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(54) **HEAT DISSIPATION DEVICE**

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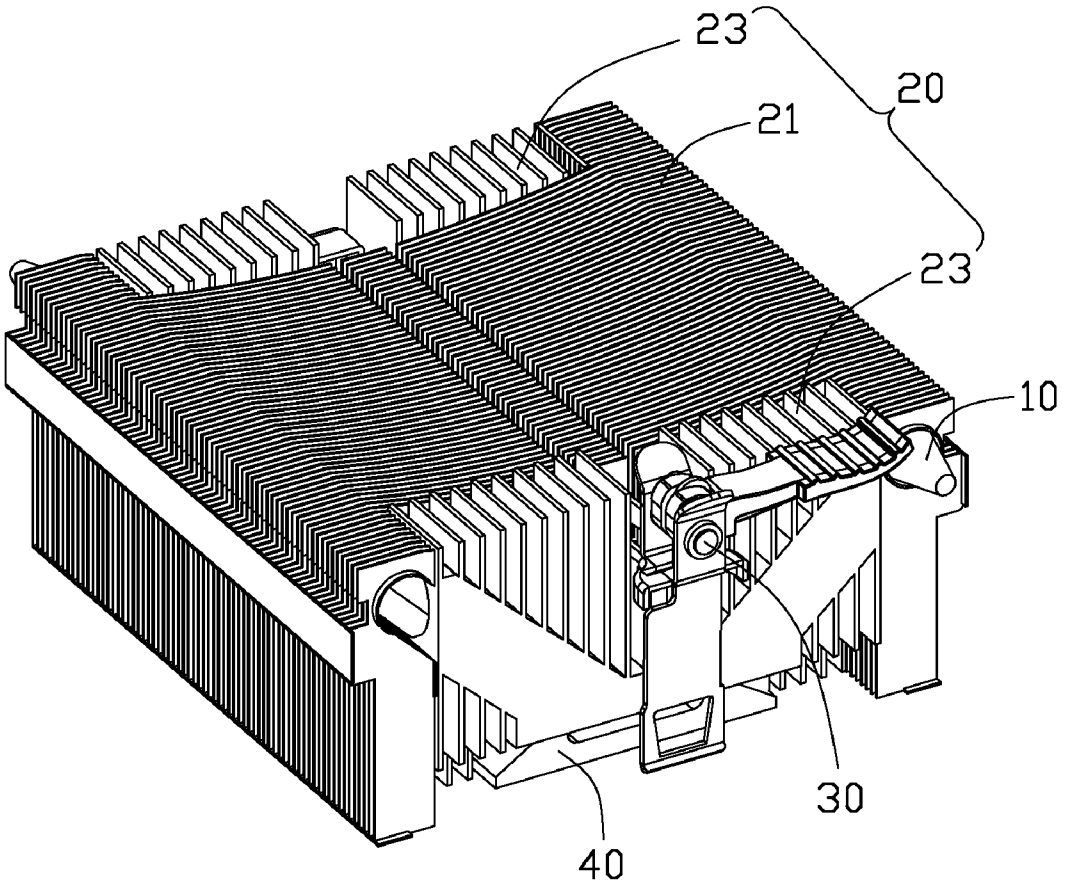
(57) **ABSTRACT**

A heat dissipation device includes a heat sink and a heat pipe. The heat sink includes a first fin assembly and two second fin assemblies located on two opposite sides of the first fin assembly respectively. The heat pipe includes an evaporator section, a first condenser section and a second condenser section extending from two opposite ends of the evaporator section in the same directions, and a third condenser section extending from a free end of the second condenser section towards a free end of the first condenser section. The third condenser section extends through the first fin assembly. The first condenser section interconnects one of the second fin assemblies to the first fin assembly. The second condenser section interconnects the other second fin assembly to the first fin assembly.



