Jan. 31, 1967 F. L. WENINGER 3,301,473

BLOWER FAN CONSTRUCTION AND IMPELLERS THEREFOR

Filed April 12, 1965

Fig. 2.

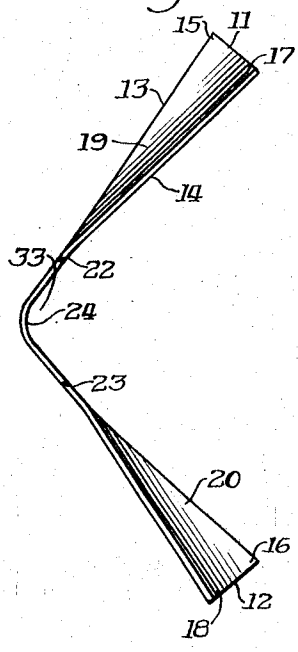


Fig. 1

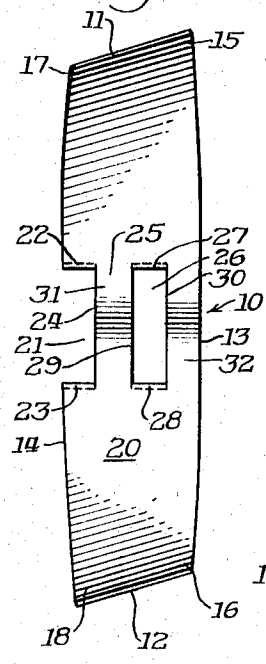


Fig. 3

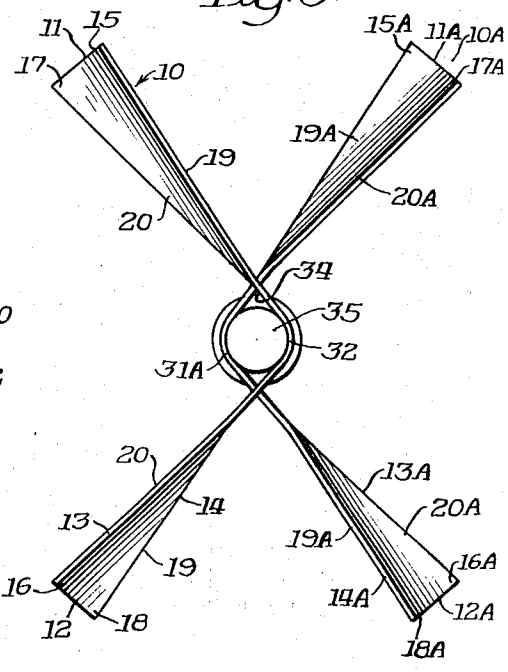


Fig. 4.

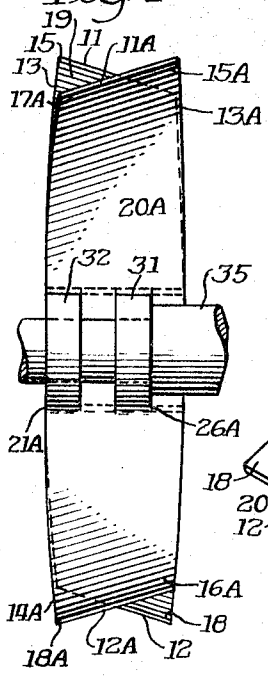


Fig. 5

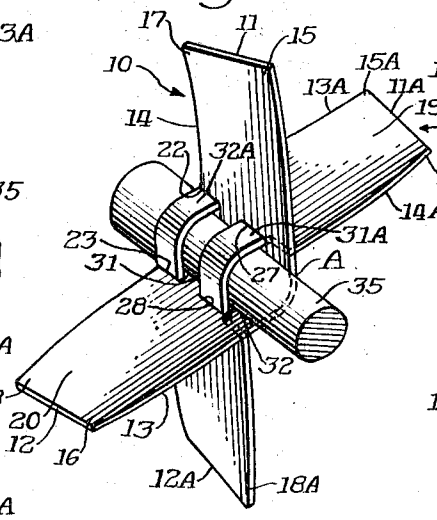
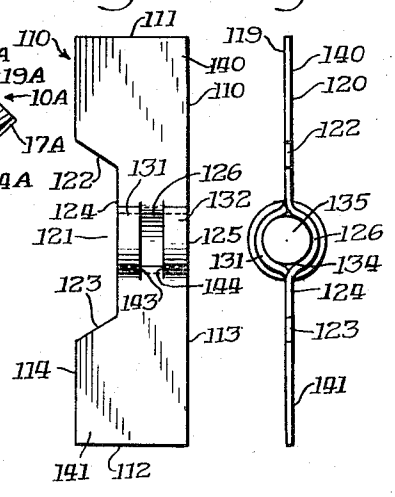


Fig. 6. Fig. 7



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BLOWER FAN CONSTRUCTION AND IMPELLERS THEREFOR

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2 Claims. (Cl. 230—134)

The instant invention relates to blower fan constructions. Particularly it relates to their impellers and the blanks from which the same are formed.

