WATER TRAY OF LIQUID BASED COOLING DEVICE

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ABSTRACT

Disclosed is a water tray for a liquid based coolant device that includes a pump for circulating a liquid coolant between the water tray that is positionable on a heat generating device and a radiator that dissipates heat into the surrounding. The water tray includes a housing on which coolant inlet and outlet are formed for receiving the coolant from the pump and discharging the coolant to the radiator. The water tray also forms a recess in which a base is received in a liquid tight manner. The base defines a spiral coolant channel having ends respectively in fluid communication with the inlet and outlet for guiding the coolant from the inlet to the outlet to absorb and remove heat from the heat generating device.
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BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention generally relates to a cooling device using a liquid, such as water, as coolant, for cooling particularly a computer system, and in particular to a water tray of the cooling device that is positionable on a heat generating device of the computer system for effectively and efficiently removing heat from the heat generating device with the coolant flowing through an internal channel of the water tray.

[0003] 2. The Related Art

[0004] Conventionally, a heat sink, such as an aluminum extrusion having spaced fins, is positionable on and in physical engagement with a heat generating device, such as a central processing unit, of a computer system for removing heat from and maintaining proper operation temperature of the central processing unit. Such a heat sink is an air-cooling device that removes heat from the central processing unit with airflows. However, such an aluminum extrusion heat sink is subject to limitation in removing a great amount of heat.

[0005] A water based cooling device is thus employed in computer systems of high speed that generate a great amount of heat to replace the conventional aluminum extrusion heat sink. In addition to the enhanced capacity of heat removal, the liquid based cooling device is advantageous in small size, which is of particular importance in the current trend of miniaturization of the computer industry, and is thus particularly suitable for portable computers, which is of a much smaller size than a fixed computer, and often requiring much higher heat removal rate.

[0006] A liquid based cooling device for computers is comprised of a water tray positionable on and in physical contact with a heat generating device of the computer, such as a central processing unit, and a radiator spaced from the water tray and often located in surroundings having temperature lower than that of the central processing unit. A water pump is arranged between the water tray and the radiator for circulating a liquid coolant, such as water, between the water tray and the radiator, which transfers the heat absorbed by the coolant flowing through the water tray to the radiator at which the heat dissipates into the surroundings.

[0007] It is of great importance that the water tray is of such a design that allows the coolant flowing therethrough to effectively absorb and thus remove heat from the heat generating device, while occupying as small a space as possible inside the computer.

[0008] Thus, the present invention is aimed to provide a water tray of a liquid based cooling device that meets the trend of miniaturization of the computer industry, while having enhanced heat removal rate.

SUMMARY OF THE INVENTION

[0009] A primary objective of the present invention is to provide a liquid based cooling device comprising a water tray that defines a spiral coolant channel through which a coolant can smoothly flow to enhance heat removal from a heat generating device on which the water tray is positioned.

[0010] Another objective of the present invention is to provide a liquid based cooling device comprising a water tray of a compact size, while being effective in removing heat by forming a spiral coolant channel inside the water tray.

[0011] To achieve the above objectives, in accordance with the present invention, a water tray is provided. The water tray constitutes in part a liquid based coolant device that comprises a pump for circulating a liquid coolant between the water tray that is positionable on a heat generating device and a radiator that dissipates heat into the surrounding. The water tray includes a housing on which coolant inlet and outlet are formed for receiving the coolant from the pump and discharging the coolant to the radiator. The water tray also forms a recess in which a base is received in a liquid tight manner. The base defines a spiral coolant channel having ends respectively in fluid communication with the inlet and outlet for guiding the coolant from the inlet to the outlet to absorb and remove heat from the heat generating device. Fasteners, such as bolts, secure the base to the housing. In operation, the pump drives the coolant into the water tray through the inlet. The coolant flows along the channel from the inlet to the outlet during which the coolant absorbs and removes heat from the heat generating device. The coolant is then discharged to the radiator and heat carried by the coolant is dissipated into the surrounding by natural convection or forced convection caused by a fan in combination with the radiator.

