ABSTRACT

A heat-dissipating module, a fan structure and an impeller. The heat-dissipating module comprises a fan structure providing the impeller to expel heat from a heat source. The impeller comprises a main body and a plurality of blade units. The main body has a base surface, and the blade units extending from the base surface of the main body. Each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface. The pattern of the guiding portions can be linear, curved, parallel or symmetrical, indented on or protruded from the blade units.
FIG. 1
FIG. 2A

FIG. 2B
FIG. 7A
HEAT-DISSIPATING MODULE, FAN STRUCTURE AND IMPELLER THEREOF

BACKGROUND

[0001] The present invention relates to a heat-dissipating module, and in particular to a heat-dissipating module comprising an impeller formed with a plurality of guiding portions dispersed on the blade surfaces thereof for reducing noise and discrete tone and expelling heat therewith.

[0002] From earlier 333 MHz to 400 MHz, 400 MHz to 533 MHz, 533 MHz to 800 MHz and 800 MHz to the present, the Front-end bus speed of computer processors are getting faster for enhancing data transmission. Computer functions are integrally systematized on the same circuit or motherboard, decreasing space available therein for convection and heat dissipation. Thus, forced air convection by an electrical fan is employed to increase flow rate of air for dissipating heat generated. Broadband noise and narrowband noise, however, are enlarged as maximum static pressure and flow rate of airflow increase.

SUMMARY

[0003] Accordingly, an object of the invention is to provide an impeller formed with a designated pattern to overcome the problems of the above described fan structure.

[0004] The impeller of the invention comprises a main body and a plurality of blade units. The main body has a base surface, and the blade units extending from the base surface of the main body. Each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface. The guiding portions are integrally indented on or protrude from the blade surface of the blade unit.

[0005] At least one of the guiding portions is substantially aligned with the blade surface of the blade unit. At least two of the guiding portions are substantially spaced apart on the blade surface of the blade unit in parallel. At least one of the guiding portions is substantially curved on the blade surface of the blade unit. Two of the guiding portions are substantially and expansively curved on the blade surface of the blade unit in the longitudinal direction thereof. At least two of the guiding portions are substantially and symmetrically spaced on the blade surface of the blade unit. Additionally, the guiding portions comprise a plurality of recesses or dimples, uniformly formed on the blade surface of the blade unit. Moreover, the guiding portions comprise a plurality of protrusions or particles, uniformly formed on the blade surface of the blade unit.

[0006] Another object of the invention is to provide a fan structure comprising an impeller therein. The fan structure comprises a housing and an impeller rotatably disposed in the housing. The impeller comprises a main body having a base surface and a plurality of blade units extending from the base surface of the main body. Each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface.

[0007] Still another object of the invention is to provide a heat-dissipating module comprising a fan structure and an impeller thereof to expel heat from a heat source such as a CPU. The heat-dissipating module comprises a conductive element disposed on the heat source and a fan structure disposed on the conductive element. The fan structure comprises a housing and an impeller rotatably disposed in the housing. The impeller comprises a main body having a base surface and a plurality of blade units extending from the base surface of the main body, and each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface.

[0008] In other preferred embodiments, the shapes of the guiding portions are selected from a group consisting of linear, curved, parallel or symmetrical, indented on or protruding from the blade units of the impeller, forming different veins, sand-like particles or rough spots on the blade surfaces of the blade unit.

[0009] The guiding portions formed on each blade units of the impeller increase remains on stagnation of airflow, meaning airflow can stay on the surfaces of the blade units longer, thus delaying the occurrence of separation flow. Furthermore, configuration of the airflow boundary layer can be adjusted to form different types of wake flow for decreasing narrowband noise.

