ABSTRACT

A cooling fan, which may be installed on a corresponding position of the cooling fans of a CPU or a cooling hole-plate of a computer mainframe, includes: a fan body, a fan frame and a fan impeller. The fan frame is circular in shape. The fan body is arranged along the outer circumference of the fan frame. The fan impeller is installed in the fan frame. A rubber layer, which is formed by secondary injection molding, is arranged at the outer surface of the fan body and the contact parts between the cooling fins and the upper and lower edges of the fan frame, respectively. Through holes are provided at the upper and lower parts of four end corners of the fan body, respectively, and rubber layers are also provided at the inner walls of the through holes.
COOLING FAN

TECHNICAL FIELD

[0001] The present invention relates to a cooling device, in particular to a cooling fan used for a cooling element such as a set of cooling fins of a CPU or a cooling hole-plate of a computer mainframe.

BACKGROUND ART

[0002] With rapid development of the information industry, the operating speed of electronic components is increasing; as a result, waste heat generated during the running of computer systems also increases substantially. If not spread, the waste heat generated during the running of computer systems will undermine the performance of computer systems or even cause damages to computer systems. Therefore, a cooling device is needed to dissipate the waste heat generated during the operation of the computer system. Usually, a cooling device used for computer systems is a fan. In order to achieve greater cooling efficiency, the rotating speed of the cooling fan is getting faster and faster. However, the vibration frequency brought by the high-speed operating fan will also increase. Vibrations of the high-speed operating fan, which is installed on a CPU cooler or in a computer mainframe, will be transmitted via the cooler to the CPU and its surrounding devices, such as a hard disk. Thus, the performance of the surrounding devices of the CPU is affected or even the surrounding devices may be easily damaged. If the cooling fan is installed in the computer mainframe, loud noise will be generated by the operation of the cooling fan due to loose contact between the cooling fan and the inner wall of the computer mainframe. Therefore, how to reduce the influence to the surrounding devices of a computer mainframe generated by the operation of the cooling fan has become an important subject. Due to excessive running speed and vibration of the cooling fan of the prior arts, the service life of the computer is affected.

SUMMARY OF THE INVENTION

[0003] To overcome the above defects of the prior arts, the present invention provides rubber layers made by secondary injection molding to the outer surface of the fan body and the upper and lower edges of the fan frame, so that flexible contact between the cooling fan and the cooling fins can be achieved, thereby effectively offsetting the longitudinal, transverse impact and vibration and reducing noise.

[0004] The cooling fan of the present invention, which is installed at the corresponding position of a cooling element, includes a fan body, a fan frame and a fan impeller, wherein the fan frame is circular in shape, the fan body is arranged along the outer circumference of the fan frame, and the fan impeller is installed in the fan frame, wherein a rubber layer, which is formed by secondary injection molding, is arranged at the outer surface of the fan body and the place that touches the cooling element at upper and lower edges of the fan frame, respectively.

[0005] The cooling element is a set of cooling fins for a CPU in a computer mainframe or a cooling hole-plate of a computer mainframe.

[0006] Preferably, through holes are provided at the upper and lower parts of four end corners of the fan body, respectively, and rubber layers are also provided at the inner walls of the through holes, so that after secondary injection molding, the outer edges of the through holes are made level with the corresponding upper and lower edges of the fan frame.

[0007] When the cooling fan is installed on the set of cooling fins, the cooling fan is preferably fastened by a steel wire button to the corresponding positions of the set of cooling fins, wherein the contact places between the cooling fan and the cooling fins are rubber layers that are formed by secondary injection molding.

[0008] When the cooling fan is installed on the set of cooling fins, the four frames of the fan body are in the shape of a three-dimensional X; the upper and lower parts of the end corners are parallel with each other; through holes are provided within the planes of the upper and lower parts of the end corners, respectively; and supporting portions are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body.

[0009] When the cooling fan is installed on the set of cooling fins, the four frames of the fan body are in the shape of a three-dimensional double U, wherein the U-shaped openings face the end corners of the fan body and the U-shaped openings of adjacent frames converge and are connected as one piece; the upper and lower parts of the end corners are parallel with each other; through holes are provided within the planes of the upper and lower parts of the end corners, respectively; and supporting portions are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body.

[0010] When the cooling fan is installed on the cooling hole-plate of a computer mainframe, the assembled cooling fan is fastened by vibration absorbing screws to the cooling hole-plate of the computer mainframe, wherein through holes of the computer mainframe are provided on the cooling hole-plate and are coaxial with the corresponding through holes of the fan body; the vibration absorbing screws are provided with a conical portion and a clipping position; when fixing the assembled cooling fan, the conical portion sequentially passes the mainframe through holes, lower through holes of the end corner of the fan body, the cooling hole-plate of the computer mainframe and the lower part of the end corner, and is clipped within the clipping position; and wherein the vibration absorbing screw is made of rubber.