[0012] Since the water tray of the present invention has a simple structure, it is ready to manufacture and re-modify for different applications in removing heat from different heat generating devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present invention will be apparent to those skilled in the art by reading the following description of a preferred embodiment thereof, with reference to the attached drawings, in which:

[0014] FIG. 1 is a perspective view of a liquid based cooling device in which a water tray constructed in accordance with the present invention is incorporated;

[0015] FIG. 2 is a perspective view of the water tray constructed in accordance with the present invention;

[0016] FIG. 3 is an exploded view of the water tray of the present invention; and

[0017] FIG. 4 is a cross-sectional view of the water tray of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] With reference to the drawings and in particular to FIG. 1, a liquid based cooling device is shown. The cooling device is operated with a liquid coolant, such as water, for cooling for example an electronic device of a computer system that generate heat that must be removed to maintain the temperature of the electronic device within a proper range. The cooling device is comprised of a coolant tray 10 having a surface positionable on and in physical contact with
the electronic device, such as a central processing unit of the computer system, a radiator 30 spaced from and located in a low temperature surrounding, and a pump 20 connected to the radiator 30 and the water tray 10 by pipes, including a first pipe 21 connected between the water tray 10 and the water pump 20 and a second pipe 22 connected between the water tray 10 and the radiator 30. An additional pipe that is not labeled in the drawings is connected between the water pump 20 and the radiator 30 to complete a circulation loop among the water tray 10, a pump 20, and the radiator 30. The pump 20 circulates a coolant between the water tray 10 and the radiator 30. Heat carried by the coolant to the radiator 30 is dissipated into the surrounding by natural convection and radiation. Preferably, a fan 40 is combined with the radiator to induce force convection for more efficiently dissipating the heat into the surrounding.

[0019] Also referring to FIGS. 2-4, the water tray 10 constructed in accordance with the present invention comprises a flat housing 11 having a top surface in which a coolant inlet 14 and a coolant outlet 15 are formed. The inlet and outlet 14, 15 are respectively connected to the first and second pipes 21, 22 to receive and discharge the coolant from the pump 20 and toward the radiator 30.

[0020] The flat housing 11 has a bottom surface opposite to the top surface and defining a recess (not labeled and shown in FIG. 4) in which a base 12 is received in a water-tight manner. The base 12 is made of a thermally conductive material, such as metal, for enhancing heat transfer therethrough, and is secured to the housing 11 by means of fasteners 16, such as bolts. This simplifies the manufacturing of the cooling device and reduces the overall size of the cooling device.

[0021] The base 12 has a top received in the recess of the housing 11 and a bottom exposed for positionability on and tight contact with the central processing unit. The top of the base 12 forms a water channel 13 having opposite ends (not labeled) respectively corresponding in position to and in fluid communication with the inlet and outlet 14, 15 of the housing 11 whereby the coolant flowing through the inlet 14 is allowed to enter an end of the channel 13, and then flowing along the channel 13 toward the other end at which the coolant is allowed to discharge through the outlet 15.

[0022] The channel 13 is made of a spiral form. In other words, the channel 13 is extended along a spiral or a winding curve in the base 12. This allows a great length of the channel 13 to be accommodated in the base 12 that has a limited volume, whereby heat removal rate is enhanced by the increased length of the channel 13, which ensures an increased contact between the coolant and the base 12. The water tight engagement between the housing 11 and the base 12 ensures no leakage of the coolant between the housing 11 and the base 12.

[0023] Referring to FIG. 1 again, the coolant that is driven by the pump 20 into the water tray 10 flows through the channel 13, which absorbs and removes heat generated by the electronic device (not shown) on which the bottom of the water tray 10 is positioned. The coolant is then discharged through the outlet 15 and is led, by the second pipe 22, to the radiator 30 where the heat carried by the coolant is dissipated into the surrounding due to natural convection and/or forced convection, as well as radiation. The coolant that releases the heat is then guided back into the pump 20 and then pumped to the water tray 10 again to start a new circulation cycle.

[0024] The water tray 10 in accordance with the present invention has a simple structure, which not only reduces manufacturing costs, but also allowing a manufacturer to make water trays of different sizes to get fit for different sizes of different heat generating devices.

[0025] Although the present invention has been described with reference to the preferred embodiment thereof, it is apparent to those skilled in the art that a variety of modifications and changes may be made without departing from the scope of the present invention which is intended to be defined by the appended claims.

What is claimed is:

1. In a liquid based cooling device comprising a pump for circulating a liquid coolant between a water tray that is positionable on a heat generating device to remove heat therefrom by the coolant flowing through the water tray and a radiator that dissipates heat carried by the coolant into the surrounding, the water tray comprising:
   a housing having defining a recess, and the housing forming an inlet for receiving the coolant and an outlet through which the coolant discharges; and
   a base received in the recess in a liquid tight manner, the base defining a spiral channel having first and second ends respectively in fluid communication with the inlet and outlet whereby the coolant is allowed to flow along the channel from the inlet to the outlet.
2. The water tray as claimed in claim 1, wherein the base and the housing are secured together by fasteners.
3. The water tray as claimed in claim 1, wherein the base has a surface that is exposed for positionability on and physical contact with the heat generating device.

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