

(19)



(11)

EP 1 619 394 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
29.05.2013 Bulletin 2013/22

(51) Int Cl.:
F04D 29/54 ^(2006.01) **F04D 25/08** ^(2006.01)

(21) Application number: **04106433.8**

(22) Date of filing: **09.12.2004**

(54) **Fan assembly**

Lüftereinheit

Ensemble ventilateur

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**

(30) Priority: **20.07.2004 CN 200410070000**

(43) Date of publication of application:
25.01.2006 Bulletin 2006/04

(73) Proprietor: **Delta Electronics, Inc.**
Taoyuan Hsien 333 (TW)

(72) Inventors:
• **LU, Lobato**
333, Taoyuan Hsien (TW)

• **WANG, Ke-Nan**
333, Taoyuan Hsien (TW)
• **HUANG, Wen-Shi**
333, Taoyuan Hsien (TW)

(74) Representative: **2K Patentanwälte Blasberg**
Kewitz & Reichel
Partnerschaft
Corneliusstraße 18
60325 Frankfurt a. M. (DE)

(56) References cited:
GB-A- 2 168 756 **US-A- 4 365 187**
US-A1- 2002 003 381

EP 1 619 394 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description**BACKGROUND**

5 **[0001]** The invention relates to a fan assembly, and in particular to a fan assembly applicable to a light source producing heat.

[0002] With the continuous development of electronic devices, heat dissipation systems become necessary as temperature is significantly increased due to heat produced during operation. If heat is not appropriately dissipated, high temperature causes performance to deteriorate and may cause the electronic devices to fail. Particularly, since the design of semiconductor and integrated circuits (IC) has improved, the integrated circuit size has been reduced and the number of transistors per unit area has substantially increased, further concentrating heat energy. Thus, a heat dissipation system is required to effectively dissipate the excess heat and maintain working temperature.

10 **[0003]** A fan assembly is the most popular heat dissipation apparatus. Fig. 1A is a top view of a conventional fan assembly, and Fig. 1B is a cross section of Fig. 1A. As shown in Figs. 1A and 1B, the conventional fan 10 comprises a frame 11, an impeller 15, and a motor (not shown). The motor is disposed in a motor base 12 to drive the impeller 15. The frame 11 comprises a body with an opening defined therein. The motor base 12 disposed in the frame 11 is supported by a plurality of ribs 13. The ribs 13 can be cylindrical, arced, or streamlined. The impeller 15 comprises a plurality of radially arranged blades 14.

20 **[0004]** As shown in Fig. 1B, as known, when two ribs 13 are both connected to the motor base 12 and the frame 11, they are not located along the same diameter of the impeller 15, and the cross section of the two ribs 13 would be discontinuous. For clear illustration, however, the ribs are shown in their entirety in Fig. 1B.

[0005] During rotation of the impeller 15, a gap is formed between the frame 11 and the blades 14 to prevent contact therebetween, which produces friction and noise, as shown in Fig. 1A. If the fan assembly 10, however, is applied to an optical machine to dissipate heat of the light source (lamp) L, the emitted light Lp may partially penetrate the gap between the frame 11 and the blades 14, causing light loss, as shown in Fig. 1B. Consequently, the projected light intensity is reduced, and if escaped light Lp continuously illuminates other areas or objects such as a desk, the surface of the desk can be damaged by the light. The escaped light not only damages the surroundings but also causes safety concerns.

25 **[0006]** GB 1 168 756 A discloses an axial flow fan having a motor which is mounted within a tubular housing on a hub flange carried by spokes, wherein the hub and spokes are coplanar with the other end plane of the tubular housing. Both the inner peripheral wall of the fan frame and the front (outer) edge of the impeller blades are, however, straight-lined. A fan frame having a concave or convex inner peripheral wall is not disclosed. The blade edges extend in parallel with the inner peripheral wall of the fan frame.

30 **[0007]** US 4,365,187 discloses a fan having a similar design. More specifically, the inner peripheral wall of the fan frame firstly extends inwards and then radially outwards but is always straight-lined. The front (outer) edge of the impeller blades has a corresponding shape and is also straight-lined.

35 **[0008]** US 2002/0003381 A1 discloses another fan frame, wherein the front (outer) edge of the impeller blade is concave but is not correspondingly shaped to the inner peripheral wall of the fan frame. Particularly, a gap between the inner peripheral wall of the fan frame and the front (outer) edge of the impeller blade is not constant but converging or funnel-shaped.

SUMMARY

40 **[0009]** It is an object of the present invention to provide an enhanced fan assembly enabling an efficient light blocking effect while efficiently dissipating heat.

45 **[0010]** This problem is solved by a fan assembly according to claim 1 or 11. Further advantageous embodiments are the subject-matter of the dependent claims.

[0011] Embodiments of the invention provide a fan assembly with various frames and corresponding blade edge designs to fully obstruct a light path between the blades and the frame, for preventing loss of light and being applicable to a light source that produces heat.

50 **[0012]** The fan assembly comprises a frame and an impeller. The frame comprises an opening and a periphery of the opening has a curved surface. The impeller is disposed in the body. When light emitted by the light source enters the opening, the light is blocked from penetrating the opening by the curved surface. Moreover, the opening of the body comprises an inlet and an outlet, the emitted light entering the inlet is blocked by the curved surface, preventing light emission from out of the outlet.

55 **[0013]** According to a further embodiment a periphery of the opening has at least one inclined surface. The impeller is disposed in the body. When light emitted by the light source enters the opening of the frame, the light is blocked from penetrating the opening by the inclined surface. The periphery of the opening comprises multi-sectional inclined surfaces with different inclined angles. The impeller comprises blade edges, parallel to the multi-sectional inclined surfaces.