[0011] When the cooling fan is installed on the cooling hole-plate of a computer mainframe, the fan body are four end corners disposed on the outer circumference of the fan frame at uniform intervals, wherein the upper and lower parts of the end corners being parallel with each other; through holes of the fan body are provided within the planes of the upper and lower parts of the end corners, respectively; and wherein supporting portions are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body.

[0012] Compared with the prior arts, the present invention provides rubber layers made by secondary injection molding to the upper and lower edges of the fan frame and the fan body. The upper edges of the through holes keep level with the upper and lower edges of the fan frame, so that the contact areas between the cooling fan and the set of cooling fins for a CPU in a computer mainframe or the cooling hole-plate of a computer mainframe are rubber layers. Thus, flexible contact between the cooling fan and the cooling fins or the cooling hole-plate of a computer mainframe can be achieved, thereby
effectively offsetting the longitudinal, transverse impact and vibration, reducing noise and extending the service life of the cooling fan.

EXPLANATION OF THE DRAWINGS

[0013] The drawings are provided to facilitate the understanding of the present invention and form a part of the description. The drawings are intended to illustrate the present invention together with the embodiments of the present invention and are not intended to limit the present invention. Among the drawings,

[0014] FIG. 1 is a schematic view of an assembled cooling fan of Embodiment 1 of the present invention (before the rubber layers are molded by secondary injection);

[0015] FIG. 2 is a schematic view of the rubber layers of the cooling fan of Embodiment 1 of the present invention after the rubber layers are molded by secondary injection;

[0016] FIG. 3 is a perspective view of an assembled cooling fan of Embodiment 1 of the present invention;

[0017] FIG. 4 is a schematic view of an assembled cooling fan of Embodiment 2 of the present invention (before the rubber layers are molded by secondary injection);

[0018] FIG. 5 is a schematic view of the rubber layers of the cooling fan of Embodiment 2 of the present invention after the rubber layers are molded by secondary injection;

[0019] FIG. 6 is a perspective view of an assembled cooling fan of Embodiment 2 of the present invention;

[0020] FIG. 7 is a schematic view of a cooling fan of the present invention assembled with a set of cooling fins (take the cooling fan of Embodiment 1 as an example);

[0021] FIG. 8 is a schematic view of a cooling fan of the present invention assembled with a set of cooling fins of FIG. 7 (i.e., an application state view);

[0022] FIG. 9 is a schematic view showing the assembling process of a cooling fan of Embodiment 3 of the present invention (before the rubber layers are molded by secondary injection);

[0023] FIG. 10 is a schematic view of the rubber layers of the cooling fan of Embodiment 3 of the present invention after the rubber layers are molded by secondary injection;

[0024] FIG. 11 is a perspective view of an assembled cooling fan of Embodiment 3 of the present invention;

[0025] FIG. 12 is a schematic view showing the assembling process of a cooling fan of the present invention with a cooling hole-plate of a computer mainframe (take the cooling fan of Embodiment 3 as an example).

[0026] The following reference signs are provided with reference to the above drawings:

[0027] 1-fan impeller, 2-fan frame, 3-fan body, 4-rubber layer, 5-set of cooling fins for a CPU, 6-steel wire button, 7-cooling hole-plate of a computer mainframe, 8-vibration absorbing screw, 31-through hole, 32-upper part of end corner, 33-lower part of end corner, 34-supporting portion, 3A-fan body, 31A-through hole, 32A-upper part of end corner, 33A-lower part of end corner, 34A-supporting portion, 4A-rubber layer, 3B-fan body, 31B-through hole, 32B-upper part of end corner, 33B-lower part of end corner, 34B-supporting portion, 4B-rubber layer, 71-through hole of computer mainframe, 81-conical portion, 82-clipping position.

EMBEDMENT

[0028] The followings will specifically describe several embodiments of this invention with reference to the drawings.

However, it should be understood that the protection scope of this invention shall not be restricted by the specific embodiments. It should be noted that the cooling fan of this invention can be installed on the element that needs cooling. The followings will specifically describe an example in which the cooling fan is installed on a set of cooling fins of a CPU or a cooling hole-plate of a computer mainframe.

