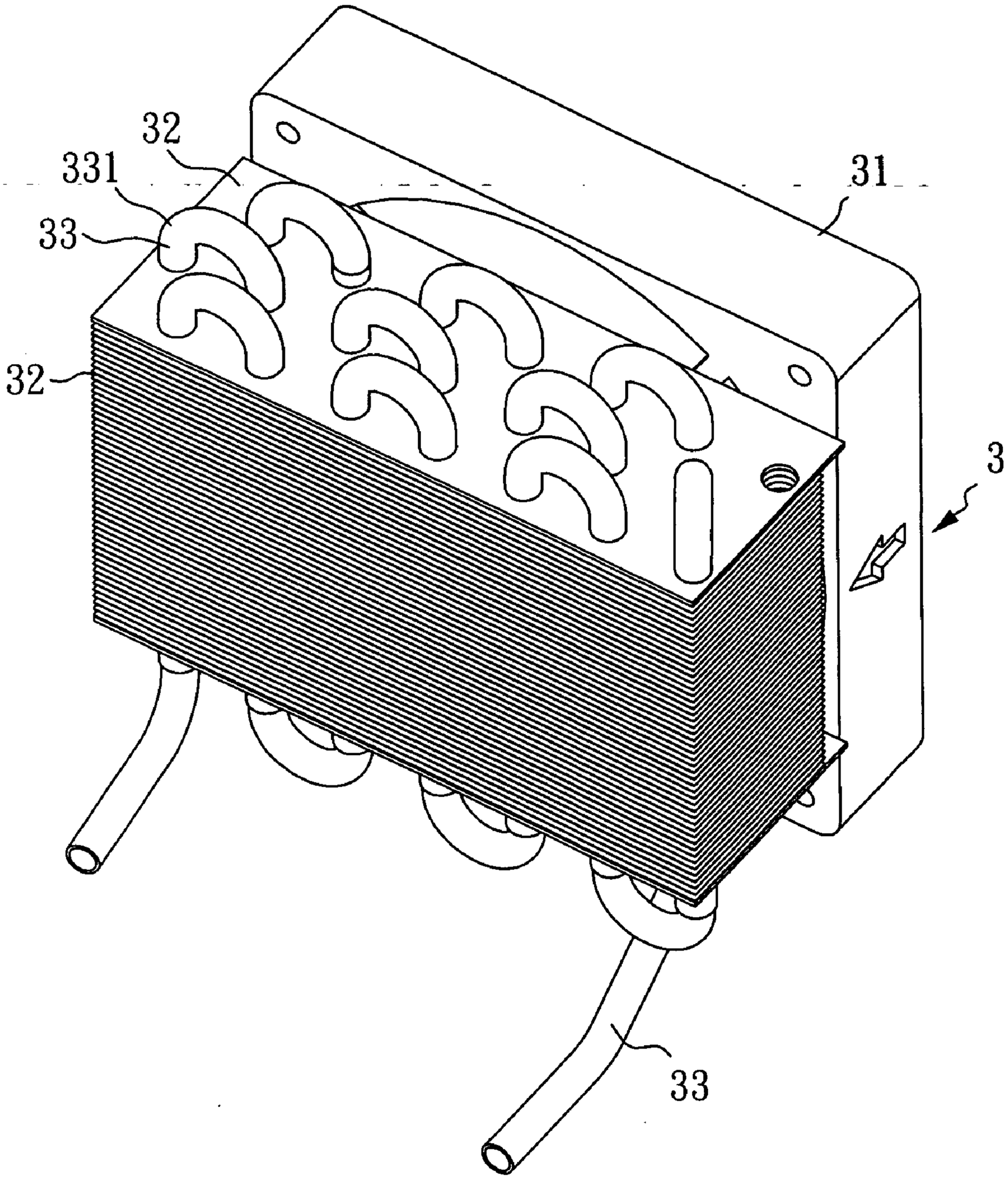


FIG. 2(Prior Art)

