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(54) FAN ASSEMBLY

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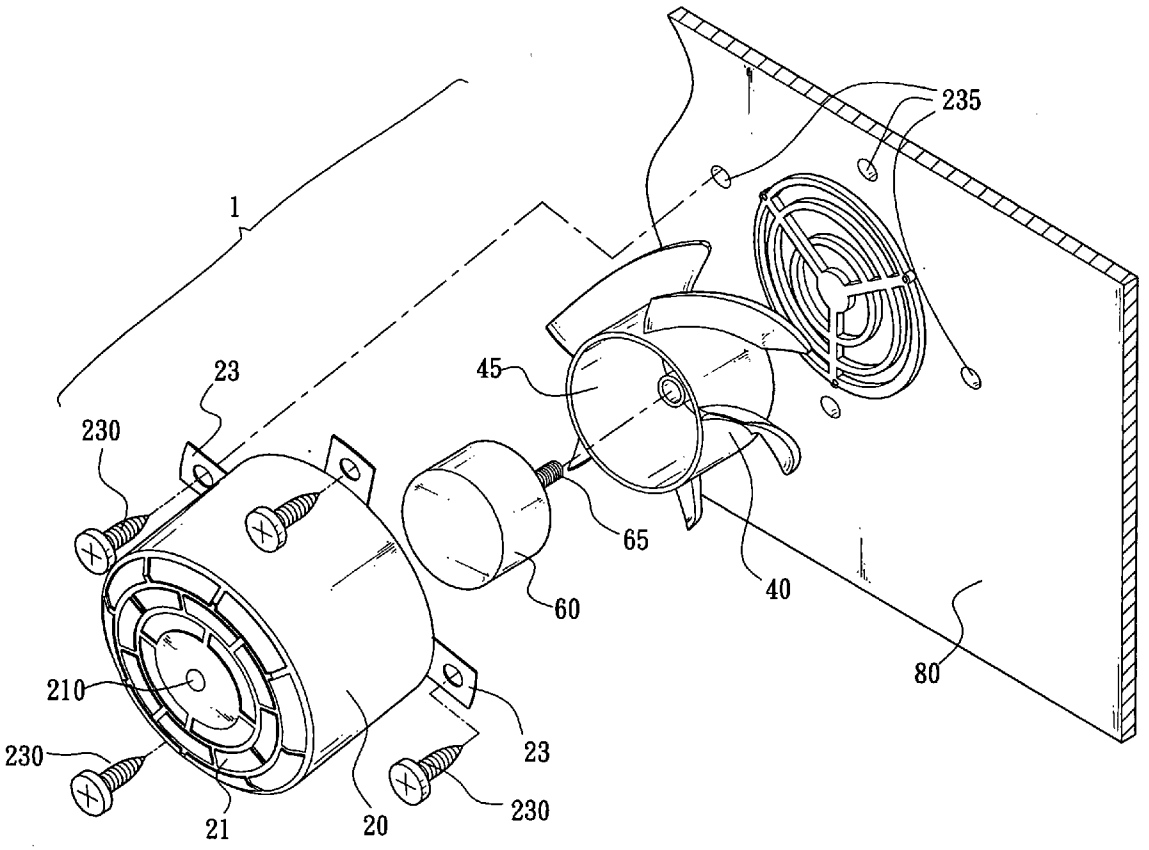
(57) ABSTRACT

A fan assembly includes a metal frame, a vane, and a driving means; wherein the driving means is installed at the middle of the metal frame and the vane is installed at an end of the driving means. With better tensile strength and structural strength of a metal, the thickness of the metal frame of the fan assembly can be made thinner, and thus improving the airflow and the heat dissipating effect to dissipate produced heat more effectively.



