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(54) HEAT DISSIPATION DEVICE

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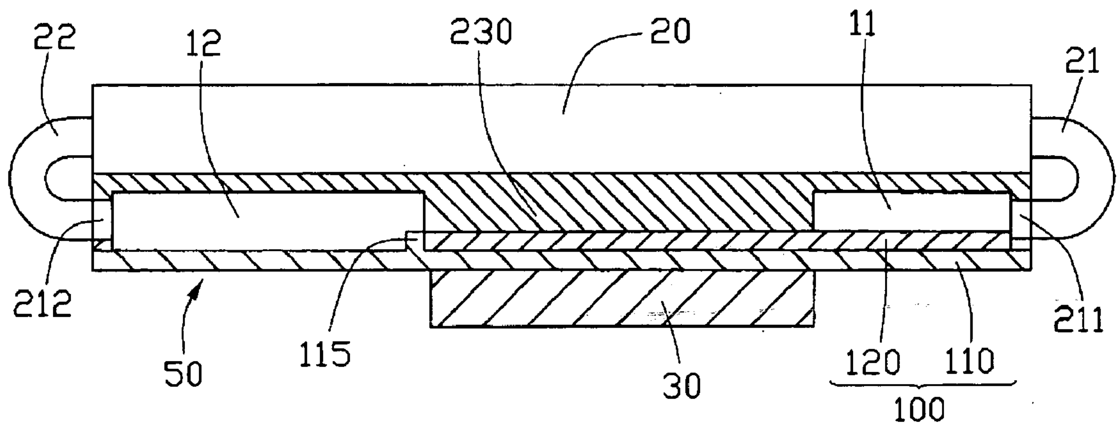
(57) **ABSTRACT**

A heat dissipation device includes a first assembly having a first shell portion and a wick layer formed thereon, a second assembly having a second shell portion and a clapboard formed thereon, and a circumfluence cavity and an evaporation cavity formed by coupling the first assembly and the second assembly together and separated by the clapboard. The circumfluence cavity and the evaporation cavity are communicated via the wick layer.