Embodiment 1

[0029] As shown in FIGS. 1-3, the cooling fan of this invention, which is installed at the corresponding position of a set of cooling fins 5 of a CPU (i.e., the outer surface thereof, see FIGS. 7-8), includes a fan body 3, a fan frame 2 and a fan impeller 1, wherein the fan impeller 1 is installed in the fan frame 2, the fan frame 2 is circular in shape, and the fan body 3 is arranged along the outer circumference of the fan frame. The frame of the fan body 3 is in a square shape, wherein the four sides of the square are in a three-dimensional X shape. The end corners of the X-shaped structure are divided into upper parts 32 (there are four upper parts in total) and lower parts 33 (there are four lower parts in total). The upper and lower parts of the end corners are parallel with each other. Supporting portions 34 are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body. Through holes 31 (there are 8 through holes in total) are provided in the planes of the upper and lower parts of the end corners, respectively. A rubber layer 4, which is formed by secondary injection molding, is arranged at the outer surface of the fan body 3 and the contact parts between the set of cooling fins and the upper and lower edges of the fan frame, respectively. After secondary injection molding, the upper edges of the through holes 31 of the fan body are made level with the corresponding upper and lower edges of the fan frame 2. The circular inner wall of the fan frame 2 is made of a rubber material that is formed by primary injection molding (i.e., secondary injection molding is not performed here).

Embodiment 2

[0030] As shown in FIGS. 4-6, the cooling fan of this invention, which is installed at the corresponding position of a set of cooling fins 5 of a CPU (i.e., the outer surface), includes a fan body 3A, a fan frame 2 and a fan impeller 1, wherein the fan impeller 1 is installed in the fan frame 2, the fan frame 2 is circular in shape, and the fan body 3A is arranged along the outer circumference of the fan frame. The frame of the fan body 3A is in a square shape, wherein the four sides of the square are in a three-dimensional double U shape. The U-shaped openings face the end corners of the fan body and the U-shaped openings of adjacent frames converge and are connected as one piece. The end corners of the U-shaped structure are divided into upper parts 32A (there are four upper parts in total) and lower parts 33A (there are four lower parts in total). The upper and lower parts of the end corners are parallel with each other. Supporting portions 34A are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body. Through holes 31A (there are 8 through holes in total) are provided in the planes of the upper and lower parts of the end corners, respectively. A rubber layer 4A, which is formed by secondary injection molding, is arranged at the outer surface of the fan body 3A and the contact parts between the set of cooling fins and the upper and lower edges of the fan frame,
respectively. After secondary injection molding, the upper edges of the through holes 31A of the fan body are made level with the corresponding upper and lower edges of the fan frame 2. The circular inner wall of the fan frame 2 is made of a rubber material that is formed by primary injection molding (i.e., secondary injection molding is not performed here).

[0031] An assembled cooling fan of the above two embodiments can be applied to a set of cooling fins of a CPU or used for cooling a computer mainframe or used for other cooling elements. The followings describe the installation process of the cooling fan of Embodiment 1 when the cooling fan is applied to a set of cooling fins of a CPU, for example. As shown in FIGS. 7-8, when the cooling fan is to be installed, the hook structures at both ends of a steel wire button pass the through holes of the lower parts of the end corners of the fan body and are clipped therein, wherein a middle portion of the steel wire button is clipped at the corresponding position of the set of cooling fins. The assembled cooling fan is clipped by the steel wire button 6 to the corresponding position of the set of cooling fins of a CPU, so that the contact parts between the cooling fan and the cooling fins are the above rubber layers made by secondary injection molding.

Embodyement 3

[0032] As shown in FIGS. 9-11, the cooling fan of this invention, which is installed at the corresponding position of a cooling hole-plate 7 of a computer mainframe, includes a fan body 3B, a fan frame 2 and a fan impeller 1, wherein the fan impeller 1 is installed in the fan frame 2, the fan frame 2 is circular in shape, and the fan body 3B is arranged along the outer circumference of the fan frame. The body 3B consists of four end corners disposed on the outer circumference of the fan frame at uniform intervals. The end corners are divided into upper parts 32B (there are four upper parts in total) and lower parts 33B (there are four lower parts in total). The upper and lower parts of the end corners are parallel with each other. Supporting portions 34B are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body. Through holes 31B (there are 8 through holes in total) are provided in the planes of the upper and lower parts of the end corners, respectively. A rubber layer 4B, which is formed by secondary injection molding, is arranged at the outer surface of the fan body 3B and the contact parts between the cooling hole-plate 7 and the upper and lower edges of the fan frame, respectively. After secondary injection molding, the upper edges of the through holes 31B of the fan body are made level with the corresponding upper and lower edges of the fan frame 2. The circular inner wall of the fan frame 2 is made of a rubber material that is formed by primary injection molding (i.e., secondary injection molding is not performed here).

