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READILY DISASSEMBLED ELECTRIC FAN

Filed Dec. 7, 1967

Sheet 1 of 3

FIG. 1

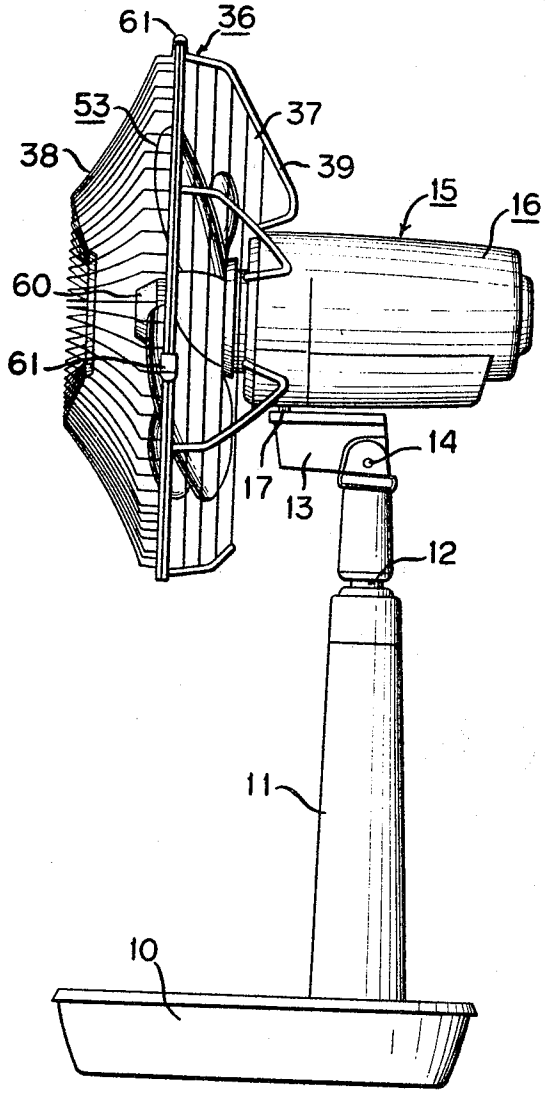


