

# Technology Review:

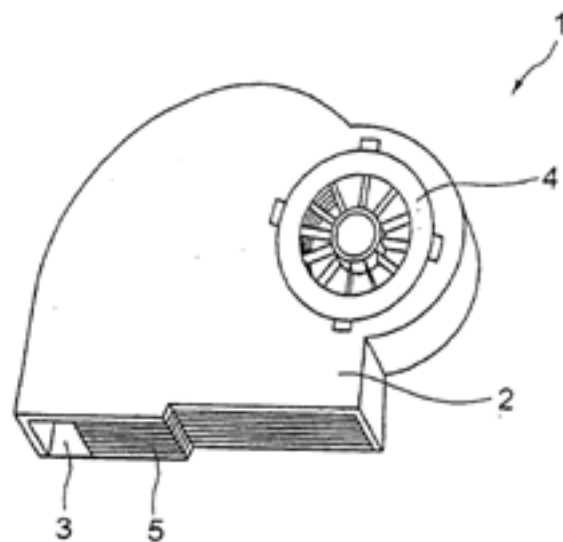
## Fan Heat Sinks

Qpedia continues its review of technologies developed for electronics cooling applications. We are presenting selected patents that were awarded to developers around the world to address cooling challenges. After reading the series, you will be more aware of both the historic developments and the latest breakthroughs in both product design and applications.

We are specifically focusing on patented technologies to show the breadth of development in thermal management product sectors. Please note that there are many patents within these areas. Limited by article space, we are presenting a small number to offer a representation of the entire field. You are encouraged to do your own patent investigation. Further, if you have been awarded a patent and would like to have it included in these reviews, please send us your patent number or patent application.

In this issue our spotlight is on fan heat sinks. There is much discussion about its deployment in the electronics industry, and these patents show some of the salient features that are the focus of different inventors.

### **A Heat Sink with a Centrifugal Fan,** EP 1830403 A3, Hashimoto, N., et al.



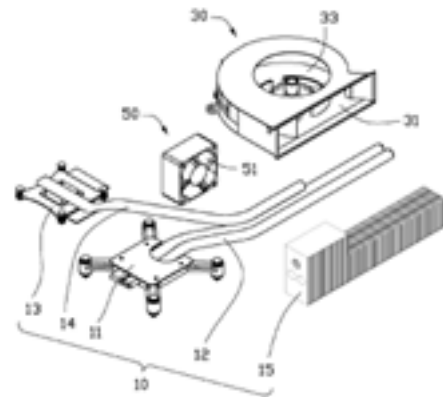
A heat sink with a centrifugal fan comprising: a cover of a prescribed shape including an air intake port and an air discharge port; a heat receiving block thermally connected to a heat generating part to be cooled; a bottom portion which is excellent in heat transferability, thermally connected to one face of said heat receiving block, and engaged to said cover to form a space portion; a heat dissipating

PATENT NUMBER	TITLE	INVENTORS	DATE OF AWARD
EP1830403 A3	A HEAT SINK WITH A CENTRIFUGAL FAN	Hashimoto, N., et al.	May 9, 2007
US 2013/0014920 A1	HEAT SINK ASSEMBLY	Chao, C., et al.	Jan 17, 2013
US 8,365,811 B2	HEAT SINK FAN	Yamishita, T., et al.	Feb 5, 2013

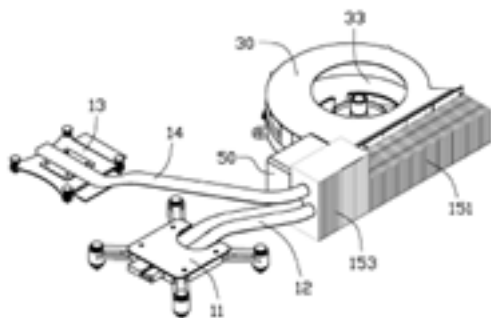
fin portion comprising a plurality of fins, received within the space portion, thermally connected to said bottom portion, and having a prescribed shape including at least an air inflow portion; and a centrifugal fan, a rotating shaft of which is arranged in a vicinity of the air inflow portion of said heat dissipating fin portion, which intakes air from the air intake port, generates an air flow through spaces formed between adjacent fins of said heat dissipating fin portion, and generates another air flow along an inner wall of said cover toward said air discharge port.