[0010] A detailed description is given in the following embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

[0012] FIG. 1 is a perspective view of an impeller (F1) according the first embodiment of the present invention;

[0013] FIG. 2A is a sectional view of a single blade unit (II) of the impeller (F1) along line A-A of FIG. 1;

[0014] FIG. 2B is a plane view of a variant blade unit (II') according to the blade unit (II) of the impeller (F1) of FIG. 2A;

[0015] FIG. 3 is a perspective view of an impeller (F2) according the second embodiment of the present invention;

[0016] FIG. 4A is a sectional view of a single blade unit (21) of the impeller (F2) along line B-B of FIG. 3;

[0017] FIG. 4B is a plane view of a variant blade unit (21') according to the blade unit (21) of the impeller (F2) of FIG. 4A;

[0018] FIG. 5 is a perspective view of an impeller (F3) according the third embodiment of the present invention;

[0019] FIG. 6A is a sectional view of a single blade unit (31) of the impeller (F3) along line C-C of FIG. 5;

[0020] FIG. 6B is a plane view of a variant blade unit (31') according to the blade unit (31) of the impeller (F3) of FIG. 6A;

[0021] FIG. 7A is a perspective view of an impeller (F4) according the fourth embodiment of the present invention, wherein the impeller (F4) comprises a plurality of blade units (41);

[0022] FIG. 7B is a plane view of a variant blade unit (41') according to the blade unit (41) of the impeller (F4) of FIG. 7A; and
FIG. 8 is a perspective view of a heat-dissipating module (M) disposed on a heat source (H), wherein the heat-dissipating module (M) comprises a conductive element (S) and a fan structure (K) having the impeller (F1).

DETAILED DESCRIPTION

The impeller of the invention is applicable to different types of fan structures or modules for dissipating heat from a heat source such as a CPU, or other electronic components that generate heat.

Referring to FIG. 1, in a first embodiment of the invention, an impeller F1 comprises a cylindrical main body 10 and a plurality of blade units 11.

The main body 10 has an annular base surface 100 on the periphery thereof. The blade units 11 extend from the base surface 100 of the main body 10. Each blade unit 11 comprises two blade surfaces 110, 110' and a plurality of guiding portions 111a, 111b. The blade surfaces 110, 110' are two opposite surfaces formed on each blade unit 11, and each blade surface 110 of each blade unit 11 functions as an active surface to form airflow while the impeller F1 rotates. The guiding portions 111a, 111b are formed on each blade surface 110 of the blade units 11.

In this embodiment, the number of guiding portions for each blade surface 110 of the blade units 11 is two (111a, 111b), and the guiding portions 111a, 111b are substantially spaced apart and disposed in parallel on the blade surface 110 of each blade unit 11, i.e., the guiding portions 111a, 111b formed on the blade surface 110 extend in the longitudinal direction L of each blade unit 11 in parallel.

In FIG. 2A, a cross-sectional view shows the rectangular structure of the blade unit 11 of the impeller F1 along line A-A of FIG. 1. The guiding portions 111a, 111b are two linear recesses, uniformly and symmetrically, formed on the blade surface 110 of the blade unit 11, i.e., the guiding portions 111a, 111b are integrally lined and indented on the blade surface 110 of the blade unit 11.

FIG. 2B shows a variant blade unit 11' differing from the blade unit 11 of the impeller F1 of FIG. 2A in that two guiding portions 111a', 111b' are integrally protruded from the blade surface 110 of the blade unit 11', i.e., the guiding portions 111a', 111b' are two linear protrusions, uniformly and symmetrically, formed on the blade surface 110 of the blade unit 11'.

Referring to FIG. 3, in a second embodiment of the invention, an impeller F2 comprises the cylindrical main body 10 and a plurality of blade units 21 extending from the base surface 100 of the main body 10.

The blade units 21 of the impeller F2 in FIG. 3 differs from the blade units 11 of the impeller F1 in FIG. 1 in that a plurality of spaced guiding portions 211a and 211b, radially and in parallel, are formed on each blade surface 210 of the blade units 21, opposite to another blade surface 210 thereof. That is to say, each guiding portion 211a, 211b formed on the blade surface 210 of the blade units 21 is linear and substantially angular to the longitudinal direction L of the blade unit 21 with an angle "a".

In FIG. 4A, a cross-sectional view shows the rectangular structure of the blade unit 21 of the impeller F2 along line B-B of FIG. 3. The guiding portions 211a, 211b are spaced linear recesses, uniformly and symmetrically, formed on the blade surface 210 of the blade unit 21, i.e., the guiding portions 211a, 211b are integrally indented on the blade surface 210 of the blade unit 21.

