United States Patent

Lester et al.

[15] **3,635,588**

[45] **Jan. 18, 1972**

[54] DETENT MECHANISM FOR RETAINING VANES IN A CIRCULARLY DRIVEN IMPELLER

[72] Inventors: **Robert W. Lester**, 54 George Street, Manhasset, N.Y. 11030; **Thomas Rockson**, 1920 Railroad Ave., Holbrook, N.Y. 11741

[22] Filed: **Feb. 16, 1970**

[21] Appl. No.: **11,687**

[52] **U.S. Cl.**.....**416/187**, 416/206, 416/207, 416/244

[51] **Int. Cl.**.....**F04d 17/00**

[58] **Field of Search**.....416/187, 216, 200, 221, 206; 415/54; 29/156.8 CF

[56] **References Cited**

UNITED STATES PATENTS

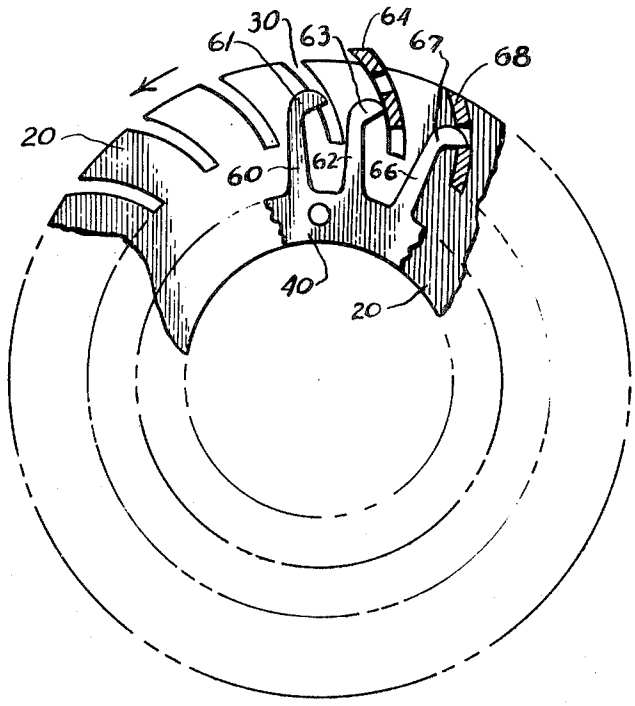
3,055,085	9/1962	Mayne	29/156.8 CF
3,181,778	5/1965	Mayne	29/156.8 CF
3,186,069	6/1965	Mayne	416/187
3,335,482	7/1967	McClatchie	29/156.8 CF
3,450,337	6/1969	Jolette	29/156.8 CF

Primary Examiner—Martin P. Schwadron
Assistant Examiner—Clemens Schimikowski
Attorney—Thomas B. Graham

[57] **ABSTRACT**

An air impeller is assembled on a group of vane holder end plates having slots therein, of somewhat crescent shape, to receive the ends of vanes held in alignment symmetrically around an axis, each vane holder end plate having coordinated therewith a spider spring which is fastened to the face of the vane holder plate, the spider spring having a plurality of circumferentially located resilient detent extensions, suited to engage each vane when it is slipped into place, the engagement being positive in a groove or notch in the vane, thereby to form a positively unitary assembled device for use in the blower.