### Heat Sink Assembly,

US 2013/0014920 A1, Chao, C., et al.



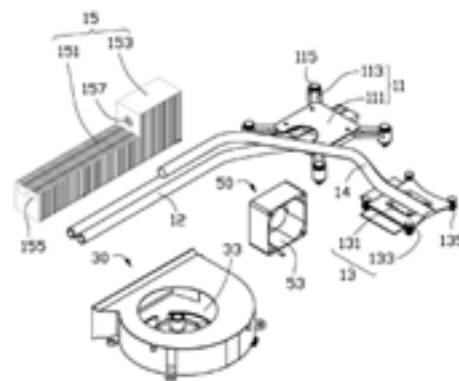
The fin assembly 15 includes a first fin module 151 and a second fin module 153. The area of each fin of the first fin module 151 is less than the area of each fin of the second fin module 153. The fin assembly 15 defines a first through hole 155 extending through the first fin module 151 and the second fin module 153. The first through hole 155 corresponds to the first heat pipe 12. The second fin module 153 defines a second through hole 157. The second through hole 157 corresponds to the second heat pipe 14. The extending direction of the first through hole 155 is substantially parallel to the extending direction of the second through hole 157. The second through hole 157 is located above the first through hole 155, and does not extend through the first fin module 151. The fin assembly 15 is L-shaped.



The heat sink 10 includes a first base 11, two first heat pipes 12 mounted to the first base 11, a second base 13, a second heat pipe 14 mounted to the second base 13, and a fin assembly 15.

The first base 11 includes a first base body 111 and four first securing portions 113, extending from four corners of the first base body 111. Each first securing portion 113 includes a first fastener 115. The first base body 111 is mounted to a heat generating element.

The second base 13 includes a second base body 131 and four second securing portions 133, extending from four corners of the second base body 131. Each second securing portion 133 includes a second fastener 135. The second base body 131 is mounted on a second heat generating element.



The first fan 30 defines a first input opening 31 and a first output opening 33. The first input opening 31 corresponds to the first fin module 151. The first input opening 31 is substantially perpendicular to the first output opening 33.

The second fan 50 defines a second input opening 51 and a second output opening 53. The second input opening 51 corresponds to the second fin module 153. The second input opening 51 is substantially parallel to the second output opening 53.

