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LI(10) **Pub. No.: US 2010/0000720 A1**(43) **Pub. Date: Jan. 7, 2010**(54) **LIQUID COOLING HEAT DISSIPATING
DEVICE WITH HEAT TUBES GATHERING
HEAT SOURCES**(30) **Foreign Application Priority Data**

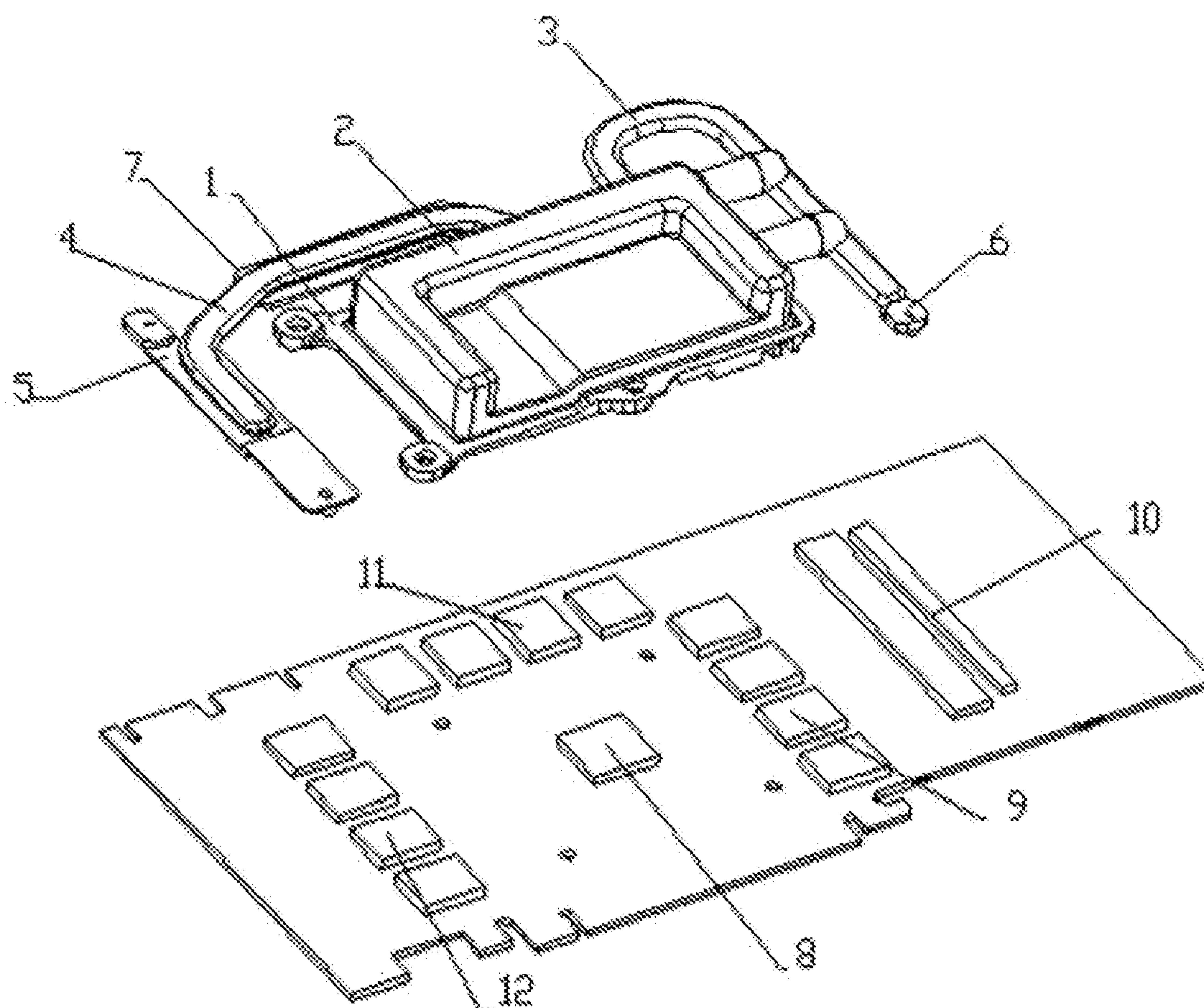
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F28D 15/00 (2006.01)(52) **U.S. Cl.** **165/104.33; 165/104.26**(57) **ABSTRACT**

A liquid cooling heat dissipating device with heat tubes gathering heat sources includes a cold plate being disposed on the heat sources and a or a plurality of heat tubes disposed between the heat sources and the cold plate to contact with the heat sources completely, and an end of the respective heat tube is fixedly attached to the cold plate, respectively. The respective heat tube is sealed with a capillary material and a vapor-liquid working median contained inside. The respective heat tube contacts with the heat sources at different spots to gather the heat for being cooled with the cold plate simply.