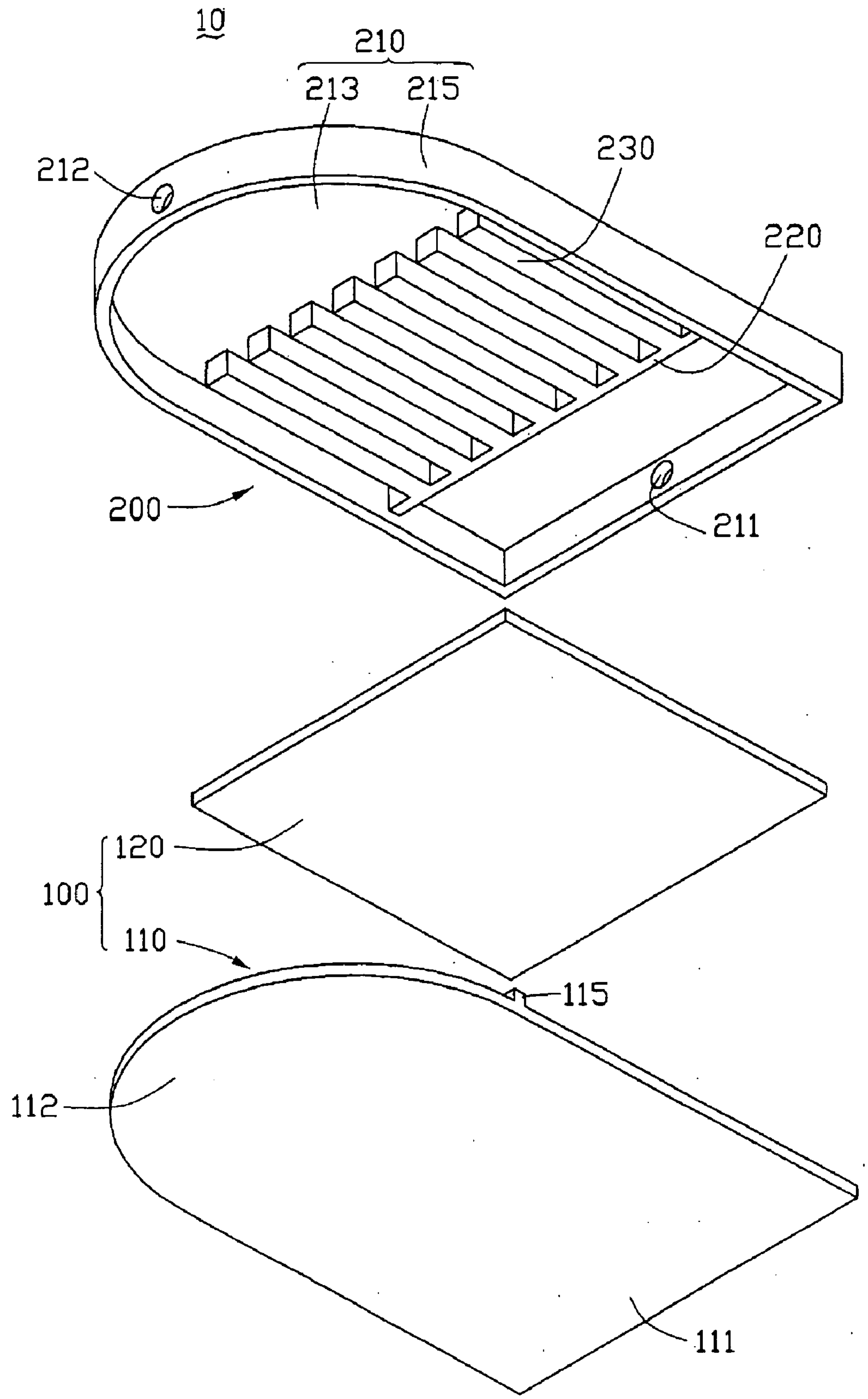


FIG. 1

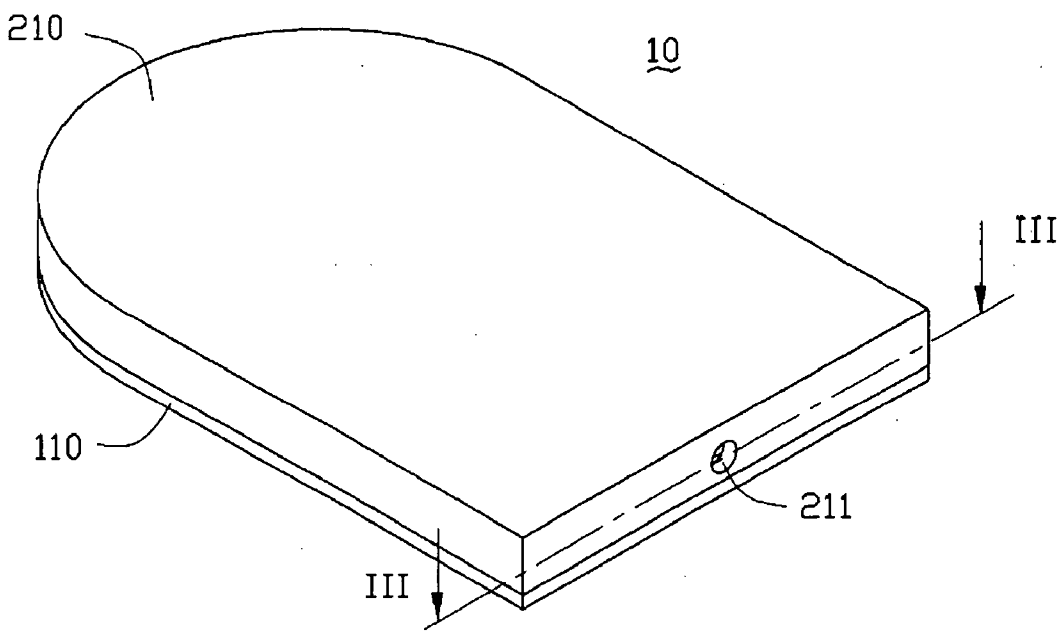


FIG. 2

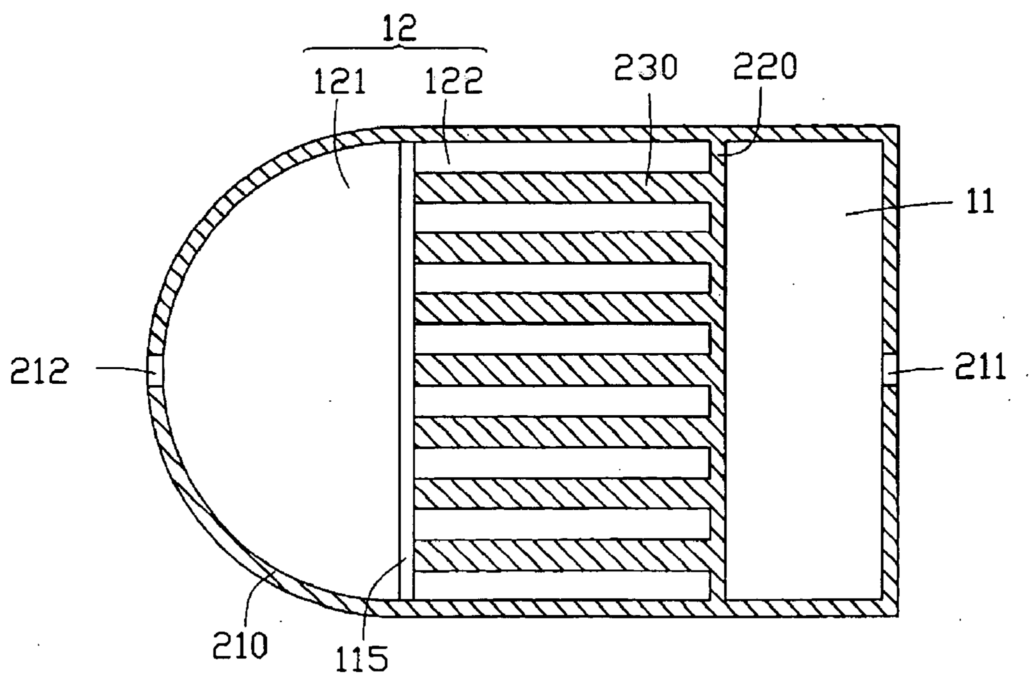


FIG. 3

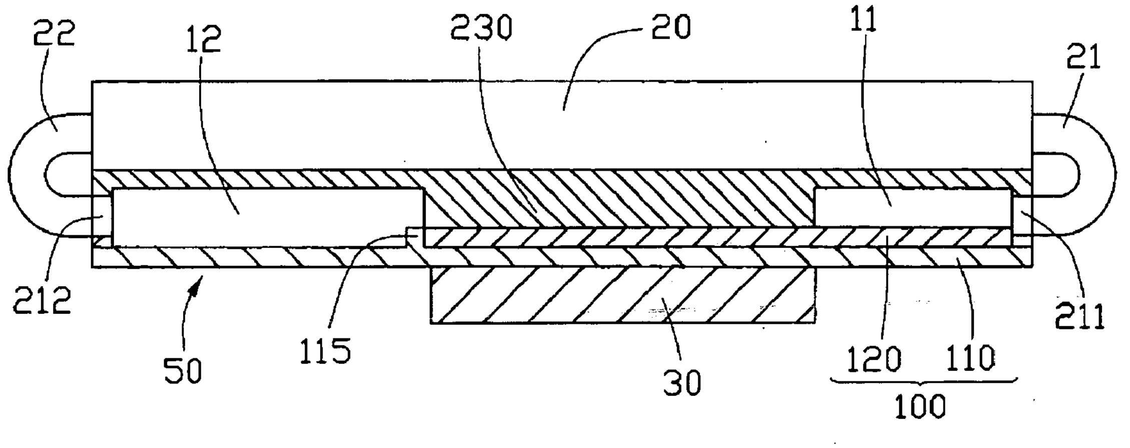


FIG. 4

HEAT DISSIPATION DEVICE

TECHNICAL FIELD

[0001] The present invention relates to a heat dissipation device, and more particularly to a heat dissipation device which utilizes a phase change heat transfer.