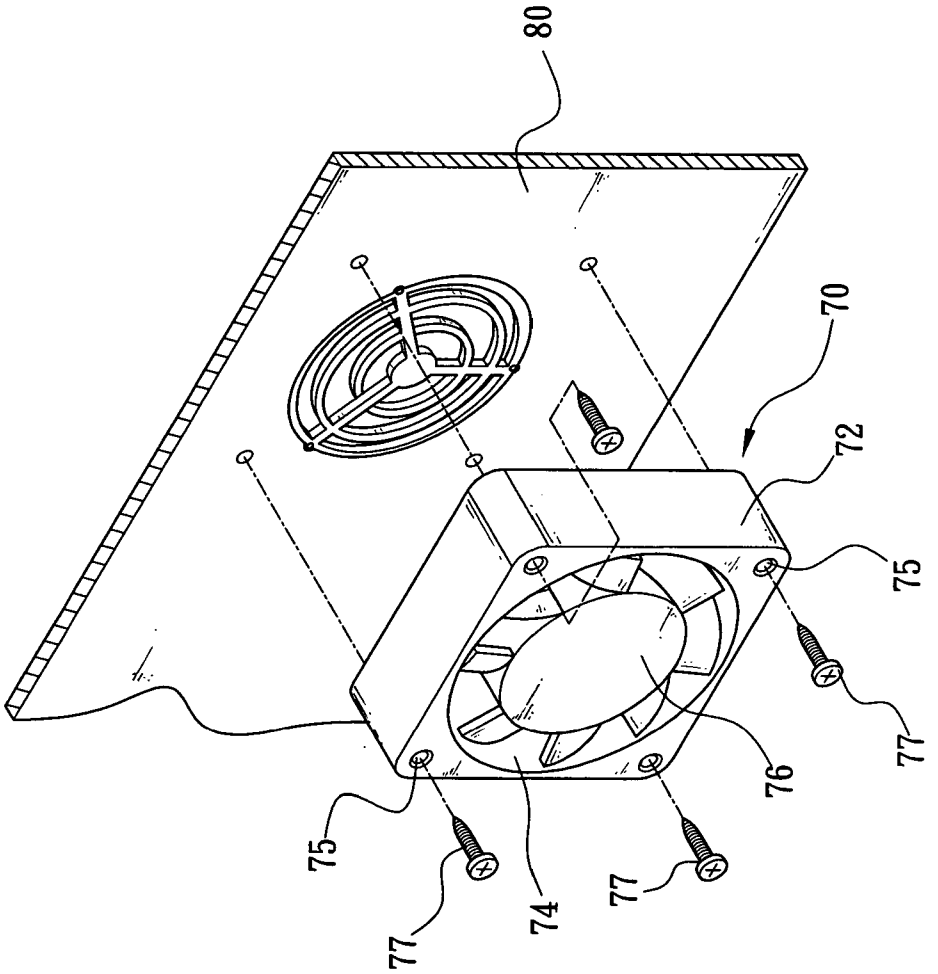


FIG. 1 (Prior Art)