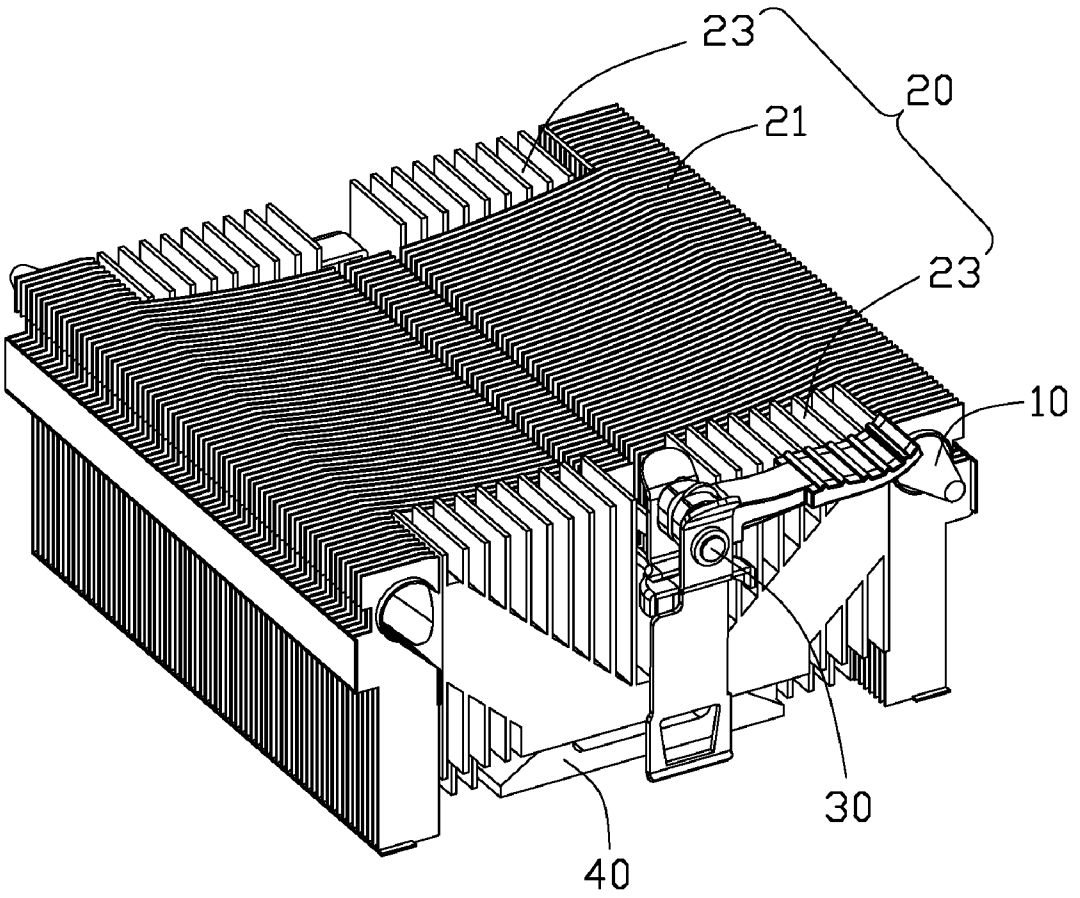


FIG. 1

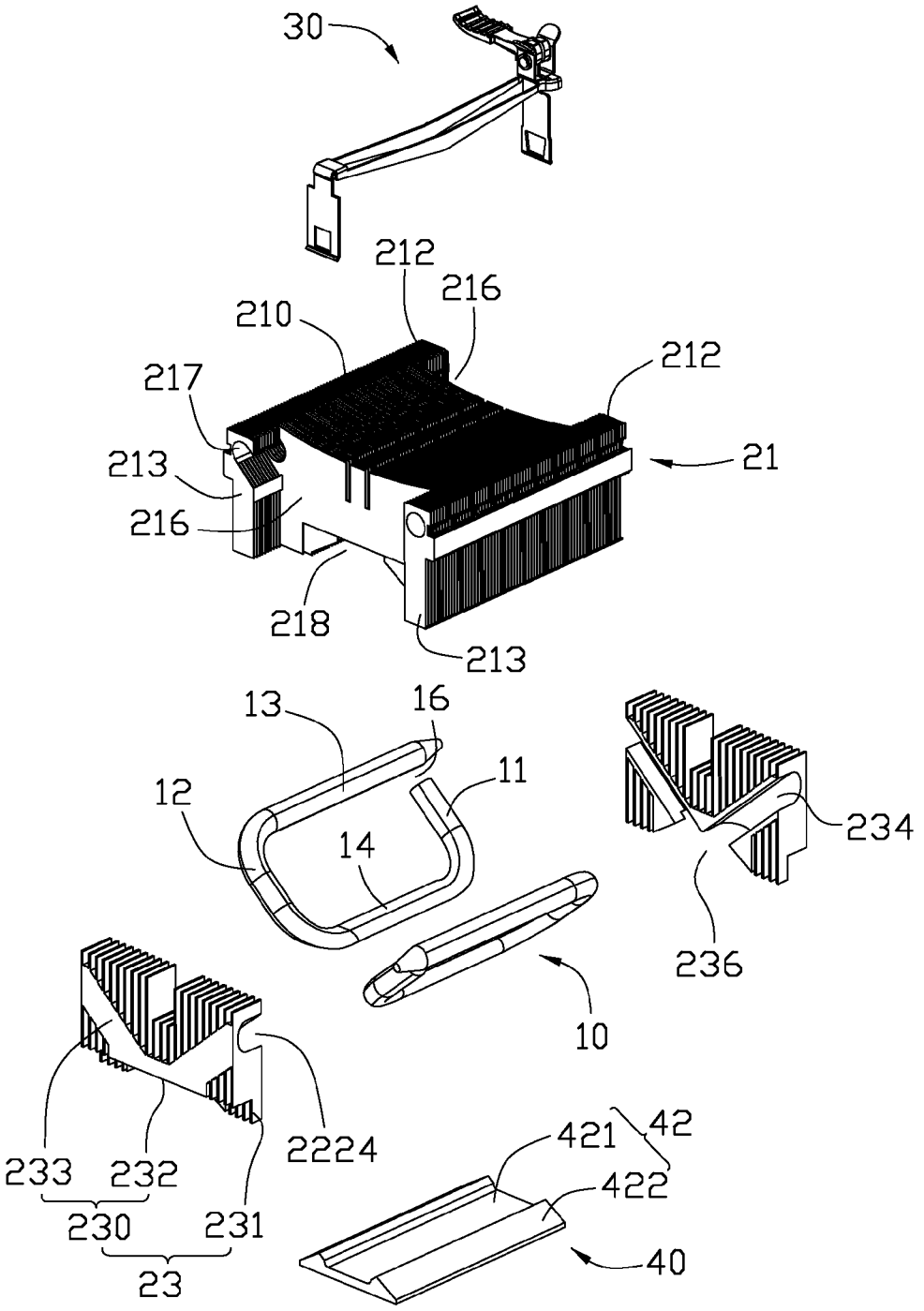

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FIG. 2

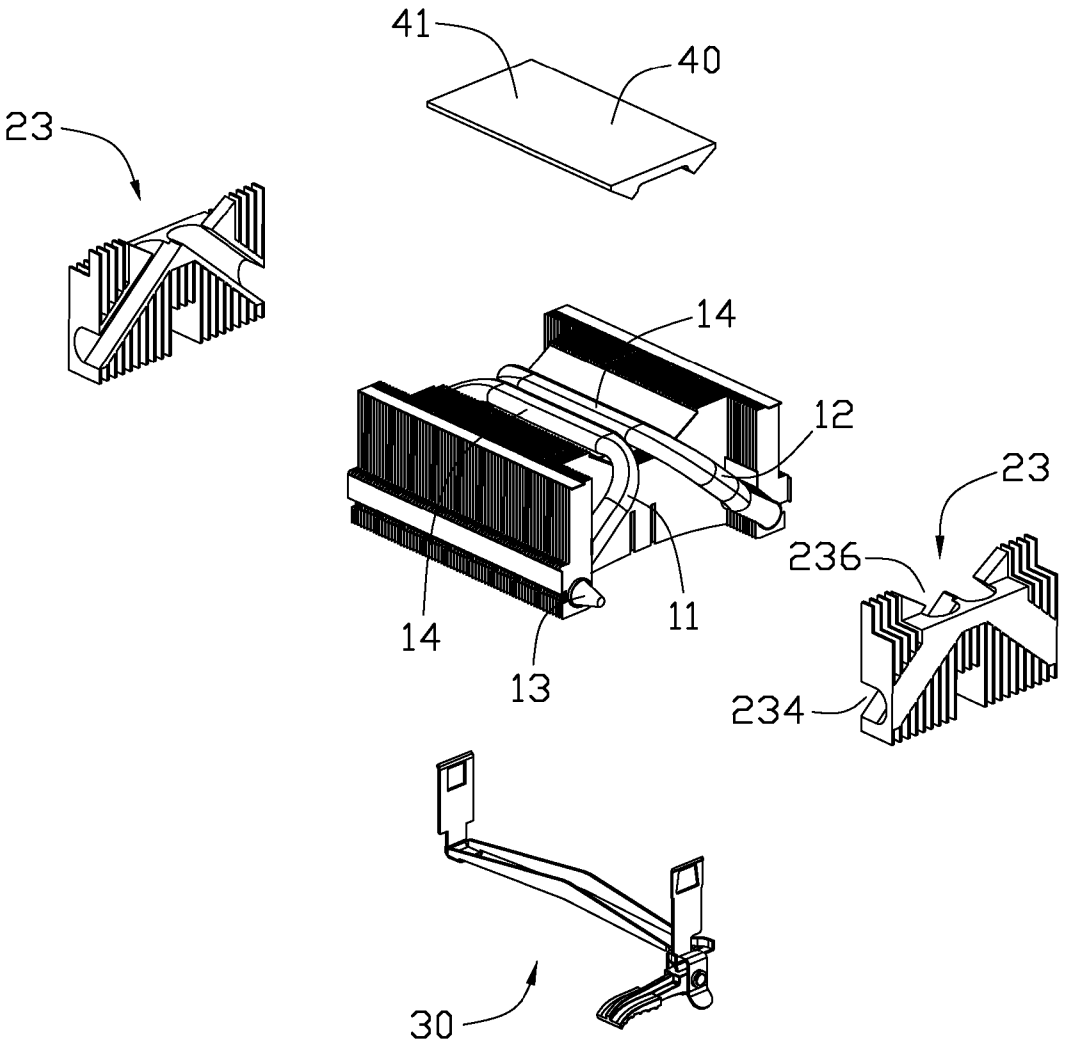

FIG. 3

HEAT DISSIPATION DEVICE

BACKGROUND

[0001] 1. Technical Field

[0002] The disclosure relates to heat dissipation, and particularly to a heat dissipation device for dissipating heat generated by an electronic component.

[0003] 2. Description of Related Art

[0004] Electronic components operating at high speed generate excessive heat which must be displaced efficiently to ensure normal operation. Typically, a heat dissipation device attached to the electronic component provides such heat dissipation.

[0005] A conventional heat dissipation device includes a metal base for contacting and absorbing heat from the electronic component, a straight heat pipe with an evaporator section thereof attached to the base, and a heat sink including a plurality fins attached to a condenser section of the