[0033] An assembled cooling fan of Embodiment 3 is fixed by vibration absorbing screws to a cooling hole-plate of a computer mainframe. The cooling hole-plate is provided with through holes 71 (there are four such through holes in total) of the computer mainframe, which are co-axial with the corresponding through holes of the fan body. The vibration absorbing screws are provided with a conical portion 81 and a clipping position 82. When fixing the assembled cooling fan, the conical portion 81 sequentially passes through the holes 71 of the computer mainframe, the lower through holes of the end corner of the fan body, the cooling hole-plate 7 of the computer mainframe and the lower part of the end corner, and is clipped within the clipping position 82. The vibration absorbing screws are also made of rubber so as to absorb vibration after the cooling fan is fixed to the computer mainframe. Of course, except for cooling a computer mainframe, the cooling fan of Embodiment 3 can also be applied to a set of cooling fins of a CPU or other cooling elements.

[0034] Since the upper and lower edges of the fan frame of the cooling fan of the present invention and the fan body, which have been secondarily injection molded, are rubber layers formed by secondary injection molding, and the upper edges of the through holes are made level with the corresponding upper and lower edges of the fan frame, the contact parts between the cooling fan and the set of cooling fins of a CPU or a computer mainframe are rubber layers. Thus, flexible contact between the cooling fan and the cooling fins or the cooling hole-plate of a computer mainframe can be achieved, thereby effectively offsetting the longitudinal, transverse impact and vibration, reducing noise and extending the service life of the cooling fan.

[0035] The above disclosure only covers several specific embodiments of the present invention, but the present invention is not limited thereto. Any variations of the present invention that a person skilled in the art can conceive of shall fall into the protection scope of this invention.

1. A cooling fan, which is installed at a corresponding position of a cooling element, comprising a fan body, a fan frame and a fan impeller, wherein the fan frame is circular in shape, the fan body is arranged along an outer circumference of the fan frame, and the fan impeller is installed in the fan frame, the cooling fan further comprising a rubber layer, which is formed by secondary injection molding, arranged at an outer surface of the fan body and contact parts between the cooling element and upper and lower edges of the fan frame, respectively.

2. The cooling fan according to claim 1, wherein the cooling element is a set of cooling fins for a CPU in a computer mainframe.

3. The cooling fan according to claim 1, wherein the cooling element is a cooling hole-plate of a computer mainframe.

4. The cooling fan according to claim 1, wherein through holes are provided at upper and lower parts of four end corners of the fan body, respectively, and rubber layers are also provided at inner walls of the through holes, so that after secondary injection molding, outer edges of the through holes are made level with the corresponding upper and lower edges of the fan frame.

5. The cooling fan according to claim 2, wherein an assembled cooling fan is fastened by a steel wire button to the corresponding positions of the set of cooling fins, wherein the contact parts between the cooling fan and the cooling fins are rubber layers that are formed by secondary injection molding.

6. The cooling fan according to claim 5, wherein the four frames of the fan body are in the shape of a three-dimensional X, wherein the upper and lower parts of the end corners are parallel with each other; through holes are provided within the planes of the upper and lower parts of the end corners, respectively; and wherein supporting portions are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body.

7. The cooling fan according to claim 5, wherein the four frames of the fan body are in the shape of a three-dimensional double U, wherein the U-shaped openings face the end corners of the fan body and the U-shaped openings of adjacent frames converge and are connected as one piece; the upper
and lower parts of the end corners are parallel with each other; through holes are provided within the planes of the upper and lower parts of the end corners, respectively; and wherein supporting portions are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body.

8. The cooling fan according to claim 3, wherein an assembled cooling fan is fastened by vibration absorbing screws to the cooling hole-plate of the computer mainframe, wherein through holes of the computer mainframe are provided on the cooling hole-plate and are co-axial with the corresponding through holes of the fan body; the vibration absorbing screws are provided with a conical portion and a clipping position; and wherein when fixing the assembled cooling fan, the conical portion sequentially passes the mainframe through holes, the lower through holes of the end corner of the fan body, the cooling hole-plate of the computer mainframe and the lower part of the end corner, and is clipped within the clipping position.

9. The cooling fan according to claim 8, wherein the vibration absorbing screw is made of rubber.

10. The cooling fan according to claim 8, wherein the fan body consists of four end corners disposed on the outer circumference of the fan frame at uniform intervals, wherein the upper and lower parts of the end corners being parallel with each other; the through holes of the fan body are provided within the planes of the upper and lower parts of the end corners, respectively; and wherein supporting portions are provided between the upper and lower parts of the end corners, the supporting portions being integrally formed with the fan body.