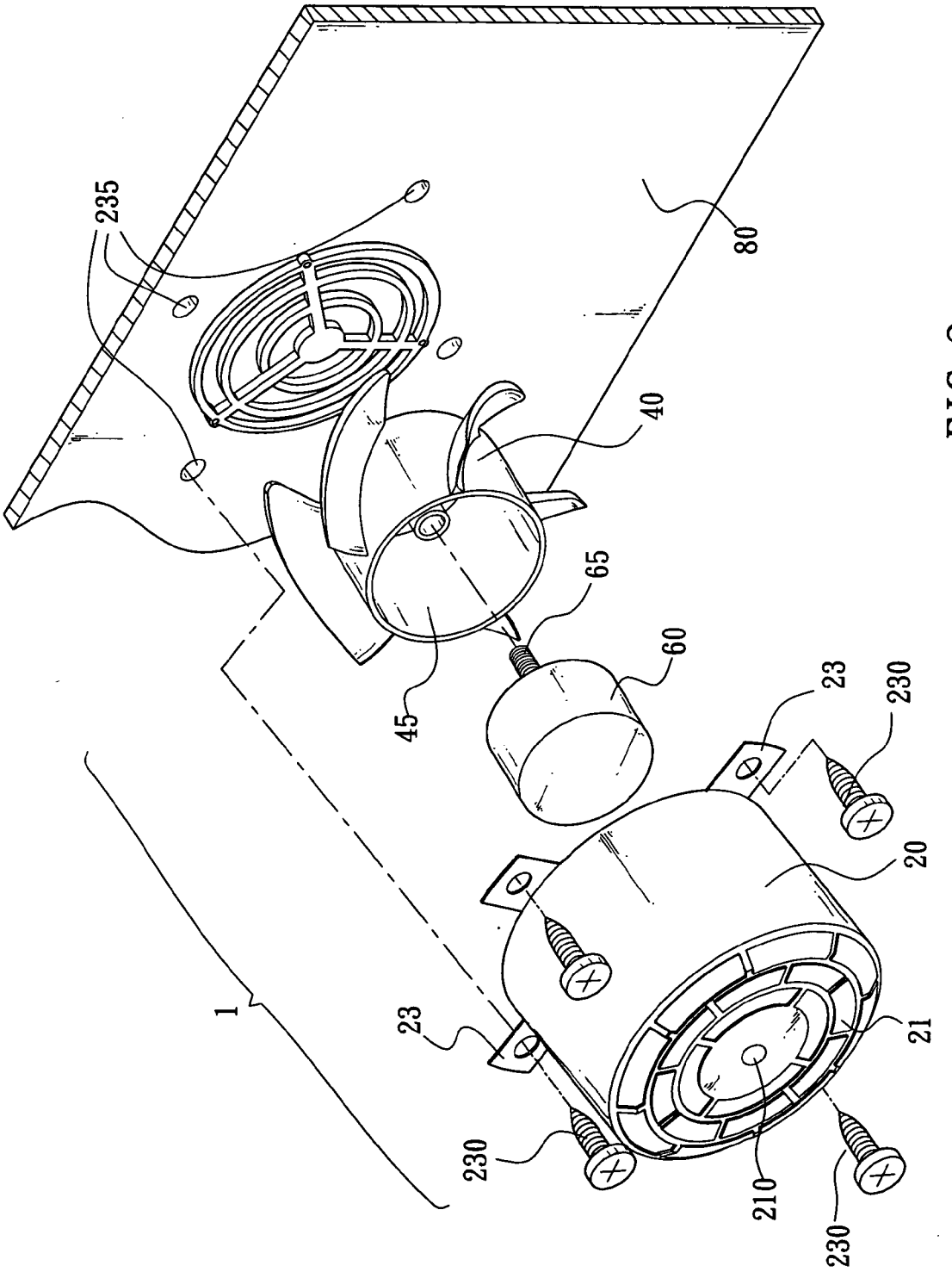


FIG. 2

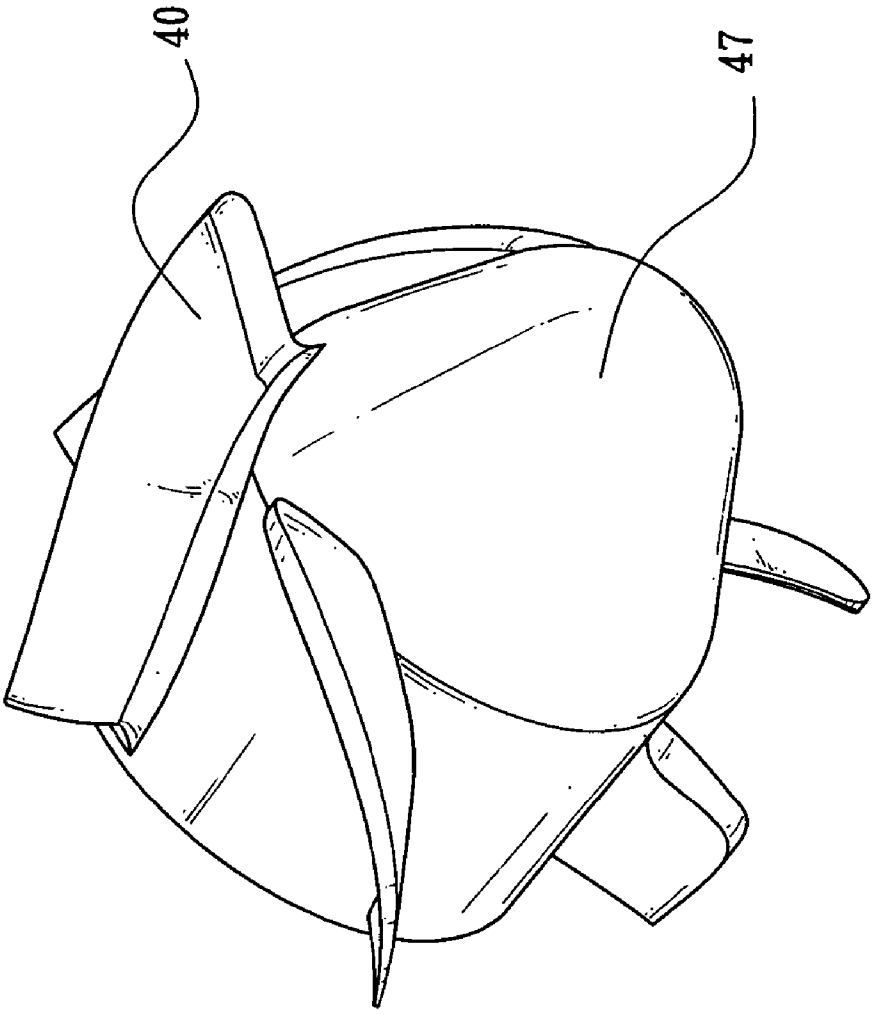


FIG. 3

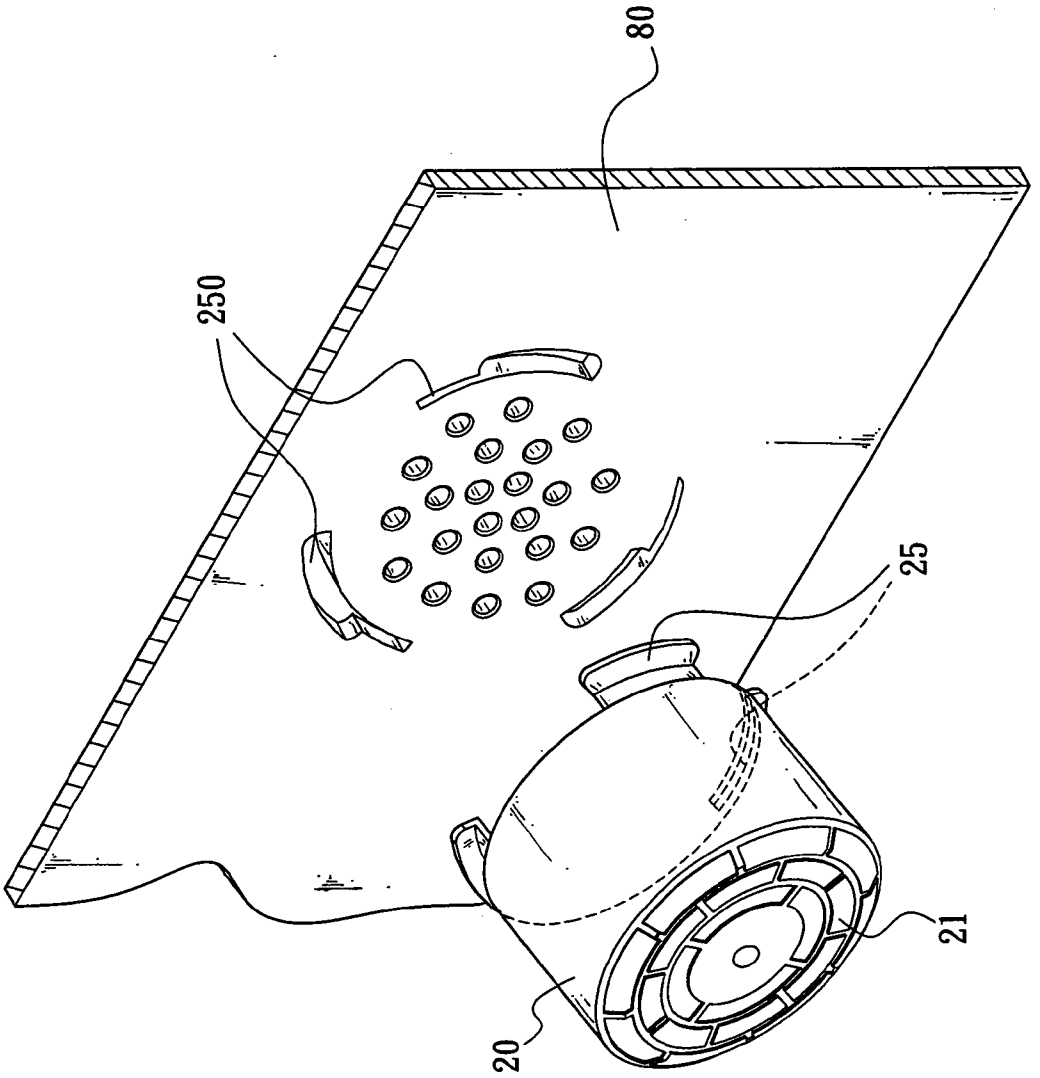


FIG. 4

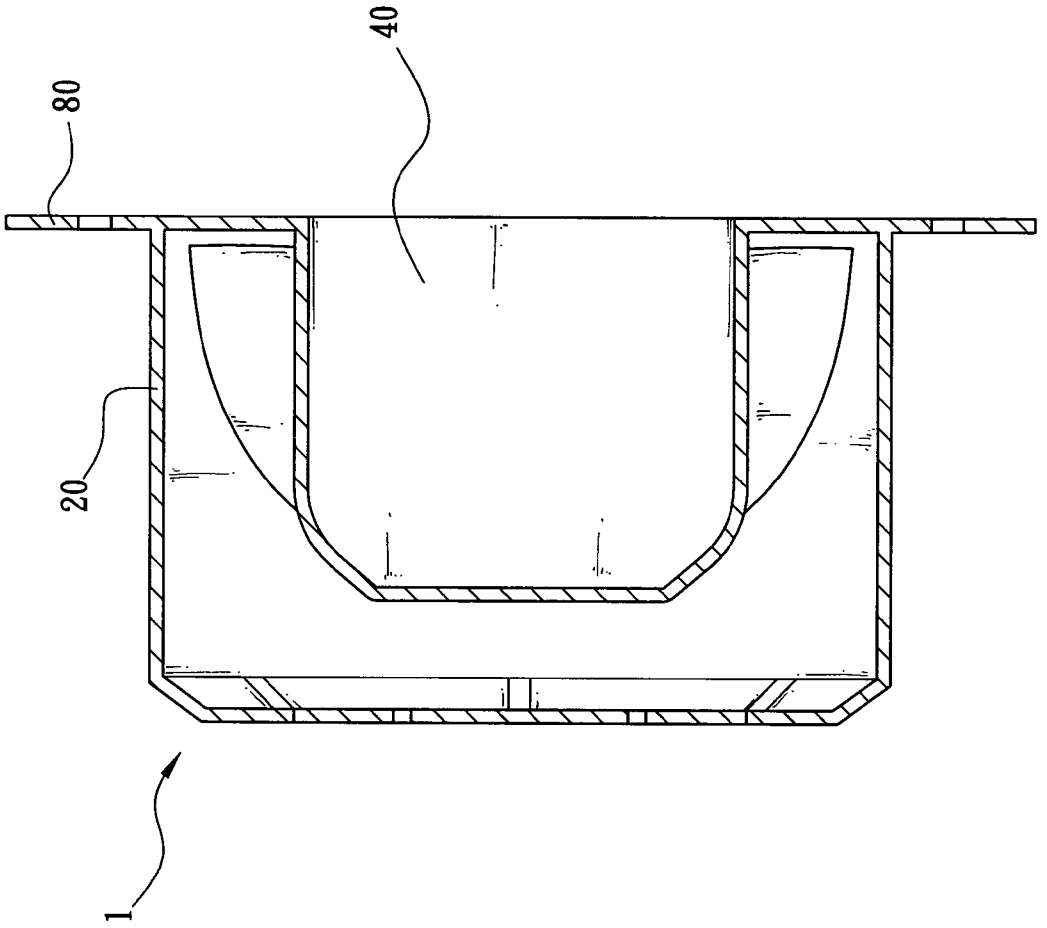


FIG. 5

FAN ASSEMBLY

FIELD OF THE INVENTION

[0001] The present invention generally relates to a fan assembly, and more particularly to a fan assembly that adopts a metal frame to reduce the thickness of an external frame and increase the diameter of the vane so as to improve the airflow and the heat dissipating effect.

BACKGROUND OF THE INVENTION

[0002] The application of a fan becomes more popular since its invention and the advancement of electronic and network communications products, and an electric fan was invented. The functions and usages of a fan are planned to satisfy the increasingly sophisticated requirements of various different electronic and network communication products. As to present industrial servers, the