Aug. 5, 1941. J. LEFLAR 2,251,888

FAN BLADE UNIT

Original Filed Aug. 28, 1935

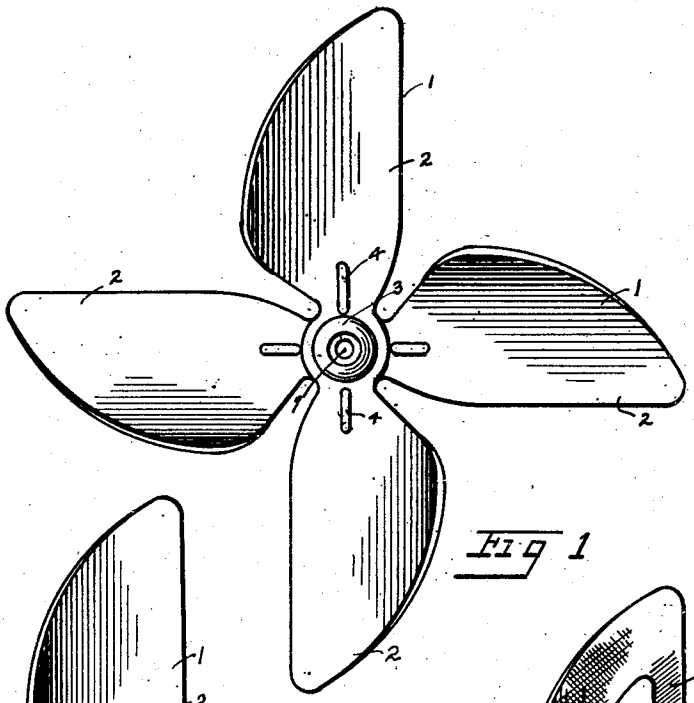

Fig 1

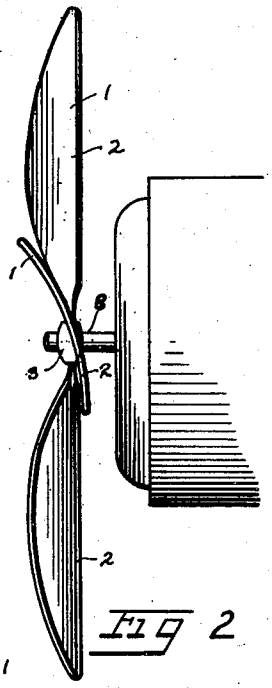

Fig 2

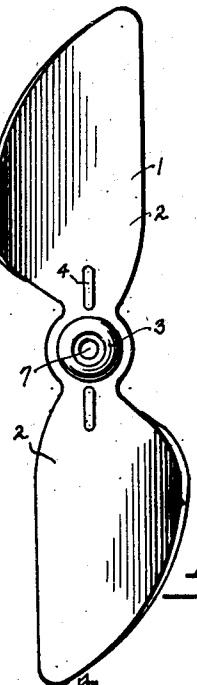

Fig 3

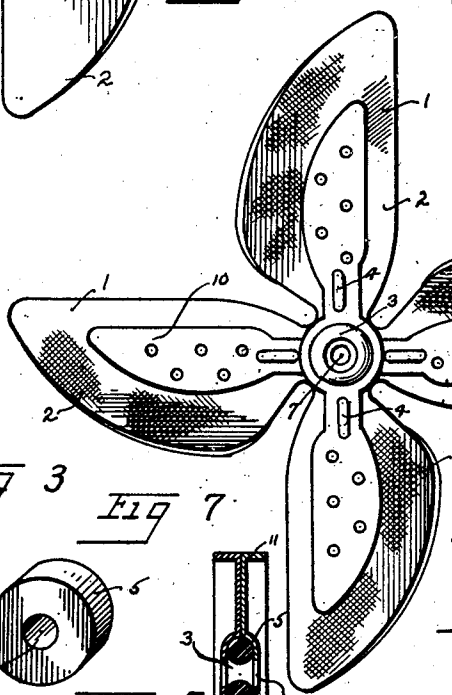

Fig 7

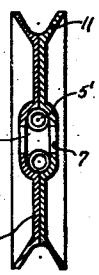

Fig 6

Fig 5

Fig 8

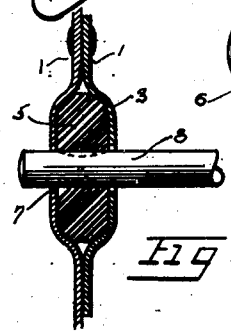

Fig 4

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UNITED STATES PATENT OFFICE

2,251,888

FAN BLADE UNIT

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Original application August 28, 1935, Serial No. 38,225. Divided and this application December 27, 1938, Serial No. 247,766

2 Claims. (Cl. 170—159)

This invention relates to ventilating fans and more particularly to a rotary fan blade assembly of the screw impeller type especially adapted for use on electric fans, but which is also applicable to other fluid circulating and propelling purposes. The present application is a division of application Serial No. 38,225 filed August 28, 1935.

