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(54) STRUCTURE AND MANUFACTURE OF A HEAT SINK WITH HIGH HEAT TRANSMISSION

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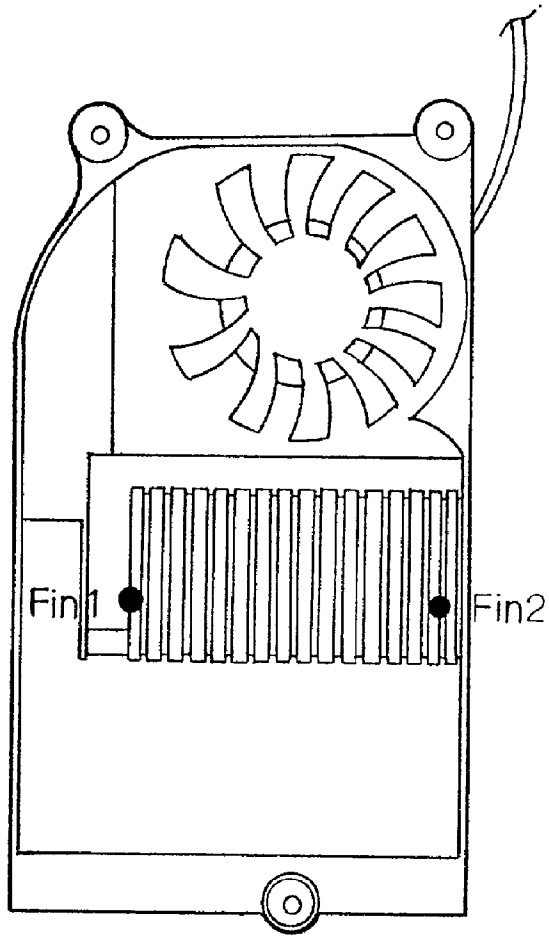
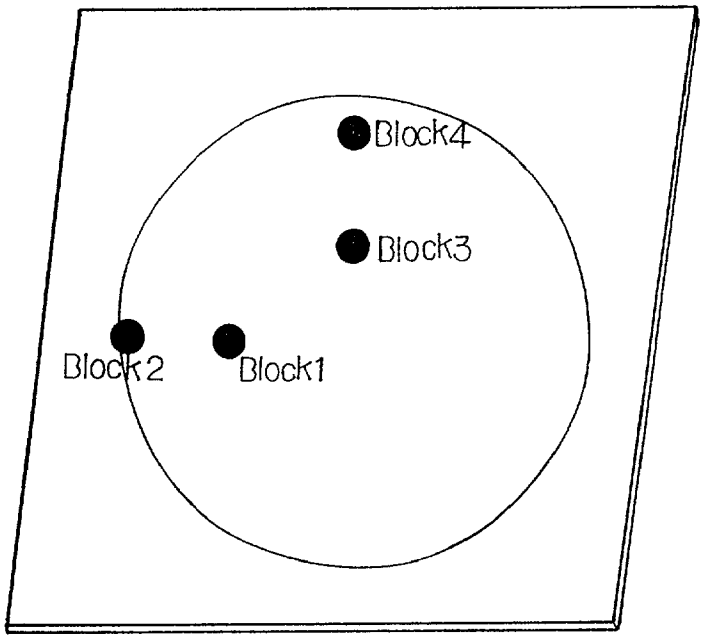
(57) **ABSTRACT**

The present invention of a structure and manufacture of a heat sink with high heat transmission mainly uses a shear stress caused by stirring to break or crush the solidified arborescent primary crystal at a solid/liquid two-phase area of a aluminum alloy to form a slag fluid with ball-filled solid crushed grit; then ceramic grains are added in and dispersed by the solid grains scattered in the liquid-phase metal; through continuous stirring, the aluminum alloy becomes a fine mixed fluid of ceramic and aluminum alloy without arborescent forms; finally, the external configuration of a heat sink is accomplished through directly compression casting by using the special nature of the aluminum alloy to mold the entire heat sink and to enhance the effect of heat dissipation of the heat sink of the same structure through the high heat transmission efficiency of the ceramic grains.





