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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Cooler with ground heated plane and grinding method and apparatus thereof

(57) The invention is to provide a method for making heated plane (34, 34', 42) of cooler (30, 30', 40) obtain better flatness and roughness. First, grinder (10) and fixture (20), with grinding plate (11), are provided. Then, the cooler (30, 30', 40) is arranged onto the fixture (20). Next, abrasive (132) is injected into the gap between the grinding plate (11) and the heated plane (34, 34', 42), making the fixture (20) press and clamp the cooler (30, 30', 40) in a way, such that the heated plane (34, 34', 42) of the cooler (30, 30', 40) contacts the abrasive (132) closely. Finally, the grinding plate (11) is rotated to make at least one grinding process to the heated plane (34, 34', 42), making the heated plane (34, 34', 42) obtain a surface with better roughness and flatness, further enhancing the contact tightness between the heated plane (34, 34', 42) and a heating element, and therefore promoting the thermally conductive efficiency between the cooler (30, 30', 40) and the heating element.

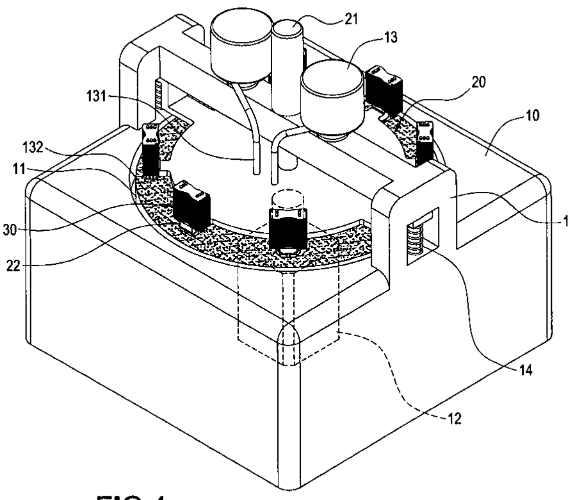

FIG.4

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention in general relates to a cooler, in particular, to a cooler, a heated plane of which is ground, and to a grinding method thereof.

Description of Prior Art

[0002] Following progress of technology, computer hardware is developed toward the directions of high speed and high frequency for increasing its execution efficiency, but its power consumption is also increased relatively. Compared to the prior arts, the heat generated from today's electronic component is much more significant than the past's. If the accumulative heat is not removed in time, the electronic component will be overheated to lower down the operation efficiency, even cause damage. So, most electronic component needs cooling device to control the working temperature and keep it operated under normal condition.

[0003] When operated, a cooling device, including vapor chamber or heat pipe, is first combined to a thermally conductive seat and is arranged a plurality of cooling fins thereon. Next, one side of the thermally conductive seat is contacted closely with the heating electronic component. Thereby, the heat generated from the heating electronic component is thermally conducted. However, since of the limitation of many factors, such as cooling space and power consumption, how to promote cooling efficiency as high as we can becomes an issue intended to be addressed urgently by industry.

[0004] Nonetheless, the more flat a heated face of a cooler is, the more compact a thermal contact between the heated face and the heating electronic component will be. In other words, a good flatness of the heated face will promote the thermally conductive efficiency of the cooler. In addition, the heated face of a general cooler is usually configured as a matte, which looks flat and smooth after machined. However, in practice, the roughness and flatness on the surface of the heated face is still poor, making the heated face and the heating component unable to be contacted closely, thereby, limiting the thermal conduction between the heated face and the heating electronic component. Therefore, if the roughness and the flatness on the heated face can be further improved, the contact tightness between the heated face and the heating electronic component will be thereby increased, so is the thermally conductive effect.

[0005] Accordingly, after a substantially devoted study, in cooperation with the application of relative academic principles, the inventor has finally proposed the present invention that is designed reasonably to possess the capability to improve the drawbacks of the prior art significantly.

SUMMARY OF THE INVENTION

[0006] The invention is mainly to provide a cooler with ground heated plane and a grinding method and apparatus thereof. By grinding the heated plane of the cooler, the roughness and flatness on the surface of the heated plane is improved. Furthermore, the thermally conductive effect is enhanced due to a better contact relative to the heating electronic component.

[0007] Secondly, the invention is to provide a method for grinding the heated plane of a cooler, the method including the following steps: (a) providing a grinder and a fixture, which have a grinding plate; (b) providing a cooler, which has a heated plane, and arranging the cooler to the fixture; (c) injecting an abrasive into the gap between the grinding plate and the heated plane; (d) making the fixture press and clamp the cooler, thereby, the heated plane being contacted closely with the abrasive; and (e) rotating the grinding plate, and undergoing at least one grinding process to the heated plane.

[0008] Thirdly, the invention is to provide an apparatus for grinding the heated plane of a cooler, in which a heated plane of a cooler is ground. The apparatus includes a grinder and a fixture, in which the grinder has a grinding plate and an abrasive supply barrel that is arranged above the grinding plate for supplying abrasive into the gap between the heated plane and the grinding plate. In the meantime, the fixture is combined to the grinder and has at least one pressure plate for arranging the cooler. Thereby, the pressure plate presses and clamps the cooler, making the heated plane of the cooler contact closely to the abrasive.

[0009] Fourthly, the invention is to provide a cooler having ground heated plane for cooling a heating electronic component, mainly including a cooler, which has a heated plane that is undergone a grinding process by being pressed and clamped by a fixture. After being ground, the roughness on the surface of the heated plane is under Ra 0.03 μm and the flatness is under 10 μm.

[0010] Compared with the prior arts, the invention is to arrange a fixture to a grinder. The fixture presses and clamps a cooler via a point contact manner, whereby the heated plane of the cooler can possess a better flatness and surface roughness after being ground. Therefore, the contact tightness between the heated plane and the heating electronic component is increased, further generating a better effect of thermal conduction and enhancing the practicability of the invention.

BRIEF DESCRIPTION OF DRAWING

[0011] The features of the invention believed to be novel are set forth with particularity in the appended claims. The invention itself, however, may be best understood by reference to the following detailed description of the invention, which describes a number of embodiments of the invention, taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an assembled illustration of a grinder and a fixture according to the present invention;

Fig. 2 is an illustration of a cooler pressed and clamped by a fixture according to the present invention;

Fig. 3 is a cross-sectional view of a cooler pressed and clamped by a fixture according to the present invention;

Fig. 4 is a using illustration showing a cooler under a grinding process according to the present invention;

Fig. 5 is a lateral view of the invention when undergoing a grinding process;

Fig. 6 is an illustration showing a grinding action of the invention;

Fig. 7 is a locally enlarging illustration of the invention when undergoing a grinding process;

Fig. 8 is a flowchart diagram showing a grinding method of the invention, in which a heated plane of a cooler is ground;

Fig. 9 shows a cooler with ground heated plane according to an embodiment of the invention;

Fig. 10 shows a cooler with ground heated plane according to another embodiment of the invention; and

Fig. 11 shows a cooler with ground heated plane according to a further embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] In cooperation with attached drawings, the technical contents and detailed description of the present invention are described thereinafter according to a number of preferable embodiments, not used to limit its executing scope. Any equivalent variation and modification made according to appended claims is all covered by the claims claimed by the present invention.

[0013] Please refer to Fig. 1, which is an assembled illustration of a grinder and a fixture according to the present invention. The invention is to provide a method for grinding the heated plane of a cooler, in which a grinder 10 having grinding plate 11 and fixing frame 15 is provided. The grinding plate 11 is actuated by a motor 12 to rotate. The fixing frame 15 is fixed onto the grinder 10 and is arranged an abrasive supply barrel 13 thereon. The abrasive supply barrel 13 is filled with abrasive and has a nozzle 131 to inject the abrasive onto the grinding plate 11.

[0014] Above the grinding plate 11, the grinder 10 is additionally connected a fixture 20. At least one elastic element 14 (e.g., spring, etc.) is arranged between the fixture 20 and the grinder 10. The elastic element 14 keeps a gap 100 between the fixture 20 and the grinder 11, such that the fixture 20 can be displaced upwardly and downwardly in an elastic way. In addition, a driving device 21, such as hydraulic cylinder or pneumatic cylinder, is arranged on the fixing frame 15. The driving device 21 is connected by abutting against the fixture. By elevating or lowering the driving device 21, the fixture 20 is moved toward or far away the grinding plate 11.