Small appliances such as still and motion picture projectors employ blower fans as components for the purpose of reducing heat developed during operation of such appliances. To the end that distribution of such appliances is maximized, there is substantial interest in minimizing the costs of components for the purpose of producing a corresponding effect on the price of such appliances in the marketplace.

A conventional blower fan adapted for use in appliances of the class indicated and exclusive of a fan motor has a total manufacturer's cost made up of materials and labor costs. Materials which include the vanes, a hub on which said vanes are mounted, and a set screw for securing the vanes on a hub, account for about 40 percent of this total cost. The remaining 60 percent of the cost is attributable to the labor in the fabrication and forming of the vanes and the hub and the assembly of the parts. By eliminating separate vane and hub construction, and the requirement of a set screw for fastening the hub and vanes to the shaft of a blower fan, substantial savings can be effected in the cost of fan construction of the class contemplated by the instant invention.

Pursuant to the instant invention, and as a primary object thereof, a new and novel blower fan construction is provided, the total cost of which is approximately 17 percent of the cost of conventional constructions of the same class.

A further object of the instant invention is the provision of a blower fan construction having an impeller defining a plurality of vanes and which has integral frictional means whereby the impeller may be mounted on the shaft of a blower fan and thereby grip the shaft in a manner such that the vanes extend radially from the shaft and are retained from movement axially and rotationally independently thereof.

It is an additional object of the instant invention to provide for a blower fan construction an impeller defining a plurality of vanes extending radially from a hub portion of said impeller, the hub portion providing a plurality of slots through which the shaft of the fan construction can be woven for frictional retention of the impeller in adjusted positions upon the shaft.

Another object of the instant invention is the provision of a blower fan construction in which a plurality of impeller means having radially extending vanes with overlapping, interlocking or meshing hub parts are frictionally lockable on the fan shaft for rotation therewith and retention thereby of said impeller means from movement independently of the fan shaft.

Still a further object of the present invention is the provision of a blower fan having a plurality of impellers defining radially extending vanes adapted for disposition angularly from each other about the axis provided by the shaft of the fan, the impellers having hubs providing knuckle-like spring members interlocking with each other and held in such interlocked position by the shaft of the blower fan on which said impellers are frictionally retained from independent movement.

The foregoing and other objects, features and advantages of the present invention will become more apparent upon consideration of the following description and appended claims, when considered in conjunction with the accompanying drawings wherein the same reference character or numeral refers to like or corresponding parts throughout the several views.

On the drawings:

FIG. 1 is an elevational view of an impeller embodying one form of the instant invention.

FIG. 2 is an elevational view looking toward the left side of FIG. 1.

FIG. 3 is a front elevation of a blower fan construction characterized by said impeller as viewed looking toward the right side of FIG. 1 and in operative association with a like impeller.

FIG. 4 is a side elevational view of the blower fan construction looking toward the right side of FIG. 3, parts shown dotted for the purpose of illustration.

FIG. 5 is a perspective view of the blower fan construction.

FIG. 6 is an elevational view of an impeller embodying a modified form of the invention.

FIG. 7 is a front elevation of a fan construction comprising the impeller shown in FIG. 6 and looking toward the left side thereof.

Referring now more particularly to the form of the invention in FIGS. 1–5, inclusive, an elongated impeller **10** fabricated from a metal having leaf spring characteristics is seen defined by a top side **11**, a bottom side **12**, a first long side **13** and an opposite long side **14**. The impeller **10** may be formed from a rectangular blank in which the sides **11** and **12** are parallel to each other and the sides **13** and **14** are parallel to each other, and having four angles **15**, **16**, **17** and **18**, and defined by opposite faces **19** and **20**.

As illustrated in FIGS. 3, 4 and 5, a pair of substantially identical impellers are provided. The second thereof **10A** has integral parts, surfaces and angles corresponding to those parts, surfaces and angles of the first impeller **10**. In order to facilitate understanding of the relationship of impellers **10** and **10A**, the parts, surfaces and angles of the impeller **10A** have been labeled with the same numeral of identification as corresponding parts, surfaces and angles of the impeller **10**. However, to distinguish the impellers, to each numeral of the second and indicia comprising A has been added or appended on the drawings.

