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(54) **HEAT DISSIPATION DEVICE**

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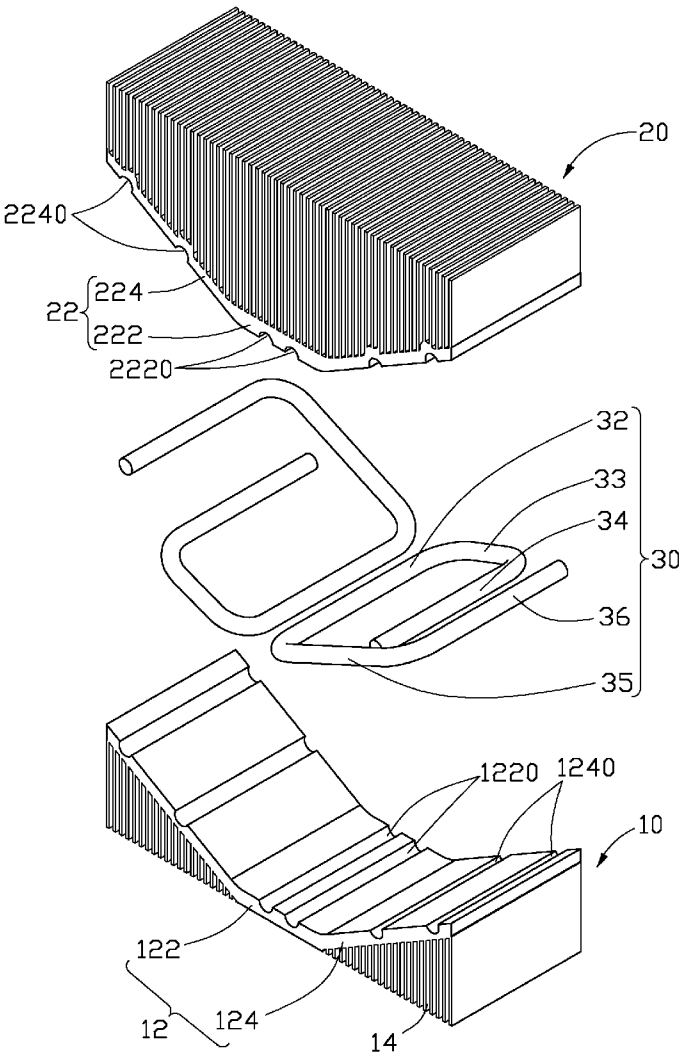
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(57) **ABSTRACT**

A heat dissipation device for removing heat from a heat generating-component mounted on a printed circuit board includes a heat sink and two heat pipes. The heat sink comprises a base plate in contact with the heat-generating component, two conducting arms extending upwardly and obliquely from two opposite ends of the base plate, a plurality of first fins extending upwardly from top surfaces of the base plate and the two conducting arms, and a plurality of second fins extending downwardly from bottoms surfaces of the conducting arms. The two heat pipes each comprise an evaporating section received in the base plate, at least a condensing section received in one of the conducting arms and at least a connecting section connecting at least an end of the evaporating section and the at least a condensing section.



