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(54) **HEATING EXCHANGE CHAMBER FOR LIQUID STATE COOLING FLUID**

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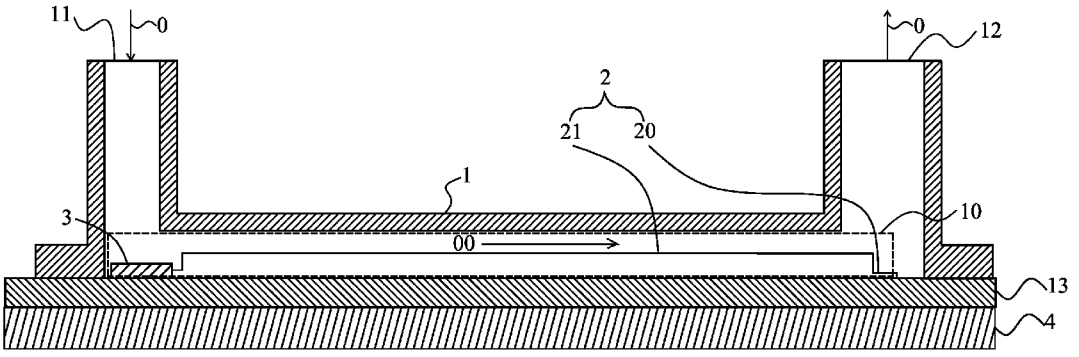
(57) **ABSTRACT**

A heat exchange chamber for liquid state cooling fluid is provided, which comprises a flow resistance, the flow resistance is sited inside a cavity at a position proximate to an inlet. In other words, the flow resistance is sited between the inlet and a thermal dissipation device. The flow resistance narrows down a flow channel from the inlet to the cavity, and it raises the resistance of the cooling fluid before the cooling fluid flows through a thermal dissipation device. Because of the heat exchange chamber for liquid state cooling fluid, the cooling fluid could be distributed uniformly through the dissipating heat device.