FIG. 2

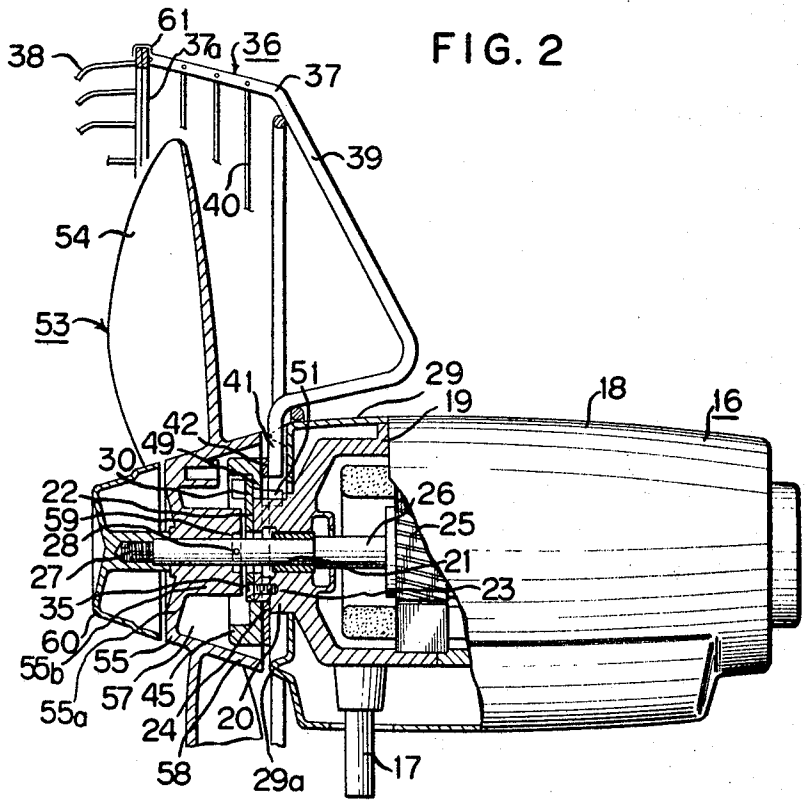
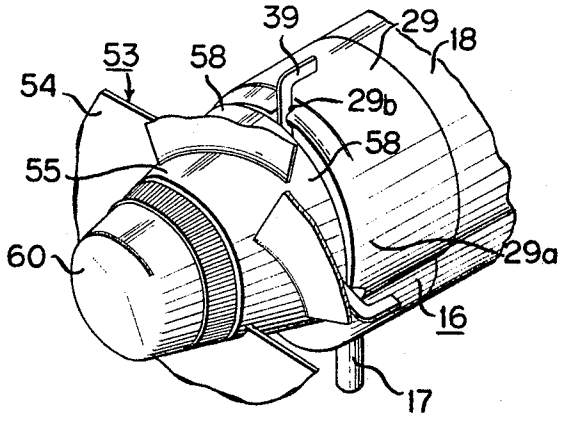
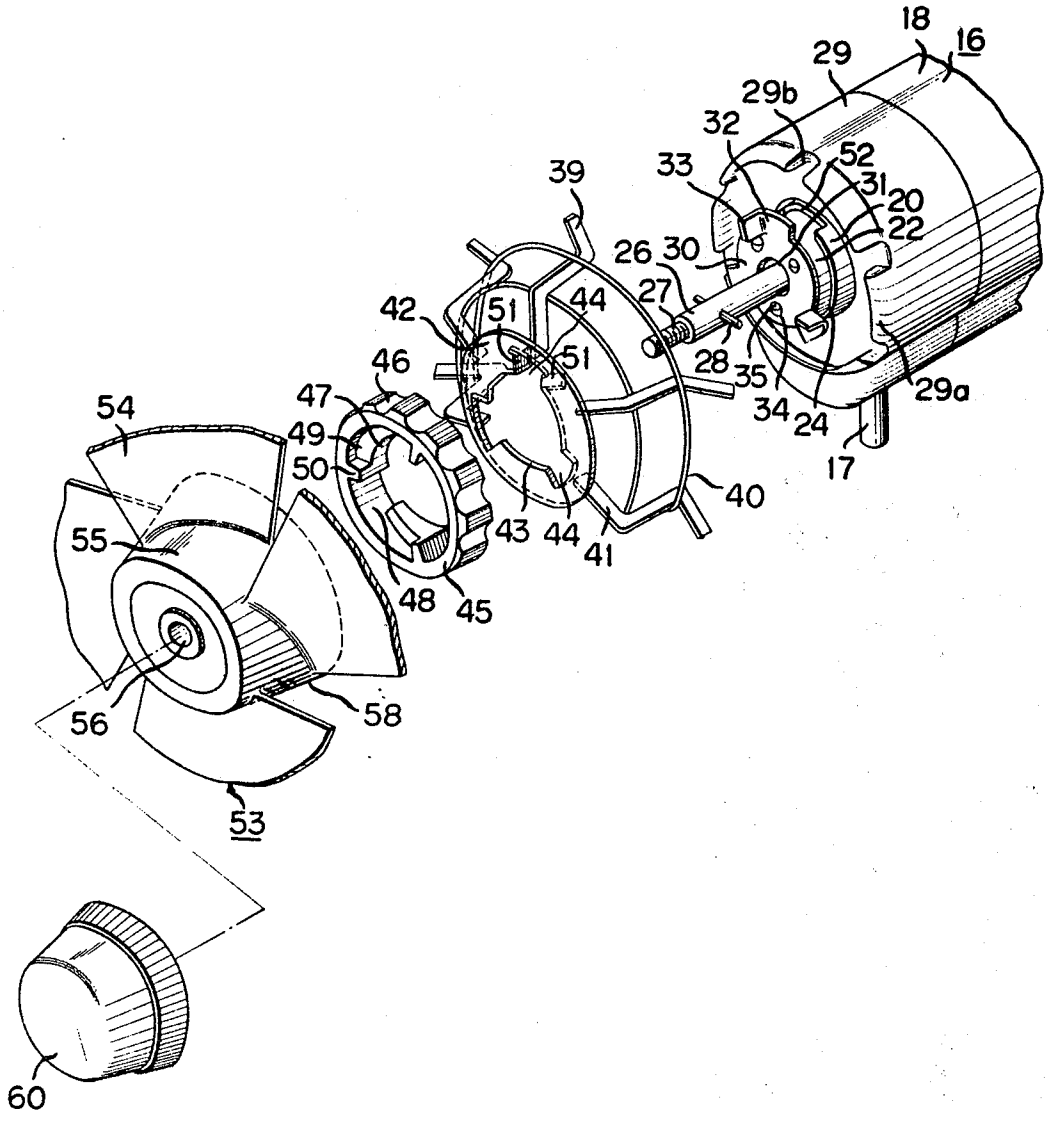