2 Claims, 8 Drawing Figures



PATENTED JAN 1 8 1972

3,635,588

SHEET 1 OF 2

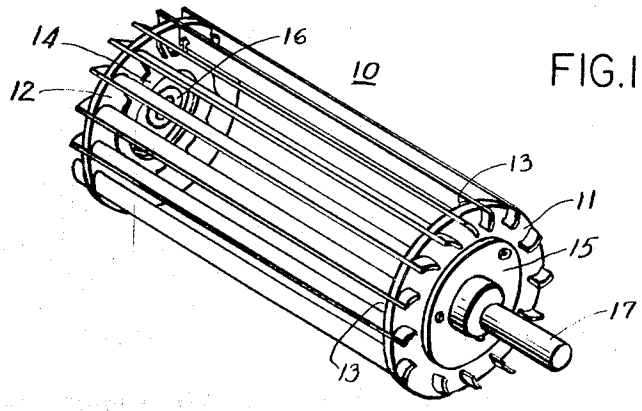
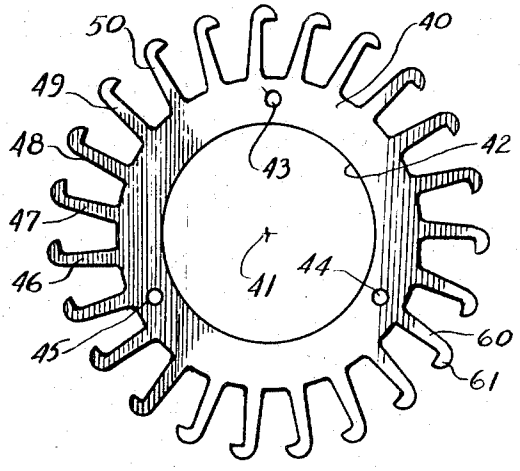


FIG.1

FIG.2

FIG.3



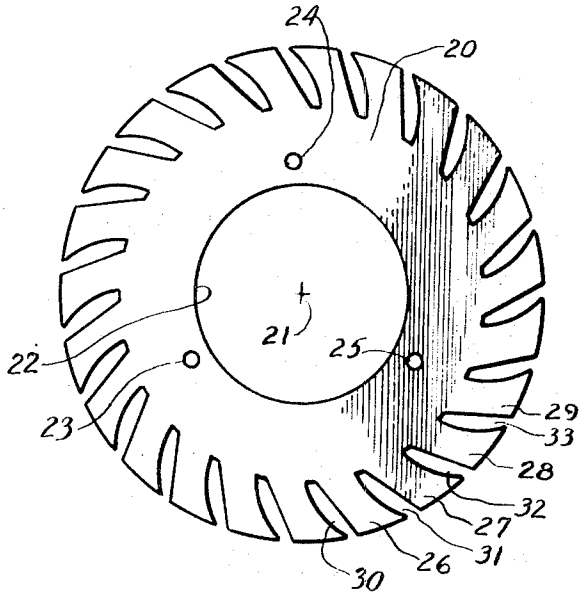
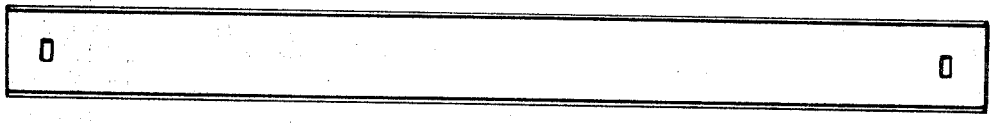


