July 25, 1967 B. L. BRISTOL ET AL 3,332,500

PROPELLER-TYPE FAN BLADE WHEEL AND METHOD OF MAKING THE SAME

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FIG. 1

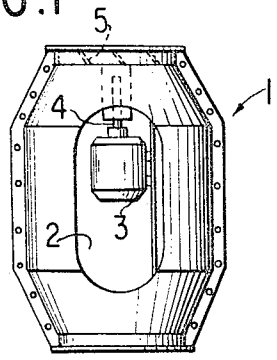


FIG. 2

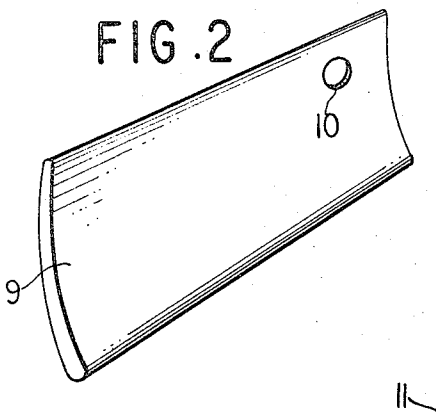


FIG. 4

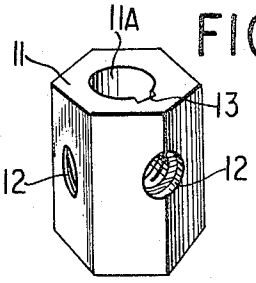


FIG. 3

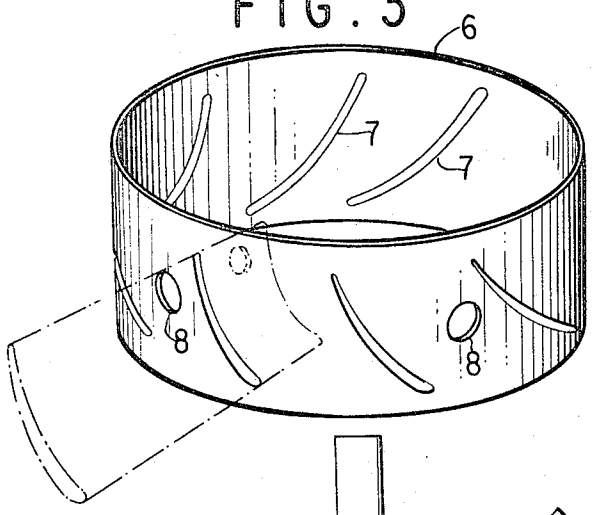


FIG. 7

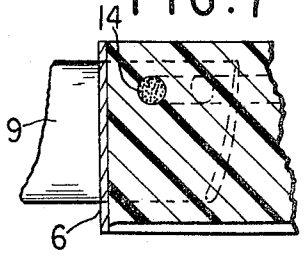


FIG. 5

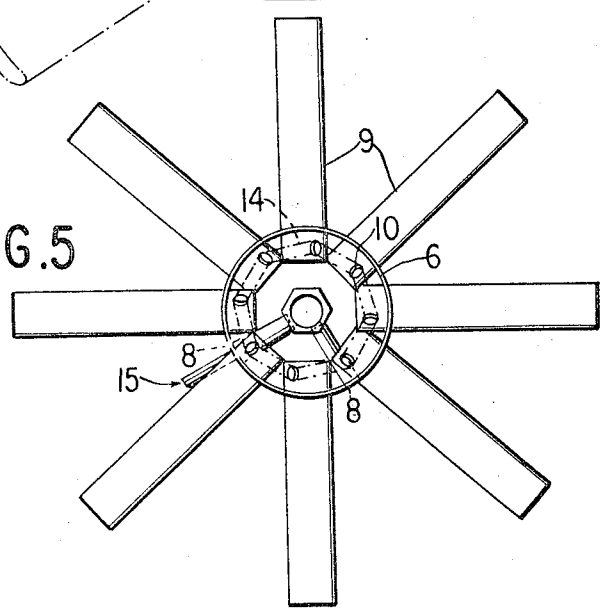
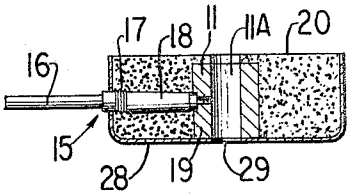