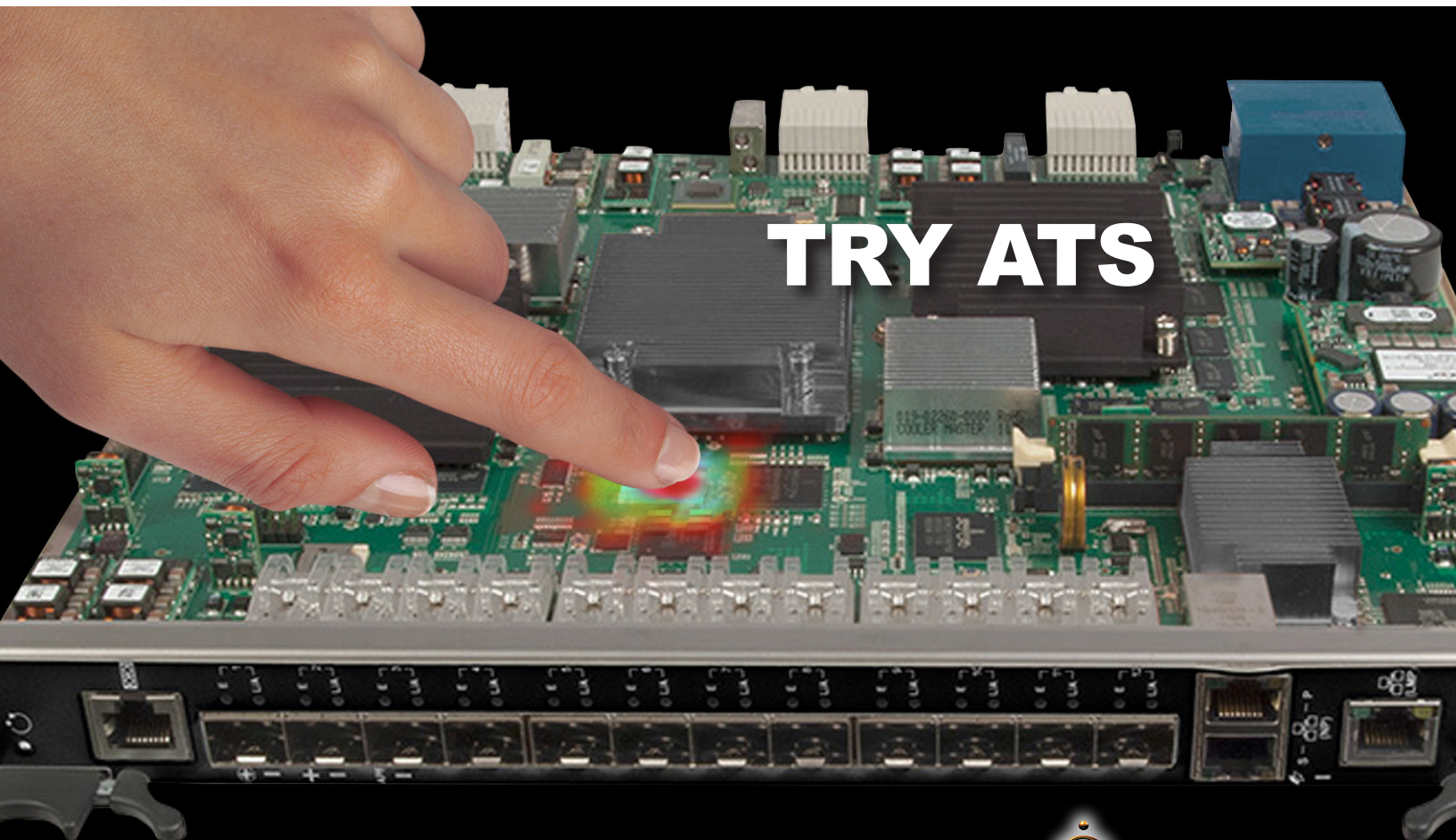
The first heat pipe 12 and the second heat pipe 14 are inserted into the first through hole 155 and the second through hole 157. The first fan 30 is mounted to a panel to enable the first input opening 31 of the first fan 30 to align with the first fin module 151. The second fan 50 is mounted to the panel to enable the second input opening 51 of the second fan 50 to align with the second fin module 153.

The heat sink assembly has a high efficiency for heat dissipation in an enclosure with little space.

### **Heat Sink Fan,**

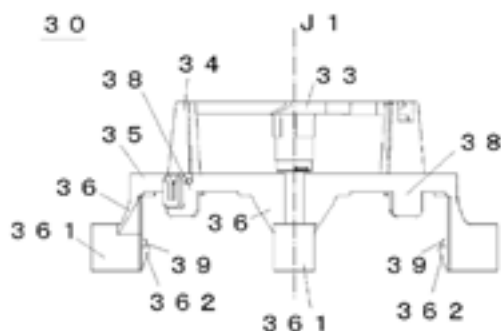
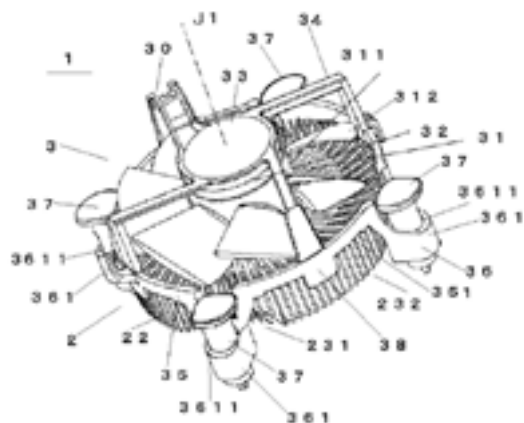
US 8,365,811 B2, Yamishita, T., et al.

The heat sink fan of the present invention includes a heat sink and a fan. The heat sink includes a base having a center axis, and a plurality of fins extending radially outwardly from an outer circumference of the base, the plurality of fins being disposed in a circumferential direction. The fan includes an impeller portion which is adjacent to the heat sink in the direction along the center axis, the impeller portion rotating about the center axis, and a frame portion for covering and fixing the impeller portion, at least part of the frame portion being opposed to the heat sink. The frame portion has at least one protruding portion. The protruding portion enters into a space between the fins which are adjacent to each other.