Moreover, the periphery of the opening comprises multi-sectional inclined surfaces, protruded toward a central axis of the opening, and the impeller comprises blade edges facing the concave sides of the multi-sectional inclined surfaces, and the periphery of the opening exceeds a line connected by two ends of the concave sides.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Embodiments of the invention can be more fully understood by reading the subsequent detailed description in conjunction with the examples and references made to the accompanying drawings, wherein:

Fig. 1A is a top view of a conventional fan assembly;
 Fig. 1B is a cross section of the conventional fan assembly;
 Figs. 2A and 2B are cross sections of two fan assemblies according to the invention;
 Figs. 3A to Fig. 4G show examples of fan assemblies serving for a better understanding of the present invention.

DETAILED DESCRIPTION

First Embodiment

[0015] Figs. 2A and 2B are cross sections of a fan assembly according to a first embodiment of the invention. The fan assembly 20 comprises a frame 21, an impeller 24, and a motor (not shown). The motor is disposed in a motor base 22 for driving the impeller 25. The frame 21 comprises a body with an opening 26 defined therein. The periphery 27 of the opening 26 has a curved surface. The motor base 22 is disposed in the body of the frame 21 and supported by a plurality of ribs 23. The impeller 25 comprises a plurality of radially arranged blades 24.

[0016] When the fan assembly 20 for dissipating heat is applied to a light source L producing heat such as a light bulb of a projector, light emitted by the light source L enters the opening 26, and the periphery 27 of the opening 26 has a curved surface for blocking the light, and thus, the light is prevented from penetrating the opening 26.

[0017] The periphery 27 of the opening 26 can have a curved surface depressed away from a central axis of the opening 26, as shown in Fig. 2A. The curved surface of the periphery 27 gradually contracts, and the blade edges of the impeller 25 correspond to the curved surface of the periphery 27 of the opening. Each edge of the blade 24 exceeds an imaginary line connecting the two ends of the curved surface of the periphery 27, namely the upper and lower end of the periphery 27. The imaginary line is represented by a dashed line in Fig. 2A. The blade edges of the impeller 25 are preferably parallel to the curved surface.

[0018] An inlet 211 and an outlet 212 are respectively formed at two ends of the opening 26 on the frame 21. The light emitted by the light source L enters the inlet 211 into the frame 21. The periphery 27 of the opening 26 having a concave surface corresponding to the blade edges can prevent light leakage from the outlet 212. Since a possible light path can be completely blocked at the location between the blades 24 and the frame 21, the problem of loss of light in a projector utilizing a conventional fan can be prevented. Furthermore, according to differing curved surfaces of the periphery 27 of the opening 26, the area of the external edge of the blades 24 can be further increased, thereby increasing air pressure.

[0019] Alternatively, the periphery 27 of the opening 26 can have a convex surface protruded toward a central axis of the opening 26, as shown in Fig. 2B. The frame 21 has an inwardly concave side, and the blade edges of the impeller 25 correspond to the convex surface of the periphery 27 of the opening 26 to form concave sides separately. The concave side edge of each blade 24 is facing and corresponding to the curved surface of the periphery 27. The blade edges of the impeller 25 are preferably parallel to the convex surface. The protruded convex surface of the periphery 27 of the opening 26 exceeds an imaginary line connecting two ends of the concave side of the blade 24 edges, namely the upper and lower end of the concave side of the blade 24 edges. The imaginary line is represented by a dashed line in Fig. 2B. Thus, when the light is emitted by the light source L, the light can be blocked from penetrating the frame 21, since the protruded surface of the periphery 27 of the opening 26 corresponds to the blade edges.

[0020] Furthermore, at the inlet 211 and the outlet 212 of the fan assembly 20 shown in Figs. 2A and 2B, the periphery 27 of the opening 26 or a vicinity thereof can be formed with an inclined angle or a guided inclined angle to increase the cross-sectional area of the flow path and increase the air flow intake. Moreover, the curved surface preferably comprises a contracting and an expanding curved surface, or a plurality of radial contracting and expanding curved surfaces in the fan assembly 20 in Fig. 2A or in Fig. 2B. Also, any two adjacent curved surfaces can have different curvature.

[0021] Figs. 3A and 3B are cross sections of a fan assembly serving for a better understanding of the present invention. The fan assembly 30 comprises a frame 31, an impeller 35, and a motor (not shown). The motor is disposed in a motor base 32 for driving the impeller 35. The frame 31 comprises a body with an opening 36 defined thereon. The periphery of the opening 36 has at least one inclined surface. The motor base 32 is disposed in the body of the frame 31 and supported by a plurality of ribs 33. The impeller 35 comprises a plurality of radially arranged blades 34.

[0022] When the fan assembly 30 for dissipating heat is applied to a light source L producing heat such as a light bulb

of a projector, light emitted by the light source L enters the opening 36, and the periphery 37 of the opening 36 has an inclined surface for blocking the light, and thus, the light is prevented from penetrating the opening 36.

[0023] The periphery 37 of the opening 36 comprises multi-sectional inclined surfaces with different inclined angles. For example, an inclined surface comprises a radially contracting inclined surface $3A_1$ and a radially expanding inclined surface $3A_2$, as shown in Fig. 3A. The cross section of the frame 31 is preferably constituted of the contracting inclined surface $3A_1$ and the expanding inclined surface $3A_2$ from the inlet 311 to the outlet 312. An external edge of the blade 34 is parallel to the contracting inclined surface $3A_1$ such that light is effectively blocked from penetrating the frame 31. Also, the expanding inclined surface $3A_2$ increases area of flow path, and increase airflow intake.

[0024] Additionally, the inclined surface comprises a plurality of a combination of radially contracting inclined surfaces and radially expanding inclined surfaces, and each two adjacent inclined surfaces are connected at different angles. For example, as shown in Fig. 3B, the cross section of the frame 31 can be considered as being consisted of several inclined surfaces with different angles, such as two contracting inclined surfaces $3B_1$, $3B_2$, and one expanding inclined surface $3B_3$, from the inlet 311 to the outlet 312. The contracting inclined surfaces $3B_1$, $3B_2$ can obstruct a potential light path between the blades 34 and the frame 31, and the external edges of the blades 34 are parallel to the contracting inclined surfaces $3B_2$. Also, the expanding inclined surfaces $3B_3$ increase area of the flow path, thereby increasing airflow intake.