To meet current commercial demands for low priced electric fans, it is necessary to minimize manufacturing costs. While considerable progress has been made in the development of inexpensive electric motor units which will afford long service under unfavorable conditions, and also in cheapening the production of motor housings and stands by die stamping from sheet metal and by plastic molding operation, the fan assembly has heretofore still required skilled workmanship to produce an accurately balanced unit and necessitated assembly of numerous parts including individual blades, a mounting spider and hub, and the use of a set screw for securing the fan unit to the motor shaft, all of which is obviated by the present invention.

The object of this invention is to simplify the construction as well as the means and mode of manufacture of rotary impeller type fan units whereby they may not only be economically manufactured but will be efficient in use, uniform in action, of few parts, and unlikely to get out of repair.

A further object of the invention is to provide an improved method of manufacture of fan units and to facilitate the assembly of the several parts into the completed unit.

A further object of the invention is to provide an improved method of mounting the fan unit upon the motor shaft and provide means for transmitting the torque of the shaft to the fan unit without the use of the usual set screw or specially machined couplings.

A further object of the invention is to provide an inexpensive fan having resilient blades and minimize danger and accidental injury incident to thrusting one's fingers into the path of rotation of the fan blades.

A further object of the invention is to provide a flexible mounting for the fan unit which will enable the unit to automatically adjust itself into a balanced plane of rotation.

A further object of the invention is to minimize the cost of manufacture and to enable the production of fan units by relatively unskilled labor.

A further object of the invention is to provide a fan unit possessing the advantageous features of construction and the meritorious characteristics hereinafter mentioned.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents, as hereinafter described or illustrated in the accompanying drawing.

Referring to the accompanying drawing, wherein is shown the preferred but obviously not necessarily the only form of embodiment of the invention, Fig. 1 is a front elevation of an assembled fan unit embodying the present invention.

Fig. 2 is a side elevation thereof.

Fig. 3 is a detail view of one of the blade elements before assembling.

Fig. 4 is a detail enlarged sectional view through the hub portion of the fan unit illustrating its flexible connection upon the motor shaft.

Fig. 5 is a detail perspective view of the rubber insert for the fan unit hub to provide a flexible coupling between the fan and the motor shaft.

Fig. 6 is a front elevation of the fan unit assembly embodying flexible fan blades.

Figs. 7 and 8 are sectional views of wheels embodying the present construction.

Like parts are indicated by similar characters of reference throughout the several views.

Briefly stated, the present rotary fan unit comprises two similar double blade elements interconnected one with the other in transverse relation by spot welding, riveting or otherwise. Each of the transversely disposed blade elements is formed with a medial, cup-shaped concavity which registers with a like concavity of the other element when the blades are assembled and encloses, under compression within the chamber thus formed, a perforate rubber body, through the opening of which the motor shaft is thrust. The compression of the rubber body contracts the shaft opening therein sufficiently that it will securely grip the shaft. The shaft openings in the respective concavities of the blade elements being of larger diameter than the shaft permit a limited degree of wobble movement of the fan unit while maintaining its driving connection with the shaft whereby the fan unit may automatically adjust itself into a balanced plane of rotation to compensate for any irregularities of manufacture or unbalanced condition existing in the assembly.

