

March 6, 1945.

M. H. FRISBIE

2,370,652

FAN IMPELLER

Original Filed June 8, 1939

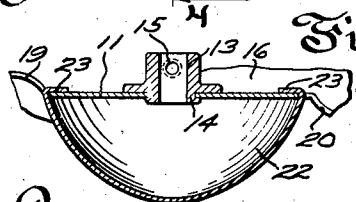
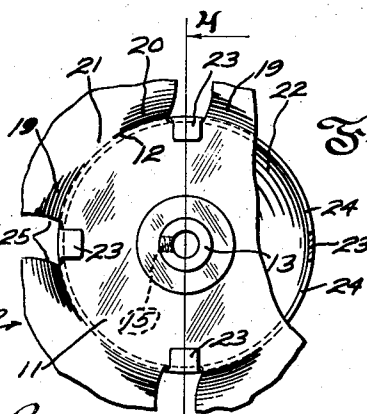
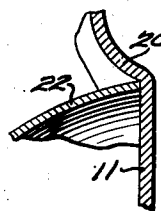
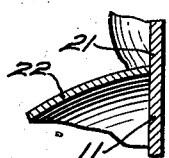
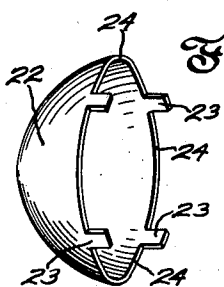
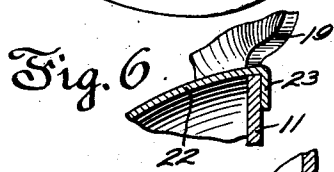
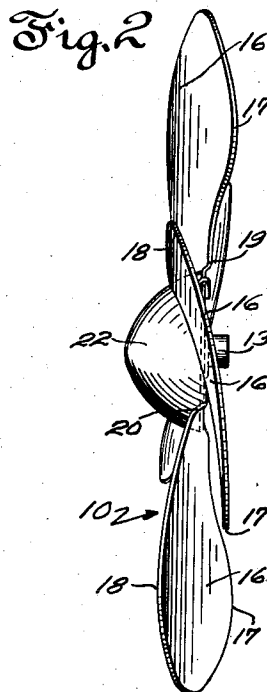
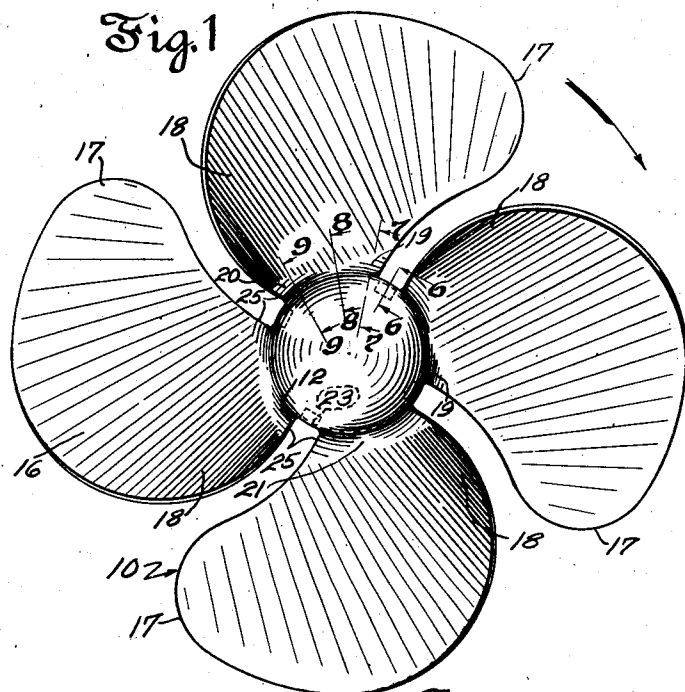


Fig. 5

INVENTOR
Marshall H. Frisbie
BY
R. Smith
ATTORNEY

UNITED STATES PATENT OFFICE

2,370,652

FAN IMPELLER

Marshall H. Frisbie, Hamden, Conn., assignor to
The A. C. Gilbert Company, New Haven, Conn.,
a corporation of Maryland

Original application June 8, 1939, Serial No.
277,984. Divided and this application July 30,
1941, Serial No. 404,585

4 Claims. (Cl. 170-159)

This invention relates to air impellers adapted to be mounted directly upon the shaft of a small motor as in fans for use in the household and office, in automobile and telephone booth interiors and other restricted places requiring air circulation.