[0025] Furthermore, as shown in Figs. 3C and 3D, the motor base 32 is disposed in the frame 31 and supported by a plurality of ribs 33. The motor base 32 and the ribs 33 can be disposed at the inlet 311 or the outlet 312. In Figs. 3C and 3D, the motor base 32 comprises a slope inclined radially in order to increase air outflow area, when the motor base 32 and the ribs 33 are disposed at the outlet 312. The slope can have a flat surface (Fig. 3C) or a curved surface (Fig. 3D). If the motor base 32 and the ribs 33 are disposed at the inlet 31 of the frame 31, the inclined motor base 32 can increase inflow area.

[0026] Furthermore, the inclined angle of the motor base 32 can be varied in accordance with different curvature of the cross section of the frame 31 to allow air smoothly flow between the motor base 32 and the frame 31, when the blades 34 rotate, so that noise can be reduced.

[0027] Figs. 4A to 4F are cross sections of a fan assembly serving for a better understanding of the present invention. The fan 40 comprises a frame 41, an impeller 45, and a motor (not shown). The motor is disposed in a motor base 42 for driving the impeller 45. The frame 41 comprises a body with an opening 46 defined thereon. The periphery 47 of the opening 46 comprises at least one inclined surface. The motor base 42 is disposed in the frame 41 and supported by a plurality of ribs 43. The impeller 45 comprises a plurality of radially arranged blades 44.

[0028] When the fan assembly 40 for dissipating heat is applied to a light source producing heat such as a light bulb of a projector, light emitted by the light source enters the opening 46, and the periphery 47 of the opening 46 has an inclined surface for blocking the light. The blades 44 have a maximum outer diameter greater than the inner diameter of the periphery 47 of the opening 46. As a result, a potential light path between the blades 44 and the frame 41 can be obstructed by an overlapping portion between the blades 44 and the periphery 47 of the opening 46. Thus, the light is prevented from penetrating the opening 46.

[0029] The frame 41 comprises at least one inclined surface or curved surface from an inlet 411 to an outlet 412. The cross section of the frame 41 can be gradually contracting curved surface, expanding curved surface or a combination thereof. The contracting curved surface obstructs the light path between the blades 44 and the frame 41. The expanding curved surface can increase area of the flow path and increase the airflow intake. Furthermore, the external edges of the blades can be designed with various shapes in accordance with the frame 41. For example, the external edges of the blades can be flat (as shown in Figs. 4C and 4D), conical (as shown in Figs. 4E and 4F), stepped shapes (as shown in Figs. 4A and 4B), and so on.

[0030] The invention is not limited to the above embodiment. Moreover, the blades 44 not only have maximum outer diameter greater than a minimum inner diameter of the periphery 47 of the opening 46, each blade 44a also partially overlaps with an adjacent blade 44b in an axial direction of the opening 46, as shown in Fig. 4G. Fig. 4G is a top view of the entire fan assembly according to the third embodiment of the invention. The overlapping blades can further effectively block the light.

[0031] Embodiments of the invention are compared to a conventional fan with a light-blocking experiment with the same size of frame from 50mm, 60mm, and 70mm frames in a black box. A 3000 Lux. of light irradiates in the black box. The amount of light passing through the fans is recorded in Table 1 as follows.

Table 1

	Frame size		
	SQ 50mm	SQ 60mm	SQ 70mm
fan assembly of the present invention	7.2 Lux	4.13 Lux	1.3 Lux
conventional fan assembly	490 Lux	329 Lux	318 Lux

[0032] In a 50mm-sized frame, the amount of light passing through the conventional fan assembly is 490 Lux, but the amount of light passing through the fan assembly of the invention designed with light-blocking characteristics is only 7.2 Lux. Thus it demonstrates that the present invention can block light effectively.

[0033] While the invention has been described by way of example and in terms of preferred embodiment, it is to be understood that the invention is not limited thereto. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope is defined by the appended claims.

Claims

1. A fan assembly, applicable to a light source producing heat, the fan assembly comprising:

a frame (21) comprising an opening (26) and a periphery (27) of the opening having a curved surface; and an impeller (25), disposed in the frame and comprising a plurality of radially extending blades (24);

characterized in that

the curved surface comprises a concave surface, which is depressed away from a central axis of the opening, and blade edges of the impeller correspond to the curved surface of the periphery of the opening and exceed an imaginary line connecting two ends of the curved surface, or

the curved surface comprises a convex surface, which is protruded toward a central axis of the opening and blade edges of the impeller correspond to the convex surface of the periphery of the curved surface to form concave sides facing the curved surface of the opening, and the curved surface of the periphery of the opening exceed an imaginary line connecting two ends of a respective concave side of the impeller

so that light emitted by the light source and entering the opening is blocked from penetrating the opening by the curved surface.

2. The fan assembly as claimed in claim 1, wherein the opening (26) forms an inlet (211) and an outlet (212) of the frame, and the emitted light entering the inlet is blocked from emitting out of the outlet by the curved surface.

3. The fan assembly as claimed in claim 2, wherein the periphery (27) of the opening comprises an inclined angle at the inlet or the outlet, or a vicinity of the periphery comprises a guided inclined angle.

4. The fan assembly as claimed in any of the preceding claims, wherein blade edges of the impeller extend in parallel to the curved surface.

5. The fan assembly as claimed in any of the preceding claims, wherein the curved surface comprises a contracting curved surface and an expanding curved surface.

6. The fan assembly as claimed in any of the preceding claims, further comprising a motor base (22) disposed in the frame, and a plurality of ribs (23) for supporting the motor base; wherein the motor base comprises a slope inclined radially, thereby increasing areas of air flow intake or outtake.