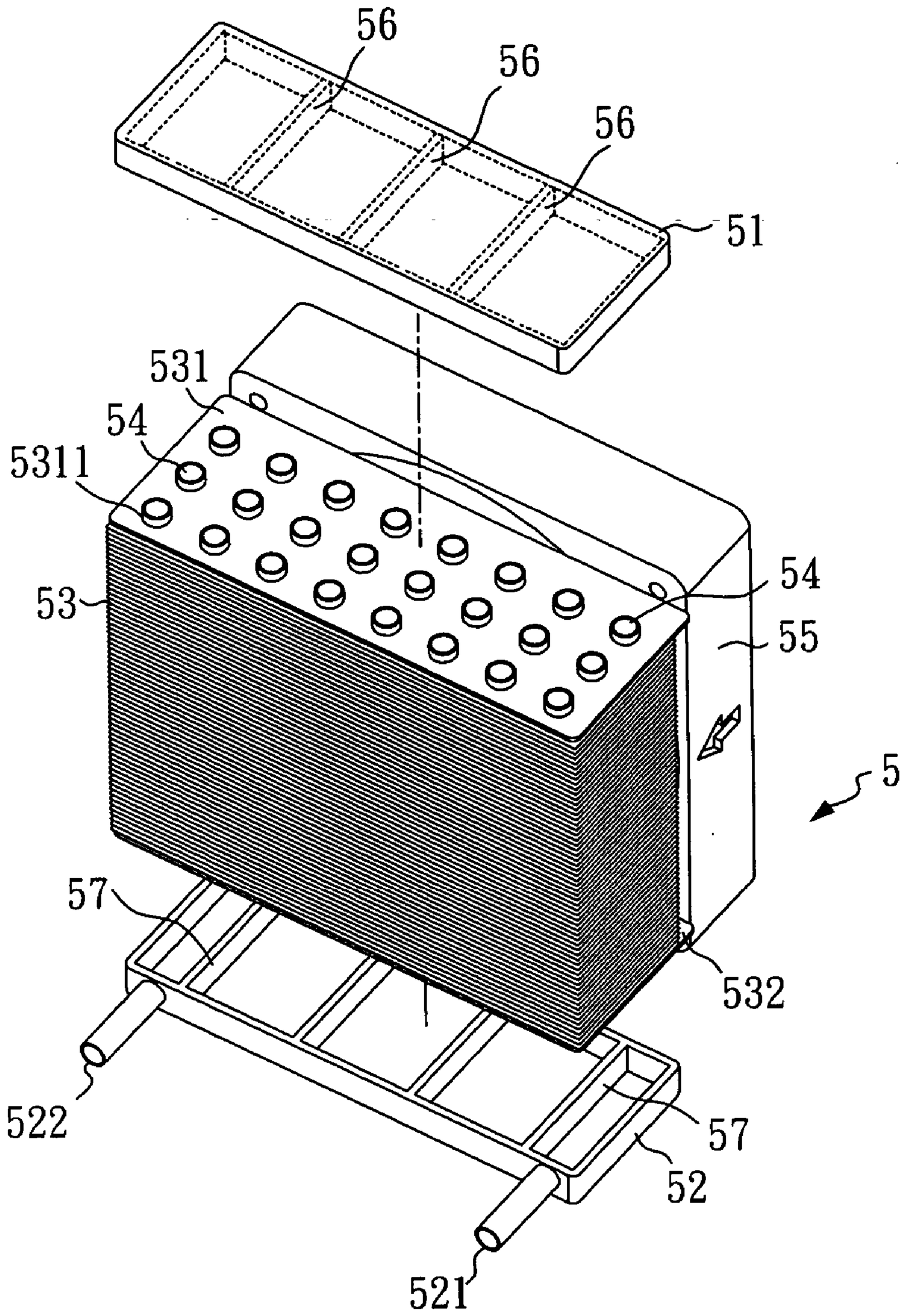


FIG. 3

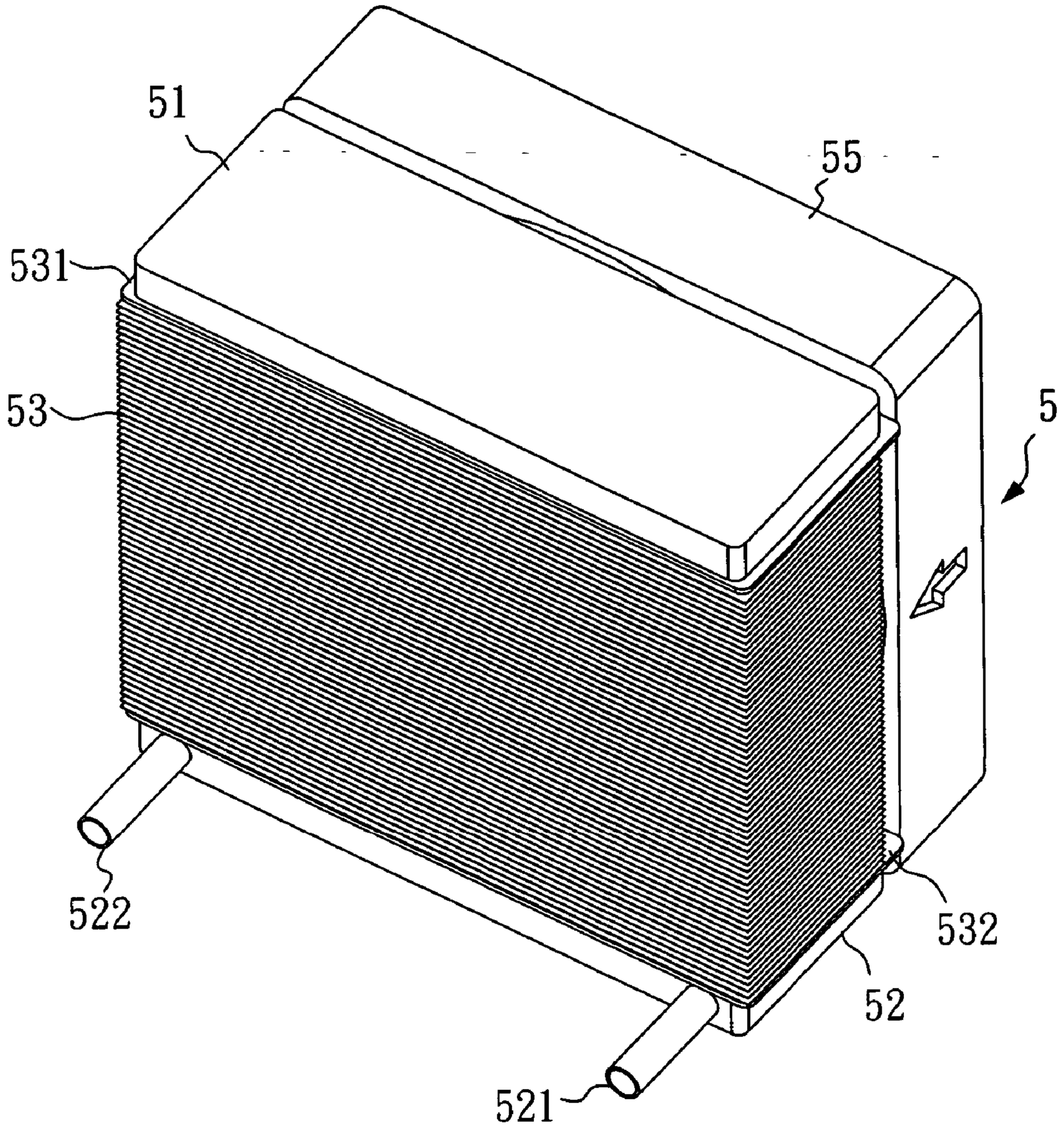


FIG. 4

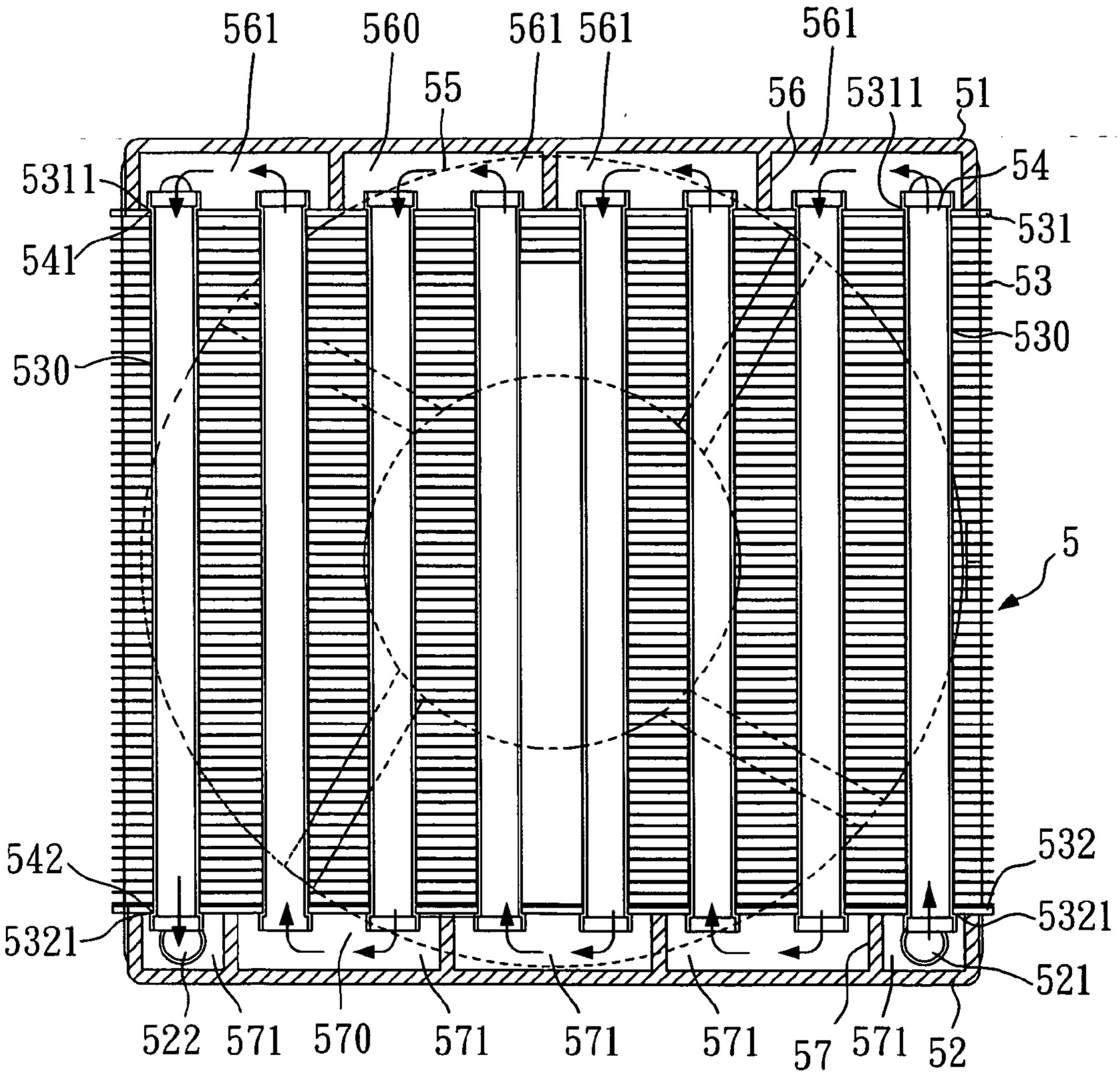

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FIG. 5

HEAT-EXCHANGE TYPE COOLER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an improved structure of cooler and more particularly, to a heat-exchange type cooler.

[0003] 2. Description of Related Art

[0004] **FIG. 1** illustrates the system architecture of a fluid cooling type cooler according to the prior art. As illustrated, the fluid-cooling type cooler **3** is connected to a heat collector **2** at a computer CPU **1**, forming with the heat collector **2** a fluid-cooling circulation system. When the heat collector **2** absorbs heat energy from the computer CPU **1**, heat-carrying fluid will be delivered to the fluid-cooling type cooler **3** to dissipate heat. After dissipation of heat, fluid is returned to the heat collector **2** to complete a circulating cycle. In a simple word, the fluid-cooling circulation system is adapted to dissipate heat from the computer CPU **1**.