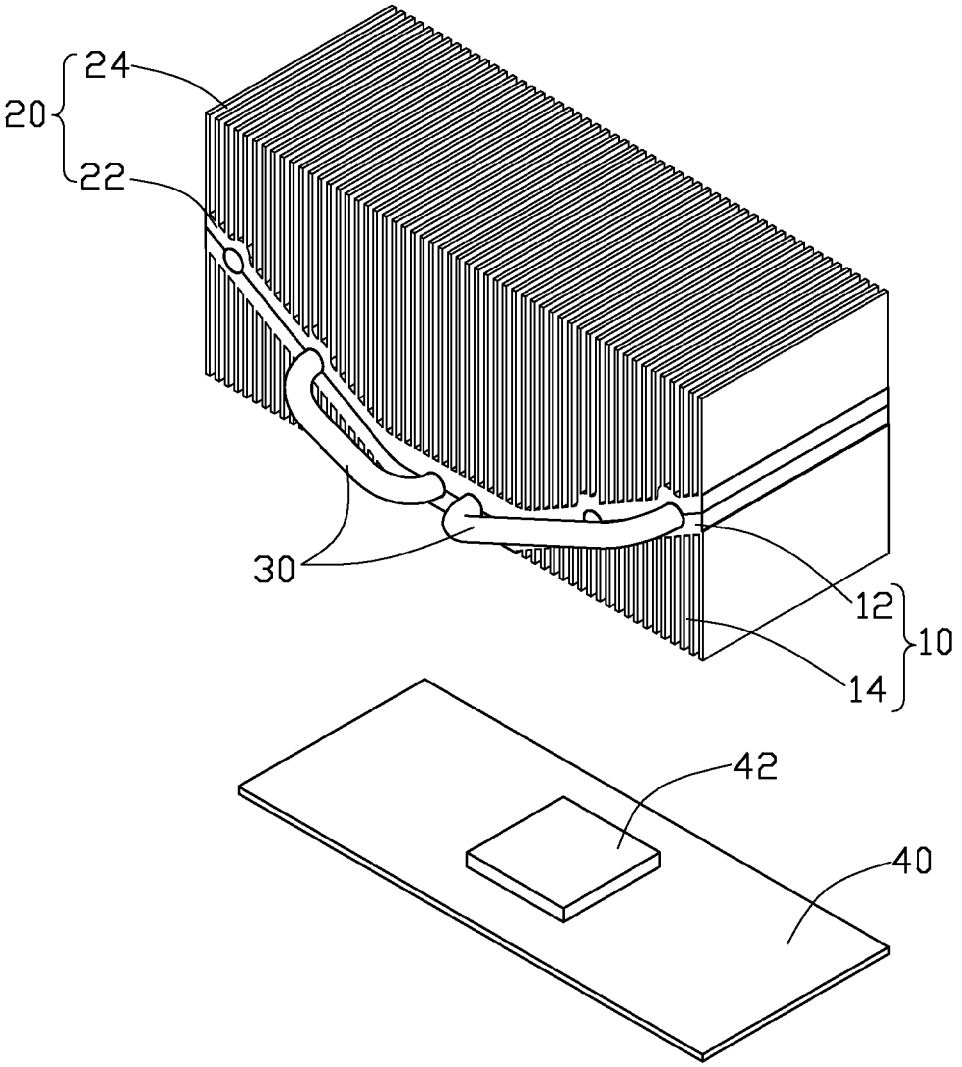


FIG. 1

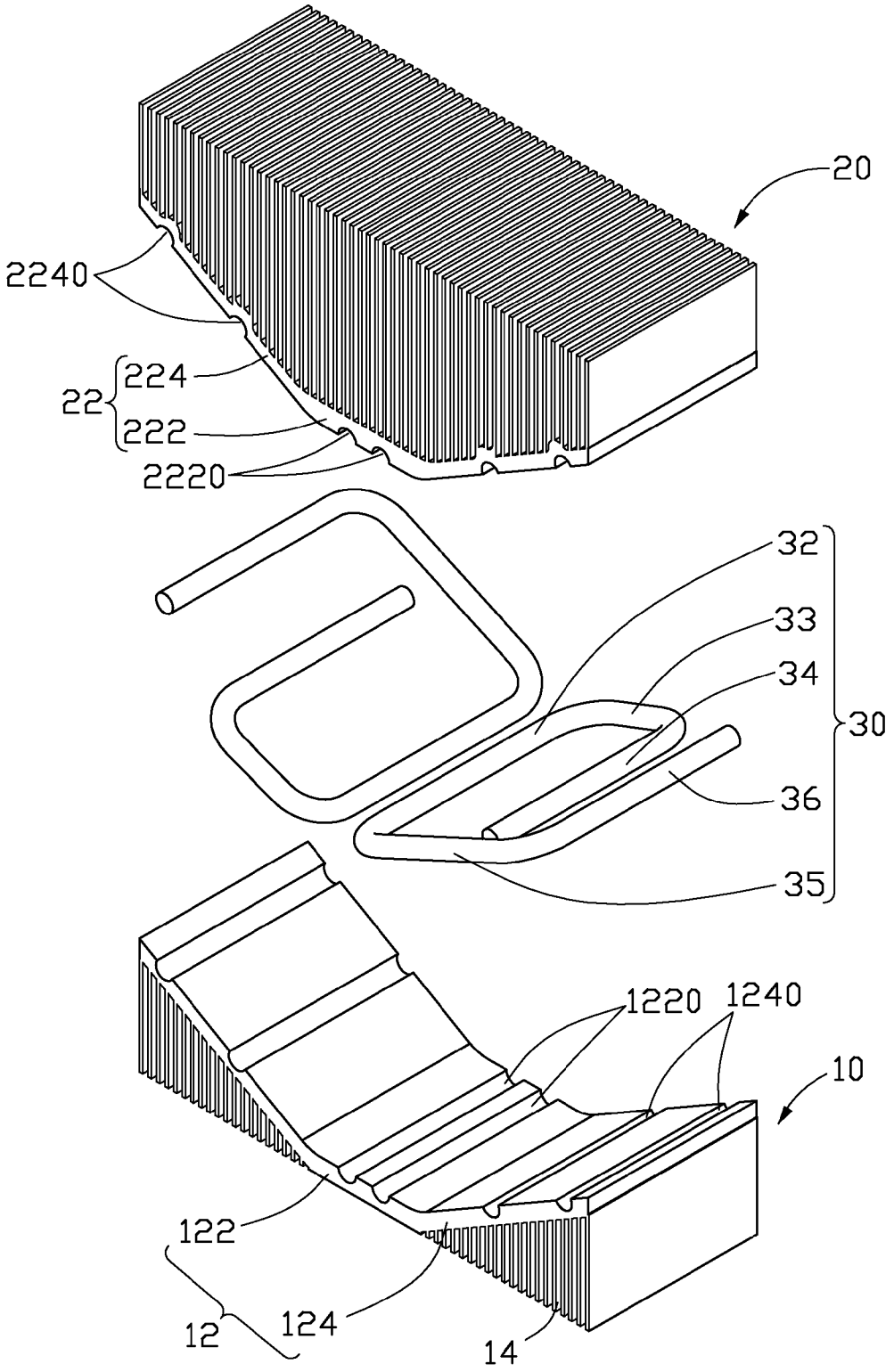

20
2240
22
224
222
2220
32
33
34
30
36
35
1220
1240
10
122
12
124
14

FIG. 2

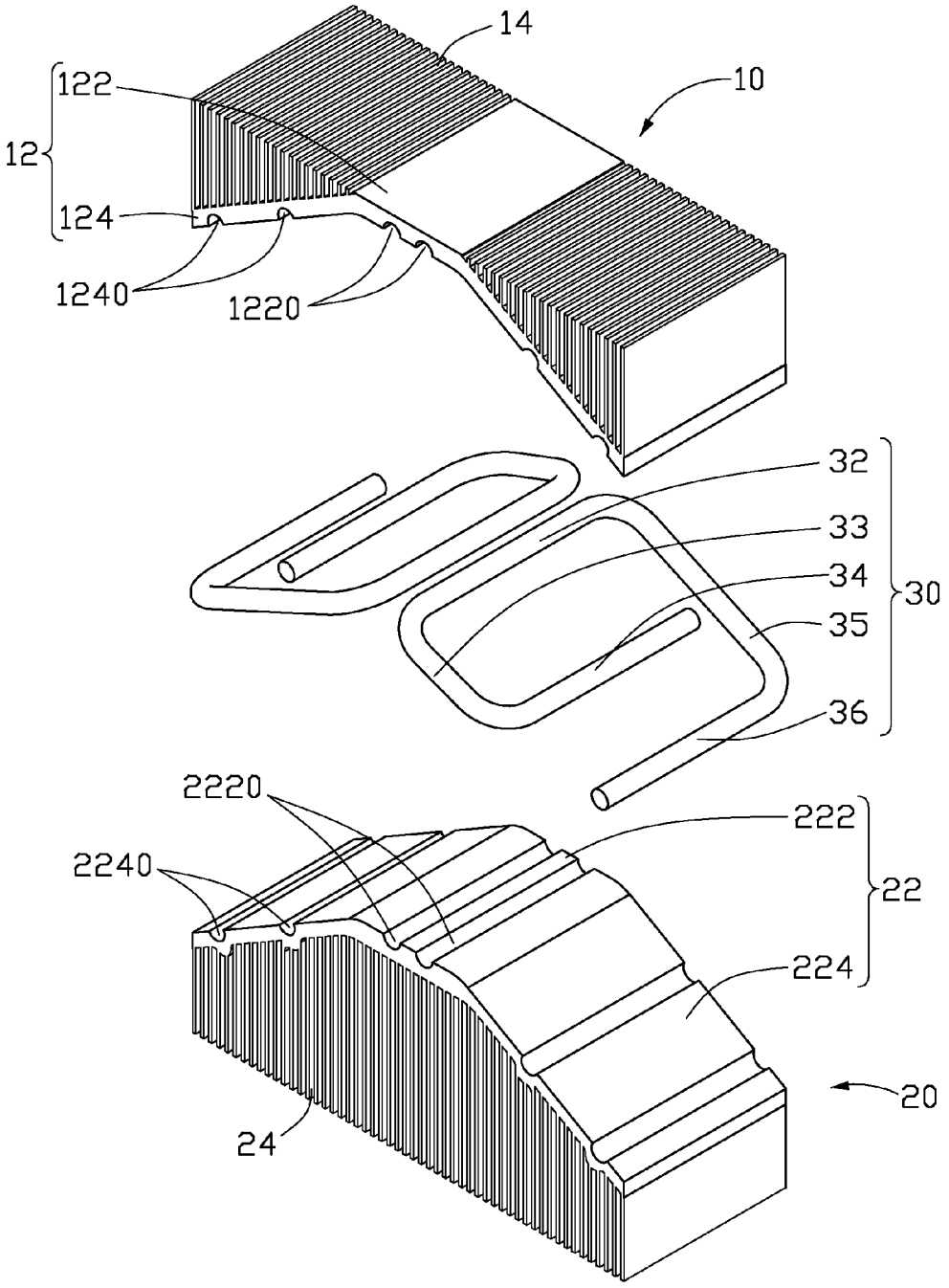

14
10
122
12
124
1240
1220
32
33
34
35
36
30
2220
222
2240
22
224
20
24

FIG. 3

HEAT DISSIPATION DEVICE

CROSS-REFERENCES TO RELATED APPLICATION

[0001] This application is related to U.S. patent application Ser. No. 11/308,852 filed on May 15, 2006 and entitled "HEAT PIPE TYPE HEAT DISSIPATION DEVICE"; the co-pending U.S. patent application is assigned to the same assignee as the instant application. The disclosure of the above-identified application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to heat dissipation devices, and more particularly to a heat pipe type heat dissipation device for removing heat from a heat-generating electronic component.

[0004] 2. Description of Related Art