7. The fan assembly as claimed in claim 6, wherein the slope is flat or curved.

8. The fan assembly as claimed in any of the preceding claims, wherein the impeller has blades with a maximum outer diameter greater than a minimum inner diameter of the periphery of the opening.

9. The fan assembly as claimed in claim 8, wherein the impeller comprises blades with flat, conical, or stepped edges.

10. The fan assembly as claimed in claim 9, wherein each blade of the impeller overlaps an adjacent blade in an axial direction of the opening.

11. A fan assembly, applied to a light source producing heat, the fan assembly comprising:

a frame comprising an opening, and a periphery of the opening having at least one inclined surface; and an impeller, disposed in the frame and comprising a plurality of radially extending blades;

characterized in that the periphery of the opening comprises multi-sectional inclined surfaces having convex sides, protruded toward a central axis of the opening, the impeller comprises blade edges and concave surfaces

facing the convex sides of the multi-sectional inclined surfaces, and the convex sides of the periphery of the opening exceed a line connecting two ends of a respective concave surface of the impeller so that light emitted by the light source and entering the opening is blocked from penetrating the opening by the inclined surface.

- 5 12. The fan assembly as claimed in claim 11, wherein the periphery of the opening comprises multi-sectional inclined surfaces with different inclined angles.
13. The fan assembly as claimed in claim 11 or 12, wherein the impeller comprises blade edges, parallel to the multi-sectional inclined surfaces.
- 10 14. The fan assembly as claimed in any of claims 11 to 13, wherein the periphery of the opening comprises multi-sectional inclined surfaces, depressed toward a central axis of the opening, and the impeller comprises blade edges exceeding a line connected by two ends of the opening.
- 15 15. The fan assembly as claimed any in claims 11 to 14, wherein the periphery of the opening comprises an expanding inclined surface.
16. The fan assembly as claimed in any of claims 11 to 15, further comprising a motor base disposed in the frame, and a plurality of ribs for supporting the motor base; wherein the motor base comprises a flat or curved slope inclined radially, thereby increasing areas of air flow intake or outtake.
- 20 17. The fan assembly as claimed in any of claims 11 to 16, wherein the impeller has blades with a maximum outer diameter greater than a minimum inner diameter of the periphery of the opening.
- 25 18. The fan assembly as claimed in any of claims 11 to 17, wherein the impeller comprises blades with flat, conical, or stepped edges.
19. The fan assembly as claimed in any of claims 11 to 18, wherein each blade of the impeller overlaps an adjacent blade in an axial direction of the opening.
- 30

Patentansprüche

- 35 1. Lüfterbaugruppe, anwendbar bei einer Lichtquelle, die Wärme erzeugt, welche Lüfterbaugruppe umfasst:

einen Rahmen (21), der eine Öffnung (26) und einen Rand (27) der Öffnung mit einer gekrümmten Oberfläche aufweist; und
ein Lüfterrad (25), das in dem Rahmen angeordnet ist und eine Mehrzahl von Flügeln aufweist, die sich radial erstrecken;

dadurch gekennzeichnet, dass

die gekrümmte Oberfläche eine konkave Fläche aufweist, die weg von der Hauptachse der Öffnung vertieft sind, und dass Flügelkanten des Lüfterrads der gekrümmten Oberfläche des Rands der Öffnung entsprechen und sich über eine gedachte Linie hinaus erstrecken, welche zwei Enden der gekrümmten Oberfläche verbindet, oder

die gekrümmte Oberfläche eine konvexe Fläche aufweist, die zur Hauptachse der Öffnung hin vorsteht, und dass Flügelkanten des Lüfterrads der konvexen Fläche des Rands der gekrümmten Oberfläche entsprechen, um konkave Seitenflächen auszubilden, die der gekrümmten Oberfläche der Öffnung zugewandt sind, und sich über eine gedachte Linie hinaus erstrecken, welche zwei Enden einer jeweiligen konkaven Seitenfläche des Lüfterrads verbindet,

sodass Licht, das von der Lichtquelle abgestrahlt wird und in die Öffnung eintritt, von der gekrümmten Oberfläche gesperrt wird und sich nicht durch die Öffnung hindurch ausbreitet.

2. Lüfterbaugruppe nach Anspruch 1, wobei die Öffnung (26) einen Einlass (211) und einen Auslass (212) des Rahmens ausbildet und das abgestrahlte Licht, das in den Einlass eintritt, gesperrt wird und nicht aus dem Auslasse der gekrümmten Oberfläche abgestrahlt wird.
3. Lüfterbaugruppe nach Anspruch 2, wobei der Rand (27) der Öffnung einen Neigungswinkel am Einlass oder am Auslass aufweist oder wobei eine Umgebung des Rands einen geführten Neigungswinkel aufweist.

4. Lüfterbaugruppe nach einem der vorhergehenden Ansprüche, wobei Flügelkanten des Lüfterrads sich parallel zu der gekrümmten Oberfläche erstrecken.
5. Lüfterbaugruppe nach einem der vorhergehenden Ansprüche, wobei die gekrümmte Oberfläche eine zusammenlaufende gekrümmte Oberfläche und eine sich aufweitende gekrümmte Oberfläche aufweist.
6. Lüfterbaugruppe nach einem der vorhergehenden Ansprüche, weiterhin umfassend einen Motorsockel (22), der in dem Rahmen angeordnet ist, und eine Mehrzahl von Rippen (23) zum Abstützen des Motorsockels; wobei der Motorsockel eine Schräge aufweist, die radial geneigt ist, wodurch der Luftströmungs-Einlassquerschnitt oder Luftströmungs-Auslassquerschnitt vergrößert wird.
7. Lüfterbaugruppe nach Anspruch 6, wobei die Schräge flach oder gekrümmt ist.
8. Lüfterbaugruppe nach einem der vorhergehenden Ansprüche, wobei das Lüfterrad Flügel mit einem maximalen Außendurchmesser aufweist, der größer als ein minimaler Innendurchmesser des Rands der Öffnung ist.
9. Lüfterbaugruppe nach Anspruch 8, wobei das Lüfterrad Flügel mit flachen, konischen oder gestuften Kanten aufweist.
10. Lüfterbaugruppe nach Anspruch 9, wobei jeder Flügel des Lüfterrads einen benachbarten Flügel in axialer Richtung der Öffnung überlappt.
11. Lüfterbaugruppe, anwendbar bei einer Lichtquelle, die Wärme erzeugt, welche Lüfterbaugruppe umfasst:

einen Rahmen, der eine Öffnung und einen Rand der Öffnung mit zumindest einer gekrümmten Oberfläche aufweist; und
ein Lüfterrad, das in dem Rahmen angeordnet ist und eine Mehrzahl von Flügeln aufweist, die sich radial erstrecken;

dadurch gekennzeichnet, dass der Rand der Öffnung in mehrere Abschnitte unterteilte geneigte Flächen aufweist, die konvexe Flächen aufweist, die in Richtung einer zentralen Achse der Öffnung vorstehen, wobei das Lüfterrad Flügelkanten aufweist, und wobei konkave Flächen den konvexen Flächen den in mehrere Abschnitte unterteilten geneigten Flächen zugewandt sind, und wobei die konvexen Seiten des Rands der Öffnung sich über eine Linie hinaus erstrecken, die zwei Enden der jeweiligen konkaven Fläche des Lüfterrads verbindet, sodass Licht, das von der Lichtquelle abgestrahlt wird und in die Öffnung eintritt, von der geneigten Fläche gesperrt wird und sich nicht durch die Öffnung hindurch ausbreitet.
12. Lüfterbaugruppe nach Anspruch 11, wobei der Rand der Öffnung in mehrere Abschnitte unterteilte geneigte Flächen mit unterschiedlichen Neigungswinkeln aufweist.
13. Lüfterbaugruppe nach Anspruch 11 oder 12, wobei das Lüfterrad Flügelkanten aufweist, die sich parallel zu den in mehrere Abschnitte unterteilten geneigten Flächen erstrecken.
14. Lüfterbaugruppe nach einem der Ansprüche 11 bis 13, wobei der Rand der Öffnung in mehrere Abschnitte unterteilte geneigte Flächen aufweist, die in Richtung einer zentralen Achse der Öffnung vertieft sind, wobei das Lüfterrad Flügelkanten aufweist, die sich über eine Linie hinaus erstrecken, welche zwei Enden der Öffnung miteinander verbindet.
15. Lüfterbaugruppe nach einem der Ansprüche 11 bis 14, wobei der Rand der Öffnung eine sich schräge Fläche aufweist.
16. Lüfterbaugruppe nach einem der Ansprüche 11 bis 15, weiterhin umfassend einen Motorsockel, der in dem Rahmen angeordnet ist, und eine Mehrzahl von Rippen zum Abstützen des Motorsockels; wobei der Motorsockel eine flache oder gekrümmte Schräge aufweist, die radial geneigt ist, wodurch der Luftströmungs-Einlassquerschnitt oder Luftströmungs-Auslassquerschnitt vergrößert wird.
17. Lüfterbaugruppe nach einem der Ansprüche 11 bis 16, wobei das Lüfterrad Flügel mit einem maximalen Außendurchmesser aufweist, der größer als ein minimaler Innendurchmesser des Rands der Öffnung ist.

18. Lüfterbaugruppe nach einem der Ansprüche 11 bis 17, wobei das Lüfterrad Flügel mit flachen, konischen oder gestuften Kanten aufweist.
19. Lüfterbaugruppe nach einem der Ansprüche 11 bis 18, wobei jeder Flügel des Lüfterrades einen benachbarten Flügel in axialer Richtung der Öffnung überlappt.

Revendications

1. Un ensemble ventilateur, applicable à une source lumineuse produisant de la chaleur, l'ensemble ventilateur comprenant :

un cadre (21) doté d'une ouverture (26) dont la périphérie présente une surface incurvée ; et une turbine (25), disposée au sein du cadre et comprenant une pluralité de lames radiales (24) ;

caractérisé en ce que

la surface incurvée comporte une surface concave, qui est enfoncée à une distance à partir d'un axe central de l'ouverture et les bords de lame de la turbine correspondent à la surface incurvée de la périphérie de l'ouverture et dépasse une ligne imaginaire connectant les deux extrémités de la surface incurvée, ou la surface incurvée comporte une surface convexe, disposée en saillie relativement à l'axe central de l'ouverture et les bords de lame de la turbine correspondent à la surface convexe de la périphérie de la surface incurvée de manière à former des côtés concaves faisant face à la surface incurvée de l'ouverture, et la surface incurvée de la périphérie de l'ouverture dépasse une ligne imaginaire connectant deux extrémités d'un côté concave respectif de la turbine ,

de telle manière que la lumière émise par la source lumineuse susceptible d'entrer via l'ouverture se trouve bloquée par la surface incurvée.

2. L'ensemble ventilateur tel que revendiqué dans la revendication 1, dans lequel l'ouverture (26) forme une entrée (211) et une sortie (212) du cadre, et la lumière émise pénétrant par l'entrée est bloquée en sortie par la surface incurvée.

3. L'ensemble ventilateur tel que revendiqué dans la revendication 2, dans lequel la périphérie (27) de l'ouverture comporte un angle incliné à l'entrée ou à la sortie, ou un voisinage de la périphérie comporte un angle incliné guidé.

4. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel les bords de lame de la turbine s'étendent parallèlement à la surface incurvée.

5. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel la surface incurvée comporte une surface incurvée contractée et une surface incurvée en expansion.

6. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications précédentes, comportant en outre une base de moteur (22) disposée au sein du cadre, et une pluralité de nervures (23) soutenant la base de moteur, dans lequel la base de moteur comporte une pente inclinée radialement, de manière à accroître la surface de prise d'air ou de sortie d'air.

7. L'ensemble ventilateur tel que revendiqué dans la revendication 6, dans lequel la pente est plate ou courbe.

8. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel la turbine présente des lames ayant un diamètre extérieur plus grand que le diamètre intérieur minimum de la périphérie de l'ouverture.

9. L'ensemble ventilateur tel que revendiqué dans la revendication 8, dans lequel la turbine comporte des lames présentant des bords plats, coniques, ou en marches.

10. L'ensemble ventilateur tel que revendiqué dans la revendication 9, dans lequel chacune des lames de la turbine recouvre une lame adjacente suivant une direction axiale de l'ouverture.

11. Un ensemble ventilateur, appliqué à une source lumineuse produisant de la chaleur, l'ensemble ventilateur comprenant :

un cadre doté d'une ouverture dont la périphérie présente au moins une surface inclinée ;

une turbine, disposée au sein du cadre et comprenant une pluralité de lames radiales;

caractérisé en ce que la périphérie de l'ouverture comporte des surfaces inclinées à sections multiples ayant des côtés convexes, en saillie par rapport à un axe central de l'ouverture, la turbine comportant des bords de lame et des surfaces concaves faisant face aux côtés convexes des surfaces inclinées à sections multiples, et les côtés convexes de la périphérie de l'ouverture dépassant une ligne connectant deux extrémités d'une surface concave respective de la turbine de telle manière que la lumière émise par la source lumineuse pénétrant par l'ouverture se trouve bloquée par la surface inclinée.

12. L'ensemble ventilateur tel que revendiqué dans la revendication 11, dans lequel la périphérie de l'ouverture comporte des surface inclinées à sections multiples ayant différents angles d'inclinaison.

13. L'ensemble ventilateur tel que revendiqué dans la revendication 11 ou 12, dans lequel la turbine comporte des bords de lame parallèles aux surfaces inclinées à sections multiples.

14. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications 11 à 13, dans lequel la périphérie de l'ouverture comporte des surfaces inclinées à sections multiples, enfoncées relativement à un axe central de l'ouverture, et la turbine comporte des bords de lame dépassant une ligne connectant deux extrémités de l'ouverture.

15. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications 11 à 14, dans lequel la périphérie de l'ouverture comporte une surface inclinée en expansion.

16. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications 11 à 15, comportant en outre une base de moteur disposée au sein du cadre, et une pluralité de nervures soutenant la base de moteur, dans lequel la base de moteur comporte une pente plate ou courbe inclinée radialement, de manière à accroître la surface de prise d'air ou de sortie d'air.

17. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications 11 à 16, dans lequel la turbine présente des lames ayant un diamètre extérieur plus grand que le diamètre intérieur minimum de la périphérie de l'ouverture.

18. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications 11 à 17, dans lequel dans lequel la turbine comporte des lames présentant des bords plats, coniques, ou en marches.

19. L'ensemble ventilateur tel que revendiqué dans l'une quelconque des revendications 11 à 18, dans lequel chacune des lames de la turbine recouvre une lame adjacente suivant une direction axiale de l'ouverture.

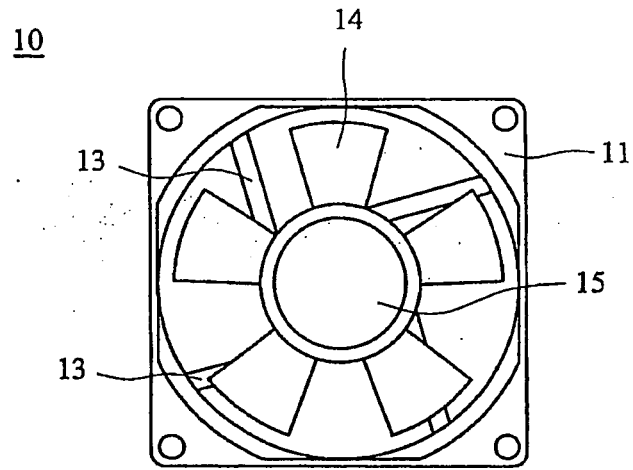


FIG. 1A (RELATED ART)

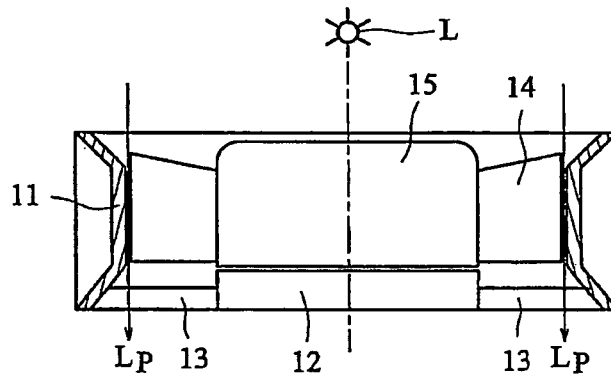


FIG. 1B (RELATED ART)