Referring to the drawing, there is shown in

Fig. 1 a four blade rotary fan assembly comprising two double blade elements 1—1 such as is shown in detail in Fig. 3. These elements 1 each comprise two oppositely disposed conventional fan blades 2 formed from a single portion of sheet material and hence integrally united. The intermediate connecting portion of the blade element is provided with a concavity 3 having therein a concentric opening of somewhat greater diameter than that of the motor shaft upon which the unit is to be mounted. The concavity 3 is preferably, although not necessarily, formed with converging side walls. The adjacent portions of the blade elements are embossed to form radial ribs 4 which serve to strengthen and stiffen the blade portions adjacent to the axis of rotation. The double blade elements are assembled in transverse relation with their central concave faces adjacent to each other and concentrically disposed, thereby forming between the elements a concentric chamber. Before uniting the transversely disposed blade elements one with the other there is inserted within the chamber formed by the registering concavities 3 a relatively fixed rubber disc 5 as shown in detail in Fig. 5, having therein a concentric hole 6 to receive the motor shaft. The dimensions of the rubber disc 5 are somewhat greater than the interior dimensions of the chamber formed by the registering concavities 3 whereby in the assembly of the blade elements the rubber insert is placed under compression. The transversely disposed blade elements 1 are fixedly united with each other by spot welding or by riveting or other means. However, spot welding, being inexpensive and capable of being readily and quickly performed, is the preferred method. The compression of the rubber insert 5 tends to distort and contract the central hole 6 therein to a proportion somewhat smaller than the motor shaft upon which the unit is to be mounted. The concentric holes 7 in the central portions of the blade elements are of somewhat larger diameter than the shaft, thereby exposing an annular portion of the rubber insert. While the fan blade portions 2 illustrated in the drawing are of conventional shape, it is to be understood that these blades may be of any desired contour. Likewise the present construction may be employed for production of units other than fan blade assemblies, as for example, small pulley wheels or wheels for toys and the like.

In assembling the fan unit upon a motor shaft as is shown in Fig. 2, the shaft 8 is thrust through the contracted opening in the rubber insert 5 thereby increasing the compression and tension of such insert body. To facilitate the insertion of the shaft the end of the shaft is preferably chamfered.

In lieu of employing sheet metal for construction of the blade elements 1 such elements may be made of stiffened fabrics, felt, or even heavy paper or other fibrous composition. In such case the medial portions of the blade elements are preferably reinforced by relatively thin metallic leaves 10 secured to the non-metallic blades 2 by riveting or otherwise. To facilitate manufacture the blade elements of stiffened fabric, paper or fiber composition are preferably continuous throughout as is shown in Fig. 3. The reinforcement leaves 10 may be secured to the non-metallic blade elements before the latter are subjected to forming operation. In such case the metallic and non-metallic portions will be simultaneously formed into exact conformity with each other and two such composite formed elements are assembled in transverse relation with a rubber insert interposed therebetween in the same manner as before described. In lieu of forming the fabric or other non-metallic blades in integral pairs as before described, the transversely interconnected metallic portions may be independently formed and assembled in transverse relation and the non-metallic blades 2 may be subsequently attached by riveting to the separately formed supporting spiders comprising the interconnected metallic portions 10.

Such non-metallic blades will yield upon meeting an obstruction and hence are less dangerous in the event that one should have a finger caught in the rotating fan.

Referring particularly to Fig. 6 of the drawing, the metallic leaves 10 afford a petaliform reinforcement for the flexible elements of the blades to which the leaves are attached and which conjointly form the fan blades. By association of the petaliform reinforcement leaves 10 with the flexible portions which extend a considerable distance beyond the peripheries of the leaves or petal sections 10, the composite fan blade is reinforced at its inner radial end and the outer radial portion thereof is relatively soft and flexible. The blades are obliquely curved transversely as is indicated by the end view of the blade shown in Fig. 2 and by the shading upon the blades of the several figures. The marginal portions of the blades are of sufficient flexibility to readily yield upon contact with an obstruction and of sufficient resilience to bend without permanent distortion and return to normal upon release from the obstruction. At the same time the petaliform reinforcement renders the inner portions of the blades sufficiently rigid to maintain them normally in radially extended form and to maintain an effective pitch angle thereof during rotation.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. In a rotary fan impeller, a single unitary reinforcement member of strain resistant character including multiple radially disposed leaves and a central portion integrally connecting the leaves one with another in inclined relation to their plane of rotation, and extensions of flexible material projecting beyond margins of the leaves, said material being amply flexible to yield under impact engagement with an object while rotating at normal speed and of sufficiently resilient character to automatically reassume normal relation upon release from pressure, the leaves being sufficiently resistant to deflection to maintain their radial relation and pitch inclination at all times.

2. As an article of manufacture, a reinforcement member for rotary fan impeller blades of flexible character comprising a unit formed from relatively stiff material including a plurality of radially disposed leaves of somewhat lesser size than the ultimate blades of the impeller beyond which the flexible material thereof may extend, and a central portion integrally connecting the radial leaves one with another, and embossed areas upon the inner radial portions of the leaves adjacent to the integral central connecting portion to stiffen and increase the rigidity thereof at such points.

JEROME LEFLAR.