The blank comprising impeller **10**, if desired, may be twisted or curved to provide variations in fluid flow in a finished fan construction in accordance with requirements, and in a manner which will be apparent to those skilled in the art. In the embodiment shown in FIGS. 1–5, inclusive, the impellers **10** and **10A** have been twisted axially by twisting the corners defined by angles **16** and **17** clockwise and counterclockwise, respectively, and in directions toward each other. It is appreciated, however, that twisting or curving of the blade for the purpose of controlling the fluid flow is not a critical aspect of the instant invention.

The blank from which the impeller **10** is constructed has therein formed a recess **21** opening to the side **14**, as illustrated in FIG. 1. The recess is limited by parallel top and bottom sides **22** and **23** and an inner side **24**. Top and bottom sides **22** and **23** of the recess **21** are preferably spaced equi-distant from the top and bottom sides **11** and **12** of the impeller **10** while the same is in its rectangular form prior to bending. That is to say, the top and bottom sides **22** and **23** are equi-distant from an axis or center line extending transversely of the sides **13** and **14**, whereby said top and bottom sides **22** and **23** may

be considered as defining a hub portion 25 of the impeller 10, as illustrated in FIG. 1.

A rectangular slot, opening or window 26 is also formed in the impeller 10, and said slot, opening or window 26 comprises parallel top and bottom sides 27 and 28 and a pair of parallel axially spaced sides 29 and 30 which are normal to top and bottom sides 27 and 28, as illustrated in FIG. 1. The window 26 is disposed in the impeller hub portion 25, the top and bottom sides 27 and 28 being axially aligned with the top and bottom sides 22 and 23, respectively, the sides 29 and 30 being parallel to the recess inner side 24 and the side 14 in the original flattened blank form of said impeller.

The spacing axially between the recess inner side 24 and the side 29 may be equal to the dimension or spacing of the side 29 from the side 30. Additionally, the spacing of the side 30 of the opening 26 from the long side 13 of the impeller 10 is equal to the axial spacing of the side 29 from the side 30. Also, the axial spacing of the side 24 of the recess 21 from the impeller long side 14 is equal to the axial spacing of the side 29 from the side 30.

The foregoing arrangement provides in the impeller 10 a fabric portion 31 disposed between recess inner side 24 and the window side 29. The construction also provides a fabric portion 32 between the window side 30 and the impeller long side 13. The fabric portions 31 and 32 may be considered bendable knuckles, each of which has an axial dimension equal to the axial dimension or spacing between the window sides 29 and 30. The hub portion 25 of the impeller 10 accordingly comprises knuckle 32, window 26, knuckle 31, and recess 21 in axial alignment, that is, in alignment transversely of the impeller sides 13 and 14. Hub components and openings corresponding to the axially aligned structural components and details of the impeller 10 are found in the impeller 10A, and, where appearing in the drawings, are labeled in the manner previously described.

As illustrated in FIGS. 3, 4 and 5, in the blower fan construction a pair of impellers 10 and 10A are employed. To that end, the impellers may be disposed adjacent each other with surfaces 19 and 19A in facing relationship in a manner such that recesses 21 and 21A are disposed in opposite directions axially. That is to say, the recess 21 faces the knuckle 32A, and the recess 21A faces the knuckle 32. Such arrangement will associate the impellers 10 and 10A in a manner such that the knuckle 31 is disposed over or adjacent the window 26A, whereas the knuckle 31A is disposed over or adjacent the window 26.

From such arrangement, each impeller may be bent to form an included angle 33, as illustrated in FIG. 1, the knuckle 32 being pushed or projected through the recess 21A, the knuckle 31 being pushed or projected through the window 26A, the knuckle 32A being pushed or projected through the window 21, and the knuckle 31A being pushed or projected through the window 26. The foregoing procedure generates an axial passage 34, as illustrated in FIG. 3, which is defined by knuckles 31 and 32 on one side which have been projected in one direction through opening 26A and recess 21A, and knuckles 31A and 32A on the other side which have been projected in an opposite direction through window 26 and recess 21. The transverse dimension of the axial path thereby generated can be varied by the extent to which the impellers are bent.