BACKGROUND

[0002] Electronic components such as semiconductor chips are becoming progressively smaller, while at the same time heat dissipation requirements thereof are increasing. In many contemporary applications, a heat pipe is one of the most efficient systems in use for transmitting heat away from such components.

[0003] Numerous kinds of heat pipes have been developed for cooling electronic components. A typical heat pipe comprises an evaporator section to take in heat and a condenser section to pass out heat. Working fluid is contained in the heat pipe to transfer heat from the evaporator section to the condenser section. Heat entering the evaporator section of the heat pipe boils the fluid and turns it into a vapor. The vapor expands in volume and travels to the condenser section where it condenses to a liquid and releases its heat. The liquid is then returned to the evaporator section by gravity and/or a wick, whereupon the cycle starts again. However, the heat transfer rate of a single heat pipe is limited. Furthermore, when a heat pipe is directly connected with a heat source, the contact surface therebetween is small, and the thermal conduction performance of the heat pipes can not be fully used.

[0004] In order to satisfy the increasing heat dissipation requirements, a typical heat dissipation apparatus always employs a plurality of heat pipes, the evaporator sections of the heat pipes are combined with a heat sink and disposed in thermal communication with a heat source via the heat sink. Therefore, the contact surface of the evaporator sections is increased, and the thermal conduction performance of the heat pipes can be fully used. However, the size of the heat dissipation apparatus is thereby increased. Furthermore, the evaporator sections of the heat pipes are disposed in thermal communication with the heat source indirectly through the heat sink. That is to say, the heat transmission between the evaporator sections and the heat sink is further restricted by the thermal conductivity of the heat sink.

[0005] What is needed, therefore, is a heat dissipation device which provides high heat transfer rate with a small size.

SUMMARY

[0006] In a preferred embodiment, a heat dissipation device comprises a first assembly having a first shell portion and a wick layer formed thereon, a second assembly having a second shell portion and a clapboard formed thereon, and a circumfluence cavity and an evaporation cavity formed by coupling the first assembly and the second assembly together and separated by the clapboard. The circumfluence cavity and the evaporation cavity are communicated via the wick layer.

[0007] Other advantages and novel features will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Many aspects of the present heat dissipation device can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, the emphasis instead being placed upon clearly illustrating the principles of the present heat dissipation device. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0009] FIG. **1** is a schematic, exploded view of a heat dissipation device in accordance with a preferred embodiment;

[0010] FIG. **2** is a schematic isometric of the heat dissipation device of FIG. **1**;

[0011] FIG. **3** is a schematic cross-sectional view taken along line III-III of FIG. **2**; and

[0012] FIG. **4** is a schematic, sectional view of the heat dissipation device of FIG. **1** employed in a heat dissipation apparatus.

[0013] The exemplifications set out herein illustrate at least one preferred embodiment of the invention, in one form, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0014] Embodiments of the present heat dissipation device will now be described in detail below and with reference to the drawings.

[0015] Referring to FIG. **1** to FIG. **3**, a heat dissipation device **10** according to a preferred embodiment is provided. The heat dissipation device **10** comprises a first assembly **100** having a first shell portion **110** and a wick layer **120** formed thereon, and a second assembly **200** having a second shell portion **210** and a clapboard **220** formed thereon. The wick layer **120** and the clapboard **220** each has a top surface (not labeled). The first assembly **100** and second assembly **200** are coupled together by jointing or sticking, and the top surface of the wick layer **120** is substantially coplanar with the top surface of the clapboard **220**, thereby a circumfluence cavity **11** and an evaporation cavity **12** separated by the clapboard **220** are thereby formed. The circumfluence cavity **11** and the evaporation cavity **12** are communicated via the wick layer **120**. Two through holes **211** and **212** are defined in the second shell portion **210** and connected with the circumfluence cavity **11** and the evaporation cavity **12** respectively. Alternatively, the through holes **211** and **212** can be defined in the first shell portion **110**, or be defined in the first shell portion **110** and the second shell portion **210** respectively.