heat pipe. By this configuration, firstly, the heat generated by the electronic component is conducted to the base, and then transferred to the heat sink through the heat pipe, and finally is dissipated to ambient by the fins.

[0006] For enhancing a heat dissipation effectiveness of the heat dissipation device, a heat dissipation area of the heat sink is greatly increased. However, a heat contacting area between the heat pipe and the heat sink, due to the restriction by the configurations of the heat pipe and the heat sink, cannot be increased. Thus, most of heat generated by the electronic component and absorbed by the evaporator section of the heat pipe can not be transferred to the heat sink timely, and therefore the heat dissipation effectiveness of the heat dissipation device is limited.

[0007] It is thus desirable to provide a heat dissipation device which can overcome the described limitations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is an isometric, assembled view of a heat dissipation device according to an exemplary embodiment.

[0009] FIG. **2** is an exploded view of the heat dissipation device of FIG. **1**.

[0010] FIG. **3** is similar to FIG. **2**, but viewed from a bottom aspect.

DETAILED DESCRIPTION

[0011] Reference will now be made to the drawing figures to describe the present heat dissipation device in detail.

[0012] FIGS. **1-2** illustrate a heat dissipation device for dissipating heat generated by an electronic component (not shown) which is mounted on a printed circuit board (not shown). The heat dissipation device includes two heat pipes **10**, a heat sink **20**, a clip **30**, and a heat-absorbing block **40**. The clip **30** spans across the heat sink **20** to secure the heat dissipation device on the printed circuit board. Heat generated by the electronic component is absorbed by the heat-absorbing block **40**, transferred to the heat sink **20** via the heat pipes **10** and dissipated into air through the heat sink **20**.