In FIG. 4B, a variant blade unit 21' differs from the blade unit 21 of the impeller F2 of FIG. 4A in that two guiding portions 211a, 211b are integrally protruded from the blade surface 210 of the blade unit 21', i.e., the guiding portions 211a', 211b' are spaced linear protrusions formed uniformly and radially on the blade surface 210 of the blade unit 21'.

Referring to FIG. 5, in a third embodiment of the invention, an impeller F3 comprises the cylindrical main body 10 and a plurality of blade units 31 extending from the base surface 100 of the main body 10.

The blade units 31 of the impeller F3 in FIG. 5 differ from the blade units 11 of the impeller F1 in FIG. 1 in that a plurality of spaced guiding portions 311a, 311b are symmetrically formed on each blade surface 310 of the blade units 31, opposite to another blade surface 310 thereof. That is to say, each guiding portion 311a, 311b formed on the blade surface 310 of the blade units 31 is symmetrical and expansively curved on the blade surface 310 of the blade units 31 in the longitudinal direction L.

In FIG. 6A, a sectional view shows the rectangular structure of the blade unit 31 of the impeller F3 along line C-C of FIG. 5. The guiding portions 311a, 311b are spaced linear recesses, uniformly and symmetrically, formed on the blade surface 310 of the blade units 31, i.e., the guiding portions 311a, 311b are integrally indented on the blade surface 310 of the blade unit 31.

FIG. 6B shows a variant blade unit 31' differing from the blade unit 31 of the impeller F3 of FIG. 6A in that two spaced guiding portions 311a', 311b' are integrally protruded from the blade surface 310 of the blade unit 31', i.e., the guiding portions 311a', 311b' are linear protrusions, uniformly and symmetrically, formed on the blade surface 310 of the blade unit 31'.

Referring to FIG. 7A, in a fourth embodiment of the invention, an impeller F4 comprises the cylindrical main body 10 and a plurality of blade units 41 extending from the base surface 100 of the main body 10.

Each blade unit 41 comprises a blade surface 410 and a plurality of guiding portions 411 formed on the blade surface 410. The blade surface 410 of each blade unit 41 functions as an active surface to form airflow while the impeller F4 rotates.

In an exploded view of FIG. 7A (dotted line), the guiding portions 411 are spaced dimples or recesses, uniformly or irregularly, formed on the blade surface 410 of the blade unit 41, i.e., the guiding portions 411 are integrally indented on the blade surface 410 of the blade unit 41.

FIG. 7B shows a variant blade unit 41' differing from the blade unit 41 of the impeller F4 of FIG. 7A in that a plurality of guiding portions 411' are spaced protrusions or sand-like particles uniformly or irregularly formed on the blade surface 410 of the blade unit 41, i.e., the guiding portions 411' are integrally protruded from the blade surface 410 of the blade unit 41.
In FIG. 8, a heat-dissipating module M is disposed on a heat source H of a circuit or motherboard P of a notebook or personal computer. The heat-dissipating module M comprises a conductive element S and a fan structure K. The conductive element S is a fin structure directly attached on the heat source H. The fan structure K, comprising a housing F0 and the impeller F1 rotatably disposed in the housing F0, is directly disposed on the conductive element S to transmit airflow to the conductive element S. In this application, the impeller F1 disposed in the housing F0 of the fan structure K can be replaced by the impeller F2, F3 or F4. During operation, the induced air flowing by the impeller F1 passes the conductive element S to dissipate heat therefrom.

With the guiding portions (111a/111b, 111a′/111b′, 211a/211b, 211a′/211b′, 311a/311b, 311a′/311b′, 411, 411′) formed on each blade unit (11, 11′, 21, 21′, 31, 31′, 41, 41′) of the impeller (F1, F2, F3, F4), designed from a group consisting of linear, curved, parallel or symmetrical, indented on or protruded from the blade units, viscosity of airflow to the surfaces of the blade units can thus increase the length of the stagnation phenomenon of airflow. That is to say, airflow remains on the surfaces of the blade units longer to delay the occurrence of separation flow.