This application is divisional from my copending application, Serial No. 277,984, filed June 8, 1939, now Patent 2,285,428, of June 9, 1942.

One object of the invention is the provision of an impeller of unusually light weight and extreme simplicity of construction which at the same time shall be silent in operation, attractive in appearance, and virtually proof against permanent deformation of its designed blade contours by any of the common accidental causes of such deformation.

A further object is to warp or distort the air fanning blade sheet portions into such surface contours that these blade portions of the sheet shall possess a greater ability to withstand forces tending to cause their deformation or collapse when the blade sheet itself is made of very thin or flexible material than would otherwise be the case. Thus rubber and other safety materials, as well as the more pliable or resilient sheet metals, or combinations of both may be employed as the material or materials of the blade sheet.

A still further object is to provide the blade with a bordering edge so outlining the blade in relation to the surface contour of the blade and in relation to the bordering edge of each neighboring blade that ambient air is scooped up and displaced in the form of a continuous stream of air emanating from the fan with increased efficiency and quietness.

These and other objects of the improvements will become apparent from the following description of typical constructions in which the invention may be embodied, said description having reference to the accompanying drawing, wherein:

Fig. 1 is a front view of a fan impeller embodying the invention.

Fig. 2 is an edgewise view of the impeller looking from the right at Fig. 1.

Fig. 3 is a fragmentary view of the rear of the impeller drawn on an enlarged scale, the blade sheet being partially broken away.

Fig. 4 is a view taken in section on the plane 4-4 in Fig. 3.

Fig. 5 is a perspective view of the nose cap before assemblage with the blade sheet.

Figs. 6, 7, 8 and 9 are further enlarged views taken in section respectively on the planes 6-6, 7-7, 8-8, and 9-9 in Fig. 1, looking in the direction of the arrows.

The multiple blade sheet of the improved impeller as a whole is designated as 10 in Figs. 1 to 6 inclusive. It consists of a central planar disc-like portion 11, whose perimeter may be considered as falling on the circumferential line 12, together with the blade portions 16 outstanding therefrom. The direction of rotation is indicated by curved arrow in Fig. 1. This disc-like portion is centrally apertured to receive the usual hub 13 made fast thereto by peaning over at 14 its inwardly projecting nipple and contains the threaded hole 15 to receive a set screw, not shown, by which hub 13 may be secured on the usual motor shaft, not shown. The root portion of each blade which flanks and is outwardly contiguous to the perimeter 12 of the disc-like portion 11, is twisted to impart to the blade portion 16 of the sheet 10 one offset 19 which positions the air entering nose 17 of the blade on the rear side of the plane of the disc-like portion 11 and an opposite offset 20 which positions the trailing end 18 of the blade on the forward side of the plane of said disc-like portion as shown in Fig. 2. At a point circumferentially between these rearward and forward offsets 19 and 20, the blade 16 forms a smooth radial outward continuation of the disc-like portion 11 as shown in Fig. 8.

The offsets 19 and 20 are confined to approximately the shaded areas so designated in Figs. 1 and 3 and merge into the general or all-over conformation of the air impelling or front face of the blade which in accordance with the principles taught in the U. S. Patent No. 2,022,417 granted to A. C. Gilbert et al. preferably forms a tapered trough whose surface contour coincides with straight line elements, roughly represented by the shade lines appearing in Fig. 1, which converge as they near the axis of impeller rotation. A trough as described may be said to be traversed by spaced perigee and apogee circumferentially extending marginal portions located respectively far from and near to the axis of rotation, or in other words, near the blade perimeter and near the blade root respectively so located, the perigee marginal portion traversing the more abruptly curved end of said trough and the apogee marginal portion traversing the less abruptly curved end of said trough. Such a trough may be said to possess a cone-like conformation and may to advantage conform to some part of the curved surface of a true cone. The tapering trough-like conformation of the

55

blade and its disposition in relation to the central disc-like portion 11, combined with the offsets 19 and 20, serve cooperatively to produce a maximum resistance of the blade to forces tending to distort its shape. Such blade even if made of unreinforced flexible resilient sheet rubber in its radially outward portions will have the strength to remain upright or sturdily outstanding without any appreciable degree of distortion or tendency to collapse when stationary or when being rotated at high speed, its cone-like curvature having the peculiar quality of imparting this "stand-up" strength. Or in fans embodying a multiple blade sheet of the shape and contours above described, the material of the sheet may be metal of more than ordinary thinness, lightness and pliancy and for the same reasons possess the "stand-up" strength of a thicker or stiffer metal not formed on these advantageous principles of curvature.