[0013] The heat-absorbing block **40** has a planar bottom surface **41** (FIG. **3**) contacting with the electronic component and a top surface **42** for supporting the heat sink **20** and the heat pipes **10** thereon. The top surface **42** includes a flat middle portion **421** and two slant portions **422** protruding upwardly and slantways from left and right sides of the flat middle portion **421**, respectively. Thus, the flat middle portion **421** is recessed between the slant portions **422**.

[0014] Each of the heat pipes **10** includes an evaporator section **14**, a first condenser section **11** and a second condenser section **12** extending perpendicularly from two opposite ends of the evaporator section **14** in the same direction, and a third condenser section **13** extending from a free end of the second condenser section **12** towards a free end of the first condenser section **11**. The first condenser section **11** is parallel to the second condenser section **12**, and has a length slightly shorter than the second condenser section **12**. The third condenser section **13** is parallel to the evaporator section **14**, and has a length slightly longer than the evaporator section **14**. The first condenser section **11**, the evaporator section **14**, the second condenser section **12** and the third condenser section **13** cooperatively form a rectangle with an opening **16** being formed between a free end of the third condenser section **13** and the free end of the first condenser section **11**.

[0015] The heat sink **20** in whole has a substantially rectangular configuration. The heat sink **20** includes a first fin assembly **21**, and two second fin assemblies **23** arranged at two opposite sides of the first fin assembly **21**, respectively.

[0016] The first fin assembly **21** includes a plurality of parallel first fins **210** arranged side by side and a plurality of parallel heat dissipation vanes **212** arranged side by side and located on two opposite sides (i.e., front and rear sides) of the first fins **210**. Each of the heat dissipation vanes **212** has a size smaller than the first fin **210**. In this embodiment, each of the first fins **210** and the heat dissipation vanes **212** extends along a left-to-right direction of the heat sink **20**. The first fins **210** are located on a middle portion of the first fin assembly **21**. The heat dissipation vanes **212** on the front side of the first fin assembly **21** are grouped into two spaced units on a left end and a right end of the heat sink **20**, respectively, thus to form two horny portions **213** on the front side of the first fin assembly **21**. A first receiving room **216** is defined between the two horny portions **213** on the front side of the first fin assembly **21**. Similarly, the heat dissipation vanes **212** on the rear side of the first fin assembly **21** are grouped into two units on the left end and the right end of the heat sink **20**, respectively, thus to form another two horny portions **213** on the rear side of the first fin assembly **21**, and a second receiving room **216** is defined between the another two horny portions **213** on the rear side of the first fin assembly **21**. Accordingly, a top plan view of the first fin assembly **21** is generally H-shaped.

[0017] Two through holes **217** are defined in the left end and the right end of the first fin assembly **21**, respectively. Each of the through holes **217** extends through the first fins **210** and the heat dissipation vanes **212** along a front-to-rear direction. Each of the through holes **217** receives the third condenser section **13** of a corresponding heat pipe **10** therein. A groove **218** is defined in a middle portion of a bottom side of the first fins **210**. The groove **218** has an upper portion having a width substantially the same as the flat middle portion **421** of the heat-absorbing block **40**, and slightly larger than a sum of the widths of the evaporator sections **14** of the heat pipes **10**. A distance between each of the through holes **217** and the groove **218** substantially equals to the distance between the third condenser section **13** and the evaporator section **14** of each heat pipe **10**, i.e., the length of the second condenser section **12**. When assembled, the block **40** couples to the bottom side of the first fins **210**, and thus the groove **218** and the flat middle portion **421** of the heat-absorbing block **40** cooperatively form a receiving space having a depth equal to

a diameter of the evaporator section **14** of the heat pipe **10**; thus, the evaporator sections **14** of the heat pipes **10** can be sandwiched closely between the bottom side of the first fins **210** and the flat middle portion **421** of the heat-absorbing block **40**.