61
38
37a
36
37
39
40
54
53
41
51
29
19
18
16
42
49
30
22
59
28
27
35
60
55b
55a
55
57
45
24
58
20
29a
17
26
25
21
23

FIG. 3


39
29
18
53
58
54
29b
58
55
60
29a
16
17

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FIG. 4



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READILY DISASSEMBLED ELECTRIC FAN

Hiroshi Suzuki, Nagoya-shi, and Tadayuki Ogawa, Nishikasugai-shi, Japan, assignors to Tokyo Shibaura Denki Kabushiki Kaisha

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U.S. Cl. 230—259
4 Claims

ABSTRACT OF THE DISCLOSURE

A mounting ring supporting the blade guard of an electric fan is dismountably mounted directly on the front boss of the motor frame and held by wedge ridges of a hand rotatable lock ring acting between radial projections fixed to the boss and the mounting ring to press and hold the mounting ring in position against the boss, and a hand rotatable spinner nut or nose piece holds a large diameter fan hub in mounted state on the motor shaft, the fan hub then enclosing and concealing the lock ring. Thus, the fan blade assembly and guard can be easily disassembled and reassembled by hand without the use of a tool.

This invention relates generally to electric fans and more particularly to a new and improved electric fan of a construction whereby the propeller or blade assembly and the blade guard surrounding the blade assembly can be readily dismounted and remounted.

A particular feature of the electric fan of the invention is that the blade guard can be readily attached to and detached from the frame of the fan motor simply by turning a lock ring by hand after removal of the blade assembly by an equally simple procedure of merely unscrewing a hand rotatable spinner nut.

In general, the blade assembly of an electric fan is fixed by a screw to the rotor shaft of an electric motor, and the guard surrounding the blade assembly is mounted on and secured to the motor frame or motor casing by a plurality of screws. For this reason, a tool such as a screwdriver is necessary when these parts are to be disassembled for cleaning various parts of the fan or for packaging. Moreover, this disassembling work is troublesome and difficult, particularly for women.

A prime object of the present invention is to provide an electric fan in which particularly the blade guard can be detachably fastened to the motor frame by the rotation of a lock ring, whereby the disassembling and reassembling of the fan can be easily and rapidly carried out without the use of a tool such as a screwdriver.

Another object of the invention is to provide mounting means for direct attachment of the blade guard to the motor frame in an electric fan of the above stated character whereby the blade guard can be mounted securely and positively yet dismountably.

Still another object of the invention is to provide an electric fan of the above stated character having a smooth, unbroken outer form, particularly by enclosing the above mentioned lock ring within the skirt part of the hub of the blade assembly in mounted state on the rotor shaft.

According to the present invention, briefly summarized, there is provided an electric fan of the type having a motor with a rotor shaft and a motor frame with a front boss, a blade assembly of blades on a hub mounted on the shaft, and a blade guard enclosing the blade assembly, characterized by the combination therewith of radial projections on the front boss, a mounting member integrally fixed to and supporting the blade guard and detachably fitted onto the front boss, a manually rotatable lock ring having inclined surface ridges disengageably engaged between the radial projections of the front boss and the mounting member by the rotation of the lock ring thereby to secure the blade guard in dismountable state on the motor frame, and hand operable means for easily mounting and dismounting the blade hub on and from the rotor shaft.