[0005] Computer electronic components, such as central processing units (CPUs), generate great amounts of heat during normal operation. If not quickly removed this can deteriorate their operational stability and damage associated electronic equipment. Thus the heat must be removed quickly to ensure normal operation thereof. A heat sink is often attached to a top surface of a CPU to remove heat therefrom.

[0006] A conventional heat sink is made of highly heat-conductive metal, such as copper or aluminum, and generally includes a base portion for contacting the electronic component to absorb heat therefrom and a plurality of fins formed on the base portion for dissipating heat. However, as the operating speed of electronic components has been continually upgraded, these kinds of conventional heat sinks can no longer meet the heat dissipation requirements of modern IC packages. In recent years, heat pipes have been widely used due to their great heat-transferring capability. Accordingly, heat sinks equipped with heat pipes come into widespread use.

[0007] Conventionally, a heat sink incorporated with heat pipes comprises a base, a plurality of individual fins located above the base and two U-shaped heat pipes thermally connecting the fins and the base together. The fins are spaced from each other, parallel to the base and define corresponding through holes therein. Each of the heat pipes comprises an evaporating section attached to a top surface of the base and two condensing sections extending perpendicularly from two opposite ends of the evaporating section and received in the corresponding through holes of the fins. In use of such type of heat sink, heat generated by the heat-generating component can be absorbed by the base and then transfer to the fins via the heat pipes timely to dissipate into ambient air.