[0015] Please refer to Fig. 2 and Fig. 3, which are an illustration and a cross-sectional view of a cooler that is pressed and clamped by a fixture according to the present invention. The fixture 20 can corresponds to the grinding plate 11 and is shown as a disk configuration. The circumference of the fixture 20 is divided equally to project out a plurality of pressure plates 22, each of which is arranged a cooler 30. In addition, the bottom portion of the pressure plate 22 is arranged a pointed bulge 221 that is abutted against the center of the cooler 30, thereby, the fixture 20 pressing and clamping the cooler 30 via a point contact manner.

[0016] In a preferable embodiment, the cooler 30 includes a thermally conductive seat 31, at least one heat pipe 32 and a plurality of cooling fins 33. The heat pipe 32 has a flat evaporation section 321 and a condensation section 322. The thermally conductive seat 31 is arranged at least one slot 310, into which the flat evaporation section 321 is inset. In the meantime, the plural cooling fins 33 are arranged by being passed through by the condensation section 322 of the heat pipe 32. In this case, the flat evaporation section 321 is formed as a heated plane 34 provided for contacting the heat source. When the top portion of the thermally conductive seat 31 is pressed and clamped by the pointed bulge 221 of the pressure plate 22, the heated plane 34 of the cooler 30 is abutted against the grinding plate 11 and is arranged correspondingly.

[0017] Please refer to Fig. 4 through Fig. 7, separately showing a using illustration of a cooler under a grinding process according to the present invention, a lateral view of the invention when undergoing a grinding process, an illustration of a grinding action of the invention, and a locally enlarging illustration of the invention when undergoing a grinding process. Firstly, a cooler 30 is separately arranged under each pressure plate 22 of the fixture 20. Secondly, an abrasive 132 is injected into the gap 100 between the grinder 11 and the heated plane 34. The abrasive 132 includes grinding liquid 1321 and grinding particle 1322, as shown in Fig. 7. Then, the driving device 21 is actuated, making the fixture 20 lowered down and the pressure plate 22 separately press and clamp the top portion of each thermally conductive seat 31. In so doing, the pointed bulge 221 presses and clamps at the center of the thermally conductive seat 31, making each heated plane 34 touch the abrasive 132 and closely contact the grinding plate 11. Next, the motor 12 is actuated to bring along the grinding plate 11 to make a circular rotation. By centrifugal force and pressing (clamping) operation, the abrasive 132 can uniformly grind the heated plane 34. Thereby, the flatness of the heated plane 34 is improved to obtain a best value of roughness on the surface. After the grinding is finished, the driving device 21 is actuated again and lifted up. In so doing, the fixture 20 is rid of press and clamp and lifted up due to the elastically recovering force of the elastic element 14. Finally, the heated plane 34 of the cooler 30 gets rid of the relative contact with the grinding plate 11.

[0018] Subsequently, the coolers 30 can be moved to another grinding machine to undergo next grinding. Or, a series of grinding can be made in a grinder by separately injecting different abrasives 132 with different particle sizes. For example, a grinding process can first be undergone by injecting an abrasive 132 with larger particles. After the first grinding process, another abrasive 132 with finer particle is then injected to undergo a second grinding process. Following each grinding process, a finer abrasive 132 is injected until the required accuracy of the heated plane 34 is reached. In an embodiment, the value of the surface roughness is under Ra 0.03 μm, preferably, between Ra 0.03 μm and Ra 0.01 μm and the flatness is between 0.3 μm and 10 μm.

[0019] Please refer to Fig. 8, which is a flowchart diagram showing a grinding method of the invention, in which a heated plane of a cooler is ground. As shown in this diagram, a grinder 10 and a fixture 20, with a grinding plate 11, is first provided (step 61); next, a cooler 30 with a heated plane 34 is further provided (step 62); then, an abrasive 132 is injected into the gap between the grinding plate 11 and the heated plane 34 (step 63); during a series of grindings, different abrasives 132 with different particle sizes can be injected and, in the meantime, the fixture 20 presses and clamps the cooler 30 via a point contact manner, for example, another side of the heated plane 34 being pressed and clamped, making the heated plane 34 contact closely to the grinding plate 11 to touch the abrasive 132 (step 64); finally, the grinding plate 11 is rotated, making the heated plane 34 undergone at least one grinding process (step 65).

[0020] Please refer to Fig. 9 showing a cooler with ground heated plane according to an embodiment of the invention. In this embodiment, the thermally conductive seat 31 has a bottom plane 311 that is arranged at least one slot 310, into which the flat evaporation section 321 of the heat pipe 32 is inset. When the surface of the flat evaporation sections 321 is higher than the bottom plane 311 of the thermally conductive seat 31, the flat evaporation sections 321 are the heated plane 34. Nonetheless, when the surface of the flat evaporation sections 321 is flush with the bottom plane 311 of the thermally conductive seat 31, the heated plane 34 then includes the flat evaporation sections 321 and the bottom plane 311. After the heated plane 34 is ground, a delicate plane like mirror is obtained, which is provided for closely contacting a heating electronic component to dissipate the heat thereof.

[0021] Please refer to Fig. 10 showing a cooler with ground heated plane according to another embodiment of the invention. This embodiment is substantially same as the first embodiment. The differences are that the bottom plane 311' of the thermally conductive seat 31' is only arranged an accommodating groove 310'; the cooler 30' has three heat pipes 32', each of which has a flat evaporation section 321' passing through a plurality of cooling fins 33'; the three heat pipes 32' arranged in parallel and pressed (clamped) in the accommodating groove 310' are flush with each other to form a flat evaporation section 321'; similarly, when the surface of the flat evaporation sections 321' is higher than the bottom plane 311' of the thermally conductive seat 31', the flat evaporation sections 321' are the heated plane 34'; on the other hand, when the surface of the flat evaporation sections 321' is flush with the bottom plane 311' of the thermally conductive seat 31', the heated plane 34' then includes the flat evaporation sections 321' and the bottom plane 311'.

[0022] Please refer to Fig. 11 showing a cooler with ground heated plane according to a further embodiment of the invention. In this case, the cooler 40 is a flat-plate heat pipe 41 that has a flat evaporation section 411 and is arranged a plurality of cooling fins 43. The flat evaporation section 411 is the heated plane 42 that is ground to make its surface possess better surface roughness and flatness, thereby, the heated plane 42 contacting the heating electronic component further closely to increase its thermally conductive effect.

[0023] Accordingly, through the constitution of aforementioned assemblies, a cooler with ground heated plane according to the invention is thus obtained.

[0024] Summarizing aforementioned description, the ground heated plane according to the invention is an indispensably design for a cooler indeed, which may positively reach the expected usage objective for solving the drawbacks of the prior arts, and which extremely possesses the innovation and progressiveness to completely fulfill the applying merits of new type patent, according to which the invention is thereby applied. Please examine the application carefully and grant it as a formal patent for protecting the rights of the inventor.

[0025] However, the aforementioned description is only a number of preferable embodiments according to the present invention, not used to limit the patent scope of the invention, so equivalently structural variation made to the contents of the present invention, for example, description and drawings, is all covered by the claims claimed thereinafter.

Claims

1. A method for grinding heated plane of cooler, including:

(a) providing a grinder (10) having a grinding plate (11) and a fixture (20);
(b) providing a cooler (30, 30', 40) having a heated plane (34, 34', 42), and arranging the cooler (30, 40) to the fixture (20);
(c) injecting an abrasive (132) into a gap between the grinding plate (11) and the heated plane (34, 34', 42);
(d) making the fixture (20) press and clamp the

cooler (30, 30', 40), thereby, the heated plane (34, 34', 42) being contacted closely with the abrasive (132); and

(e) rotating the grinding plate (11), and undergoing at least one grinding process to the heated plane(34, 34', 42).

2. The method for grinding heated plane of cooler according to claim 1 wherein, in step (c), the abrasive (132) includes a grinding liquid (1321) and grinding particles (1322).

3. The method for grinding heated plane of cooler according to claim 1 wherein, in step (c), a series of grinding processes can be undergone and, in each grinding processes, different abrasives (132) with different particle sizes can be injected.