The nature, details, utility, and advantageous features of the invention will be more clearly apparent from the following detailed description with respect to preferred embodiments of the invention when read in conjunction with the accompanying drawings, in which like parts are designated by like reference numerals.

In the drawings:

FIG. 1 is a side elevation view showing one example of an electric fan embodying the invention;

FIG. 2 is a relatively enlarged side elevation view, with parts cut away, showing the essential parts of the electric fan shown in FIG. 1;

FIG. 3 is a fragmentary perspective view showing the front part of the electric fan shown in FIGS. 1 and 2; and

FIG. 4 is a partial exploded perspective view showing the essential parts of the electric fan shown in FIGS. 1, 2, and 3.

Throughout the present disclosure, directional terms such as "front" and "forward" designate the direction from the motor toward the fan blade, i.e., toward the left as viewed in FIGS. 1 and 2, and terms such as "rear" and "rearward" designate the opposite direction.

Referring to FIG. 1, the electric fan shown therein is supported on a support structure of known type comprising a base **10**, an upright hollow column **11** fixed to the base **10**, a movable column **12** movably inserted within the column **11** and provided with means for locking its vertically adjustable position, and a neck piece **13** pivoted for rotation about a horizontal axis afforded by a horizontal pivot **14** supported on the upper end of the movable column **12**.

On the neck piece **13**, the head **15** of the fan is rotatably supported by a support shaft **17** supporting an electric motor **16** housed within the nacelle or casing **18** of the head, which thereby is rotatable in a horizontal plane when the neck piece **13** is in an attitude such that the shaft **17** is vertical.

The motor **16** has a frame **19** of die-cast aluminum or zinc and enclosed by the above mentioned casing **18** as shown in FIGS. 2 and 3. The front part of the frame **19** is in the form of a cylindrical front boss **20** projecting forward and having a central bore **21** for accommodating the front bearing of the rotor shaft **26**. The boss **20** further has a stepped shoulder part **24** at its outer periphery to the rear of its extreme front face, which constitutes a mounting face **22** provided with a plurality of tapped holes **23**.

The motor frame **19** supports therewithin an electric motor mechanism **25**, the rotor shaft **26** of which extends forward through the front bearing in the boss **20** and has a front extension for mounting the hub of the blade assembly thereon and a threaded front end **27**. A pin **28** is passed transversely through the front extension of the shaft **26** at a point spaced apart rearward from the threaded end **27** and projects radially outward from the shaft on opposite sides thereof.

The casing **18** is provided at its front end with a cowling **29** enclosing the front part of the motor frame **19**. The cowling **29** is molded from a synthetic resin material or is made by drawing a sheet metal and is fixed to the front face of the frame **19** by screws (not shown) passed through holes in the front part of the cowling **29**. The cowling **29** has an annular, forward projecting rim **29***a* formed around the front periphery thereof and having

radially aligned slots 29*b* adapted to receive the support legs of a rear guard described hereinafter.

For the purpose of providing forwardly projecting fastening lugs around the front periphery of the aforementioned boss **20**, a fastening plate **30** is fixed to the front face of the boss **20**. More specifically, the plate **30** has a central hole **31** for extension of the shaft **26** therethrough and a plurality of radial projections **32** on its periphery, the projections **32** respectively having forwardly bent flanges on their same sides in the circumferential direction which form fastening lugs **33**. The plate **30** is further provided with mounting holes **34** through which screws **35** are passed and screwed into the aforementioned tapped holes **23** to mount the plate **30** on and against the mounting face **22** of the boss **20** of the motor frame **19**. Alternatively, the projections **32** and their lugs **33** can be formed integrally on the outer periphery of the boss **20**.

The fan propeller or blade assembly **53** is made of metal or a synthetic resin and consists essentially of fan blades **54** and a hub **55** on which the blades **54** are rigidly supported. The hub **55** has an outer shell **58** of the shape of a truncated cone joined by a front web **55***a* to a central boss **55***b*, an annular cavity **57** opens at the rear being formed between the outer shell **58** and the boss **55***b*. The boss **55***b* has a central bore **56** for fitting onto the aforementioned front extension of the rotor shaft **26** for mounting the blade assembly **53**. The boss **55***b* is further provided at its rear face with four recesses **59** which are open at the rear and on their inner sides communicating with the central bore **56** and are spaced 90 degrees of angle apart at the rear rim of the bore **56** in a cross formation.