FIG. 6



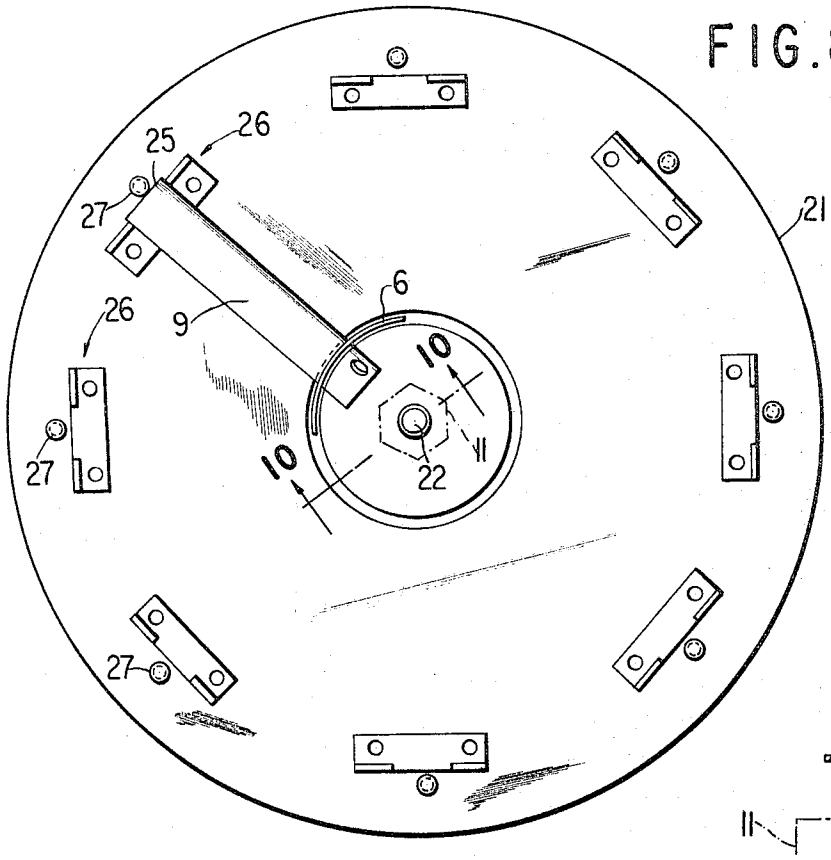
INVENTORS
BILLY L. BRISTOL
CHARLES L. HINTERBERGER
BY Smythe & Moore
ATTORNEYS

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FIG. 8



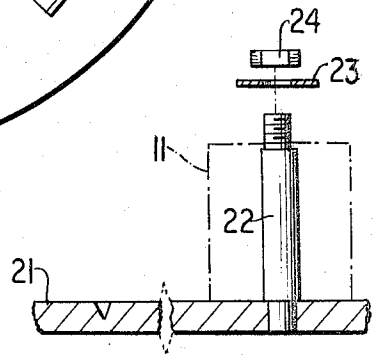
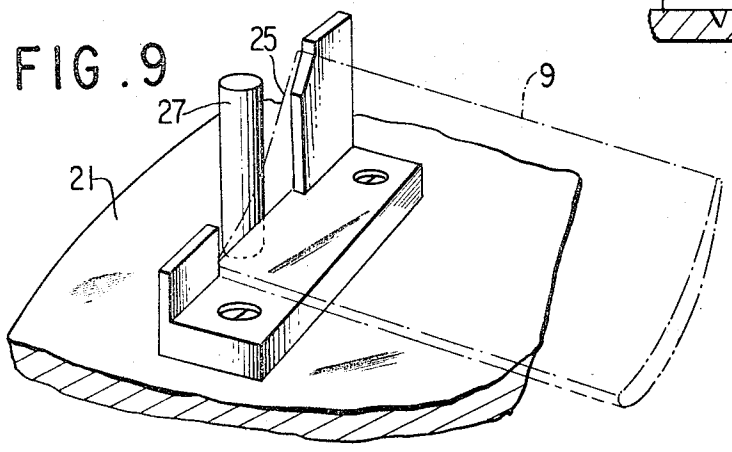