4. The method for grinding heated plane of cooler according to claim 3, wherein the abrasive (132) with larger particles can be first injected to undergo a first grinding and, after the first grinding is finished, another abrasive (132) with finer particles can then be injected to undergo a second grinding.

5. The method for grinding heated plane of cooler according to claim 1 wherein, in step (d), the fixture (20) presses and clamps another face of the heated plane (34, 34', 42), and the fixture (20) presses and clamps the cooler (30, 30', 40) via a point contact and clamp manner.

6. An apparatus for grinding heated plane of cooler, in which a heated plane (34, 34', 42) of a cooler (30, 30',40) is ground, and which includes:

a grinder (10), which has a grinding plate (11) and an abrasive supply barrel (13) that is arranged above the grinding plate (11) for supplying an abrasive (132) into a gap between the heated plane (34, 34', 42) and the grinding plate (11); and

a fixture (20), which is combined to the grinder (10) and has at least one pressure plate (22) for arranging the cooler (30, 30', 40);

thereby, the pressure plate (22) pressing and clamping the cooler (30, 30', 40), making the heated plane (34, 34', 42) contact closely to the abrasive (132).

7. The apparatus for grinding heated plane of cooler according to claim 6, wherein the grinder (10) is arranged a fixing frame (15) fixed to the grinder (10) and at least one elastic element (14) arranged between the fixture (20) and the grinder (10) for elastically arranging the fixture (20) to the grinder (10), and the grinder (10) further includes a driving device (21) arranged on the fixing frame (15) and abutted against the fixture (20) for driving the fixture (20) being elevated and lowered elastically to press and clamp the cooler (30, 30', 40) and, corresponding to the grinding plate (11), the fixture (20) is shown as a disk configuration, a circumference of which is divided into equal parts to project out a plurality of pressure plates (22), at a bottom part of each of which at least one pointed bulge (221) is arranged, which presses and clamps the cooler (30, 30', 40), such that the pressure plate (22) can press and clamp the cooler (30, 30', 40) via a point contact manner, and the abrasive (132) includes a grinding liquid (1321) and grinding particles (1322), while the abrasive supply barrel (13) has a nozzle (131).

8. A cooler having ground heated plane for cooling heating electronic component, mainly including a cooler (30, 30', 40), which has a heated plane (34, 34', 42) pressed and clamped to a grinder (10) by a fixture (20) and, after the heated plane (34, 34', 42) is ground, a roughness on a surface of the heated plane (34, 34', 42) is under Ra 0.03 μm and a flatness thereof is under 10 μm.

9. The cooler having ground heated plane according to claim 8, wherein the surface roughness of the heated plane (34, 34', 42) is between Ra 0.03 μm and Ra 0.01 μm.

10. The cooler having ground heated plane according to claim 8, wherein the flatness of the heated plane (34, 34', 42) is between 0.3 μm and 10 μm.

11. The cooler having ground heated plane according to claim 8, wherein the cooler (40) includes a flat-plate heat pipe (41) and a plurality of cooling fins (43) arranged by being passed through by the flat-plate heat pipe (41), and the flat-plate heat pipe (41) has a flat evaporation section (411), which is the heated plane (42).

12. The cooler having ground heated plane according to claim 8, wherein the cooler (30) includes a thermally conductive seat (31), at least one heat pipe (32) and a plurality of cooling fins (33) passed through by the heat pipe (32), and the thermally conductive seat (31) has a bottom plane (311) having at least one slot (310) corresponding to a quantity of the heat pipe (32), and the heat pipe (32) has a flat evaporation section (321) insect into the slot (310) and flush with the bottom plane (311), and the heated plane (34) includes the bottom plane (311) and the flat evaporation section (321).

13. The cooler having ground heated plane according to claim 8, wherein the cooler (30) includes a thermally conductive seat (31), at least one heat pipe (32) and a plurality of cooling fins (33) passed through by the heat pipe (32), and the thermally conductive seat (31) has a bottom plane (311) having at least one slot (310) corresponding to a quantity of the heat pipe (32), and the heat pipe (32) has a flat evaporation section (321) insect into the slot (310) and higher than the bottom plane (311), and the heated plane (34) is the flat evaporation section (321).

14. The cooler having ground heated plane according to claim 8, wherein the cooler (30') includes a thermally conductive seat (31'), at least two heat pipes (32') and a plurality of cooling fins (33') passed through by the heat pipes (32'), and the thermally conductive seat (31') has a bottom plane (311') arranged an accommodating groove (310'), and each heat pipes (32') has a flat evaporation section (321'), and the flat evaporation sections (321') are arranged in parallel, flush with each other and flush with the bottom plane (311') by being pressed and clamped in the accommodating groove (310'), and the heated plane (34') includes the bottom plane (311') and the flat evaporation sections (321').

15. The cooler having ground heated plane according to claim 8, wherein the cooler (30') includes a thermally conductive seat (31'), at least two heat pipes (32') and a plurality of cooling fins (33') passed through by the heat pipes (32'), and the thermally conductive seat (31') has a bottom plane (311') arranged an accommodating groove (310'), and each heat pipes (32') has a flat evaporation section (321'), and the flat evaporation sections (321') are arranged in parallel, flush with each other and higher than the bottom plane (311') by being pressed and clamped in the accommodating groove (310'), and the heated plane (34') is the flat evaporation sections (321').

Amended claims in accordance with Rule 137(2) EPC.

1. A method for grinding heated plane of cooler, including:

(a) providing a grinder (10) having a grinding plate (11) and a fixture (20);
(b) providing a cooler (30, 30', 40) having a heated plane (34, 34', 42), and arranging the cooler (30, 40) to the fixture (20);
(c) injecting an abrasive (132) into a gap between the grinding plate (11) and the heated plane (34, 34', 42);
(d) making the fixture (20) press and clamp the cooler (30, 30', 40), thereby, the heated plane (34, 34', 42) being contacted closely with the abrasive (132); and (e) rotating the grinding plate (11), and undergoing at least one grinding process to the heated plane(34, 34', 42).

2. The method for grinding heated plane of cooler according to claim 1 wherein, in step (c), the abrasive (132) includes a grinding liquid (1321) and grinding particles (1322).

3. The method for grinding heated plane of cooler according to claim 1 wherein, in step (c), a series of grinding processes can be undergone and, in each grinding processes, different abrasives (132) with different particle sizes can be injected.

4. The method for grinding heated plane of cooler according to claim 3, wherein the abrasive (132) with larger particles can be first injected to undergo a first grinding and, after the first grinding is finished, another abrasive (132) with finer particles can then be injected to undergo a second grinding.

5. The method for grinding heated plane of cooler according to claim 1 wherein, in step (d), the fixture (20) presses and clamps another face of the heated plane (34, 34', 42), and the fixture (20) presses and clamps the cooler (30, 30', 40) via a point contact and clamp manner.

6. An apparatus for grinding heated plane of cooler, in which a heated plane (34, 34', 42) of a cooler (30, 30',40) is ground, and which includes:

- a grinder (10), which has a grinding plate (11) and an abrasive supply barrel (13) that is arranged above the grinding plate (11) for supplying an abrasive (132) into a gap between the heated plane (34, 34', 42) and the grinding plate (11); and
- a fixture (20), which is combined to the grinder (10) and has at least one pressure plate (22) for arranging the cooler (30, 30', 40);
- thereby, the pressure plate (22) pressing and clamping the cooler (30, 30', 40), making the heated plane (34, 34', 42) contact closely to the abrasive (132)

characterized in that the grinder (10) is arranged a fixing frame (15) fixed to the grinder (10) and at least one elastic element (14) arranged between the fixture (20) and the grinder (10) for elastically arranging the fixture (20) to the grinder (10), and the grinder (10) further includes a driving device (21) arranged on the fixing frame (15) and abutted against the fixture (20) for driving the fixture (20) being elevated and lowered elastically to press and clamp the cooler (30, 30', 40) and, corresponding to the grinding plate (11), the fixture (20) is shown as a disk configuration, a circumference of which is divided into equal parts to project out a plurality of pressure plates (22), at a bottom part of each of which at least one pointed bulge (221) is arranged, which presses and clamps the cooler (30, 30', 40), such that the pressure plate (22) can press and clamp the cooler (30, 30', 40) via a point contact manner, and the abrasive (132) includes a grinding liquid (1321) and grinding particles (1322), while the abrasive supply barrel (13) has a nozzle (131).