When the hub **55** is fitted onto the shaft **26**, two diametrically opposed recesses **59** engage with the projecting parts of the aforementioned pin **28** passed through the shaft **26**, whereby the hub **55** and, therefore, the blade assembly **53** are held fixed in the rearward axial direction and in the rotational directions relative to the shaft **26**. The hub **55** is held in this locked state and, moreover, prevented from moving forward by a spinner nut **60** screwed onto the threaded end **27** of the rotor shaft **26**. The spinner nut **60** is made of die-cast zinc or of a synthetic resin and has an outer shell with a knurled outer periphery for facilitating turning by hand.

In the mounted state of the blade assembly **53**, the rear skirt of the spinner nut **60** contacts or very closely confronts the front peripheral edge of the hub shell **58**, the rear skirt of which in turn closely confronts the aforementioned projecting rim **29***a* of the cowling **29**. Furthermore, the external forms of the motor casing **18**, the cowling **29**, the hub shell **58**, and the outer shell of the spinner nut **60** are designed to constitute a unitary form with aesthetically pleasing and aerodynamically fair lines.

The blade assembly **53** and the spinner nut **60** are enclosed by a fan blade guard **36** made up of a rear guard **37** detachably secured to the motor frame **19** and a front guard **38** detachbaly fastened in the conventional manner by clips **61** to the rear guard. The rear guard **37** is of knwon construction at its outer part, which is in the form of an annular basket consisting of radial support legs **39** made of a mild steel wire or angle material, a ring **37***a* fixed to the outer ends of the legs **39**, and a number of guard wires **40** of ring form strung between and supported by the legs **39**.

The support legs **39** have respective inner root parts **41** which lie substantially in a single plane perpendicular to the fan axis and are fixed at their innermost ends to a mounting ring **42** with a circular inner edge **43**. Cutouts **44** corresponding respectively to the aforementioned radial projections **32** of the fastening plate **30** for clearance in passing thereby are formed in the inner edge **43**.

When the rear guard **37** is to be assembled on the fan, the mounting ring **42** is mounted on the boss **20** of the motor frame **19** and held in place as described hereinafter by a tightening lock ring **45** of a synthetic resin or die-cast aluminum or zinc. The lock ring **45** is provided around its outer periphery with knob teeth **46** for facilitating manual gripping and turning and an inner surface **47**, in which are formed cutouts **48** corresponding respectively to the aforementioned radial projections **32** of the fastening plate **30**. Between the cutouts **48**, there are formed ridges **49** of wedge shape with inclined surfaces facing the front whereby the width of each ridge in the axial direction progressively increases in the counterclockwise direction as viewed from the front. A stop **50** is formed at the end of greatest width of each wedge-shaped ridge **49**.

The side edges of a cutout **44**, for example, the upper cutout **44**, of the mounting ring **42** of the rear guard **37** are provided with rearwardly bent flanges or projections **51**. In a position corresponding to these projections **51**, an engagement slot **52** is formed in the shoulder part **24** provided on the boss **20** of the motor frame **19**. When the mounting ring **42** is fitted against the boss **20**, the projections **51** of the mounting ring engage with this slot **52** to determine the alignment and positioning of the rear guard **37** relative to the motor frame **19**.

When the electric fan is in assembled state, the lock ring **45** and the front part of the boss **20** of the motor frame **19** are disposed within the aforementioned cavity **57** of the hub **55** and are thereby enclosed and concealed within the skirt part of the outer shell **58** of the hub.

The electric fan of the above described organization is assembled in the following manner. First, the rear guard **37** is fitted in place by passing the opening bounded by inner surface **43** of the mounting ring **42** around and along the rotor shaft **26** from the front end thereof toward the rear, clearing the radial projections **32** by causing the cutouts **44** of the mounting ring **42** to pass thereover and thereby, and fitting the mounting ring **42** against the boss **20** of the motor frame **19** in a manner such that the projections **51** engage with the slot **52** in the boss **20**, and the mounting ring **42** abuts against the shoulder part **24**, whereby the mounting ring alignment and position are determined.