[0008] However, the fins are discrete from each other and each of the fins is a thin flake and has flanges extending perpendicularly from edges of the through holes thereof to maximize a contacting area between the heat pipes and the fins, manufacturing of such fins is very expensive and time-consuming. Additionally, combination of the fins and the heat pipes completed by soldering is no so good in reliability that in risk of collapse when last a long time.

[0009] What is needed is a improved heat dissipation device can overcome the above problems.

SUMMARY OF THE INVENTION

[0010] A heat dissipation device for removing heat from a heat generating-component mounted on a printed circuit board includes a heat sink and two heat pipes. The heat sink comprises a base plate kept in contacting with the heat-generating component, two conducting arms extending upwardly and obliquely from two opposite ends of the base plate, a plurality of first fins extending upwardly from top surfaces of the base plate and the two conducting arms, and a plurality of second fins extending downwardly from bottoms surfaces of the conducting arms. The two heat pipes each comprise a evaporating section received in the base plate, at least a condensing section received in one of the conducting arms and at least a connecting section connecting at least an end of the evaporating section and the at least a condensing section.

[0011] Other advantages and novel features will become more apparent from the following detailed description of preferred embodiments when taken in conjunction with the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Many aspects of the present embodiments can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present embodiment. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0013] FIG. **1** is an assembled isometric view of a heat dissipation device in accordance with a preferred embodiment of the present invention;

[0014] FIG. **2** is an exploded, isometric view of FIG. **1**; and

[0015] FIG. **3** is an inverted view of FIG. **2**.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Referring to FIG. **1** to FIG. **3**, a heat dissipation device in accordance with a preferred embodiment of the invention is adapted for dissipating heat from a heat-generating component **42** which is mounted on a printed circuit board **40**. The heat dissipation device is cuboid in configuration and comprises a first heat sink **10** having a bottom surface contacting with the heat-generating component **42**, a second heat sink **20** disposed on the first heat sink **10** and two tortuous heat pipes **30** sandwiched between the first and second heat sinks **10**, **20**.

[0017] Particularly referring to FIG. **2**, the first heat sink **10** integrally formed of a metal with a good heat conductivity such as aluminum, copper and allay, comprises a first plate **12** and a plurality of first fins **14** extending vertically and downwardly from two lateral portions of the first plate **12**. The first plate **12** comprises a first horizontal part **122** and two first oblique parts **124** extending obliquely from two opposite ends of the first horizontal part **122**. The two first oblique parts **124** are symmetrical to each other relative to a midline of the first horizontal part **122**. The horizontal part **122** in a top surface thereof defines two spaced first receiving grooves **1220** that perpendicular to two lateral sides thereof. Each of the oblique parts **124** in a top surface thereof defines two spaced second receiving grooves **1240** that perpendicular to two lateral sides thereof, wherein an outer one of the second

receiving grooves **1240** is adjacent to free end of the corresponding first oblique part **124**. The first fins **14** are perpendicular to the horizontal part **122** of the first plate **12** and extend vertically from bottom surfaces of the two oblique parts **124** of the first plate **12**. Bottom ends of the first fins **14** level with a bottom surface of the first horizontal part **122**, it means heights of the first fins **14** increase gradually along two lateral directions from the opposite ends of the horizontal part **122** toward ends of the oblique parts **124**.