A nose cap 22 may be employed and made of thin drawn sheet metal or any other low cost material and for its purposes of reinforcing the blade sheet need be fastened only to the blade sheet, itself. For conveniently fastening this nose cap in one form of the invention, the latter is provided with tangs 23 formed by rearward extensions of its walls which elsewhere terminate in the planar edge or face 24. Tangs 23 are wide enough snugly to fill the circumferential extent of spaces 25 between adjacent edges of neighboring blades along the perimeter line 12 so that when these tangs extend through the said spaces, respectively, the nose cap is rotatively interlocked with the blade sheet. The tangs are then bent radially inward over and snugly against the rear surface of the blade sheet as shown in Figs. 3, 4 and 6 so that they draw the planar face or edge 24 of the nose cap 22 firmly against the front surface of the disc-like portion 11 at its perimeter thereby reinforcing and making this disc-like portion rigid to all intents and purposes by preventing its distortion in any part away from its designed plane of rotation. This manner of assembling the nose cap with the blade sheet also causes the nose cap to look more like an integral part of the whole impeller due to the fact that the blade offset 20 closely overhangs the nose cap while the blade offset 19 merges into and forms in appearance a rearward continuation of the outer wall of the nose cap.

In the relationship of the blades shown in Fig. 1 it will be observed that in this front view projection of the blades, each space 25 between blade edges extends radially outward in arcuate form and is of uniform width from the nose cap 22 to the narrow air entering nose 27 of the blade 16. Also it will be noted that the concave edge of the entering portion of the blade extends for at least half the radiating extent of the blade in directions more nearly radiating than circumferential with respect to the axis of rotation of the blade. It will also be observed that the trailing edge of each blade is much closer to the leading edge of the following blade than it is to the trailing edge of said following blade. In the edge view of the nearest or vertically central blade in Fig. 2 it will be observed that each blade has a materially greater pitch

in its trailing or blunt end portion than it has in its leading or pointed end portion. These are factors in the quietness and efficiency of air pick-up and displacement.

The term "sheet" as used herein is inclusive of laminated or conjoined sheet-like structures well known in the art.

Further modifications of the particular structures herein shown and described will occur to those skilled in the art as capable of incorporating the principles of these improvements, and the appended claims are directed to and intended to cover all fair equivalents of the combinations, elements and features which fairly fall within the meaning of their terms.

The following is claimed:

1. A fan impeller having four blades, each of which blades has at least as much circumferential extent as it has radial extent with respect to the axis of impeller rotation, each blade further having a relatively blunt-ended trailing portion terminating in a convex trailing edge and an air entering portion which is relatively elongated in a circumferential direction, the pitch angle of the working face of each blade being a maximum in said trailing portion and being a minimum in said entering portion and said entering portion including a concave air entering edge extending for at least half the radiating extent of the blade in directions more nearly radiating than circumferential with respect to the axis of rotation of the blade, said entering edge and trailing edge of adjacent blades being shaped and relatively disposed to form when projected onto a plane perpendicular to said axis of rotation an arcuate space therebetween of substantially uniform width curving radially outward from the roots of the blades in a direction inclined toward the direction of blade travel.

2. A fan impeller as defined in claim 1 having blade surfaces acting against the air each of which surfaces is contoured to form a tapering trough and contains straight lines which converge as they near the axis of impeller rotation.

3. A fan impeller as defined in claim 1 having blade surfaces acting against the air each of which surfaces is contoured to form a tapering trough of conical conformation traversed by spaced perigee and apogee marginal portions, said perigee marginal portion traversing the more abruptly curved end of said trough.

4. A fan impeller having a plurality of circumferentially spaced blades, each blade having a relatively blunt-ended trailing portion and an air entering portion which is relatively elongated and tapers in a circumferential direction and terminates in a relatively narrow air entering nose, the trailing edge of each blade being much closer to the leading edge and air entering nose of the following blade than it is to the trailing edge of said following blade and said neighboring trailing and leading edges of adjacent blades being shaped and relatively disposed to form when projected onto a plane perpendicular to the axis of rotation an arcuate space therebetween of substantially uniform width curving radially outwardly from the roots of the blades in a direction inclined toward the direction of blade travel.

MARSHALL H. FRISBIE.