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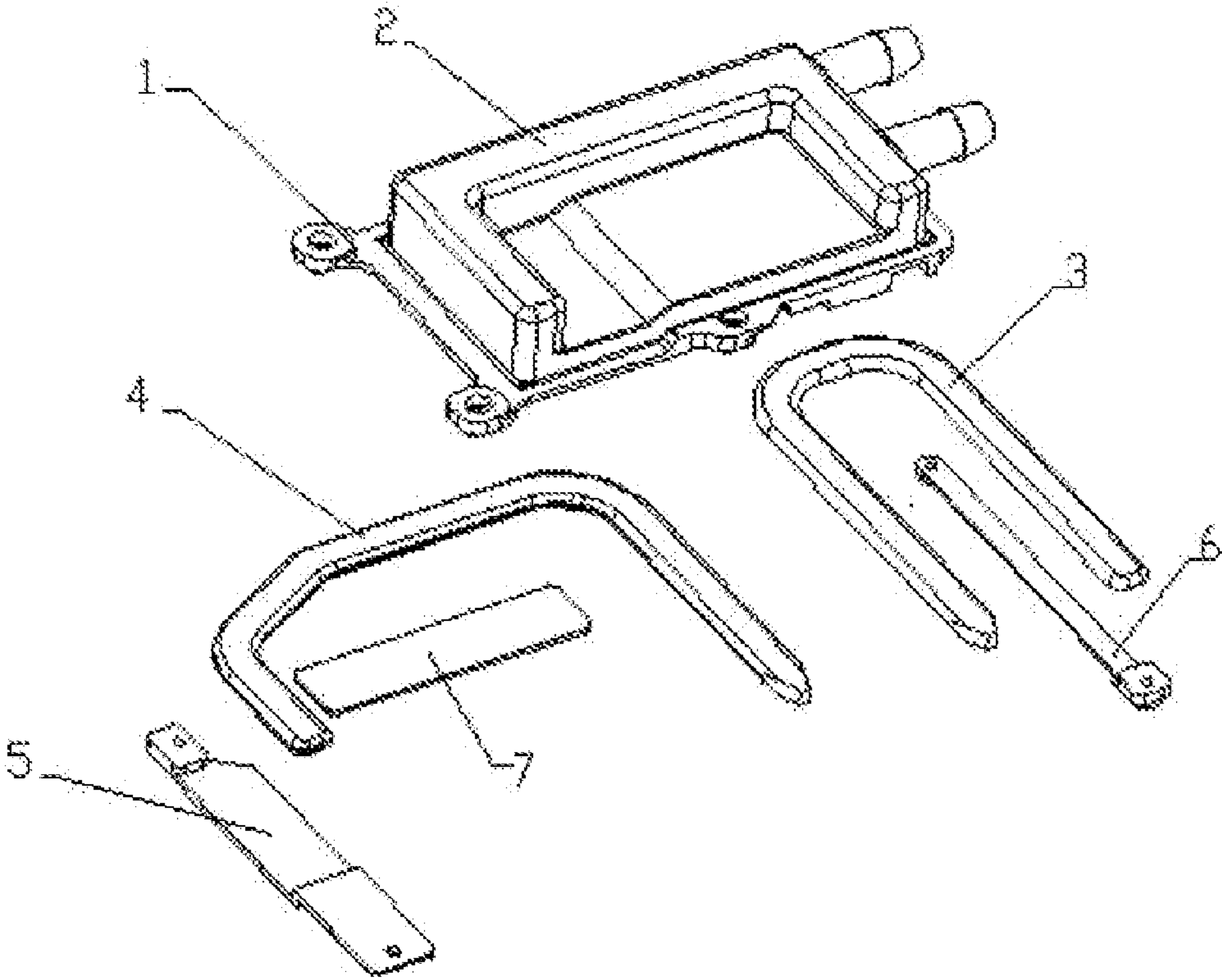