[0016] The first shell portion **110** employs a base plate comprises a rectangular portion **111** and an arc-shaped portion **112** extending from one side of the rectangular portion **111**. Preferably, the first shell portion **110** further comprises a narrow raised strip **115** protruded from the junction of the rectangular portion **111** and the arc-shaped portion **112** perpendicularly. The wick layer **120** is shaped in accordance with the rectangular portion **111** of the first shell portion **110** and formed thereon. The narrow raised strip **115** has a top surface substantially coplanar with the top surface of the wick layer **120**. The wick layer **120** can be made from a sintered layer or a carbon nanotube layer. The sintered layer can be sintered with metal powder. The metal powder can be selected from the group comprising of copper (Cu) powder, aluminum (Al) powder, and iron (Fe) powder. In the preferred embodiment, the wick layer **120** employs a sintered layer of copper powder.

[**0017**] The second shell portion **210** of the second assembly **200** comprises a flat portion **213** in accordance with the first shell portion **110**, and a side wall portion **215** extended from the edge of the flat portion **213** perpendicularly In the preferred embodiment, the second assembly **200** further comprises a plurality of guiding pieces **230** extended from the flat portion **213** of the second shell portion **210**. The top surfaces of the guiding pieces **230** are substantially coplanar with the top surface of the clapboard **220**. The side wall portion **215**, the clapboard **220**, and the guiding pieces **230** are extended from the flat portion **213** on the same side. Preferably, the second shell portion **210**, the clapboard **220**, and the guiding pieces **230** are integrally formed. More preferably, the guiding pieces **230** are substantially parallel to each other and orthogonal to the clapboard **220**. Furthermore, one end of each guiding pieces **230** is coupled to the clapboard **220**. The first shell portion **110** and the second assembly **200** can be made from material selected from the group comprising of copper, aluminum, iron, and any suitable alloy thereof.

[**0018**] The evaporation cavity **12** comprises a arc-shaped gas collecting chamber **121** in accordance with the arc-shaped portion **112** of the first shell portion **110**, and a plurality guiding channels **122** defined by the guiding pieces **230** together with the flat portion **213** and the side wall portion **215**. The through hole **212** is defined in the side wall portion **215** of the second shell portion **210** and positioned at the vertex of the arc-shaped gas collecting chamber. The through hole **211** is defined in the side wall portion **215** of the second shell portion **210** provided around the circumfluence cavity **11**.

[**0019**] Referring to FIG. **1** to FIG. **4**, the heat dissipation device **10** is employed in a heat dissipation apparatus **50** for cooling down a heat source **30**. In the preferred embodiment, a section of evaporation cavity **12** is in thermal communication with the heat source **30**, and the section is overlapped with the wick layer **120**. In detail, the heat source **30** is connected with the first shell portion **110** directly. The two through holes **211** and **212** of the heat dissipation device **10** are connected with a condenser **20** via two pipes **21** and **22** of the condenser **20** respectively. During the cooling process, a liquid operating fluid (not shown) is injected into the circumfluence cavity **11** via the through hole **211**. The operating fluid is moved from the circumfluence cavity **11** to the evaporation cavity **12** through the wick layer **120** by capillary action of the wick layer **120**. When the heat of the heat source **30** is absorbed by the wick layer **120** via the first shell portion **110**, and further absorbed by the operating fluid inside the wick layer **120**, the operating fluid is then vaporized to steam. The steam is guided to the gas collecting chamber **121** via the guiding channels **122**, and then flows to the condenser **20** via the through hole **212** and the pipe **22**. The steam changes back to the liquid operating fluid in the condenser **20** and then flows back to the circumfluence cavity **11** via the through hole **211** and the pipe **21**. The heat source **30** is then cooled down by phase change cycles of the operating fluid.