FIG. 10

FIG. 9



INVENTORS
BILLY L. BRISTOL
CHARLES L. HINTERBERGER
BY
Smythe & Moore
ATTORNEYS

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PROPELLER-TYPE FAN BLADE WHEEL AND METHOD OF MAKING THE SAME

Billy L. Bristol, Silvis, Ill., and Charles L. Hinterberger, Bettendorf, Iowa, assignors to Ametek, Inc., New York, N.Y., a corporation of Delaware

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4 Claims. (Cl. 170—160.6)

The present invention relates to a fan blade wheel of the propeller type, and more particularly to such a fan wheel made from a plastic and to the method of forming such a fan wheel.

A propeller-type fan blade wheel essentially comprises a hub portion having a plurality of blades radiating outwardly therefrom, the length of the blades being relatively long with respect to the diameter of the hub. In certain applications, such as the moving of corrosive fluids, it is desirable to utilize a plastic fan wheel which is corrosion resistant. However, numerous difficulties have been encountered in the manufacture of a plastic fan wheel which is sufficiently strong to resist the centrifugal forces due to rotation while at the same time keeping the cost of such manufacture relatively low. Manufacturing such a blade wheel by casting is unsatisfactory since a complicated mold is required, and the resulting one-piece fan blade wheel is not sufficiently strong. The assembling of such a fan wheel from preformed plastic components also has not been satisfactory since difficulty has been encountered in making such an assembled fan wheel sufficiently strong to withstand the centrifugal forces encountered during rotation.

It is therefore an object of the present invention to provide an improved propeller-type fan blade wheel formed from plastic.

Another object of the invention is to provide a simple and economical process for making a propeller-type fan blade wheel from plastic.

In one aspect of the invention, the fan wheel comprises a cylindrical hub casing which has a plurality of angularly disposed slots spaced around the wall thereof. A plurality of fan blades are circularly arranged so as to radiate outwardly from the hub casing with the inner ends of the fan blades being inserted into the casing slots. There are holes in the inner ends of the fan blades, and a flexible cord is passed through these holes to interconnect the fan blades. A hub having a shaft opening therethrough is positioned in the center of the hub casing with a set screw being provided in the hub to secure the fan wheel upon a shaft. The hub casing is filled with a plastic filler material to secure the fan blade ends and the hub in position within the casing. A radial passage is provided in the hub portion thus formed to communicate with the set screw in the hub and the outer surface of the hub casing so as to provide access to the set screw.

In making the fan blade wheel, a jig is provided with the hub casing being positioned at the center of the jig. Additional jig fixtures are provided to position the blades at the correct pitch and at the correct length with respect to the hub casing. These jig fixtures can be adjusted to obtain various blade relationships with respect to the hub casing, particularly the length of the blade projecting from the casing.

In providing the communicating passage in the hub portion for the set screw, a cylindrical member is positioned within the hub casing prior to filling the casing with the filler material.

Other objects, advantages and features of the invention will become apparent from the following description and accompanying drawings which are merely exemplary.

In the drawings:

FIG. 1 is a side elevational view of a tubular fan casing having a propeller-type fan blade wheel mounted therein;

FIG. 2 is an overall perspective view of a blade used in forming the fan wheel of the invention;

FIG. 3 is an overall perspective view of the hub casing used in fabricating the fan wheel;

FIG. 4 is an overall perspective view of the hub by which the fan wheel is secured upon a shaft;

FIG. 5 is a top plan view of the assembled components of the fan wheel prior to filling the hub casing with filler material;

FIG. 6 is a central longitudinal sectional view of a modified hub showing the filler material therein and a mandrel positioned in the filler;

FIG. 7 is a partial sectional view similar to FIG. 6 but with the plane of the section rotated slightly to show a blade;

FIG. 8 is a top plan view of the jig used in assembling the fan wheel;

FIG. 9 is a perspective view of the jig fixture for positioning the outer end of the blade upon the jig; and

FIG. 10 is a sectional view taken along the line 10—10 of FIG. 8, but with the fan wheel hub being omitted.