Next, the lock ring **45** is similarly passed around and along the rotor shaft **26** from the front end thereof toward the rear, clearing the radial projections **32** by causing the cutouts **48** of the lock ring **45** to pass thereover and thereby, placing and holding the lock ring **45** firmly against the front face of the mounting ring **42**, and, as the lock ring **45** is thus held, turning it in the clockwise direction as viewed from the front. The wedge-shaped ridges **49** of the lock ring **45** are thereupon interposed between respective radial projections **32** and the mounting ring **42**, which is thereby pressed tightly against and fixed to the shoulder part **24** of the boss **20** by the wedge action of the ridges **49** produced by the turning of the lock ring **45**.

Next, the blade assembly **53** is mounted on the rotor shaft **26** by fitting the propeller hub **55** along the front part of the shaft **26** until two of the recesses **59** engage with the projecting ends of the pin **28** fixed to the shaft **26**, then screwing the spinner nut **60** onto the threaded front end **27** of the rotor shaft **26**, and tightening the nut **60** thereby to fix the hub **55** of the blade assembly **53** to the rotor shaft **26**.

Finally, the front guard **38** is mounted on the front face of the rear guard **37** and fastened thereto by the clips **61**. Thus, the blade assembly **53** in mounted state is enclosed by the assembled guard **36**, and the assembly is completed.

For disassembly, the above described procedure is reversed. That is, the front guard **38** is first removed, and then spinner nut **60** is unscrewed and removed, whereupon the blade assembly **53** can be pulled forward off the rotor shaft **26**. The lock ring **45** is then turned in the counterclockwise direction as viewed from the front to disengage the wedge-shaped ridges **49** from the radial projections **32**, and the lock ring **45** is moved forward as the cutouts **44**

are passed over and past respective radial projections **32** thereby to remove the lock ring **45**. The rear guard **37** can then be disconnected and removed from the motor assembly.

With the fan in this disassembled state, the various parts thereof can be readily and thoroughly cleaned. At the same time, the electric fan in this disassembled state can be conveniently packaged into a compact package for economical storage and/or transportation.

Furthermore, it is to be observed that the so-called "streamlined" shape of the combination of the motor casing, fan hub, and spinner structure, which conforms to a recent trend in the design of electric fans of the instant class, conveniently makes possible the use of a lock ring **45** and a spinner nut **60** of relatively large diameters, which facilitate the turning thereof by hand.

While one example of inclined surface of the wedge-shaped ridges **49** of the lock ring **45** has been illustrated, it will be apparent that other forms for utilizing the principle of the inclined surface are possible. Furthermore, it will be apparent that, for the means of mounting the blade assembly onto the rotor shaft, modifications of the means described above and as illustrated in the drawings can also be used provided that they afford easy mounting and dismounting of the blade assembly.

What we claim is:

1. An electric fan comprising: an electric motor having a rotor shaft extending toward the front of the fan and a motor frame with a front boss provided with radial projections; a blade assembly having blades radially supported by a hub dismountably mounted on said rotor shaft; a blade guard enclosing said blade assembly and having a mounting member integral therewith detachably fitted onto said front boss of said motor frame; and a manually rotatable lock ring having inclined surface ridges disengageably engaged between said radial projections of the front boss and said mounting member in fitted state by the rotation of said lock ring thereby to secure and hold the blade guard in dismountable state on said motor frame, said hub being readily mounted on and dismounted from the rotor shaft by hand operable means.

2. The electric fan as claimed in claim **1** in which a shoulder part is provided around the periphery of the front boss of the motor frame for abutment thereagainst of the mounting member of the blade guard.

3. The electric fan as claimed in claim **2** in which an engagement slot is formed in said shoulder part of the front boss, and at least one projection for engagement with said slot is formed in the mounting member of the blade guard.

4. The electric fan as claimed in claim **1** in which the hub of the blade assembly has a cavity on the side thereof facing the motor, and the front part of the front boss of the motor frame and the lock ring in assembled state are disposed and concealed within said cavity when the hub is in mounted state on the rotor shaft.

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LEONARD H. GERIN, *Primary Examiner.*

U.S. Cl. X.R.

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