[0005] Referring to **FIG. 2**, which is a perspective view in an enlarged scale of the fluid cooling type cooler shown in **FIG. 1**, due to the limitation of the bending angle **331** of the heat transfer tubes **33** and arrange way of the heat transfer tubes **33**, the contact area between the heat transfer tubes **33** and the radiation fins **32** and the total surface area of the radiation fins **32** for receiving wind from the fan **31** are reduced, resulting in non-satisfactory heat dissipation effect.

SUMMARY OF THE INVENTION

[0006] It is therefore the main object of the present invention to provide a heat-exchange type cooler, which eliminates the drawbacks of the aforesaid prior art design, the heat-exchange type cooler comprises a plurality of radiation fins arranged in parallel and vertically spaced from one another at a predetermined pitch, the radiation fins each having a plurality of vertical through holes; a plurality of heat exchange tubes respectively vertically mounted in the vertical through holes of the radiation fins, the heat exchange tubes each having a top end and a bottom end respectively protruding over top and bottom sides of the radiation fins; a top panel arranged in parallel to the radiation fins at a top side, the top panel having a plurality of through holes respectively coupled to the top end of each of the heat-exchange tubes and sealed to the outside periphery of each of the heat-exchange tubes; a bottom panel arranged in parallel to the radiation fins at a bottom side, the bottom panel having a plurality of through holes respectively coupled to the bottom end of each of the heat-exchange tubes and sealed to the outside periphery of each of the heat-exchange tubes; a top cover covered on a top side of the top panel and defining with the top panel a watertight top chamber; and a bottom cover covered on a bottom side of the bottom panel and defining with the bottom panel a watertight bottom chamber; wherein partition plates are respectively mounted inside the top chamber and the bottom chamber, dividing the top chamber into a plurality of top sub-chambers and dividing the bottom chamber into a plurality of bottom sub-chambers; the top and bottom ends of each of the heat exchange tubes are respectively disposed in fluid communication with at least one of the top sub-chambers and at least one of the bottom sub-chambers such that the heat exchange tubes and the top sub-chambers and the bottom sub-chambers form a detoured one-way fluid passage for guiding a heat exchange fluid in one direction in a roundabout way.