FIG.4



INVENTORS
ROBERT W. LESTER
THOMAS ROCKSON

BY

ATTORNEY

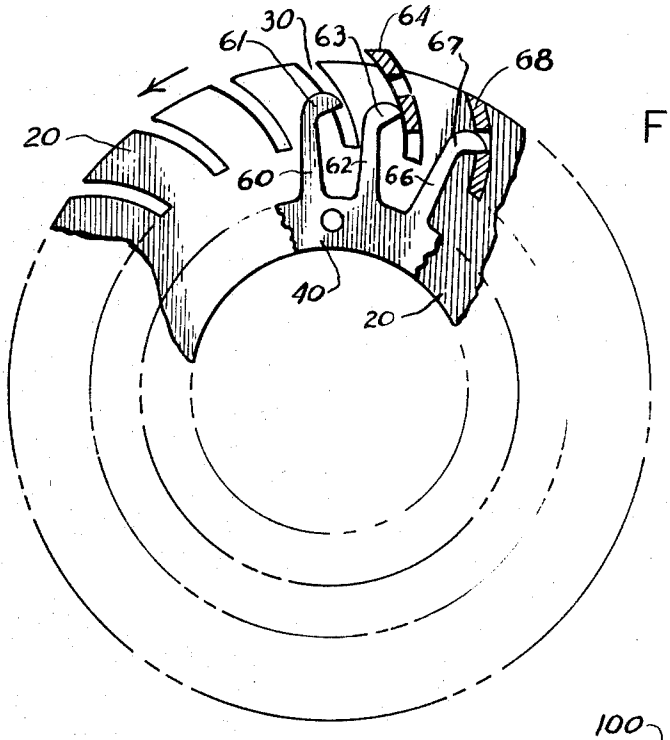


FIG.5

FIG.6

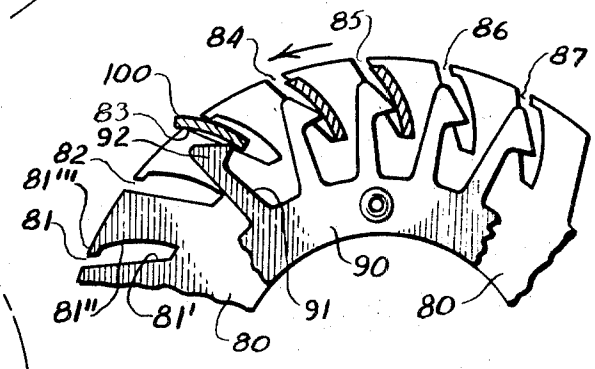


FIG.7

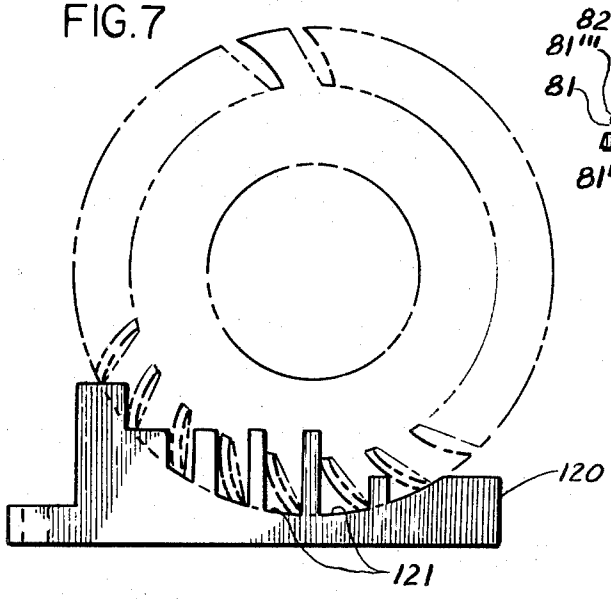
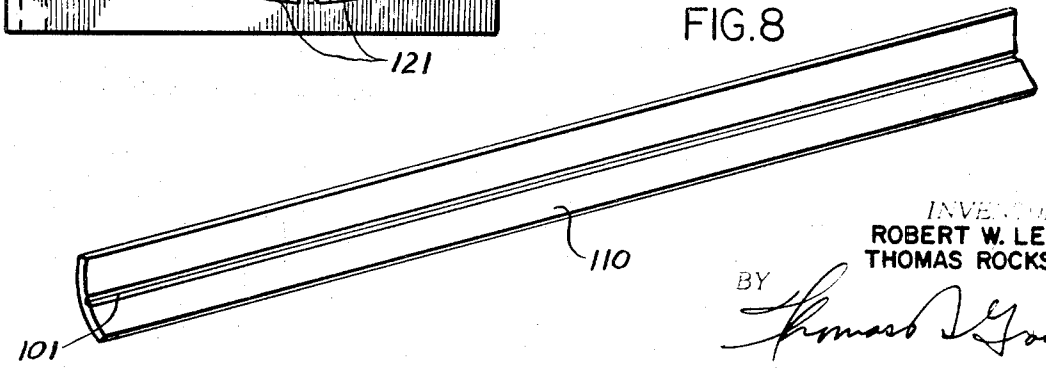