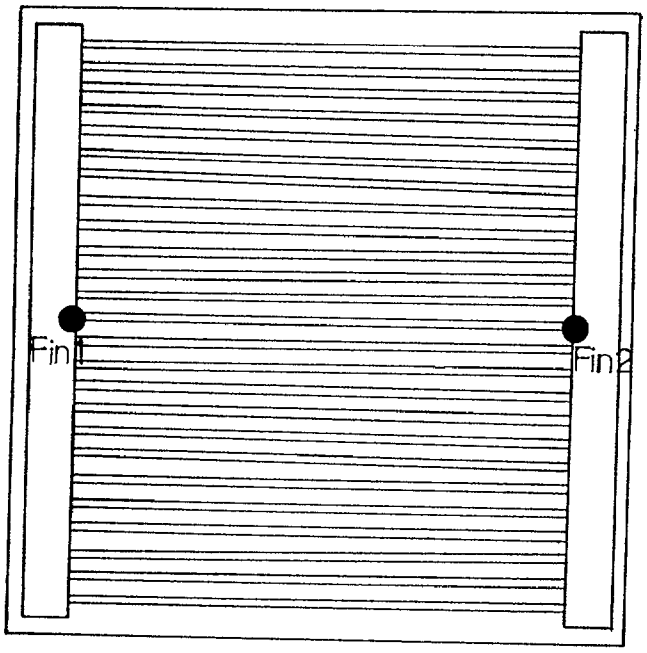


FIG.1

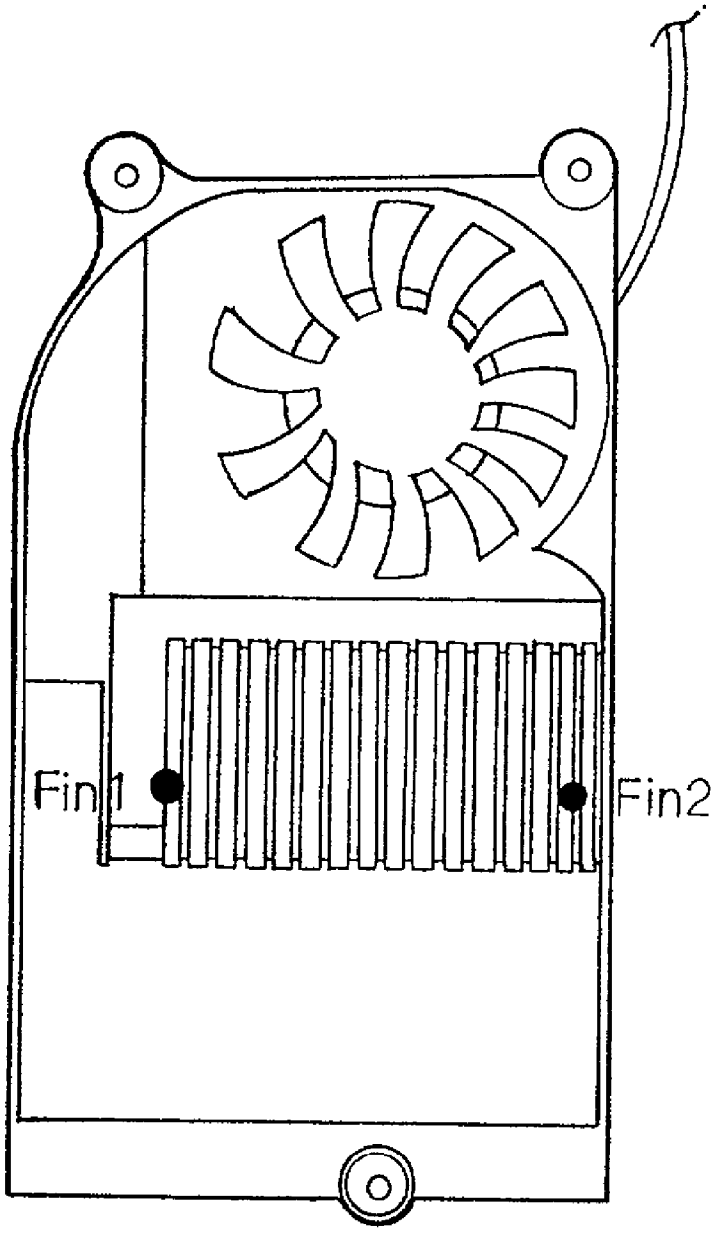


FIG.2

Table of Testing Results

	Copper-made Heat Sink	Ceramic Grains-mixed Heat Sink
Herter1	54.9	43.7
Heater2	57.2	46.1
Block1	43.6	35.1
Block2	43.5	37.1
Block3	42.8	35.9
Block4	41.7	34.7
Fin1	35.9	32.9
Fin2	33	34.5
Ambient	24.3	23.3
Heater-Block$_{1,2}$ave (℃/W)	0.156	0.11
Fin1,2ave-Ambient (℃/W)	0.127	0.13
Heater-Ambient (℃/W)	0.4	0.27