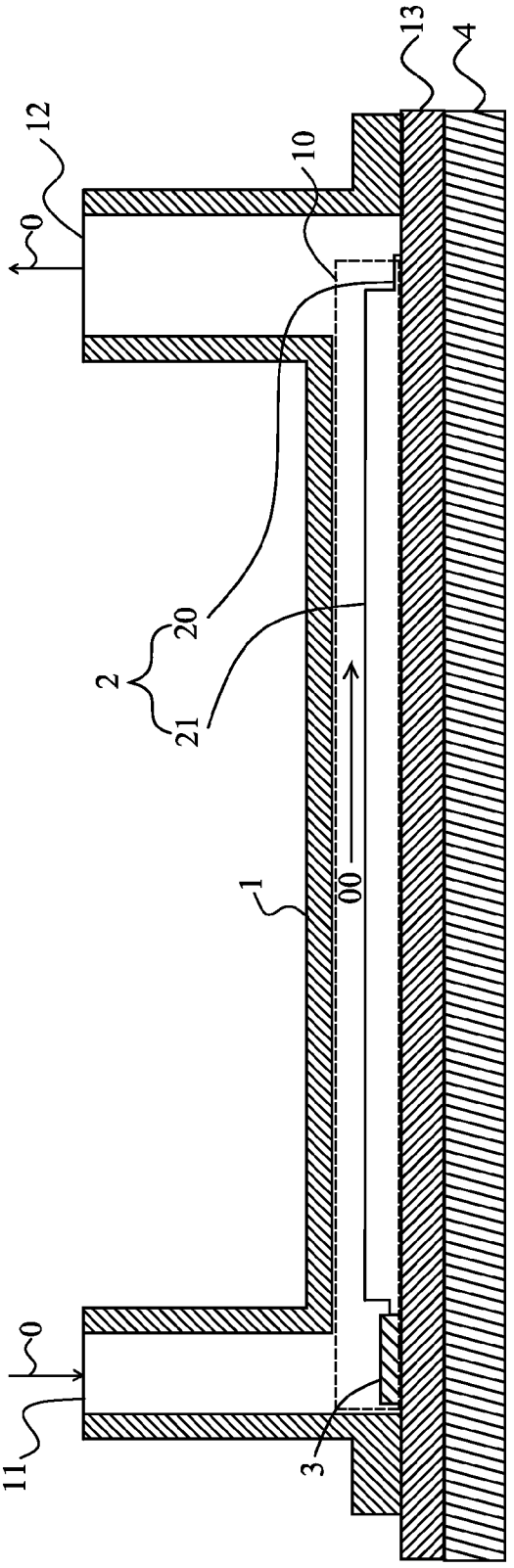


FIG. 1

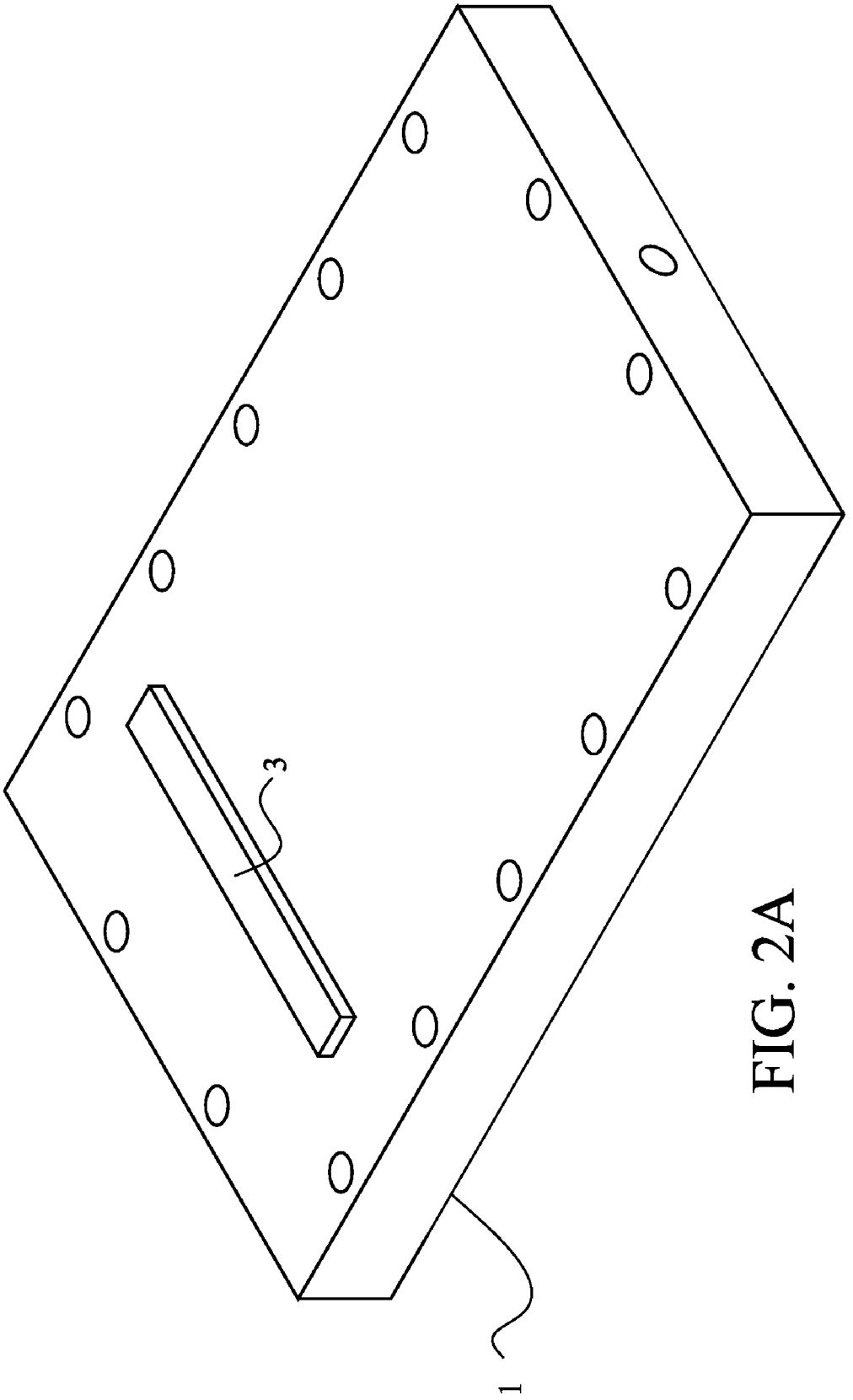


FIG. 2A

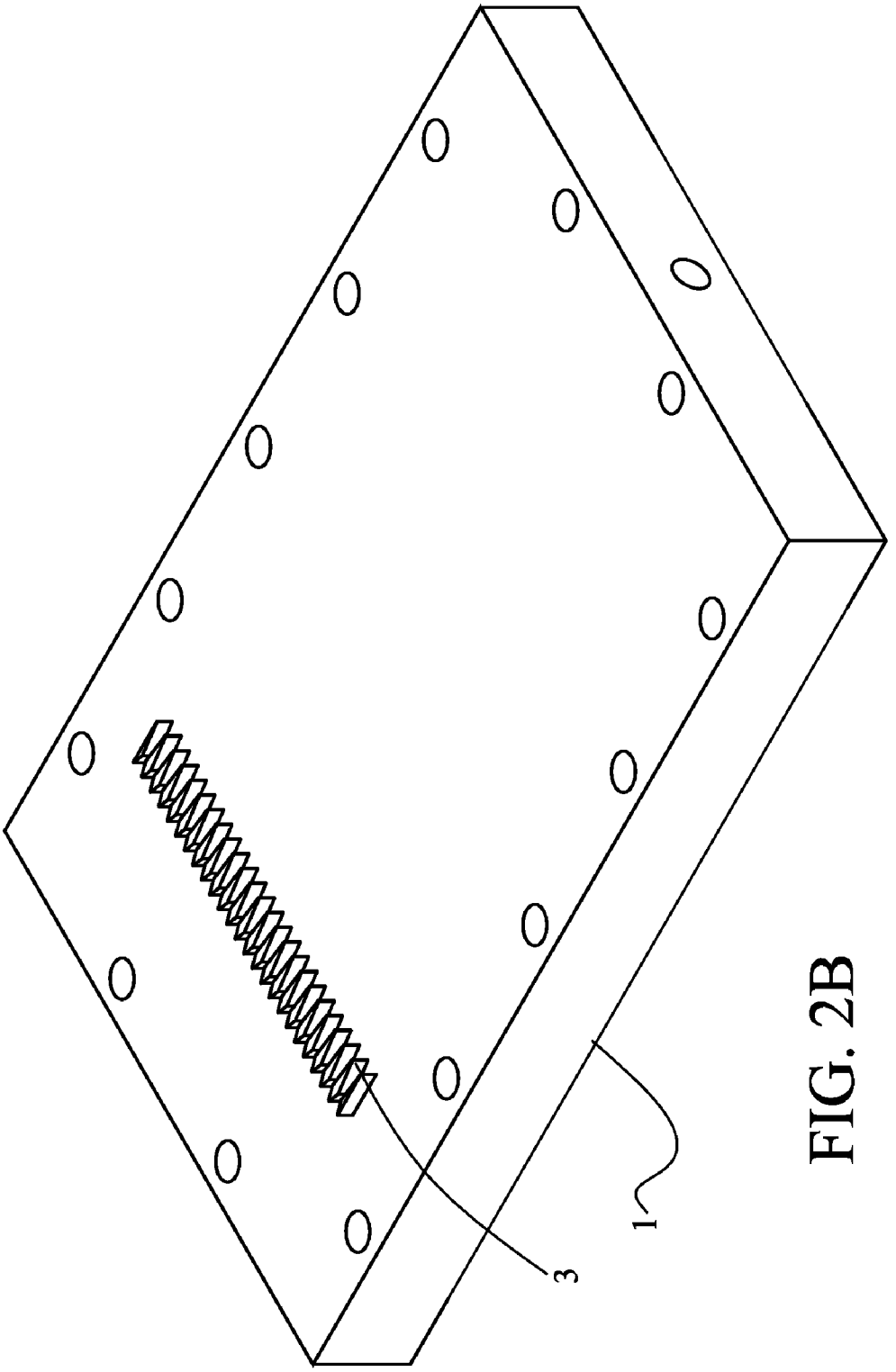


FIG. 2B

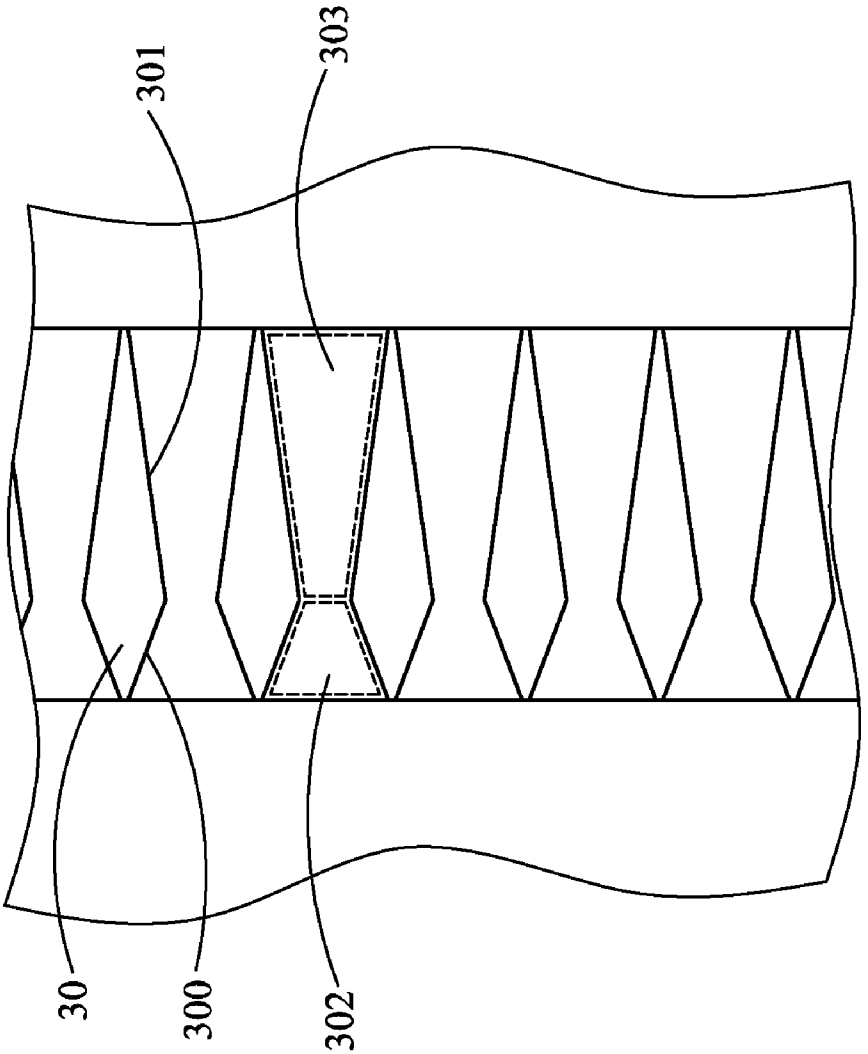


FIG. 2C

HEATING EXCHANGE CHAMBER FOR LIQUID STATE COOLING FLUID

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional application claims priority under **35** U.S.C. § 119(a) on Patent Application No(s). 099136467 filed in Taiwan, R.O.C. on Oct. 26, 2010, the entire contents of which are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a heat dissipation module using cooling fluid, and more particularly, to a heat exchange chamber having a flow resistance disposed at a position proximate to the inlet of its cavity for narrowing down a flow channel from the inlet to the cavity so as to raise the resistance to the flow of the cooling fluid before the cooling fluid flows through a thermal dissipation device, and thus enable the cooling fluid to be distributed uniformly through the thermal dissipation device.

BACKGROUND OF THE INVENTION

[0003] In many typical mainframe computers such as servers, poor heat dissipation performance is usually the case that cause the computer to malfunction so that how to design a heat sink or heat dissipating device with optimized heat dissipation performance is becoming the key issue in modern electronic computing industry. IN addition, taking the power consumed by servers of any common data center for instance, the power used by the heat dissipation system for maintaining the operation of such servers is also twice as much. And not to mention that the complexity of the heat dissipation system for modern cloud data centers that are crowded with servers in high density is generally almost double comparing with those for common data centers. That is, in the enclosed space of a server room of a cloud data center, the heat that all those boxes generate can quickly increase the ambient temperature beyond equipment specifications. The results can be ugly if there is no proper heat dissipation system with good performance available and consequently all distinct possibilities can be caused, such as the operation of the servers may be unstable or even fail, energy can be wasted, the performance of the personnel working in the server room may be poor since an uncomfortable working environment can be resulted, the cost for managing the server room may increase, and so on.