[**0020**] As stated above, the wick layer **120** is formed on the first shell portion **110**, the size of the wick layer **120** can be adjusted according to different heat dissipation requirements, and the evaporation cavity **12** is in thermal communication with the heat source **30** directly, thereby high contact surface and low thermal contact resistance can be provided by the present heat dissipation device at the same time. Therefore, the present heat dissipation device can provide high heat transfer rate with a small size. Furthermore, the guiding channels **122** formed by the guiding pieces **230** lead to the arc-shaped gas collecting chamber **121**, the flow resistance of the steam can be reduced.

[**0021**] It is believed that the present embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the examples hereinbefore described merely being preferred or exemplary embodiments of the invention.

What is claimed is:

1. A heat dissipation device comprising:

a first assembly comprising a first shell portion and a wick layer formed thereon;

a second assembly comprising a second shell portion and a clapboard formed thereon; and

a circumfluence cavity and an evaporation cavity being formed by coupling the first assembly and the second assembly together and separated from each other by the clapboard;

wherein, the circumfluence cavity and the evaporation cavity are communicated via the wick layer of the first assembly.

2. The heat dissipation device in accordance with claim 1, wherein the circumfluence cavity and the evaporation cavity each having a through hole defined in one of the shell portions.

3. The heat dissipation device in accordance with claim 1, wherein a top surface of the wick layer is coplanar with a top surface of the clapboard.

4. The heat dissipation device in accordance with claim 1, wherein the second shell portion comprises a flat portion in accordance with the first shell portion, and a side wall portion extending from the edge of the flat portion perpendicularly.

5. The heat dissipation device in accordance with claim 4, wherein the second assembly further comprises a plurality of guiding pieces extending from the second shell portion.

6. The heat dissipation device in accordance with claim 5, wherein the guiding pieces form top surfaces coplanar with a top surface of the clapboard.

7. The heat dissipation device in accordance with claim 5, wherein the guiding pieces are substantially parallel to each other and orthogonal to the clapboard.

8. The heat dissipation device in accordance with claim 5, wherein one end of each guiding pieces is coupled to the clapboard.

9. The heat dissipation device in accordance with claim 5, wherein the second shell portion, the clapboard, and the guiding pieces are integrally formed.

10. The heat dissipation device in accordance with claim 5, wherein the evaporation cavity comprises a gas collecting chamber and a plurality of guiding channels defined by the guiding pieces with the second shell portion.

11. The heat dissipation device in accordance with claim 10, wherein the gas collecting chamber is an arc-shaped gas collecting chamber.

12. The heat dissipation device in accordance with claim 1, wherein the first shell portion and the second assembly are made from material selected from the group comprising of copper, aluminum, iron, and any alloy thereof.

13. The heat dissipation device in accordance with claim 1, wherein the wick layer is made from a sintered layer.

14. The heat dissipation device in accordance with claim 13, wherein the sintered layer is sintered with material selected from the group comprising of copper powder, aluminum powder, and iron powder.

15. The heat dissipation device in accordance with claim 1, wherein the wick layer is made from a carbon nanotube layer.

16. The heat dissipation device in accordance with claim 1, wherein the first assembly and second assembly are coupled together by jointing.

17. The heat dissipation device in accordance with claim 1, wherein the first assembly and second assembly are coupled together by sticking.

18. A heat dissipation device comprising:

a first assembly comprising a first shell portion and a wick layer formed thereon;

a second assembly comprising a second shell portion and a clapboard formed thereon; and

a cavity having a circumfluence portion and an evaporation portion formed by coupling the first assembly and the second assembly together;

wherein, the circumfluence portion and the evaporation portion are separated by the clapboard of the second assembly and communicated with each other via the wick layer of the first assembly, each of the circumfluence portion and the evaporation portion having a through hole defined in one of the shell portions of the first assembly and the second assembly.

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