[0018] The second fin assemblies **23** have substantially the same configuration to each other, and are received in the first and the second receiving rooms **216** of the first fin assembly **21**, respectively. Each of the second fin assemblies **23** includes a base **230**, a plurality of second fins **231** extending perpendicularly and upwardly from a top surface of the base **230** and a plurality of second fins **231** extending perpendicularly and downwardly from a bottom surface of the base **230**. The second fins **231** are parallel to each other and arranged side by side. Each of the second fins **231** extends along the front-to-rear direction of the heat sink **20**, being perpendicular to the first fins **210**.

[0019] The base **230** includes an elongated plated portion **232** and a pair of aliform portions **233** extending upwardly and slantways from two opposite ends (i.e., left and right ends) of the plated portion **232**, respectively, to render the base **230** to have a substantially V-shaped configuration. A pair of slots **234** concaved from inner sides of the aliform portions **233**, respectively, which face the first fin assembly **21**. One slot **234** receives the second condenser section **12** of one of the heat pipes **10**, and the other slot **234** receives the first condenser section **11** of the other heat pipe **10**. A trough **236** is defined under the plated portion **232** of the base **230** to prevent the heat pipes **10** from interfering with the second fin assemblies **23**. The trough **236** communicates with bottom ends of the slots **234**, and has a shape substantially equal to the groove **218** of the first fin assembly **21**. The trough **236** and the groove **218** cooperatively form a receiving channel under the bottom side of the heat sink **20** for receiving the evaporator sections **14** of the heat pipes **10** side by side.

[0020] During assembly of the heat sink **20**, referring to FIG. **3**, the first fin assembly **21** is pre-assembled with the heat pipes **10** extending therethrough. The third condenser sections **13** of the heat pipes **10** insert into the through holes **217** formed at the left side and the right side of the first fin assembly **21**, respectively. The evaporator sections **14** received in the groove **218** are in thermal engagement with the bottom side of the first fin assembly **21**. The second condenser sections **12** extend outwardly from the third condenser sections **13** to the evaporator sections **14** and the first condenser sections **11** extend outwardly from the evaporator sections **14** towards the free end of the third condenser sections **13** are in thermal engagement with outmost first fins **210** at the front and the rear sides of the first fin assembly **21**, respectively. Then, the second fin assemblies **23** are received in the first and the second receiving rooms **216** of the first fin assembly **21**, respectively, with the first condenser sections **11** and the second condenser sections **12** of the heat pipes **10** being received in the slots **234** of the base **230** correspondingly. The first condenser sections **11** and the second condenser sections **12** of the heat pipes **10** embedded into the slots **234** of the second fin assemblies **23** are connected with the second fin assemblies **23** by soldering. Accordingly, the heat sink **20** is assembled.

[0021] The heat-absorbing block **40** is installed on the electronic component with the bottom surface **41** thereof attaching to the electronic component; the heat sink **20** with the heat pipes **30** is mounted on the heat-absorbing block **40**; and the heat sink **20** is mounted on the printed circuit board via the clip **30**. The bottom side of the first fin assembly **21** and the second fin assemblies **23** and the evaporator sections **14** of the heat pipes **10** are in thermal contact with the top surface **42** of the heat-absorbing block **40**.

[0022] During operation of the heat dissipation device, the heat-absorbing block **40** absorbs heat from the electronic component; the heat is spread on the first fins **210**, the heat dissipation vanes **212** and the second fins **231** via the heat pipes **10**; and finally the heat is dissipated to ambient air via the first fins **210**, the heat dissipation vanes **212** and the second fins **231**. Since each of the heat pipes **10** includes the first condenser section **11**, the second condenser section **12** and the third condenser section **13** which are fully in thermal contact with the first fin assembly **21** and the second fin assemblies **23**, a large heat contacting area between the heat pipes **10** and the heat sink **20** is provided. The heat pipes **10** have excellent heat transfer performance due to their low thermal resistance, and therefore heat generated by the electronic component is absorbed by the evaporator sections **14** of the heat pipes **10** and is quickly and effectively transferred to different portions of the heat sink **20** far from the electronic component, via the large heat contacting area between the condenser sections **11**, **12**, **13** of the heat pipe **10** and the heat sink **20**, respectively. Accordingly, the heat dissipation efficiency of the heat dissipation device is improved.