[0007] The aforesaid structure eliminates the problems produced due to the use of curved heat exchange tubes and greatly increases the contact area between the radiation fins and the heat exchange tubes. When a fan is fastened to one lateral side of the radiation fins, much surface area of the radiation fins is provided for receiving wind from the fan. Further, because straight heat exchange tubes are used, they can be installed in the radiation fins in a high density to form a detoured long fluid passage to increase the staying time of heat exchange fluid in the heat exchange tubes so as to improve heat dissipation efficiency.

[0008] Further, a water inlet and a water outlet are formed in the bottom cover respectively disposed in fluid communication with the first end and last end of the bottom sub-chambers. Alternatively, the water inlet and the water outlet can be formed in the top cover, or respectively formed in the top cover and the bottom cover.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** illustrates the system architecture of a fluid cooling type cooler according to the prior art.

[0010] **FIG. 2** is a perspective view in an enlarged scale of the fluid cooling type cooler shown in **FIG. 1**.

[0011] **FIG. 3** is an exploded view of a heat-exchange type cooler according to the present invention.

[0012] **FIG. 4** is a perspective assembly view of the heat-exchange type cooler according to the present invention.

[0013] **FIG. 5** is a sectional view of the heat-exchange type cooler according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Referring to **FIG. 3** to **FIG. 5**, a heat-exchange type cooler **5** in accordance with the present invention is shown comprising a plurality of radiation fins **53**, a plurality of heat-exchange tubes **54**, a top panel **531**, a bottom panel **532**, a top cover **51**, a bottom cover **52**, and a fan **55**. The radiation fins **53** are horizontally arranged in parallel and vertically spaced from one another at a predetermined pitch, each having a plurality of vertical through holes **530**.

[0015] The heat-exchange tubes **54** are respectively vertically mounted in the vertical through holes **530** of the radiation fins **53**. The top panel **531** is arranged in parallel to the radiation fins **53** at one side, namely, the top side of the radiation fins **53**, having a plurality of through holes **5311** respectively coupled to the top end of each of the heat-exchange tubes **54** and then sealed to the outside periphery of each of the heat-exchange tubes **54**. The bottom panel **532** is arranged in parallel to the radiation fins **53** at the other side, namely, the bottom side of the radiation fins **53**, having a plurality of through holes **5321** respectively coupled to the bottom end of each of the heat-exchange tubes **54** and then sealed to the outside periphery of each of the heat-exchange tubes **54**. The fan **55** is vertically fastened at one lateral side of the radiation fins **53**.

[0016] Referring to **FIG. 3** to **FIG. 5** again, the top cover **51** is covered on the topside of the top panel **531** in a watertight status, defining with the top panel **531** a top chamber **560**. The bottom cover **52** is covered on the bottom side of the bottom panel **532** in a watertight status, defining with the bottom panel **532** a bottom chamber **570**.

[0017] Partition plates **56** are mounted inside the top chamber **560**, dividing the top chamber **560** into a plurality of top sub-chambers **561**. Partition-plates **57** are mounted inside the bottom chamber **570**, dividing the bottom chamber **570** into a plurality of bottom sub-chambers **571**. Therefore, the first one of the top sub-chambers **561** is in fluid communication with the top end of the first one of the heat exchange tubes **54**, the bottom end of the first one of the heat exchange tubes **54** is in fluid communication with the first one of the bottom sub-chambers **571**, the first one of the bottom sub-chambers **571** is also in fluid communication with the bottom end of the second one of the heat exchange tubes **54**, the top end of the second one of the heat exchange tubes **54** is in fluid communication with the second one of the top sub-chambers **561**, the second one of the top sub-chambers **561** is also in fluid communication with the top end of the third one of the heat exchange tubes **54**, the bottom end of the third one of the heat exchange tubes **54** is in fluid communication with the second one of the bottom sub-chambe3rs **571**, and so on.