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In addition, the frame portion of the heat sink fan includes an annular member for enclosing the impeller portion, the annular member being opposed to the heat sink in the direction along the center axis. In the frame portion, the protruding portion can be formed on a face of the annular member which is opposed to the heat sink.

Moreover, the frame portion of the heat sink fan includes a plurality of first extending portions extending in the direction along the center axis from the annular member. At least part of the first extending portion is radially opposed to the fins has a cylindrical portion, and the first extending portion has a cylindrical portion at its end in the direction along the center axis. On an outer face of the cylindrical portion, a pawl portion protruding radially inwardly, and axially opposed to the heat sink is formed. The protruding portion can be formed on a face of the pawl portion opposite to the heat sink. The frame portion of the heat sink fan further includes a plurality of second extending portions extending in the direction along the center axis from

the annular member. The second extending portions are radially opposed to the fins. The protruding portion can be formed on a face of the second extending portion which is opposed to the fins in the direction along the center axis.

The frame portion of the heat sink fan includes a base portion to which the impeller portion is fixed, the base portion being opposed to the impeller portion in the direction along the center axis, and a coupling member for coupling the base portion with the annular member.

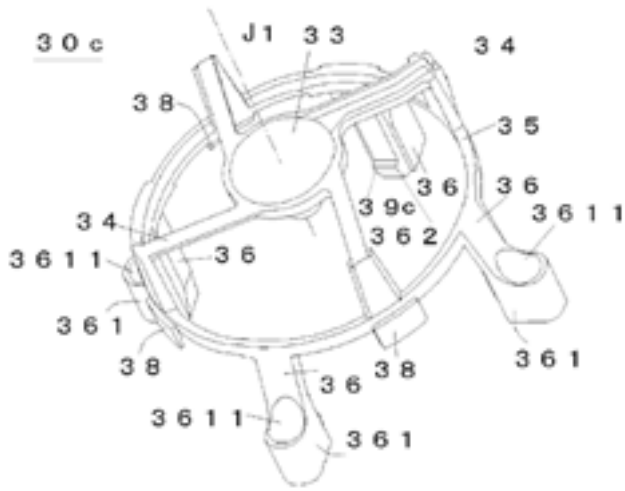
The at least one protruding portion formed in the frame portion has a shape which is tapered toward its extending direction. When the protruding portion is viewed from the direction along the center axis, all of the faces constituting the protruding portion are visible.

When viewed from the direction along the center axis, an outer shape of the heat sink of the heat sink fan is constituted by at least one arcuate portion which is substantially arcuate with respect to the center axis, and at least one side portion which is substantially linear. The first extending portion is opposed to the side portion.

A space in the circumferential direction between the fins constituting the side portion is smaller than a space in the circumferential direction between the fins constituting the arcuate portion.

When the protruding portion and the pawl portion are viewed from the direction along the center axis, an area enclosed by an outer shape of the protruding portion may be substantially equal to an area enclosed by an outer shape of the pawl portion. Moreover, at least one recessed portion which is recessed in the direction along the center axis may be formed on the heat sink, and the recessed portion may be engaged with the protruding portion.

The method for producing a heat sink fan of the present invention including: a heat sink including a base having a center axis, and a plurality of fins



member for enclosing the impeller portion, a first extending portion axially extending from the annular member and having a pawl portion extending radially inwardly at its end, and a second extending portion axially extending from the annular member, one or more protruding portion being formed on at least one of the annular member, the first extending portion, and the second extending portion, includes the steps of: (A) heating and melting a resin material; (B) injecting the molten resin material into a metal die having a shape corresponding to the frame portion; (C) cooling and hardening the resin material in the metal die, thereby molding the resin material into the shape of the frame portion; (D) removing the resin material from the metal die, thereby forming the frame portion; (E) attaching the impeller portion to the frame portion; and (F) assembling the heat sink and the frame portion by inserting the protruding portion of the frame portion into a space between adjacent fins of the heat sink. By using the method for producing the heat sink fan, a heat sink fan can be produced.

radially extending from an outer circumference of the base; and a cooling fan including an impeller portion rotating about the center axis, and a frame portion, the frame portion including an annular

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