FIG. 1

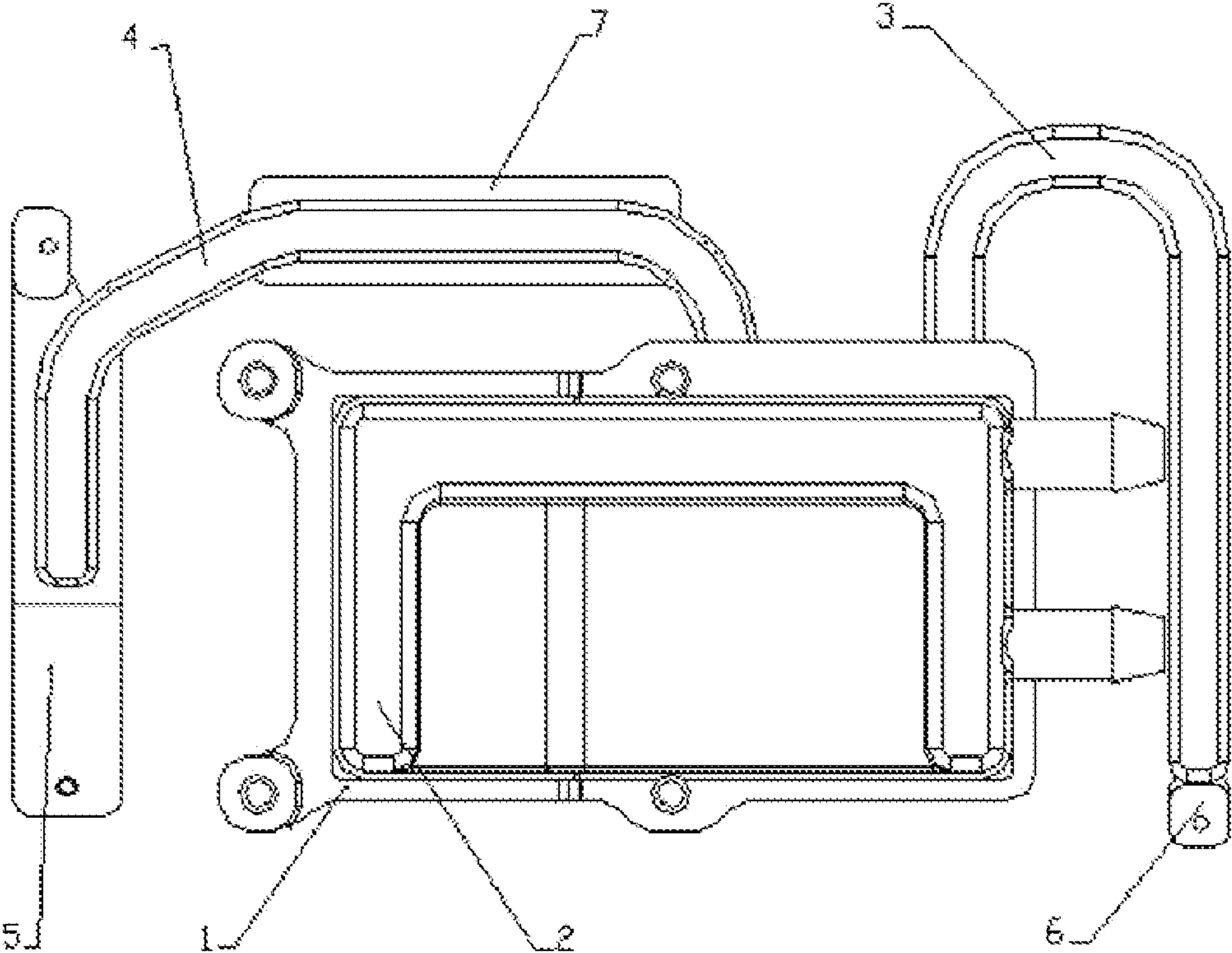


FIG. 2

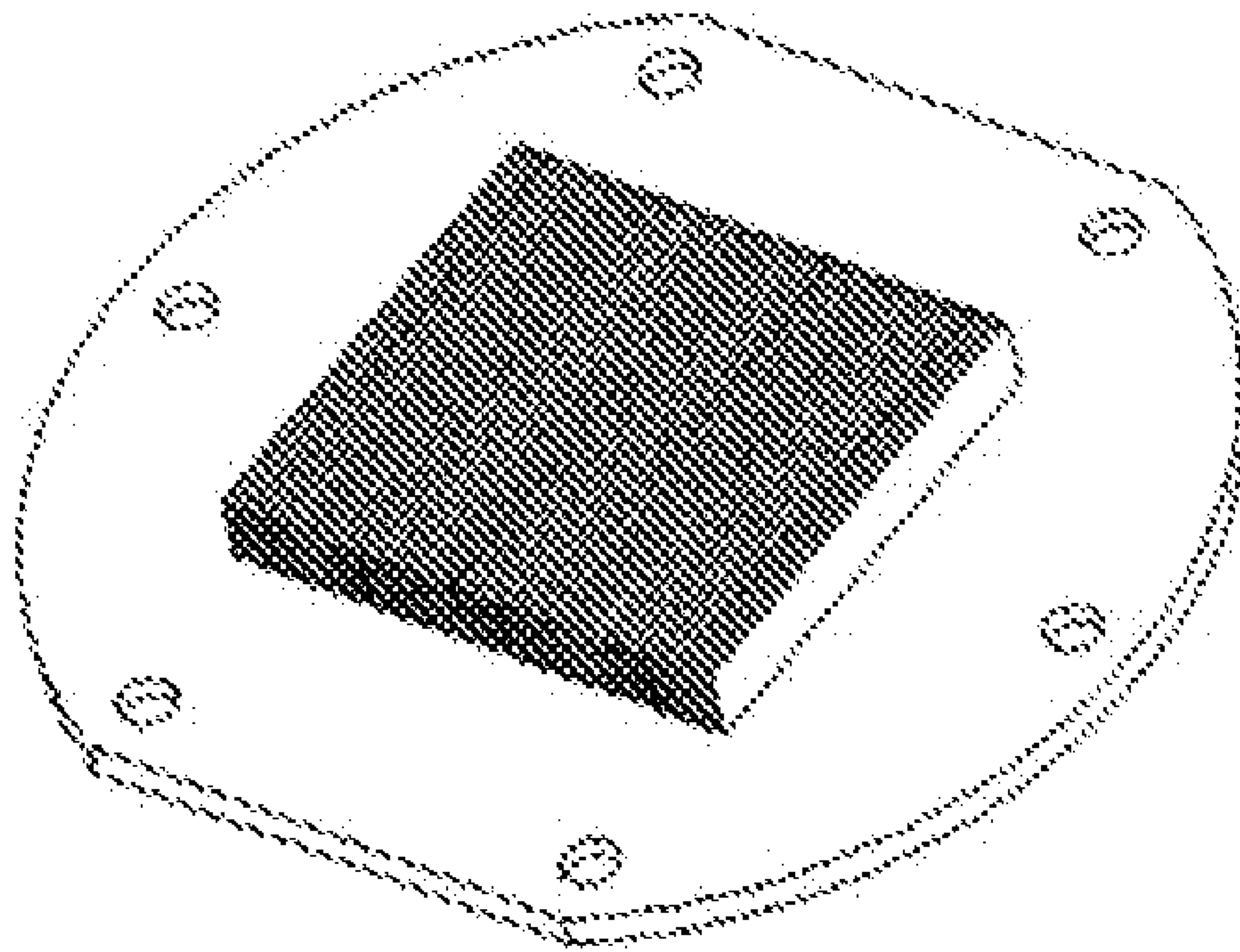


FIG. 3

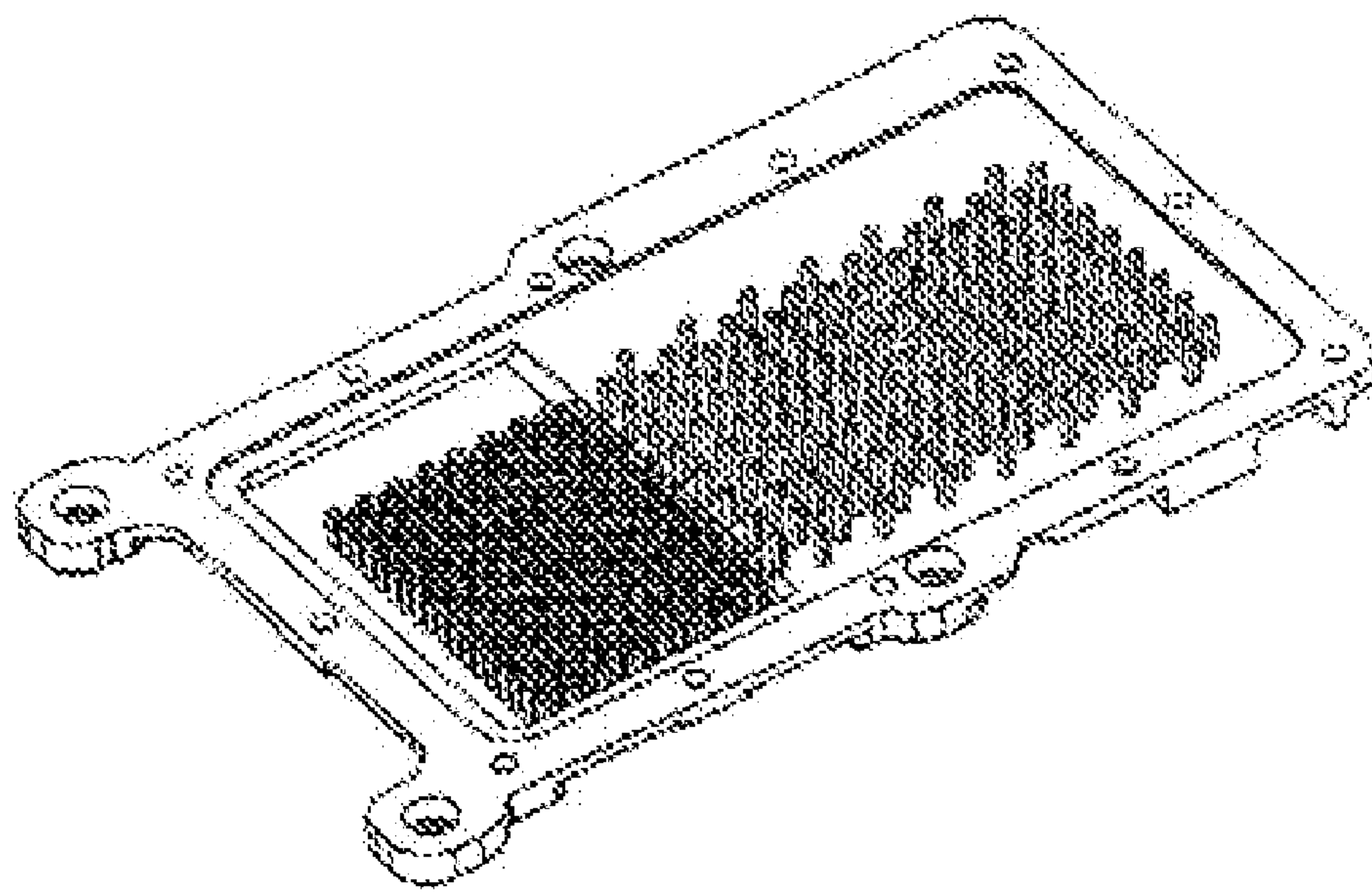


FIG. 4

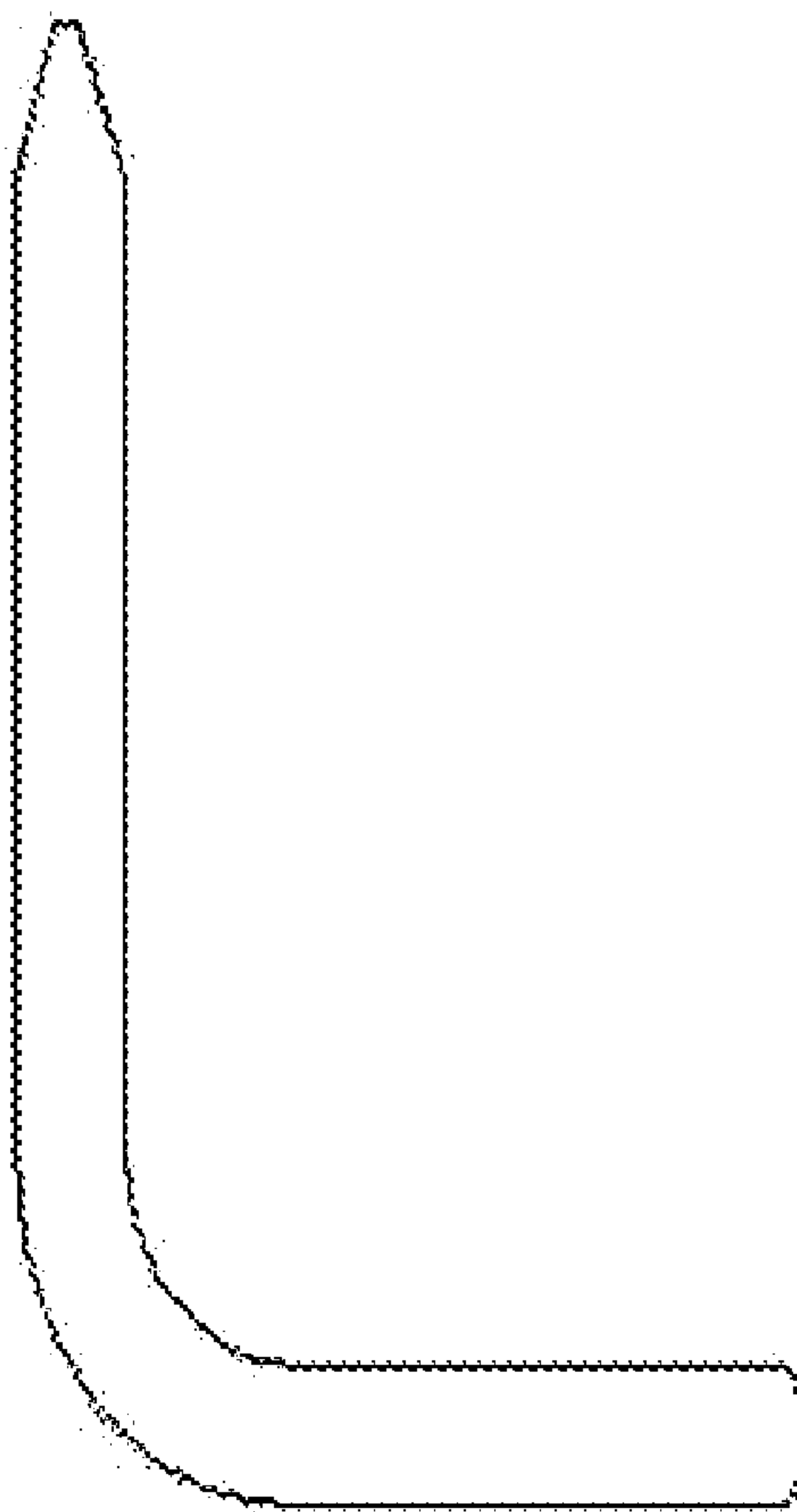


FIG. 5

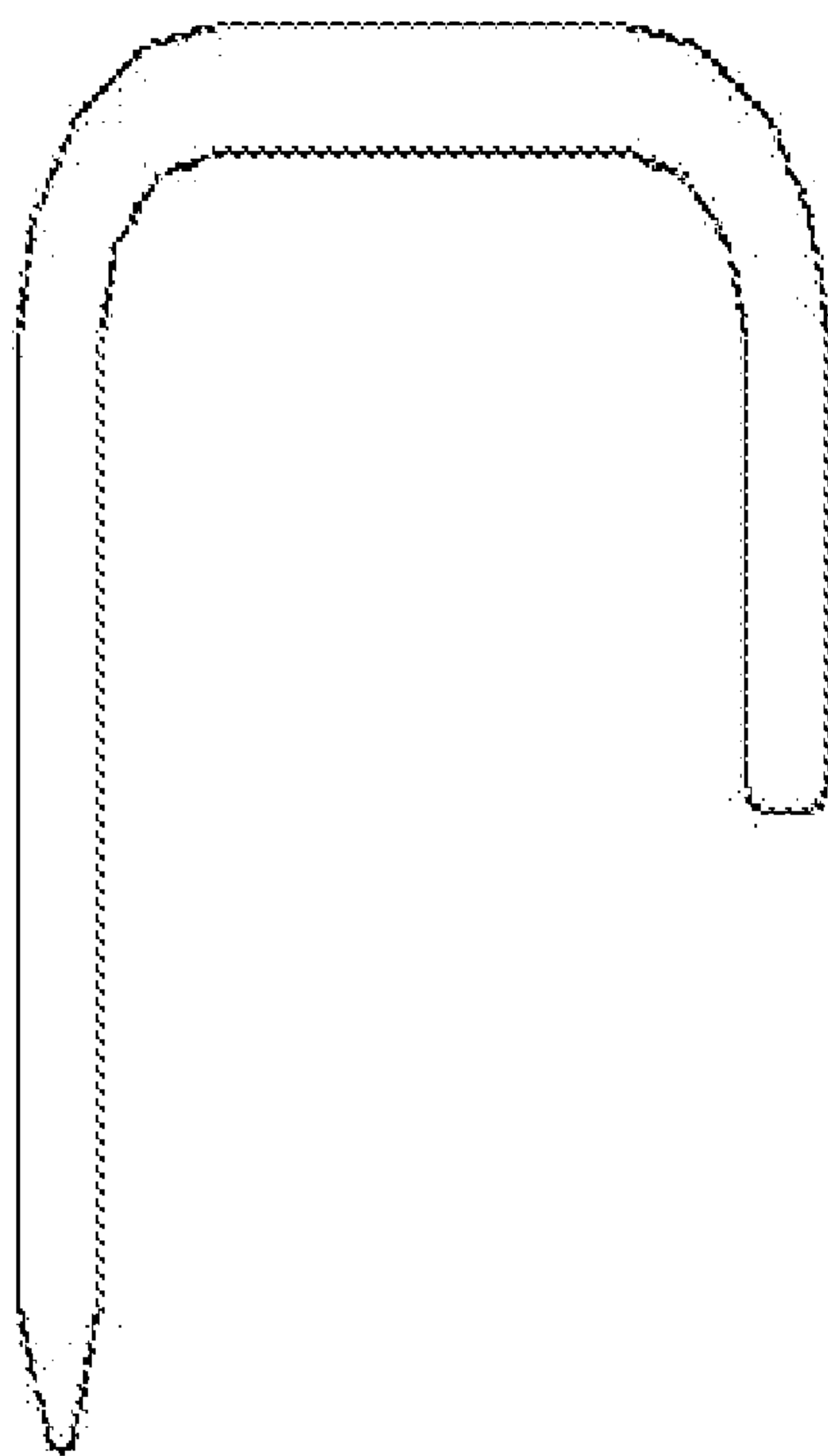


FIG. 6

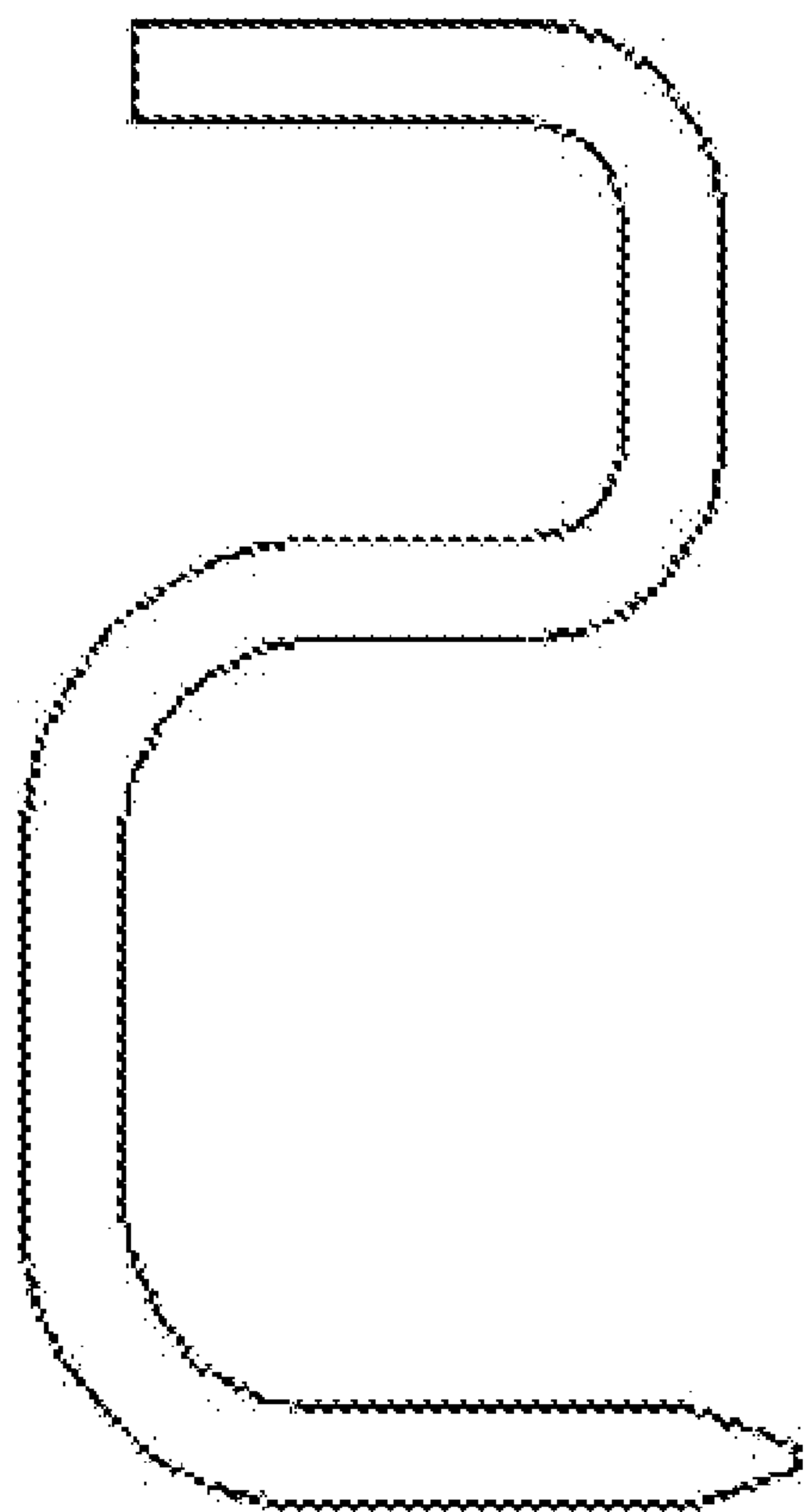


FIG. 7

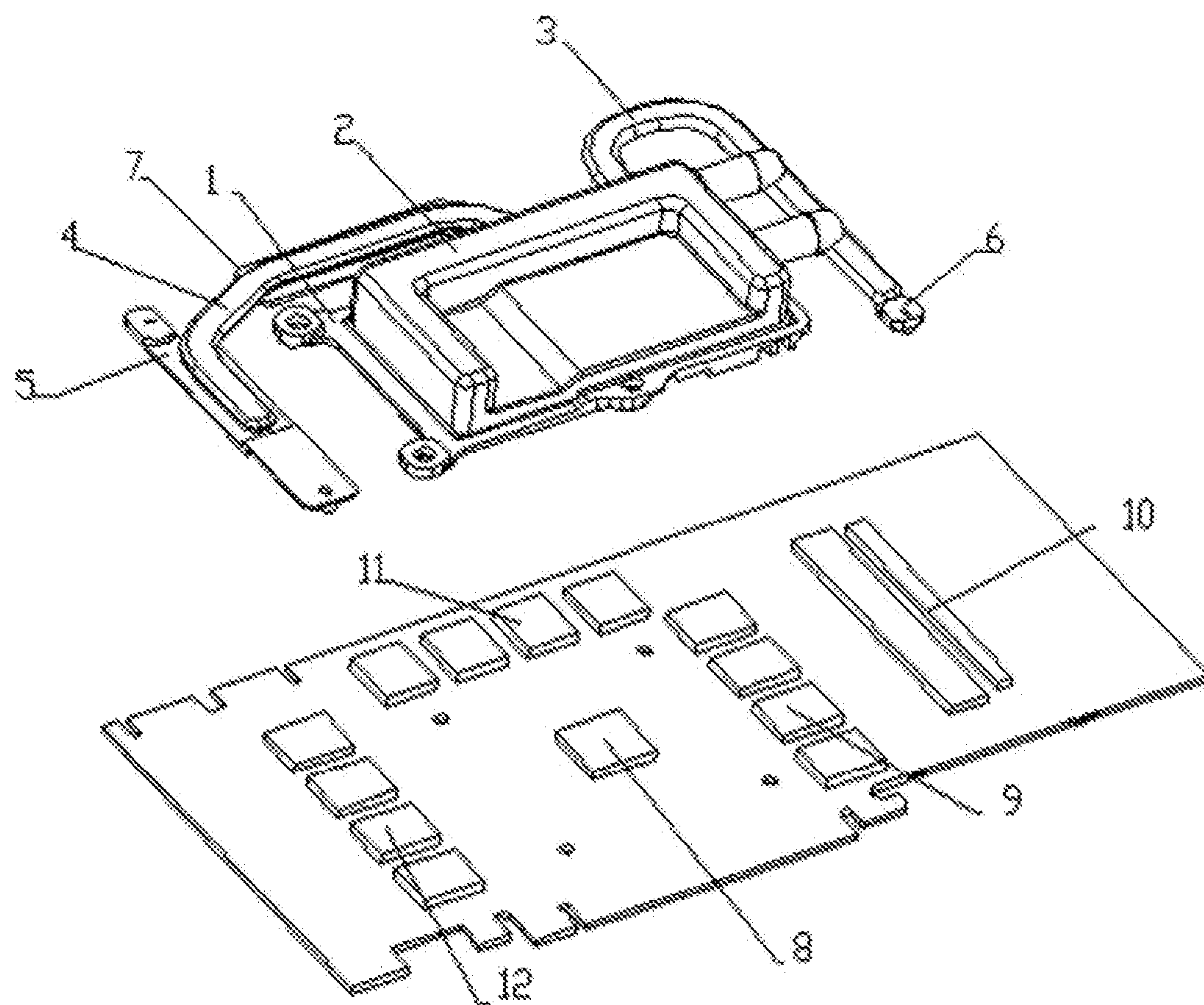


FIG. 8

LIQUID COOLING HEAT DISSIPATING DEVICE WITH HEAT TUBES GATHERING HEAT SOURCES

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention is related to a heat dissipation device for an electronic product and particularly to a liquid cooling heat dissipation device.

[0003] 2. Brief Description of the Related Art

[0004] The liquid cooling type heat dissipation device is widely used in the electronic products. Currently, the heat generating from the CPU in the high speed electronic