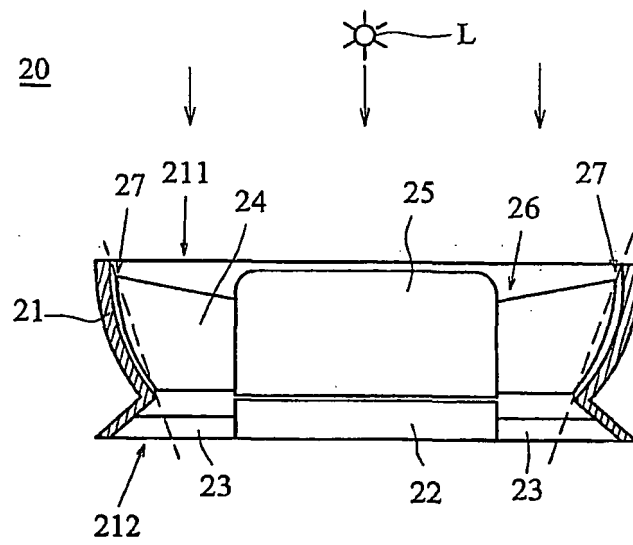


FIG. 2A

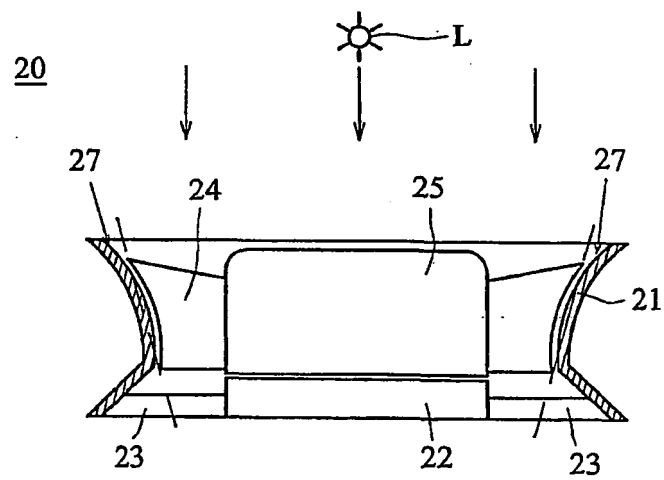


FIG. 2B

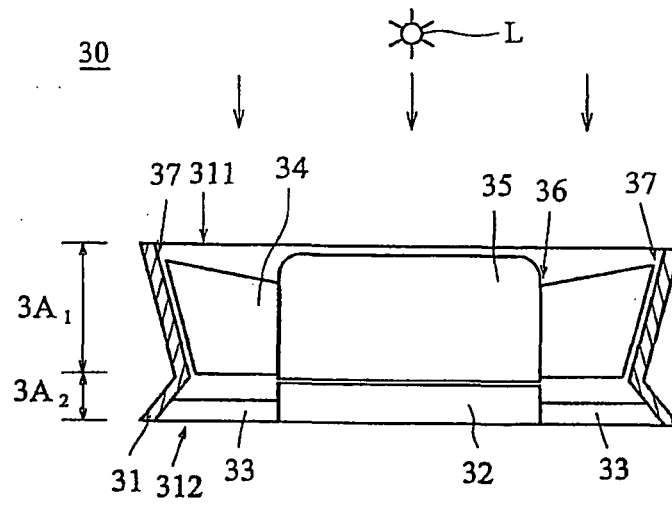


FIG. 3A

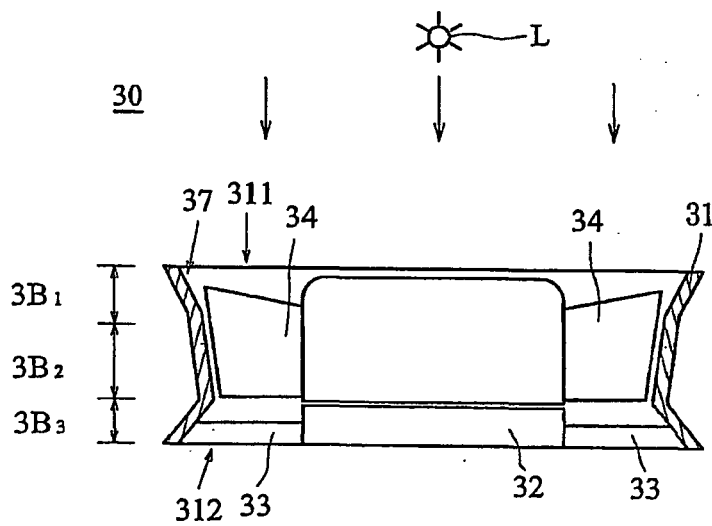


FIG. 3B

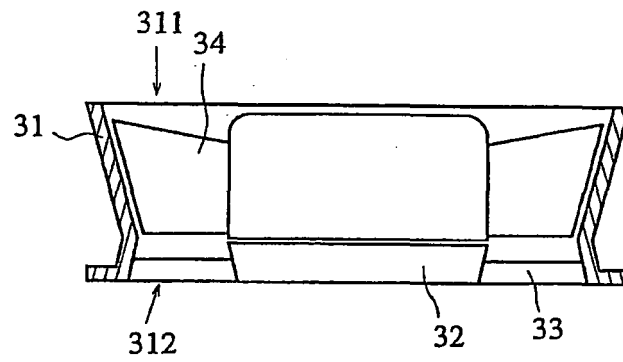


FIG. 3C

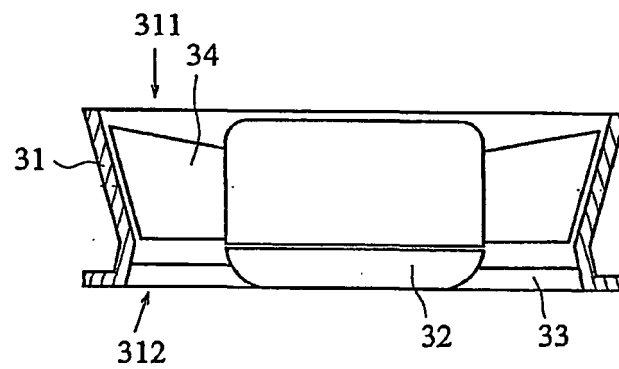


FIG. 3D

40

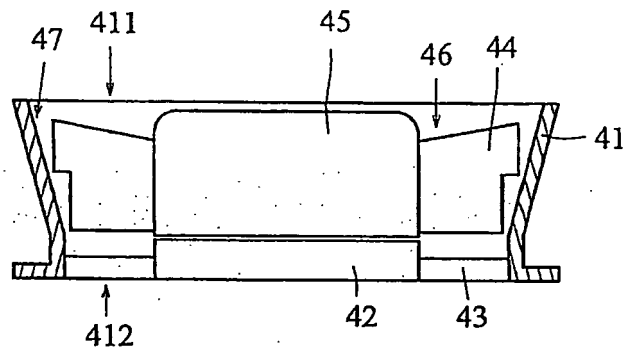


FIG. 4A

40

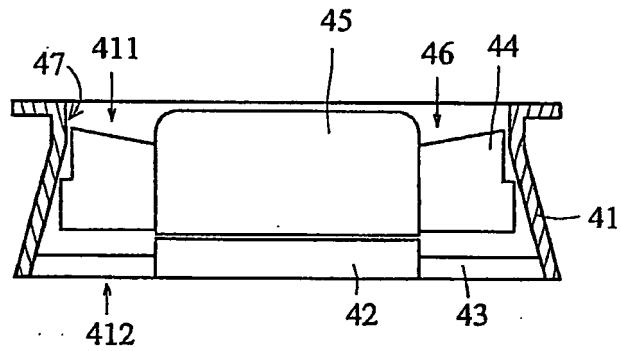