[0004] Among those many conventional apparatus for heat dissipation, the heat exchange chamber for liquid state cooling fluid is the one that is commonly seen and used for allowing a cooling fluid to flow therein while enabling a heat exchanging process to be performed between the cooling fluid and a heat source, and thus reducing the temperature of the heat source. However, since the cooling fluid is flowing at a specific speed while being fed into the heat exchange chamber, instead of being distributed uniformly through the whole heat exchange chamber, most of such cooling fluid flow will flow concentrating to the center of the flow channels formed inside the heat exchange chamber. Thereby, the heat dissipating efficiency can be severely affected since there must be a portion of the thermal dissipation device inside the heat exchange chamber that is sit idle as it is not in any thermal contact with the cooling fluid.

[0005] Therefore, it is in need of a heat exchange chamber for enabling a cooling fluid to be distributed uniformly therein.

SUMMARY OF THE INVENTION

[0006] In view of the disadvantages of prior art, the primary object of the present invention is to provide a heat exchange chamber capable of utilizing a flow resistance to raise resistance to the flowing of a cooling fluid and thus enabling the cooling fluid to be distributed uniformly inside a cavity formed inside a cavity of the heat exchange chamber.

[0007] To achieve the above object, the present invention provides a heat exchange chamber, comprising: a casing, configured with a cavity, an inlet and an outlet in a manner that the inlet is provided for allowing a cooling fluid to flow into the cavity and the outlet is provided for allowing the cooling fluid to flow out of the cavity as the cooling fluid is enabled to flow in a flowing direction through of the cavity; a thermal dissipation device, disposed inside the cavity; and a flow resistance, disposed inside the cavity at a position proximate to the inlet to be used for narrowing down a flow channel from the inlet to the cavity and thus raising the resistance to the flow of the cooling fluid before the cooling fluid flows through the thermal dissipation device, so as to enable the cooling fluid to be distributed uniformly through the thermal dissipation device.

[0008] Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein:

[0010] FIG. **1** is a side view of a heat exchange chamber according to the present invention.

[0011] FIG. **2**A is a schematic diagram showing a flow resistance according to a first embodiment of the invention.

[0012] FIG. **2**B is a schematic diagram showing a flow resistance according to a second embodiment of the invention.

[0013] FIG. **2**C is a partial top view of FIG. **2**B.

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0014] For your esteemed members of reviewing committee to further understand and recognize the fulfilled functions and structural characteristics of the invention, several exemplary embodiments cooperating with detailed description are presented as the follows.

[0015] Please refer to FIG. **1** and FIG. **2**A, which is a schematic diagram showing a heat exchange chamber for liquid state cooling fluid according to the present invention, and a schematic diagram showing a flow resistance according to a first embodiment of the invention. As shown in FIG. **1**, the

heat exchange chamber comprises: a casing **1**, a thermal dissipation device **2**, and a flow resistance **3**. The casing **1** is configured with a cavity **10**, an inlet **11** and an outlet **12** in a manner that the inlet **11** is provided for allowing a cooling fluid **0** to flow into the cavity **10** and the outlet **12** is provided for allowing the cooling fluid **0** to flow out of the cavity **10** as the cooling fluid is enabled to flow in a flowing direction through the cavity **10**, as the arrow **00** shown in FIG. **1**. In this embodiment, the diameter of the outlet **12** is larger than that of the inlet **11**, by that the cavity **10** can be prevented from having too much gas being accumulated therein, and thus the boiling point of the cooling fluid **0** can be prevented form increasing with the increasing of the pressure inside the cavity **10** caused by the gas accumulation, so that the heat dissipating efficacy of the cooling fluid is prevented from reducing. The thermal dissipation device **2** is disposed inside the cavity **10**. Moreover, the flow resistance **3** is disposed inside the cavity **10** at a position proximate to the inlet **11**, i.e. it is disposed at a position between the thermal dissipation device **2** and the inlet **11**. As shown in FIG. **2**A, the flow resistance **3** is substantially a protrusion constructed for narrowing down a flow channel from the inlet **11** to the cavity **10** so as to raise the resistance to the flow of the cooling fluid **0** before the cooling fluid flows through a thermal dissipation device **2**, and thus enable the cooling fluid **0** to be distributed uniformly through the thermal dissipation device **2**.