FIG.3

STRUCTURE AND MANUFACTURE OF A HEAT SINK WITH HIGH HEAT TRANSMISSION

BACKGROUND OF THE INVENTION

[0001] 1) Field of the Invention

[0002] The present invention of a structure and manufacture of a heat sink with high heat transmission aims to provide a heat sink with light weight and heat transmission higher than that of a conventional copper/aluminum alloy to accomplish the external configuration of various heat sinks through direct compression casting for dissipating high heat sources in a central process unit of a computer.

[0003] 2) Description of the Prior Art

[0004] Accordingly, with continuously increased operating speed, the power of a central process unit (CPU) of a computer is also enhanced; at the same time, more heat sources are generated; the common heat sink applied to the CPU mainly uses a heat transmission action to dissipate the heat source thereof; therefore, heat fins are properly spaced on the main body of the heat sink; the disposition of heat fins increases the air contact area so as to achieve the release of heat sources; therefore, basically, the effect of heat dissipation depends on the heat transmission efficiency of the main body of the heat sink; as a result, the heat sink with an aluminum alloy main body used for a CPU of a conventional computer has been gradually replaced by the copper alloy with higher efficiency of heat transmission.

[0005] However, although the main body of the conventional heat sinks can be processed into various external configurations through drawing or extruding the copper/aluminum alloy, with limited efficiency of heat transmission of the structure thereof, it fails to meet the heat dissipation demands of a CPU with higher operating speed; more especially, in spite of having heat transmission efficiency better than the aluminum alloy, the specific gravity of the entire heat sink of copper alloy is higher than that of the heat sink of aluminum alloy and that does not meet the requirements of a lightweight computer.

SUMMARY OF THE INVENTION

[0006] Therefore, the primary objective of the present invention is to use a shear stress caused by stirring to break or crush the solidified arborescent primary crystal at a solid/liquid two-phase area of a aluminum alloy to form a slag fluid with ball-filled solid crushed grit; then ceramic grains are added in and dispersed by the solid grains scattered in the liquid-phase metal; through continuous stirring, the aluminum alloy becomes a fine mixed fluid of ceramic and aluminum alloy without arborescent forms; finally, the external configuration of a heat sink is accomplished through directly compression casting by using the special nature of the aluminum alloy to mold the entire heat sink and to enhance the effect of heat dissipation of the heat sink of the same structure through the high heat transmission efficiency of the ceramic grains.

[0007] Another objective of the present invention is to mix a proper ratio of ceramic grains into the aluminum alloy for tremendously reducing the mass of the entire heat sink so as to meet the requirements of the designing demands of the lightweight computer even more.

[0008] To enable a further understanding the structure and objectives of the present invention, the brief description of the drawings below is followed by the detailed description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** illustrates the tested result obtained by simulating a desk-top computer using the same 80 watt heat source for the conventional copper-made heat sink and the heat sink of the present invention.

[0010] **FIG. 2** illustrates the tested result obtained by simulating a notebook computer using the same 35 watt heat source for the conventional copper-made heat sink and the heat sink of the present invention.

[0011] **FIG. 3** is a cross reference table of coefficients of the heat drag obtained through the experiments of the conventional copper-made heat sink and the heat sink of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The present invention of a structure and manufacture of a heat sink with high heat transmission has the entire heat sink thereof manufactured into various almost net shapes according to the need of the practical application; furthermore, ceramic grains in a proper ratio are mixed into the aluminum alloy of a main body of the entire structure so as to use the special nature of the aluminum alloy to mold the entire heat sink and to enhance the effect of heat dissipation of the heat sink of the same structure through the high heat transmission efficiency of the ceramic grains; wherein, the aluminum alloy is composed by freely grouping AlSi, AlSiCu, AlSiZn, AlSiMg, AlSiCuMg, AlGe, AlGeSi, AlCu, AlMn, AlLi, AlSn and AlPb; the ceramic grains are grains of silicon carbide with the size of 40-3000 μm.