FIG. 4B

40

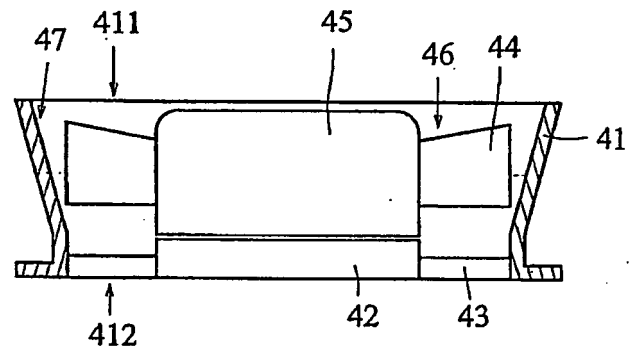


FIG. 4C

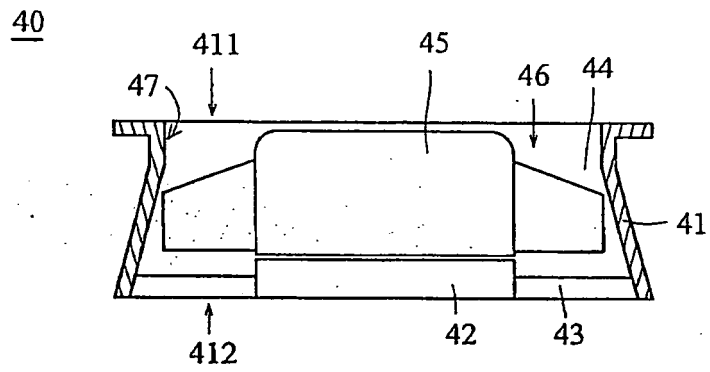


FIG. 4D

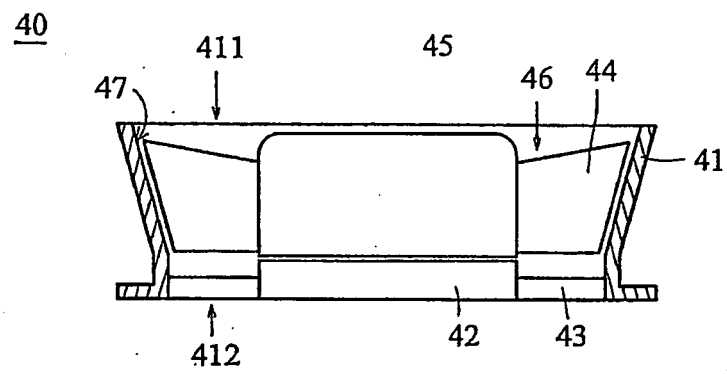


FIG. 4E

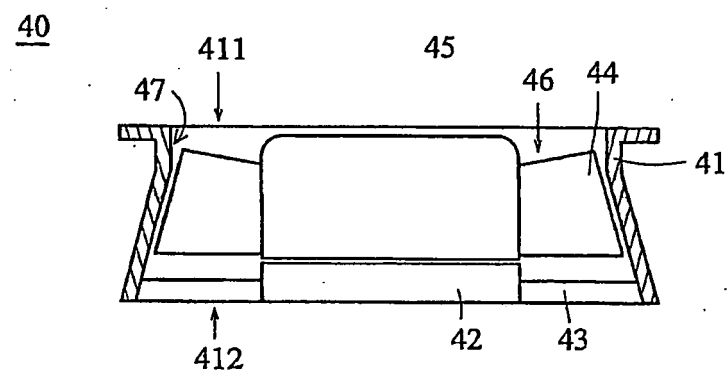


FIG. 4F

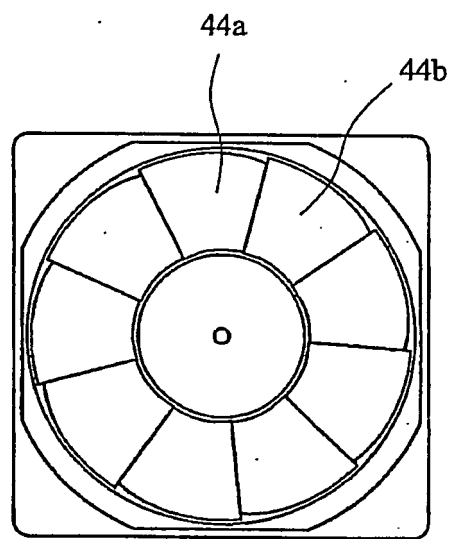


FIG. 4G

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 1168756 A [0006]
- US 4365187 A [0007]
- US 20020003381 A1 [0008]