7. A cooler having ground heated plane for cooling heating electronic component, mainly including a cooler (30, 30', 40), which has a heated plane (34, 34', 42) pressed and clamped to a grinder (10) by a fixture (20) and, after the heated plane (34, 34', 42) is ground, a roughness on a surface of the heated plane (34, 34', 42) is under Ra 0.03μm and a flatness thereof is under 10μm.

8. The cooler having ground heated plane according to claim 8, wherein the surface roughness of the heated plane (34, 34', 42) is between Ra 0.03μm and Ra 0.01μm.

9. The cooler having ground heated plane according to claim 8, wherein the flatness of the heated plane (34, 34', 42) is between 0.3μm and 10μm.

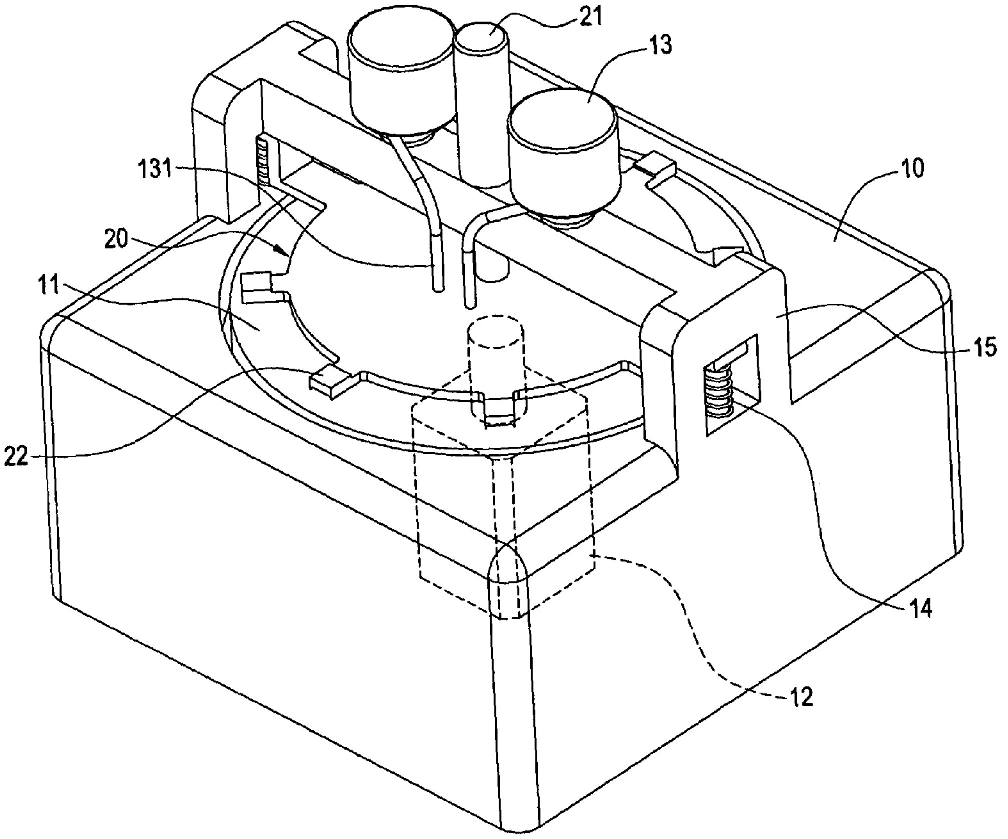

FIG.1

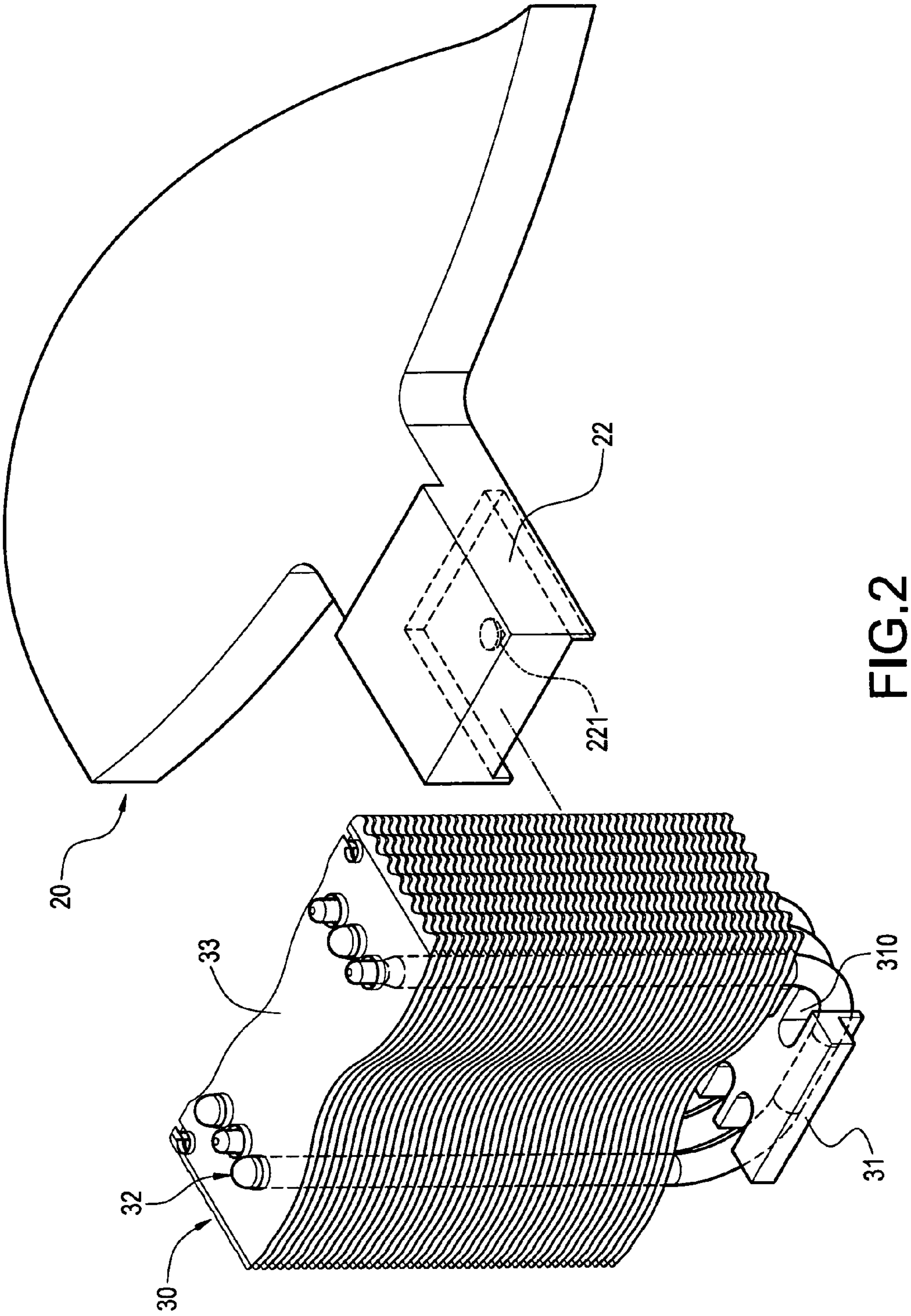

FIG.2

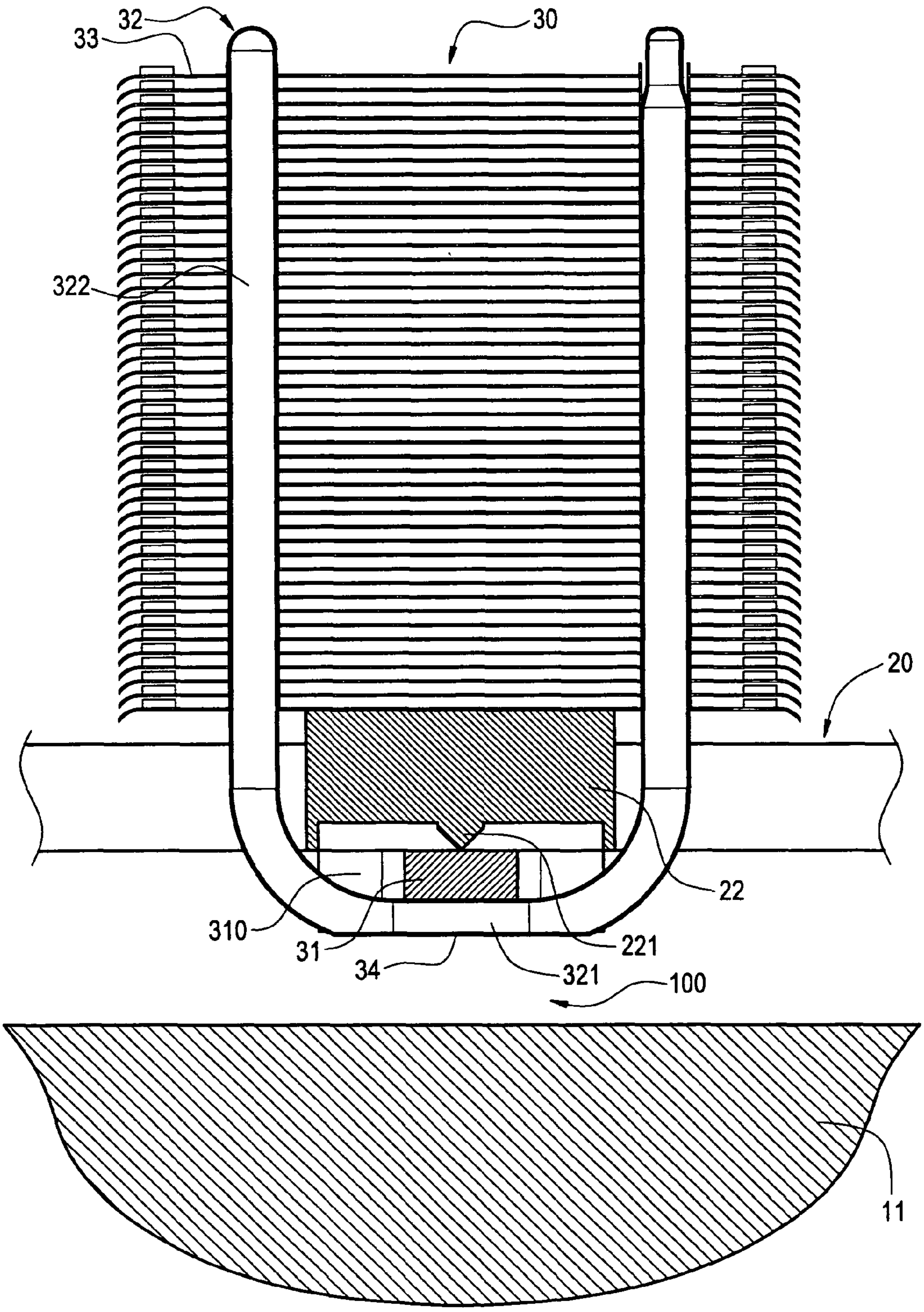

FIG.3

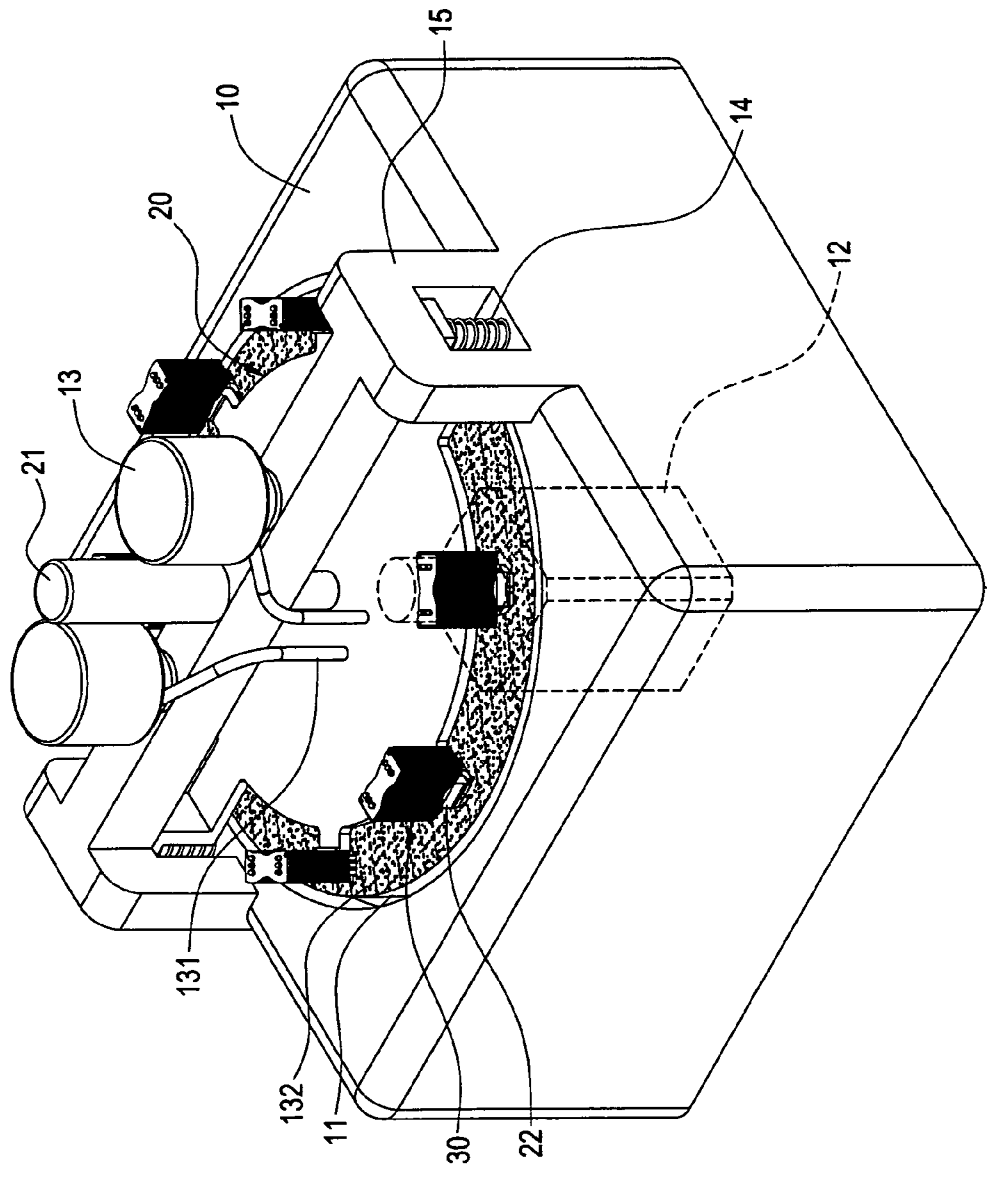

FIG.4

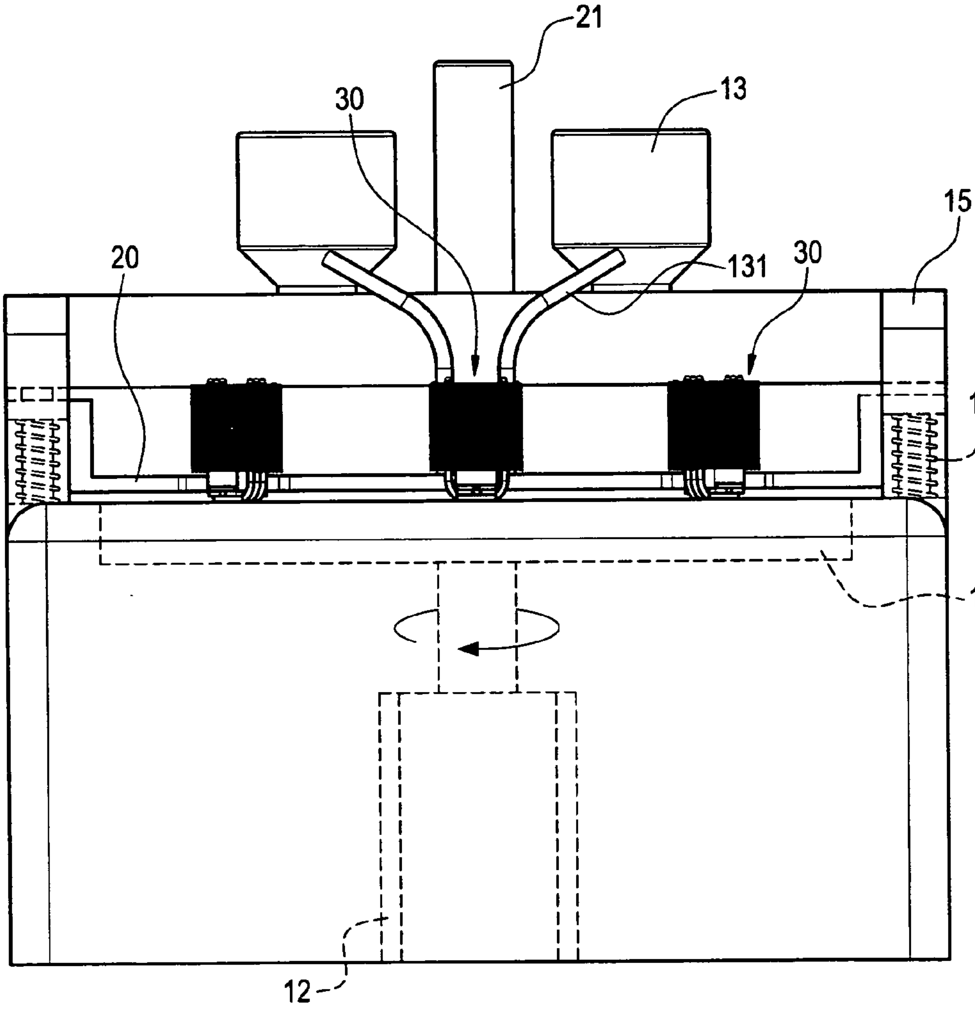

FIG.5

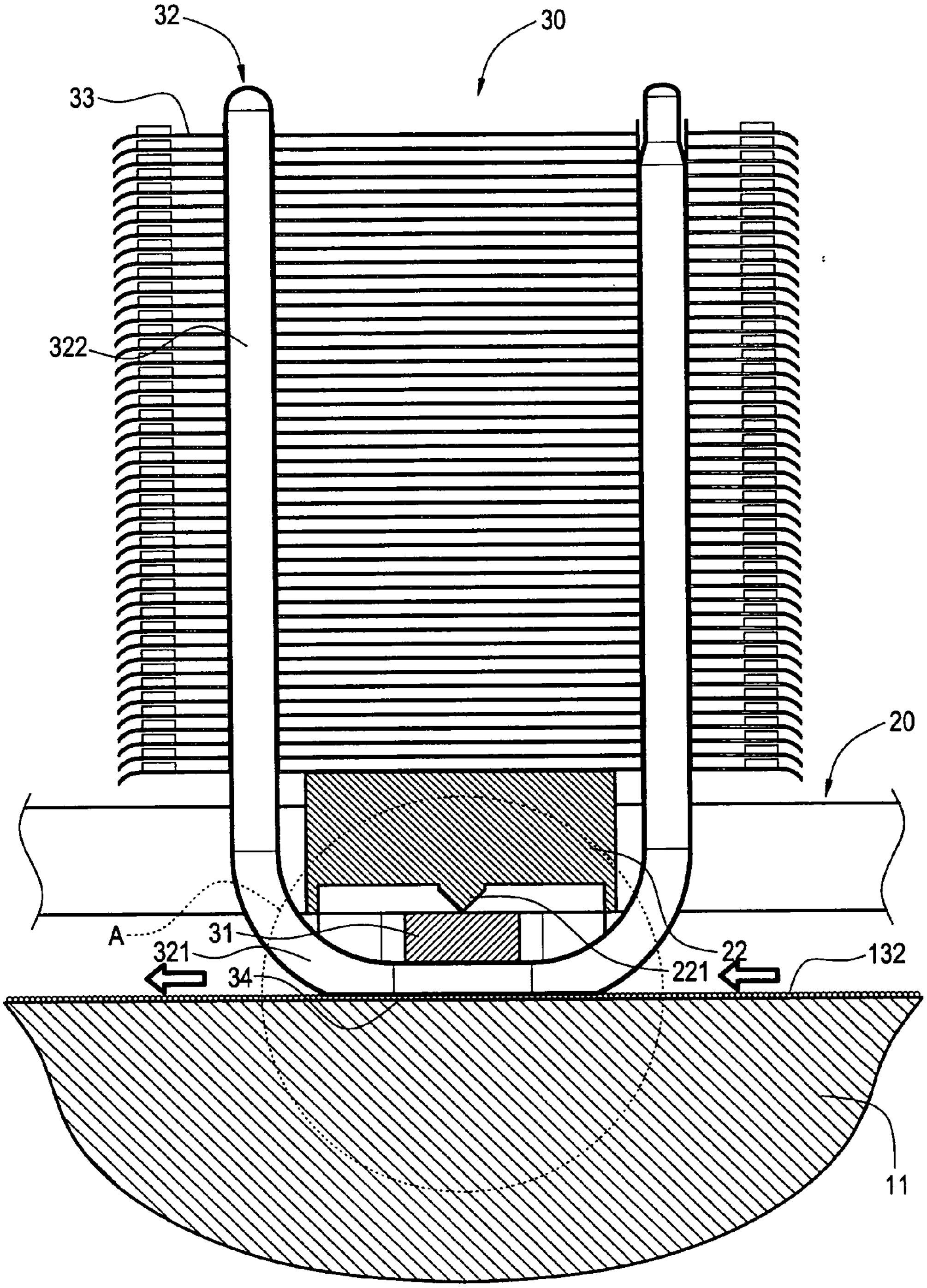

FIG.6

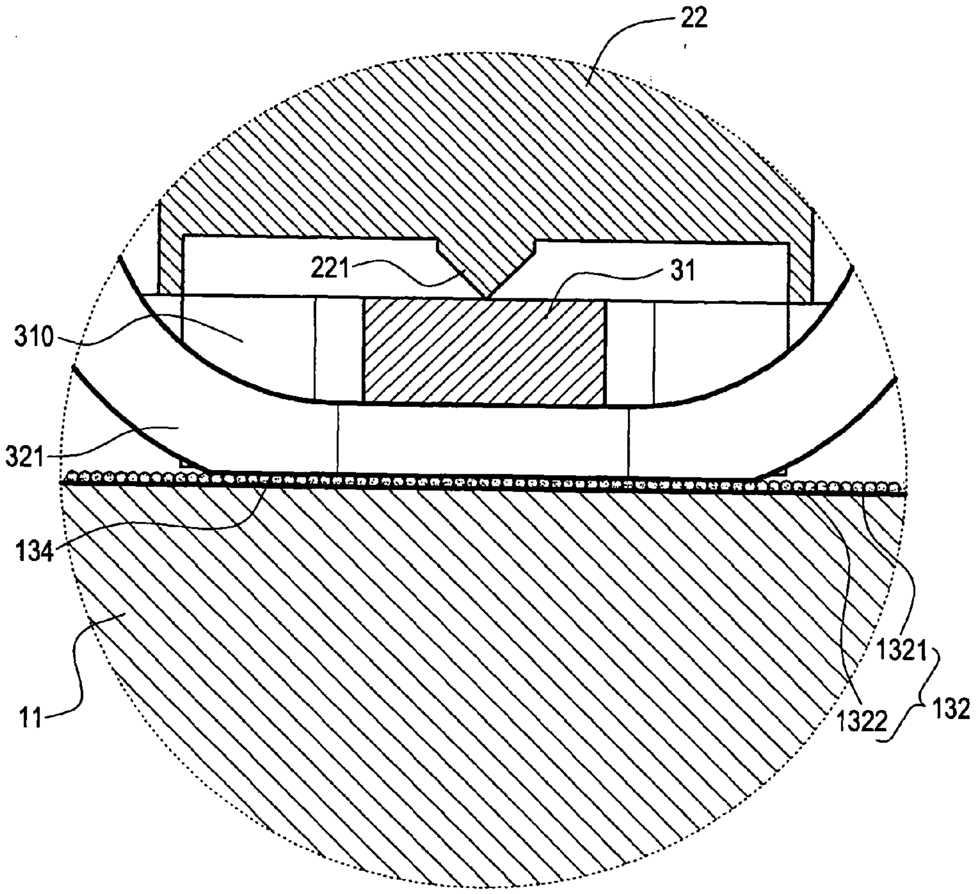