[0013] Furthermore, the manufacturing of the entire heat sink uses a shear stress caused by stirring to break or crush the solidified arborescent primary crystal at a solid/liquid two-phase area of a aluminum alloy to form a slag fluid with ball-filled solid crushed grit; then ceramic grains are added in and dispersed by the solid grains scattered in the liquid-phase metal; through continuous stirring, the aluminum alloy becomes a fine mixed fluid of ceramic and aluminum alloy without arborescent forms; finally, the external configuration of a heat sink is accomplished through directly compression casting.

[0014] In the present invention, since a proper ratio of ceramic grains are mixed into the aluminum alloy, the high heat transmission efficiency of the ceramic grains is used to enhance the heat dissipation effect of the structure of the same form; as indicated in FIGS. **1** to **3**, the experimental comparison between the finished sample of the present invention and a conventional copper-made heat sink, the heat transmission efficiency of the heat sink of the present invention is 485 W/mK higher than the magnitude of 4000 W/mK of the copper-made heat sink; furthermore, with different contents of the ceramic grains, the heat transmission coefficients of the heat sink of the present invention are between 150 and 485 W/mK and that can be applied to a central process unit (CPU) with heat source above 85 W or

speed of 2.2 GHz; however, the heat transmission coefficient of the conventional copper-made heat sink is only 400 W/mK and that can only be used for a CPU with heat source of 80 W at the most; more especially, with different contents of the ceramic grains, the density of the heat sink of the present invention is between 2.7 and 3.5 g/cm^3; to compare with 8.6 g/cm^3 of the conventional copper-made heat sink, the weight can be reduced about ½ to ⅔; therefore, it meets the requirements of the designing demands of a notebook computer even more.

[0015] The present invention of a structure and manufacture of a heat sink with high heat transmission mainly uses a shear stress caused by stirring to break or crush the solidified arborescent primary crystal at a solid/liquid two-phase area of a aluminum alloy to form a slag fluid with ball-filled solid crushed grit; then ceramic grains are added in and dispersed by the solid grains scattered in the liquid-phase metal; through continuous stirring, the aluminum alloy becomes a fine mixed fluid of ceramic and aluminum alloy without arborescent forms; finally, the external configuration of a heat sink is accomplished through directly compression casting by using the special nature of the aluminum alloy to mold the entire heat sink and to enhance the effect of heat dissipation of the heat sink of the same structure through the high heat transmission efficiency of the ceramic grains; therefore, the present invention provides another structure and manufacture of a heat sink with higher heat transmission and is lawfully submitted to the patent application hereby.

[0016] It is of course to be understood that the embodiment described herein is merely illustrative of the principles of the invention and that a wide variety of modifications thereto may be effected by persons skilled in the art without departing from the spirit and scope of the invention as set forth in the following claims.

1. A heat sink with high heat transmission is characterized that the entire heat sink thereof is manufactured into various almost net shapes according to the need of the practical application; furthermore, ceramic grains are mixed in a proper ratio into the aluminum alloy of a main body of the entire structure so as to use the special nature of the aluminum alloy to mold the entire heat sink and to enhance the effect of heat dissipation of the heat sink of the same structure through the high heat transmission efficiency of the ceramic grains

2. The present invention of a heat sink with high heat transmission according to claim 1, wherein, the aluminum alloy is composed by freely grouping AlSi, AlSiCu, AlSiZn, AlSiMg, AlSiCuMg, AlGe, AlGeSi, AlCu, AlMn, AlLi, AlSn and AlPb.

3. The present invention of a heat sink with high heat transmission according to claim 1, wherein, the ceramic grains are grains of silicon carbide.

4. The present invention of a heat sink with high heat transmission according to claim 1, wherein, the sizes of grains of silicon carbides are preferred to be between 40-3000 μm.

5. The present invention of a heat sink with high heat transmission according to claim 1, wherein, the ceramic grains occupy weight ratio 0.5-80% of the entire heat sink.

6. A structure and manufacture of a heat sink with high heat transmission mainly uses a shear stress caused by stirring to break or crush the solidified arborescent primary crystal at a solid/liquid two-phase area of a aluminum alloy to form a slag fluid with ball-filled solid crushed grit; then ceramic grains are added in and dispersed by the solid grains scattered in the liquid-phase metal; through continuous stirring, the aluminum alloy becomes a fine mixed fluid of ceramic and aluminum alloy without arborescent forms; finally, the external configuration of a heat sink is accomplished through directly compression casting.

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