Furthermore, the guiding portions (111a/111b, 111a′/111b′, 211a/211b, 211a′/211b′, 311a/311b, 311a′/311b′, 411, 411′) formed on the blade units (11, 11′, 21, 21′, 31, 31′, 41, 41′) of the impeller (F1, F2, F3, F4) can change the configuration of the airflow boundary layer of airflow to form different types of wake flow thereby decreasing narrowband noise.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to accommodate various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. An impeller, comprising:
   a main body comprising a base surface; and
   a plurality of blade units extending from the base surface of the main body, wherein each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface.

2. The impeller as claimed in claim 1, wherein the guiding portions are integrally indented structures on the blade surface of the blade unit.

3. The impeller as claimed in claim 1, wherein the guiding portions are integrally protruded structures from the blade surface of the blade unit.

4. The impeller as claimed in claim 1, wherein at least one of the guiding portions is substantially aligned with the blade surface of the blade unit.

5. The impeller as claimed in claim 1, wherein at least two of the guiding portions are substantially spaced on the blade surface of the blade unit in parallel.

6. The impeller as claimed in claim 1, wherein at least one of the guiding portions is substantially curved on the blade surface of the blade unit.

7. The impeller as claimed in claim 6, wherein two of the guiding portions are substantially and expansively curved on the blade surface of the blade unit in the longitudinal direction thereof.

8. The impeller as claimed in claim 1, wherein at least two of the guiding portions are substantially and symmetrically spaced on the blade surface of the blade unit.

9. The impeller as claimed in claim 1, wherein the guiding portions are substantially and expansively linear structures on the blade surface of the blade unit in the longitudinal direction thereof.

10. The impeller as claimed in claim 1, wherein the guiding portions comprise a plurality of recesses or protrusions, formed on the blade surface of the blade unit.

11. A fan structure, comprising:
   a housing;
   an impeller rotatably disposed in the housing, comprising a main body having a base surface and a plurality of blade units extending from the base surface of the main body, wherein each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface.

12. The impeller as claimed in claim 11, wherein the guiding portions of the impeller are integrally indented structures on the blade surface of the blade unit.

13. The fan structure as claimed in claim 11, wherein the guiding portions of the impeller are integrally protruded structures from the blade surface of the blade unit.

14. The fan structure as claimed in claim 11, wherein at least one of the guiding portions of the impeller is substantially aligned with the blade surface of the blade unit.

15. The fan structure as claimed in claim 11, wherein at least two of the guiding portions of the impeller are substantially spaced apart in parallel and on the blade surface of the blade unit.

16. The fan structure as claimed in claim 11, wherein at least one of the guiding portions of the impeller is substantially curved on the blade surface of the blade unit.

17. The fan structure as claimed in claim 16, wherein two of the guiding portions of the impeller are substantially and expansively curved on the blade surface of the blade unit in the longitudinal direction thereof.

18. The fan structure as claimed in claim 11, wherein at least two of the guiding portions of the impeller are substantially and symmetrically spaced on the blade surface of the blade unit.

19. The fan structure as claimed in claim 11, wherein the guiding portions are substantially and expansively linear structures on the blade surface of the blade unit in the longitudinal direction thereof.

20. The fan structure as claimed in claim 11, wherein the guiding portions of the impeller comprise a plurality of recesses or protrusions, formed on the blade surface of the blade unit.

21. A heat-dissipating module for dissipating heat from a heat source, comprising:
   a conductive element disposed on the heat source;
   a fan structure disposed on the conductive element, comprising a housing and an impeller rotatably disposed in
the housing, wherein the impeller comprises a main body having a base surface and a plurality of blade units extending from the base surface of the main body, and each blade unit comprises a blade surface and a plurality of guiding portions disposed on the blade surface.

22. The heat-dissipating module as claimed in claim 21, wherein the guiding portions of the impeller are integral recesses or protrusions on the blade surface of the blade unit.