height of the server is designed as 1U (where 1U=44.45 cm), but the processing speed of related electronic components and CPU in the server increases, and thus resulting a large amount of heat produced in such high-speed operations and working conditions. The large amount of heat so produced is cooled to a temperature lower than the maximum operating temperature by at least one fan, so that the server can maintain a normal operating environment.

[0003] In general, the specification of a fan used for servers is generally 40 cm×40 cm×20 cm, and the heat dissipation rate of this specification is preferably higher than those for other smaller fans such as the 30 cm×30 cm×10 cm and the 25 cm×25 cm×10 cm. In the meantime, the smaller is the design of the volume of the fan axle, the more difficult is the manufacture and the higher is the cost. Therefore, the 40 cm×40 cm×20 cm specification is widely used for the limited space in present servers due to the consideration of its cost, heat dissipation, and structure.

[0004] Referring to **FIG. 1**, a conventional prior fan (60 cm×60 cm×20 cm) comes with a vane **76** disposed in an accommodating space **74** of a general external frame **72**. With the consideration of the strength of the structure, the fan **70** must have a thicker and a larger external frame, and thus the minimum thickness of one side of the external frame is 2~3 cm, the external diameter of the vane **76** must fall into the range of 54~56 cm, and the airflow produced after the rotation is very limited.

[0005] Further, the general external frame **72** has a screw hole **75** disposed at four corners separately, so that the fan can be fixed onto a casing **80** by securing a screw **77** into the screw hole **75**. When the fan **70** is turned on to dissipate heat, the heat in the casing **80** can be discharged from the casing or external air can be blown directly into the casing to maintain the normal operation of electronic components in the casing **80**.

[0006] However, the shortcomings of the foregoing fan **70** resides on its structure having a weight heavier than a general external frame **72**, and thus the area of the air inlet or outlet is limited and larger airflow cannot be obtained. As a result, the maximum flow is restricted significantly.

[0007] Further, the presently developed servers tend to have a flat design, and the space for installing a cooling fan in a server becomes smaller, and thus the fan installed in the server is smaller. It is an important subject for manufacturers in the related industry to maximize the airflow in the limited space for installing a small fan, and everyone is happy to see a design of an improved fan assembly that can effectively overcoming the foregoing shortcomings.