product is not the only heat needed to remove for an electronic product. The video graphics array (VGA) chip, the internal storage chip and the north bridge chip in the high resolution graphics card also generate a lot of heat to be removed.

[0005] The conventional technique of liquid cooling device usually provides copper tubes and multiple cold plates. The so-called cold plate is a chamber body with an inlet and an outlet for admitting the liquid flowing through, and a facial side thereof is touched to the heat source tightly such that the heat generated by the heat source is carried outward with the liquid flow. The conventional cooling device has the following disadvantages:

[0006] (1) The flow passage of the cooling liquid is tortuous and complicated with excessive large flow resistances, and it results in insufficient flow rate such that it needs a supercharging device to increase the pressure and produces many unfavorable problems.

[0007] (2) Some parts of the cooling device need to connect with each other detachably such that there are many detachable joints installed in the cooling device to increase the risk of leakage undesirably.

[0008] (3) It is inconvenient while being set up. When the parts of the cooling device are assembled, they impede to each other easily such that not only the quality thereof is difficult to be controlled but also the production cost thereof becomes much higher.

SUMMARY OF THE INVENTION

[0009] In order to overcome the deficiencies the conventional liquid cooling heat dissipation device, the main object of the present invention is to provide a liquid cooling heat dissipating device with heat tubes gathering heat sources with which the heat