FIG.7

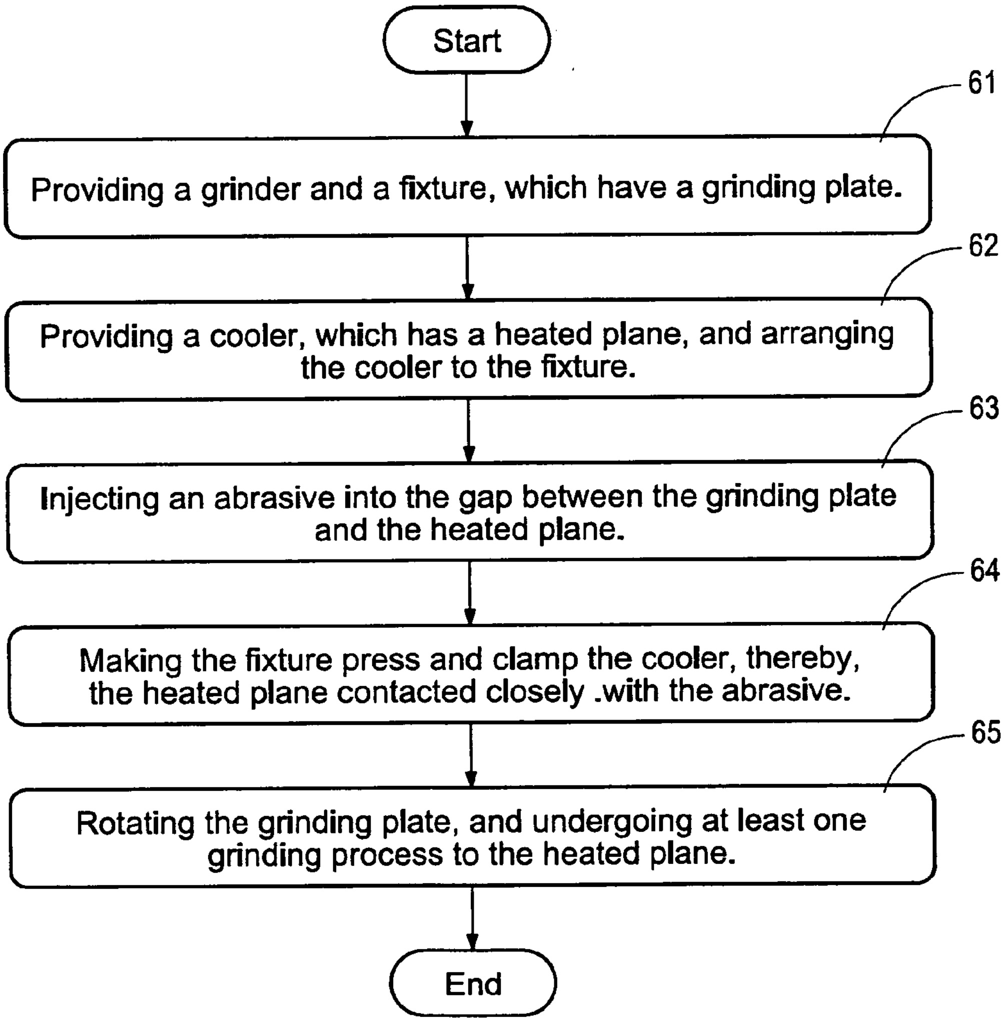
Start
61
Providing a grinder and a fixture, which have a grinding plate.
62
Providing a cooler, which has a heated plane, and arranging the cooler to the fixture.
63
Injecting an abrasive into the gap between the grinding plate and the heated plane.
64
Making the fixture press and clamp the cooler, thereby, the heated plane contacted closely .with the abrasive.
65
Rotating the grinding plate, and undergoing at least one grinding process to the heated plane.
End