[0023] It is to be understood, however, that even though numerous characteristics and advantages of the disclosure have been set forth in the foregoing description, together with details of the structure and function of the embodiments, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A heat dissipation device comprising:

a heat sink comprising a first fin assembly and two second fin assemblies located on two opposite sides of the first fin assembly respectively; and

a heat pipe comprising an evaporator section, a first condenser section and a second condenser section extending from two opposite ends of the evaporator section in the same directions, and a third condenser section extending from a free end of the second condenser section towards a free end of the first condenser section, the third condenser section extending through the first fin assembly, the first condenser section interconnecting one of the second fin assemblies to the first fin assembly, and the second condenser section interconnecting the other second fin assembly to the first fin assembly.

2. The heat dissipation device as described in claim **1**, wherein the first condenser section, the evaporator section, the second condenser section and the third condenser section cooperatively from a rectangle, with an opening being formed between a free end of the third condenser section and the free end of the first condenser section.

3. The heat dissipation device as described in claim **1**, wherein the first fin assembly defines a through hole for the third condenser section of the heat pipe extending therethrough, the evaporator section thermally contacting with a bottom side of the first fin assembly.

4. The heat dissipation device as described in claim **3**, wherein each of the second assemblies defines a slot facing the first fin assembly, and the first condenser section and the

second condenser section of the heat pipe are received in the slots of the second assemblies, respectively.

5. The heat dissipation device as described in claim **4**, wherein the first fin assembly comprises a plurality of first fins and a plurality of heat dissipation vanes each having a smaller size than each of the first fins, the heat dissipation vanes arranged on four corners of the first fin assembly to form four horny portions on the four corners correspondingly, two receiving rooms being defined in the two opposite side of the first fin assembly respectively, each of the receiving rooms being defined between two corresponding horny portions, the second assemblies being received in the receiving rooms respectively.

6. The heat dissipation device as described in claim **1**, further comprising another heat pipe having the same configuration with the heat pipe, the first fin assembly defining another through hole for a third condenser section of the another heat pipe extending therethrough, an evaporator section of the another heat pipe thermally contacting with the bottom side of the first fin assembly and be arranged side by side to the evaporator diction of the heat pipe.

7. The heat dissipation device as described in claim **6**, wherein each of the second assemblies defines a pair of slots facing the first fin assembly, the first condenser section of the heat pipe and a second condenser section of the another heat pipe are received in the pair of slots of one of the second assemblies, respectively, and the second condenser section of the heat pipe and a first condenser section of the another heat pipe are received in the pair of slots of the other one of the second assemblies, respectively.

8. The heat dissipation device as described in claim **7**, wherein each of the second assemblies comprises a base and a plurality of second fins extending outwardly from the base, the base comprising a plated portion and a pair of aliform portions extending upwardly and slantways from two opposite ends of the plated portion to make the base have a substantially V-shaped configuration, the slots being defined in one surface of the aliform portions of the base facing the first fin assembly.

9. The heat dissipation device as described in claim **7**, wherein the slots defined in each of the second fin assemblies are V-shaped.

10. A heat dissipation device comprising:

a heat sink comprising a first fin assembly and two second fin assemblies located on two opposite sides of the first fin assembly respectively; and

a heat pipe comprising an evaporator section and three condenser sections, the evaporator section and the three condenser sections cooperatively form a rectangle with an opening being formed between free ends of the heat pipe, one of the condenser sections interconnecting one of the second fin assemblies to the first fin assembly, one of the condenser sections interconnecting the other second fin assembly to the first fin assembly, and the one of the condenser sections extending through the first fin assembly.

11. The heat dissipation device as described in claim **10**, further comprising another heat pipe having the same configuration with the heat pipe, the first fin assembly defining two through holes for the two condenser sections of the heat pipes extending therethrough, the evaporator sections of the heat pipes being arranged side by side and thermally contacting with bottom side of the first fin assembly.

12. The heat dissipation device as described in claim **11**, wherein each of the second fin assemblies defines a pair of slots on one side facing the first fin assembly, the other four condenser sections of the heat pipes interconnecting the second fin assemblies and the first fin assembly being received in the slots of the second fin assemblies correspondingly.

13. The heat dissipation device as described in claim **12**, wherein the slots of each second fin assembly receive two condenser sections of different heat pipes therein.

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