sources at different spots can be gathered to a single cold plate and the cooling liquid can flow to the entire device with simple assembly and less risk of leakage.

[0010] Accordingly, the liquid cooling heat dissipating device with heat tubes gathering heat sources according to the present invention includes a cold plate being disposed on the heat sources and a or a plurality of heat pipes disposed between the heat sources, wherein the cold plate contacts with the heat sources completely, an end of the respective heat pipe is fixedly attached to the cold plate.

[0011] The respective heat pipe is sealed with a capillary material and a vapor-liquid working median contained inside.

[0012] The heat tubes, which provide a high heat conductivity respectively, contact with the heat sources at different spots to gather the heat generated by the heat sources to the single cold plate. When an end of the respective heat tube contacts the high temperature heat, the working media in the heat tubes are vaporized. The vapor moves to the low tem-

perature end of the respective heat tube and is condensed. Meanwhile, the cooling liquid carries all the heat at the cold plate outward the electronic product to perform the heat dissipation effectively. The condensed liquid at the low temperature end passes through the capillary material in the respective heat tube to the high temperature end with the capillary attraction of the capillary material to complete the internal cooling cycle. Due to the latent heat being created at the time of the phase change of the working medium, the respective heat tube is capable of having very high heat transfer capability and the equivalent heat conductivity.