Referring to the drawings wherein like reference symbols indicate the same parts throughout the various views, a specific embodiment and modifications of the invention will be described in detail.

The propeller-type fan blade wheel of the present invention is primarily intended for use in a tubular fan casing such as indicated generally at 1 in FIG. 1, although the fan wheel is not limited to this application. The tubular fan casing 1 has a transversely extending tunnel or passage 2 in which is mounted the drive motor 3. The motor 3 has an output shaft 4 at the end of which is mounted the propeller-type fan blade wheel 5.

The fan blade wheel 5 comprises a cylindrical hub casing 6 which is preformed from a plastic such as a polyester resin reinforced with glass fibers. This plastic may comprise the resin known as "Atlas 382" produced by Atlas Chemical Industries, Inc. The cylindrical wall of the casing 6 is provided with a plurality of angularly disposed arcuate slots 7 spaced therearound, the shape of these slots conforming to the cross section of the blades which are to be inserted therein, as indicated in the phantom lines of FIG. 3. The casing 6 is also provided with circular openings 8 which are for the purpose of providing access to the set screw of the hub in a manner to be described later.

Referring to FIG. 2, the fan blade 9 which is inserted into the casing slot 7 is preformed from a suitable plastic of the above-described type, or from metal or other suitable material. The inner end of the blade 9 is provided with an opening 10 which is used for interconnecting the ends of the fan blades.

A plurality of fan blades 9 are inserted into the casing slots 7 in a circular arrangement so as to radiate outwardly from the hub casing as illustrated in FIG. 5. A hub 11, shown in FIG. 4, is positioned in the center of the casing as seen in FIG. 5. The hub 11 is hexagonal in cross section and has an axial passage 11A therethrough to accommodate a shaft. The hub is also provided with threaded openings 12 for set screws. The passage 11A may be provided with a slot 13 shown in FIG. 4.

The inner ends of the fan blades may be interconnected by a flexible cord 14 as seen in FIG. 5. Interconnecting the blades in this manner strengthens the assembled blades to withstand the centrifugal forces encountered during the rotation of the blade wheel.

Referring to FIG. 6, in order to provide an access passage in the hub casing 28 to the set screw, a mandrel 15 is used. The mandrel has a handle 16 and a central threaded portion 17 which is used to form threads in the hub casing to accommodate a plug. The remaining por-

tion of the mandrel indicated at **18** communicates with a set screw such as **19** in the hub **11**. Hub casing **28** is then filled with a plastic filler material **20** (FIG. 6) and, when hardened, secures the inner ends of the fan blades and the hub in the hub portion thus formed. The mandrel **15** is then removed and a passage is formed in the filler material by the space occupied by the mandrel portion **18**. This passage may then be closed by a plug threaded into the threads formed in the hub portion by the mandrel threaded portion **17**.

In making the fan blade wheel, a jig is used as illustrated in FIG. 8. The jig comprises a circular base or bed **21** with a vertical shaft **22** upstanding from the center thereof. The shaft **22** has a threaded portion at the upper end and receives a washer **23** and a nut **24**. The washer and nut, when assembled on the shaft **22**, will retain in position the hub **11** indicated in phantom lines. Hub **11** can be precisely centered and then retained in position by the nut **24** and washer **23** being tightened down upon the hub.