FIG.8

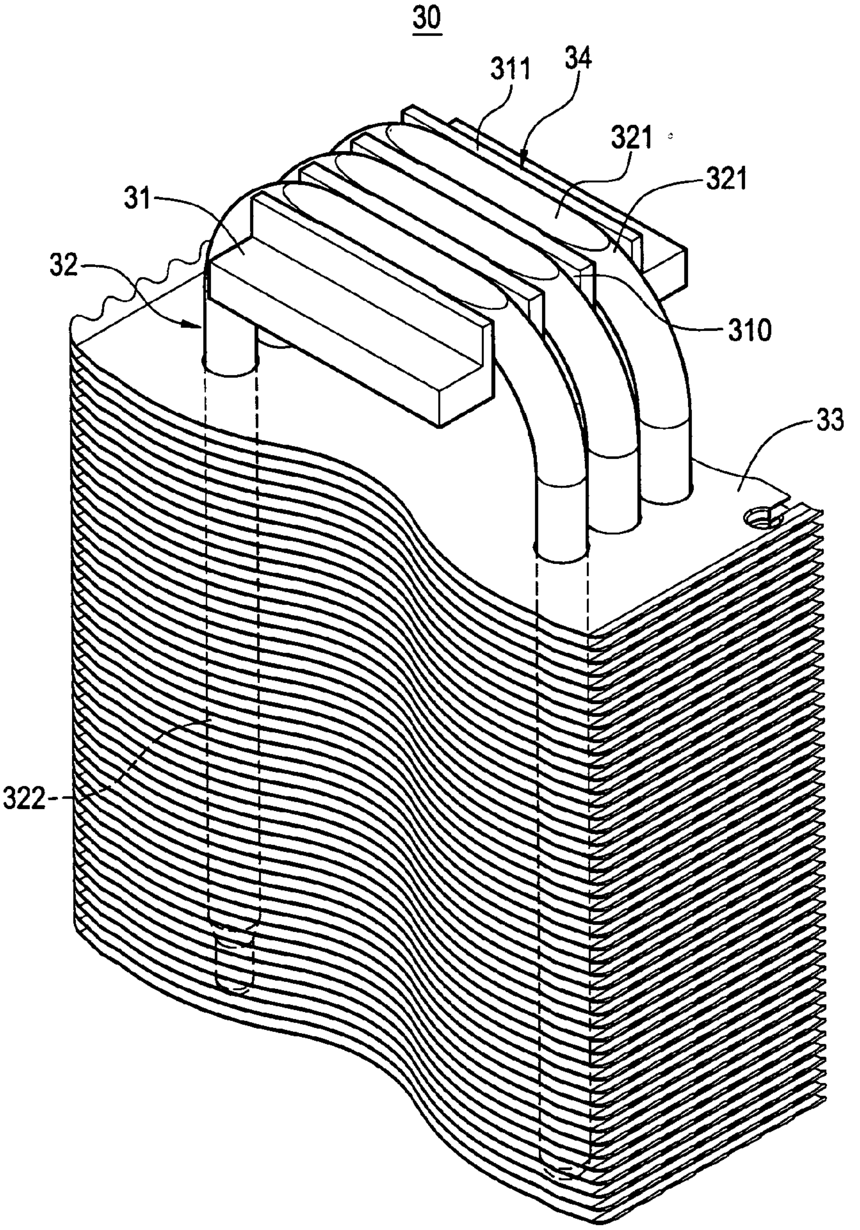

FIG.9

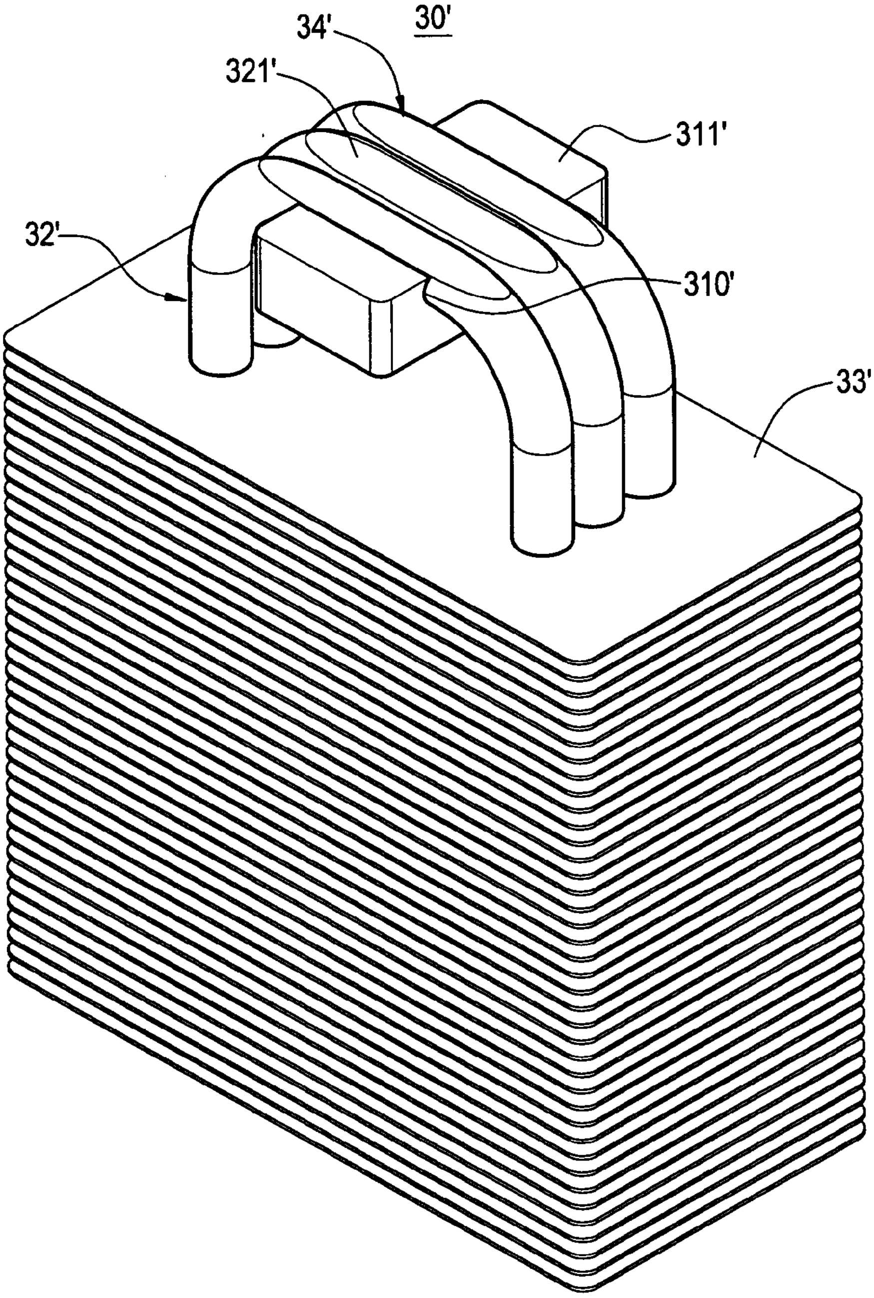

FIG.10

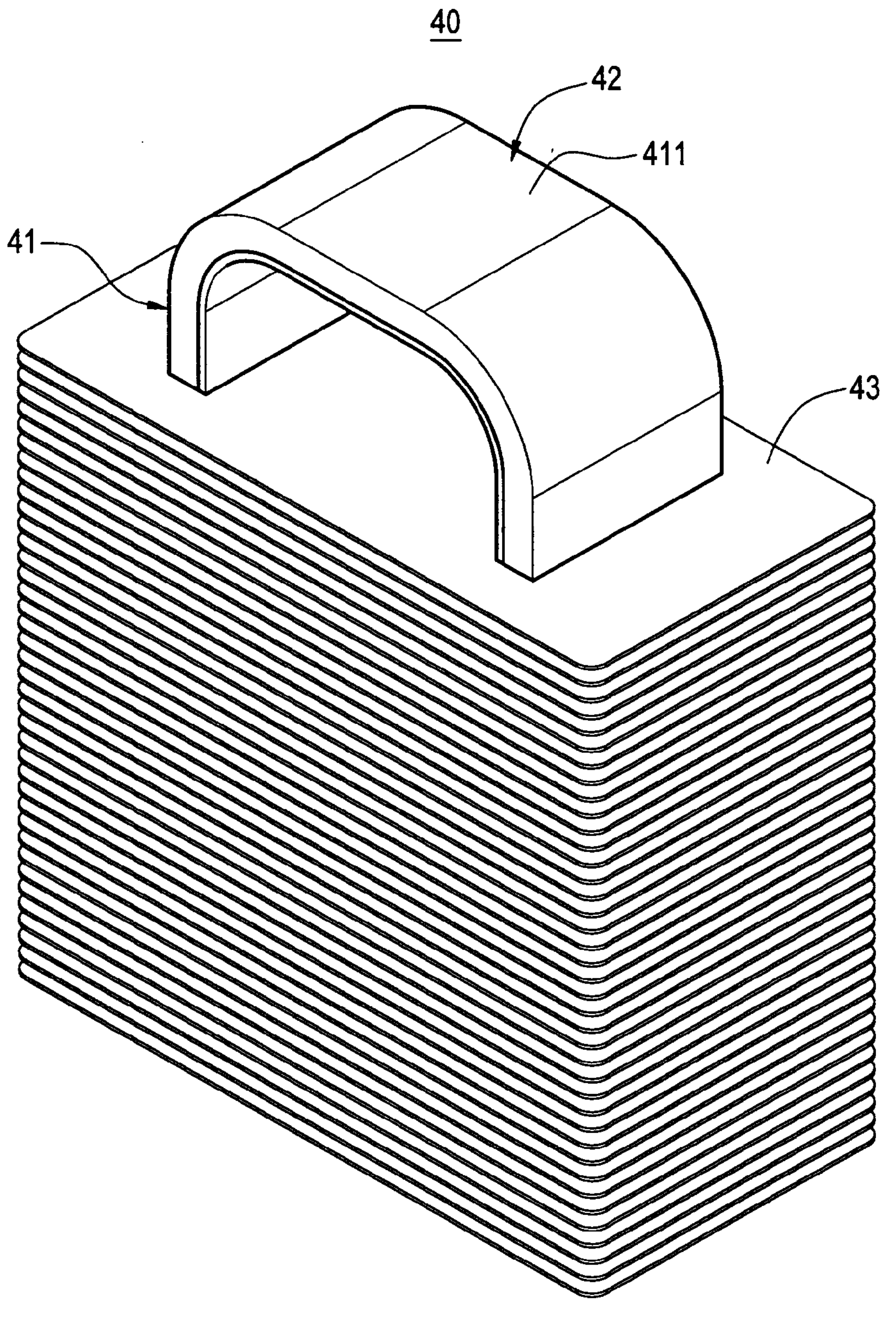

FIG.11

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EUROPEAN SEARCH REPORT

Application Number
EP 09 00 7778

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	JP 2003 188320 A (MATSUSHITA ELECTRIC IND CO LTD) 4 July 2003 (2003-07-04) * paragraphs [0017], [0018], [0040] *	8-10 1-5	INV. B24B37/04 H05K7/20
X Y	US 6 074 283 A (MAEDA HIROSHI [JP] ET AL) 13 June 2000 (2000-06-13) * column 7, line 14 - column 8, line 18; figures 3-5 *	6 1-5,7	
Y	EP 0 480 678 A (JAPAN ABRASIVE [JP]) 15 April 1992 (1992-04-15) * page 2, lines 23-27 *	3-4	
Y	US 6 435 496 B1 (PHILLIPS STEVEN E [US]) 20 August 2002 (2002-08-20) * column 4, lines 39-44 * * column 5, lines 49-57; figures 13-15 *	5,7	

TECHNICAL FIELDS SEARCHED (IPC)

B24B
H05K

~~The present search report has been drawn up for all claims~~

4

Place of search	Date of completion of the search	Examiner
Munich	2 March 2010	Zeckau, Jochen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
&: member of the same patent family, corresponding document

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-10

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 09 00 7778

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4, 6, 8-10

   Method or, respectively, apparatus for grinding a heat receiving plane of a cooler; cooler having a ground heat receiving plane

   ---

2. claims: 5, 7

   Method or, respectively, apparatus for grinding a heat receiving plane of a cooler, wherein a fixture presses and clamps the cooler via a point contact manner

   ---

3. claims: 11-15

   Cooler having a ground heat receiving plane and comprising at least one heat pipe

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 00 7778

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-03-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82