[0013] Comparing to the prior art, the liquid cooling heat dissipating device with heat tubes gathering heat sources according to the present invention has the following advantages:

[0014] (1) The flow passage of the cooling device and the entire structure of the heat dissipating device are simplified substantively, and the flow resistance can be controlled effectively.

[0015] (2) The cooling device is easily fabricated with suitable fixtures during welding process.

[0016] (3) The cooling device has less connecting joints with less risk of leakage to enhance the safety.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The detail structure, the applied principle, the function and the effectiveness of the present invention can be more fully understood with reference to the following description and accompanying drawings, in which:

[0018] FIG. 1 is a disassembled perspective view of a liquid cooling heat dissipating device with heat tubes gathering heat sources according to the present invention;

[0019] FIG. 2 is a perspective view of the liquid cooling heat dissipating device with heat tubes gathering heat sources according to the present invention;

[0020] FIG. 3 is a perspective view illustrating the first type structure of the cold plate shown in FIG. 1;

[0021] FIG. 4 is a perspective view illustrating the second type structure of the cold plate shown in FIG. 1;

[0022] FIG. 5 is a plan view of the "L" shaped heat pipe;

[0023] FIG. 6 is a plan view of the "N" shaped heat pipe;

[0024] FIG. 7 is a plan view of the "S" shaped heat pipe; and

[0025] FIG. 8 is an exploded perspective view illustrating an implement of the heat dissipating device according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Referring to FIGS. 1 and 2, a preferred embodiment of a heat dissipating device with heat tubes gathering heat sources according to the present invention is illustrated. The heat dissipating device shown in FIGS. 1 and 2 is a liquid cooling heat dissipating device for an electronic product. The heat dissipating device has a cold plate 1 and two heat tubes 3, 4. There is a cold plate cover 2 on the cold plate 1. When the heat dissipating device is in use, the cold plate 1 is disposed on electronic heat sources. The cold plate 1 can be implemented with the needle type cold plate as shown in FIG. 4 or the like in addition to the micro passage type cold plate shown in FIG. 3. The cold plate is made of metal, alloy or other composites with high heat conductivity and certain strength such as copper, aluminum, or graphite. The heat pipes 3, 4 are placed between the heat source and the cold plate 1 to contact with the electronic heat source completely. An end of the respective heat pipe 3, 4 is fixedly connected to the cold plate. The

heat tubes **3**, **4** are sealed with a capillary material and a liquid-vapor working median. The respective heat tube wall and the capillary material are made of copper and the working medium is water in the embodiment. It is noted that copper and water here only for exemplification and not for restriction. In order to make sure the electronic heat sources contacting with the heat tubes **3**, **4** sufficiently, a metal plate can be disposed at the bottom of the heat tubes **3**, **4** respectively under a certain constant pressure for securing the connection. The metal plate is high heat conductivity with certain strength such as copper or silver. It can be seen in FIG. **1** that a metal plate **6** is fixed at the bottom of the heat tube **3**, and two metal plates **5**, **7** are fixed at the bottom of the heat tube **4**. The heat tubes **3**, **4** are fabricated with powder sintering or groove type tube. The respective heat tube can be “L” shaped as shown in FIG. **5**, “N” shaped as shown in FIG. **6**, and “S” shaped as shown in FIG. **7**. It is noted that other shapes for the heat tube is possible and it is not restricted with the preceding shapes. The cross section of the respective heat tube **3**, **4** can be round, square, or triangle. It is noted that other suitable cross section for the heat tubes can be used instead of the preceding cross sections. Further, the heat tubes can be attached to the cold plate and the metal plates with welding, gluing or screw fastening, but it is not restricted the preceding joining ways.

[0027] For large size electronic products, the heat source can be gathered at an area, two areas or multiple areas with the corresponding amount of the cold plates to transmit the heat outward.

[0028] FIG. **8** shows a typical example of application of the heat dissipating device with heat tubes gathering heat sources according to the present invention. The heat from the heat source **10** is transmitted to the cold plate **1** via the metal plates **5**, **7** and the heat pipe **4**. The heat sources **8**, **9** are cooled with the cold plate directly, and the cooling liquid passes through the cold plate **1** to carry all the heat outward to perform the function of heat dissipation.

[0029] While the invention has been described with referencing to the preferred embodiment thereof, it is to be understood that modifications or variations may be easily made without departing from the spirit of this invention, which is defined by the appended claims.

What is claimed is:

1. A liquid cooling heat dissipating device with heat tubes gathering heat sources comprising:
a cold plate being disposed on said heat sources;
a or a plurality of heat tubes being disposed between said heat sources and said cold plate to contact with said heat sources completely, and having an end thereof to fixedly attached to said cold plate, respectively.
2. The liquid cooling heat dissipating as defined in claim 1, wherein the bottom of the respective heat tube fixedly connected with a metal plate.
3. The liquid cooling heat dissipating device as defined in claim 1, wherein the respective heat tube is sealed with a capillary material and a vapor-liquid working median being contained therein.
4. The liquid cooling heat dissipating device as defined in claim 3, wherein said capillary material and the wall of the respective heat tube is made of copper, and the working median is water.
5. The liquid cooling device as defined in claim 1, wherein the respective heat tube has an outer shape of “L”, “N” or “S”, and has a cross section of round, square or triangle.
6. The liquid cooling heat dissipating device as defined in claim 1, wherein the respective heat tube is attached to said cold plate and said metal plate with welding, gluing or screw fastening.
7. The liquid cooling heat dissipating device as defined in claim 2, wherein the respective heat tube is attached to said cold plate and said metal plate with welding, gluing or screw fastening.

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