[0018] Particularly referring to FIG. **3**, the second heat sink **20** is integrally formed of a metal with a good heat conductivity such as aluminum, copper and allay. The second heat sink **20** is complementary with the first heat sink **10** and comprises a second plate **22** similar to the first plate **12** of the first heat sink **10** and a plurality of second fins **24** extending vertically and upwardly from two lateral portions of the second plate **22**. The second plate **22** comprises a second horizontal part **222** and two second oblique parts **224** extending obliquely from two opposite ends of the second horizontal part **222**. The two second oblique parts **224** are symmetrical to each other relative to a midline of the second horizontal part **222**. The horizontal part **222** in a bottom surface thereof defines two spaced first receiving grooves **2220** that are perpendicular to two lateral sides thereof. Each of the oblique parts **224** in a bottom surface thereof defines two spaced second receiving grooves **2240** that perpendicular to two lateral sides thereof, wherein an outer one of the second receiving grooves **2240** is adjacent to free end of the corresponding second oblique part **224**. The first and second receiving grooves **2220**, **2240** of the second plate **22** of the second heat sink **20** are corresponding to the first and second receiving grooves **1220**, **1240**. The second fins **24** are perpendicular to the horizontal part **222** of the second plate **22** and extend vertically from bottom surfaces of the two oblique parts **224** of the second plate **22**. Top ends of the second fins **24** level with each other, it means heights of the second fins **24** decrease gradually along two lateral directions from ends of oblique parts **224** to the opposite ends of the horizontal part **222**. When the first and second heat sink **10**, **20** are assembled together, the first and second plates **12**, **22** are combined together to define a base plate; the first and second oblique parts **124**, **224** are respectively combined to define two conducting arms; the first and second receiving grooves **2220**, **2240** of the second plate **22** of the second heat sink **20** respectively cooperate with the first and second receiving grooves **1220**, **1240** of the first plate **12** of the first heat sink **10** to form a first through hole in the base plate and second through holes for receiving the heat pipes **30** in each of the conducting arms.

[0019] Each of the heat pipes **30** comprises an evaporating section **32**, a first condensing section **34**, a first connecting section **33** connecting an end of the evaporating section **32** and the first condensing section **34**, a second condensing section **36** parallel to the evaporating section **32**, and a second connecting section **35** connecting another end of the evaporating section **32** and the second condensing section **36** together. The first condensing section **34** is located between and parallel to the evaporating section **32** and the second condensing section **36**. The first condensing section **34** is more far away from the evaporating section **32** than the second condensing section **36**. The first and second connecting sections **33**, **35** are parallel to each other and perpendicular to the evaporating section **32**.

[0020] In assembly of the heat dissipation device, the second heat sink **20** is disposed on the first heat sink **10** and complementary with the first heat sink **10**. The two evaporating sections **32** of the two heat pipes **30** are intimately received in the first through holes of the base plate. The first and second condensing sections **34**, **36** of each of the heat pipes **30** are intimately received in the second through holes of one of the conducting arm adjacent to the corresponding first through hole. The two connecting sections **33**, **35** of each of the heat pipes **30** are exposed out of the first and second heat sinks **10**, **20** and located at two lateral sides of one of the two conducting arms.

[0021] In use of the heat dissipation device, heat absorbed by the base plate is transferred to the two conducting arms and then distributed to the fins **14**, **24** to dissipate into ambient. A thermal conductive capability between the base plate and the two conducting arms is dramatically enhanced, heat accumulated in the base plate is more quickly conducted to the conducting arms and heat dissipation efficiency of the heat dissipation device is thus greatly improved. As contacting area between the first and second heat sink **10**, **20** is adequately large, assembly of the first, second heat sink **10**, **20** and the heat pipes **30** sandwiched between the first and second heat pipes **30** is more secure and reliable.

[0022] 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 adapted for removing heat from a heat generating-component mounted on a printed circuit board comprising:

a first heat sink comprising a first plate having a first horizontal part in contact with the heat generating-component and two oblique parts integrally extending obliquely from two opposite ends of the first horizontal part, a plurality of first fins extending downwardly from bottom surfaces of the two oblique parts;

a second heat sink in complementary with the first heat sink, comprising a second plate having a second horizontal part and two oblique parts integrally extending obliquely from two opposite ends of the first horizontal part, a plurality of second fins extending upwardly from top surfaces of the second plate;

two heat pipes each comprising an evaporating section, two condensing sections, two connecting sections connecting two opposite ends of the evaporating section with the two condensing sections;

wherein the two evaporating sections of two heat pipes are sandwiched between two horizontal parts of the first and second plates, the condensing sections of one of the two heat pipes are sandwiched between the corresponding oblique parts of the first and second plates and the two connecting sections are located beyond the first and second heat sinks.

2. The heat dissipation device as claimed in claim **1**, wherein the condensing sections of the heat pipes are parallel to the evaporating sections and perpendicular to the connecting sections, and the condensing sections of the heat pipes are located at a same side of the evaporating sections.