[0016] Please refer to FIG. **2**B and FIG. **2**C, which is a schematic diagram showing a flow resistance according to a second embodiment of the invention, and a partial top view of FIG. **2**B. As shown in FIG. **2**B, the flow resistance **3**, that is composed of a plurality of protrusions **30**, is designed for narrowing down a flow channel from the inlet **11** to the cavity **10** so as to raise the resistance to the flow of the cooling fluid **0** before the cooling fluid flows through a thermal dissipation device **2**, and thus enable the cooling fluid **0** to be distributed uniformly through the thermal dissipation device **2**. As shown in FIG. **2**C, the two sides of each protrusion is formed with a first ramp **300** and a second ramp **301**, and consequently, by the defining of two corresponding first ramps **300** on any two neighboring protrusions **30**, a converging channel **302** is formed, and the same time, by the defining of two corresponding second ramps **301** on any two neighboring protrusions **30**, a diverging channel **303** is formed. With the formation of the plural protrusions as well as the formation of ramped surfaces on two sides of each protrusion, the resistance to the flow of the cooling fluid before it flow through the thermal dissipation device **2** is raised, but it is noted that the shape of each protrusion is not limited thereby.

[0017] The difference between the first embodiment and the second embodiment of the invention is that: in the first embodiment, the raising of the resistance to the flow of the cooling fluid **0** is achieved by the use of the protrusions of the flow resistance **3** for narrowing down the flow channel; but in the second embodiment, after achieving the raising of the resistance by the use of the converging channels **302**, the providing of the diverging channels **303** will speed up the flowing of the cooling fluid **0** after being evenly distributed by the damping of the converging channels **302**.

[0018] Moreover, the casing **1** further comprises: a base **13**, being provided for engaging with a heat source **4**, by that the heat emitted from the heat source **4** can be transmitted to the heat exchange chamber through the base **13**. It is noted that the heat source **3** can be a center processing unit or a chip module, but is not limited thereby. In addition, the base **13** is also being arranged in thermal contact with the thermal dissipation device **2** so as to transmit heat thereto. Hence, the flow resistance **3** of the present invention can be mounted on the base **13** while being disposed inside the cavity **10**, or can be mounted on a top panel of the casing that is hanging downward while being disposed inside the cavity **10**. Nevertheless, the shape, the orientation and the position of the flow resistance **3** are not limited thereby.

[0019] By the disposition of the flow resistance **3** inside the cavity **10** at a position proximate to the inlet **11** for narrowing down the flow channel, the cross-section area of the flow channel is smaller than that of the inlet **11**, by that the flow of the cooling fluid **0** is slowing down before reaching the thermal dissipation device **2** while enabling the same to be uniformly distributed through the thermal dissipation device **2**. In addition, the flow resisting effect of the flow resistance **3** can further be enhanced by a better design relating to its structure and shape as well. Thus, in the heat exchange chamber for liquid state cooling fluid of the invention, the cooling fluid could be distributed uniformly through the dissipating heat device with satisfactory heat dissipating efficacy.

[0020] With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

What is claimed is:

1. A heat exchange chamber, comprising:

a casing, configured with a cavity, an inlet and an outlet in a manner that the inlet is provided for allowing a cooling fluid to flow into the cavity and the outlet is provided for allowing the cooling fluid to flow out of the cavity as the cooling fluid is enabled to flow in a flowing direction through of the cavity;

a thermal dissipation device, disposed inside the cavity; and

a flow resistance, disposed inside the cavity at a position proximate to the inlet to be used for narrowing down a flow channel from the inlet to the cavity.

2. The heat exchange chamber of claim **1**, wherein the diameter of the outlet is larger than that of the inlet.

3. The heat exchange chamber of claim **1**, wherein the flow resistance further comprises: a plurality of protrusions.

4. The heat exchange chamber of claim **3**, wherein the flow resistance further comprises: a plurality of flow channels, each being formed by the sandwiching of any two neighboring protrusions.

5. The heat exchange chamber of claim **4**, wherein each of the plural flow channels is composed of a diverging channel and a converging channel.

6. The heat exchange chamber of claim **1**, wherein the thermal dissipation device further comprises: a plate; and a plurality of heat dissipating fins formed on the plate.

7. The heat exchange chamber of claim **1**, wherein the casing further comprises: a base, being provided for engaging with a heat source while being arranged in thermal contact with the thermal dissipation device.

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