SUMMARY OF THE INVENTION

[0008] In view of the shortcomings of the prior-art, the inventor of the present invention conducted extensive researches and experiments and finally invented an improved fan assembly.

[0009] It is therefore a primary objective of the present invention to design and develop a fan assembly that comprises a metal frame, a vane, and a driving means; wherein the driving means is installed at the central position of the metal frame, and the vane is installed at an end of the driving means. With better tensile strength and structural strength of metal, the thickness of an external frame of a fan in accordance with the present invention can be made thinner than that of a general fan. Therefore, the airflow of such fan is larger than the airflow of a general fan and the invention provides a better heat dissipating effect for dissipating the produced heat more easily.

[0010] The above and other objects, features and advantages of the present invention will become apparent from the following detailed description taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] **FIG. 1** is a schematic view of a fan assembly of a prior art;

[0012] **FIG. 2** is an exploded view of a fan assembly of the present invention;

[0013] **FIG. 3 a** schematic view of a fan assembly of a preferred embodiment of the present invention;

[0014] **FIG. 4** is a perspective view of a fan assembly of a preferred embodiment of the present invention; and

[0015] **FIG. 5** is a schematic cross-sectional view of a fan assembly of a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Referring to **FIG. 2**, a fan assembly in accordance with the present invention is illustrated. The fan assembly comprises a metal frame **20**, a vane **40**, and a driving means **60**; wherein the vane **40** is installed at an end of the driving means **60**, and the driving means is installed at the central position of the metal frame **20**. With the tensile strength and structural strength of the metal, the thickness of the metal frame of a fan **1** in accordance with the present invention can be made thinner than a general fan, so that the external diameter of the vane **40** can be larger than a general vane. As a result, the airflow of the fan **1** is larger than that of a general fan, and the fan **1** of the invention can give a better heat dissipating effect.

[0017] Referring to **FIG. 2** that illustrates a preferred embodiment, the metal frame **20** includes a protective grid **21** at an external edge, and the protective grid **21** is coupled closely with an end of the metal frame **20** so that foreign

matters will not fall into the fan **1** easily. The protective grid **21** has a fixing member **210** disposed at a central position on the surface of the protective grid **21**, and the fixing member **210** is connected to an end of the driving means **60** for supporting the driving means **60** to reduce vibrations produced during its rotation.

[**0018**] Further, the driving means **60** includes an axle **65** pivotally connected to another end of the fixing member **210**, such that the driving means **60** can drive the axle **65** to rotate, and the vane **40** includes a groove **45** disposed thereon at a position facing the axle **65**, and the groove **45** can be latched with another end of the axle **65**. When the driving means **60** is operated to drive the axle **65**, the vane **40** can be rotated.

[**0019**] Referring to **FIG. 3**, the vane **40** includes a wing nose **47** disposed at an end of the groove **45**, and the design of the wing nose **47** is streamlined, so that the vane **40** is operated to guide the direction of the airflow, reduce the wind resistance, and improve the performance of the fan **1**.

[**0020**] Referring to **FIG. 2**, the metal frame **20** of the invention comprises a plurality of lugs **23** disposed at the external periphery of the metal frame **20**, and the position of the lug **23** varies according to the requirements of the design of the casing **80**, and the casing **80** has a plurality of bores **235** disposed on one side of the casing **80** and the quantity of the bores **235** is equal to that of the lugs **23** for fixing the lugs **23** onto the cores **235** of the casing by a plurality of bolts **230** to reduce vibrations and noises.