[0018] According to the present preferred embodiment, the bottom cover **52** has a water inlet **521** and a water outlet **522** respectively disposed in fluid communication with the first end and last end of the bottom sub-chambers **571**, so that fluid can flow from the water inlet **521** to the water outlet **522** through the bottom sub-chambers **571**, the heat exchange tubes **54** and the top sub-chambers **561** in one direction in a roundabout way. The water inlet **521** and the water outlet **522** cannot be set corresponding to one common top sub-chamber **561** or bottom sub-chamber **571**, however they can be formed in the same cover **51** or **52** or respectively formed in the top cover **51** and the bottom cover **52**.

[0019] Referring to **FIG. 5**, each heat exchange tube **54** has a top shoulder **541** and a bottom shoulder **542** respectively disposed at the top and bottom ends and respectively stopped at the outer side of the corresponding vertical through hole **5311** of the top panel **531** and the outer side of the corresponding vertical through hole **5321** of the bottom panel **532**.

[0020] Further, the radiation fins **53** are aluminum fins, however the heat exchange tubes **54**, the top panel **531**, the bottom panel **532**, the top cover **51** and the bottom cover **52** are respectively made of copper. Sealing between each two copper members is achieved by: melting a phosphor copper solder into a molten fluid, and then having the molten fluid to fill up the gap between each two copper members through a capillary effect, and then cooling down the molten fluid to the solid state.

[0021] According to the aforesaid structure, the heat exchange tubes **54** are straight tubes without bending angle, therefore the contact area between the radiation fins **53** and the heat exchange tubes **54** and the total surface area of the radiation fins **53** for receiving wind from the fan **55** can be maximized to improve heat dissipation efficiency. Further, because the heat exchange tubes **54** are straight tubes without bending angle, they can be installed in the radiation fins **53** in a high density to form a detoured long fluid passage, i.e., the staying time of fluid in the heat exchange tubes **54** can be increased to improve heat dissipation efficiency.

[0022] Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A heat-exchange type cooler comprising:

a plurality of radiation fins arranged in parallel and vertically spaced from one another at a predetermined pitch, said radiation fins each having a plurality of vertical through holes;

a plurality of heat exchange tubes respectively vertically mounted in the vertical through holes of said radiation fins, said heat exchange tubes each having a top end and a bottom end respectively protruding over top and bottom sides of said radiation fins;

a top panel arranged in parallel to said radiation fins at a top side, said top panel having a plurality of through holes respectively coupled to the top end of each of said heat-exchange tubes and sealed to the outside periphery of each of said heat-exchange tubes;

a bottom panel arranged in parallel to said radiation fins at a bottom side, said bottom panel having a plurality of through holes respectively coupled to the bottom end of each of said heat-exchange tubes and sealed to the outside periphery of each of said heat-exchange tubes;

a top cover covered on a top side of said top panel and defining with said top panel a watertight top chamber; and

a bottom cover covered on a bottom side of said bottom panel and defining with said bottom panel a watertight bottom chamber;

wherein partition plates are respectively mounted inside said top chamber and said bottom chamber, dividing said top chamber into a plurality of top sub-chambers and dividing said bottom chamber into a plurality of bottom sub-chambers;

wherein the top and bottom ends of each of said heat exchange tubes are respectively disposed in fluid communication with at least one of said top sub-chambers and at least one of said bottom sub-chambers such that said heat exchange tubes and said top sub-chambers and said bottom sub-chambers form a detoured one-way fluid passage for guiding a heat exchange fluid in one direction in a roundabout way.

2. The heat-exchange type cooler as claimed in claim 1, wherein said bottom cover has a water inlet in fluid communication with one of said bottom sub-chambers in a first end of said detoured one-way fluid passage.

3. The heat-exchange type cooler as claimed in claim 1, wherein said bottom cover has a water outlet in fluid communication with one of said bottom sub-chambers in a last end of said detoured one-way fluid passage.

4. The heat-exchange type cooler as claimed in claim 1, wherein said heat exchange tubes each have a top shoulder disposed around the top end thereof and stopped at the top side of said top panel.

5. The heat-exchange type cooler as claimed in claim 1, wherein said heat exchange tubes each have a bottom shoulder disposed around the bottom end thereof and stopped at the bottom side of said bottom panel.

6. The heat-exchange type cooler as claimed in claim 1, further comprising a fan fastened to said radiation fins at one lateral side.

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