The joined together impellers having knuckles interposed between each other can be mounted upon a driven shaft 35 to form a blower fan construction. That is to say, the impellers can be bent to provide an opening 34 larger than the diameter of the shaft 35, and the normal spring action after mounting of said impellers about the shaft 35 in the manner illustrated in FIGS. 3, 4 and 5 will then cause the impellers to spring back and grip the shaft 35, said impellers being retained in tensioned positions by abutment against top and bottom sides 26, 28, 26A and 28A, respectively.

It is apparent from the foregoing that no additional mechanical fasteners are required, and that the impellers 10 and 10A will be restrained from movement independently of the shaft 35 by frictional engagement; and that, in accordance with the foregoing construction, each of the impellers provides a pair of rotatable vanes extending somewhat radially from the shaft 35 and driven thereby. If desired, the retention of the impellers may be insured by knurling the surface of the shaft 35 in an obvious fashion or by providing recesses in the surface of the shaft 35 in which the knuckles of the impellers engage, whereby movement axially of the shaft 35 would be further precluded.

Should it be desired to provide a greater interlocking of the impellers, a plurality of openings corresponding to the window 26 may be provided in each impeller, with such windows disposed axially and spaced from each other a distance equivalent to their respective axial or transverse dimensions, thereby generating additional alternating knuckles permitting a hinge-type connection between such impellers in a manner such as that heretofore described.

An impeller 110 comprises the modified form of the invention, and said impeller may be formed from a rectangular blank having top and bottom sides 111 and 112 which are parallel to each other, and parallel sides 113 and 114 which are disposed normally to the sides 111 and 112, as illustrated in FIG. 6. The impeller 110 has a recess 121 opening outwardly through the side 114 and bounded by upwardly and outwardly sloping top and bottom sides 122 and 123, respectively, and an inner side 124. What will define a pair of vanes 140 and 141 are projected in opposite directions outwardly or radially from a hub or central portion 125, the axis of rotation of which extends transversely of the sides 113 and 114.

By providing in the blank from which the impeller 110 is fabricated a plurality of axially spaced apart slits 143 and 144 parallel to the sides 113 and 114 and disposed medially of the hub 125 extending equi-distant from the axis thereof, a facility for securely mounting the impeller 110 on a driven shaft 135 is provided. That is to say, in accordance with the foregoing construction, the hub 125 is divided into a plurality of axially aligned sections 131, 126 and 132 separated by the parallel slits 143 and 144. Alternate, that is, every other of said sections 131, 126 and 132 is pushed, projected or bent outwardly from surface 119 of said impeller 110, while the other of said sections 131, 126 and 132 is pushed, projected or bent outwardly from the surface 121 of said impeller 110. Thereby, there is provided an axially extending passage 134 which will accommodate the driven shaft 135 to provide a blower fan construction.

The manner in which a plurality of impellers 110 may be assembled to provide blower fans with more than the pair of vanes illustrated will be apparent without the requirement of encumbering the instant description. The spring-like character of the metal from which the impeller 110 is fabricated will provide the characteristics in the sections 131, 126 and 132 which will cause them to tightly frictionally grip the shaft 135 when mounted. In the manner previously indicated in connection with impellers 10 and 10A, additional facility may be provided to enhance the gripping of the impeller 110, that is, by knurling the surface of the shaft 135 to enhance the frictional gripping or by providing recesses in the surface of said shaft 135 to generate shoulders or abutments for the sides of hub sections 126, 131 and 132 precluding axial movement of the impeller 110 on said shaft 135.

From the foregoing, it is apparent that there is provided an exceedingly simple blower fan construction which, by reason of impeller means self-retained on the blower fan shaft, minimizes cost of blower fan construction.

As many substitutions or changes could be made in the above described construction, and as many apparently widely different embodiments of the invention within the

scope of the claims could be constructed without departing from the scope and spirit thereof, it is intended that all matter contained in the accompanying specification shall be interpreted as being illustrative and not in a limiting sense.

What is claimed is:

1. In a blower fan construction having a drivable shaft defining an axis of rotation, the improvement comprising:

a pair of associated impellers having opposed fan fins and medial hub portions;

said hub portions defining shaft semi-encircling members curved under tension;

said shaft semi-encircling members of each impeller being projected between the shaft semi-encircling members of the other impeller and defining an axial path for said shaft;

said impellers being frictionally retained on said shaft only by the torque of the tension of said shaft semi-encircling members.

2. A blower fan construction as in claim 1, said impellers being formed as identical one-piece blanks of bendable material, whereby simultaneous pressure inwardly on the opposed fins of each impeller blank enlarges said axial path to release the impeller for axial adjustment along said shaft, and upon release of said pressure cause said frictional grip of said impellers on said shaft.

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