[**0021**] Referring to **FIG. 4** for another preferred embodiment, the metal frame **20** comprises a plurality of L-shape hook sections **25** disposed at the external periphery of the metal frame **20**, and the position of the L-shape hook section **25** varies according to the requirements of the design of the casing **80**. The casing **80** has a groove **250** disposed at a corresponding position of the metal frame **20** that fits the L-shape hook section **25**, and the metal frame **20** can be rotated and embedded into the groove **250**, and the fan **1** can be fixed into the casing to reduce vibrations and noises produced during the operation of the fan **1**.

[**0022**] In the foregoing preferred embodiments, the thickness of the metal frame **20** of the fan **1** is thinner than a general plastic frame, and the minimum thickness of a side of the metal frame **20** can be reduced to 1 cm (while the minimum thickness of a side of a plastic frame is 2~3 cm.) When the thickness of the metal frame **20** is reduced, the external diameter of the vane **40** can be increased to 58 cm without changing its structural strength, and thus enhancing the airflow during the operation of the fan **1** and improving the performance of the fan **1**.

[**0023**] In the foregoing preferred embodiments, the metal frame **20** and the casing **80** can be coupled integrally. Referring to **FIG. 5**, the metal frame **20** can be cast directly onto the surface of the casing **80** and integrally coupled with the casing **80** by a mold design due to the tensile strength of the metal. Therefore, the metal frame **20** can firmly support the fan **1**, and the metal frame **20** together with the casing **80** can absorb the vibration and noise produced during the operation of the fan **1**.

[**0024**] In the foregoing preferred embodiments, the vane **40** of the fan **1** is made by metal, since metals have better thermal conductivity (the coefficient of thermal conductivity is 0.94 W/MK for copper, 0.05 W/MK for stainless steel, and 0.034 W/MK for plastics) that can easily reduce the heat produced by the operation of the vane **40**, and the heat can be dissipated from the surface quickly. In general, the plastic material of a plastic vane will be worn out or deformed by the heat accumulated for some time. Unlike the plastic vane, the life of a metal vane **40** is much longer.

[**0025**] Since the present servers tend to have a flat design, the space for installing a cooling fan in a server becomes smaller, and the size of the fan has to be smaller. The fan **1** used for network servers according to the foregoing preferred embodiments seems to be unable to increase the length of the vane **40** of fan **1** in a substantial amount, but several fans **1** can be serially installed into the server to increase the airflow for cooling and circulation, and thus greatly improving the heat dissipating effect.

[**0026**] While the invention herein disclosed has been described by means of specific embodiments, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope and spirit of the invention set forth in the claims.

What is claimed is:

1. A fan assembly, comprising:

a metal frame;

a driving means, disposed at the central position of said metal frame; and

a vane, disposed at an end of said driving device.

2. The fan assembly of claim 1, wherein said metal frame comprises a protective grid disposed at an external edge of an end of said metal frame and closely coupled with a side of said metal frame.

3. The fan assembly of claim 2, wherein said protective grid comprises a solid fixing piece disposed at the central position of said protective grid and coupled to an end of said driving means.

4. The fan assembly of claim 3, wherein said driving means comprises an axle pivotally installed at another end of said driving means, and said driving means drives said axle to rotate, and said vane has a groove disposed at a position facing said axle for latching onto said axle, and said driving means drives said vane to rotate after said driving means is operated to drive said axle.

5. The fan assembly of claim 4, wherein said vane comprises an arc-shaped wing nose disposed at said vane with its back facing an end of said groove, and said wing nose is streamlined.

6. The fan assembly of claim 1, wherein said metal frame comprises a plurality of lugs disposed around an external periphery of said metal frame and a plurality of bores disposed on a side of a casing and having the same quantity as that of said plurality of lugs for fixing said plurality of lugs onto said bores of said casing by a plurality of bolts.

7. The fan assembly of claim 1, wherein said metal frame comprises a plurality of L-shaped hook sections disposed around an external periphery of said metal frame, and said casing comprises a plurality of grooves disposed at corresponding positions of said metal frame.

8. The fan assembly of claim 1, wherein said metal frame and said casing are integrally coupled with each other.

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