As seen in FIG. 8, the hub casing **6** is then positioned on the jig after which the blades **9** are positioned in a circular arrangement with the inner ends of the blades being inserted into the slots **7** in the casing **6**. The outer ends of the blades indicated at **25** rest upon a jig fixture **26** which retains the outer ends of the blades at a predetermined angle of pitch as seen in FIG. 9. A vertical pin **27** defines the outer position of the blade end and the end **25** of the blade is positioned against this pin, as shown in FIGS. 8 and 9. The pin **27** is fixed and threaded into the base **21**.

When the fan blades have been assembled in position, the flexible cord **14** is then passed through the openings **10** in the inner ends of the blades to interconnect the blades.

The mandrel **15** is positioned as shown in FIG. 6 in order to form the access passage in the hub for the set screw.

The hub is then filled with the plastic filler material (FIG. 6) and the assembly is set aside for the plastic to harden. Upon hardening, the mandrel is removed and the assembled fan wheel can be lifted from the jig.

As illustrated in FIG. 6, the hub casing may be cup-shaped and as such will comprise a base **28** with a shaft opening **29**. The hub **11** is then positioned to surround the shaft opening **29**.

While the fan wheel has been described above as having blades and a hub casing made of plastic, it is to be understood that the hub casing may be of other materials, such as metal, and the blades similarly may be preformed from other suitable materials. However, the entire assembly is secured together by the plastic hub portion formed by molding the plastic filler material within the hub casing.

Thus, it can be seen that the present invention has disclosed a propeller-type fan blade wheel of plastic and a simple yet economical method of fabricating such a fan wheel.

It is to be understood that changes can be made in various details of construction and arrangement of parts without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. A propeller-type fan wheel comprising a cylindrical hub casing having a plurality of angularly disposed slots spaced in the wall thereof, a hub within said casing having a passage therethrough for a shaft, a plurality of fan blades having their inner ends inserted in said casing slots with said blades radiating outwardly from said casing, means within said casing interconnecting the inner ends of said blades, a filler material within said hub casing, said hub and blade inner ends being embedded therein, a set screw in said hub, there being an opening in said casing radially opposite said set screw, means in said filler material defining a passage therein between said hub casing opening and said set screw to provide access to said set screw from the exterior of said casing, said casing having a cup-shaped bottom wall, there being a shaft opening in said bottom wall, the hub within said casing surrounding said shaft opening, there being holes in the inner ends of said blades, and a flexible cord passing through said blade holes to interconnect the blades within said casing.

2. A propeller-type fan wheel according to claim **1** wherein said hub casing, hub, blades, and filler material are of a polyester resin material.

3. A propeller-type fan wheel according to claim **1** wherein said hub has a hexagonal cross section and a central bore therethrough for a shaft.

4. The method of making a propeller-type fan wheel from plastic, comprising the steps of positioning a plurality of fan blades in a circular arrangement with the inner ends of the blades being closely spaced about a point from which the blades radiate outwardly, interconnecting the inner ends of the blades, molding a hub portion from a plastic material over the inner ends of the blades to embed said ends therein, and forming a shaft opening in said hub portion at said point, the above steps including the steps of inserting the inner ends of the blades into angularly disposed slots formed in a cylindrical casing, filling said cylindrical casing with said plastic material to form said hub portion, forming a hole in the inner end of each blade and passing a flexible cord through said blade holes to interconnect the blade ends, positioning a hub having a shaft opening therethrough within said cylindrical casing before filling the casing with plastic material so that the hub is embedded within said hub portion, a threaded opening in said hub for a set screw, and positioning a cylindrical member within said casing between said hub threaded opening and an opening in said casing, positioning the cylindrical casing in the center of a suitable jig with said fan blades being positioned by said jig in a circular arrangement from said cylindrical casing, and positioning the outer ends of said blades in the jig to obtain a predetermined pitch and length of the blades.

References Cited

UNITED STATES PATENTS

2,160,467	5/1939	Ward	170—159
2,183,891	12/1939	Newnham	170—159
2,649,243	8/1953	Stalker.	
2,857,094	10/1958	Erwin	230—134
3,085,632	4/1963	Schwegler	170—167

MARTIN P. SCHWADRON, *Primary Examiner.*

EVERETTE A. POWELL, JR., *Examiner.*