3. The heat dissipation device as claimed in claim **1**, wherein the two connecting sections are located to two lateral sides of the oblique parts of the first and second plates.

4. The heat dissipation device as claimed in claim **1**, wherein receiving grooves are correspondingly defined in a top surface of the first plate and in a bottom surface of the second plate, and cooperate with one another to form receiving through holes to receive the evaporating sections and the condensing sections of the heat pipes.

5. The heat dissipation device as claimed in claim **4**, wherein the through holes extending in a direction parallel to that of the first and second fins, and perpendicular to two lateral sides of the first and second plates.

6. The heat dissipation device as claimed in claim **1**, wherein the two oblique parts of the first or second plates are symmetrical to each other relative to a midline of the horizontal part of the first or two plate.

7. The heat dissipation device as claimed in claim **1**, wherein the first and second fins are perpendicular to the horizontal parts of the first and second plates.

8. The heat dissipation device as claimed in claim **1**, wherein bottom ends of the first fins level with each other.

9. The heat dissipation device as claimed in claim **1**, wherein top ends of the second fins are coplanar.

10. The heat dissipation device as claimed in claim **9**, wherein heights of the first fins at the oblique parts increase gradually toward a lateral direction from the horizontal part to the oblique parts of the first heat sink, heights of the second fins arranged on the oblique parts decrease gradually toward a lateral direction from the horizontal part toward the oblique parts of the second heat sink.

11. A heat dissipation device for removing heat from a heat generating-component mounted on a printed circuit board comprising:

a heat sink comprising a base plate in contact with the heat-generating component, two conducting arms extending upwardly and obliquely from two opposite ends of the base plate, a plurality of first fins extending upwardly from top surfaces of the base plate and the two conducting arms, and a plurality of second fins extending downwardly from bottoms surfaces of the conducting arms; and

two heat pipes each comprising an evaporating section received in the base plate, at least a condensing section received in one of the conducting arms and at least a connecting section connecting at least an end of the evaporating section and the at least a condensing section.

12. The heat dissipation device as claimed in claim **11**, wherein the base plate and the conducting arms therein defines through holes receiving the corresponding evaporating and condensing sections.

13. The heat dissipation device as claimed in claim **12**, wherein the through holes extend in a direction parallel to the first and second fins, and perpendicular to two lateral sides of the base plate and the conducting arms.

14. The heat dissipation device as claimed in claim **11**, wherein the two conducting arms plates are symmetrical to each other relative to a midline of the base plate.

15. The heat dissipation device as claimed in claim **11**, wherein the first and second fins are perpendicular to the base plates.

16. The heat dissipation device as claimed in claim **11**, wherein bottom ends of the first fins level with each other and top ends of the second fins are coplanar.

17. A heat dissipation device comprising:

a first heat sink having a first base plate and a pair of first wings slantwise extending outwardly and upwardly from two opposite free ends of the first base plate, a plurality of first fins extending vertically and downwardly from a bottom surface of each first wing;

a second heat sink having a second base plate parallel and corresponding to the first base plate of the first heat sink and a pair of second wings slantwise extending outwardly and upwardly from two opposite free ends of the second base plate, a plurality of second fins extending vertically and upwardly from top surfaces of the second base plate and the second wings; and

first and second heat pipes sandwiched between the first and second heat sinks, the first and second heat pipes each having an evaporating section sandwiched between the first and second base plates, and a condensing section interconnecting the evaporating section via a connecting section;

wherein the condensing sections of the first and second heat pipes are embedded in the first and second wings, the connecting sections of the first and second heat pipes are exposed out of the first and second wings.

18. The heat dissipation device as claimed in claim **17**, wherein a bottom surface of the first fins is coplanar with a bottom surface of the first base plate of the first heat sink, a bottom surface of the second fins is coplanar.

19. The heat dissipation device as claimed in claim **18**, wherein the evaporating sections of the first and second heat pipes are parallel to the condensing sections of the first and second heat pipes.

20. The heat dissipation device as claimed in claim **19**, wherein the first and second heat pipes each comprise another condensing section parallel to the evaporating sections and another connecting section parallel to said connecting sections.

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