FIG.8



INVENTORS
ROBERT W. LESTER
THOMAS ROCKSON

BY

ATTORNEY

DETENT MECHANISM FOR RETAINING VANES IN A CIRCULARLY DRIVEN IMPELLER

BACKGROUND OF THE INVENTION

In the manufacture of blowers for small appliances generally, that is, air-moving devices, the tangential impeller type having fundamentally turbine-shaped blades arranged around a vane holder, the entire structure being symmetrical around a central axis, the whole being driven by an electric motor, is a very popular device, because the capacity of the blower can be increased without increasing its diameter by extending the length of the cage made up of the impeller vanes. The cage is much like a squirrel cage and by extending the length its capacity for moving air can be increased. The device, of course, has the disadvantage that it consists of many pieces and it must be assembled by assembling a sequence of a long number of individual pieces and in view of the fact that the structure is relatively complicated it has led to complications in fabrication. The conventional form of assembly is to have a jig in which the vanes are fitted to a vane holder plate and spot welded into place. This type of arrangement has inherent problems in view of the fact that it is complicated and spotwelding has its limitations. Reference to U.S. Pat. Nos. 3,260,442, Laing, dated July 12, 1966 and 3,397,463, Laing, dated Aug. 20, 1968, and others cited therein will indicate the type of blower and appliance to which we refer.

It is, accordingly, a fundamental object of this invention to provide a novel assembly of a squirrel cage tangential-type air impeller for blowers characterized by the unique structure of the vane holder end plates coordinated with a detent mechanism, mounted with the vane holder end plate to make a unitary assembly giving position engagement to the vanes in a manner such that the assembly is generally useful for the fabrication of this type of impeller mechanism.

DETAILED DESCRIPTION OF THE INVENTION

The invention accordingly is embodied in a support structure for a blower impeller vanes assembled in a squirrel cage type structure, the ends being characterized by a coordinated vane holder end plate and spider spring forming a positive detent for holding each vane in place. The entire combination has the advantage, of course, that the vane holder plate and the spider spring can be made of sheet metal stampings and can all be made alike, the left and right-hand versions needed for opposing ends of a single shaft being obtained by merely facing the vanes correctly. That is one end of the shaft is merely a mirror image of the other and the vane holder end plate suitable for one end is suitable for the other, but has its opposite face toward the shaft. In assembly it is necessary merely to provide a simple jig in which to support the vane holder end plate with its spider spring while the blades of the impeller are inserted manually and, of course, as each one snaps into place against the tension of the spring, this fact becomes known to the operator through his hearing and feeling the snap.

The invention thus is embodied in the combination of elements and assembly of parts characterizing the entire squirrel cage vane assembly, particularly, the end assembly having the features and combinations of parts more fully described herein and the method of assembly characterized by the steps and combinations of stamps involving putting the entire assembly together.

The invention will be better understood by reference to the drawings wherein

FIG. 1 is a small isometric view of the impeller assembly shown in order that the details of the structure of the invention can be properly oriented with respect to a physical embodiment of the total assembly.

FIG. 2 is a plan view of the end vane holder plate.

FIG. 3 is a plan view of the spider spring coordinated with vane holder plate.

FIG. 4 is a plan view of a blower impeller plate or vane.

FIG. 5 is a plan view showing the process of assembling the vanes in place on the end vane holder plate.

FIG. 6 is a plan view of a variant of the structure employing the vane plate, the spider spring, in the assembly of the entire impeller cage.

FIG. 7 is a plan view of a vane holder plate held in a jig suitable for the assembly operation. It is apparent that as many jigs as there are holder plates in a particular squirrel cage will be used.

FIG. 8 is an isometric view of a vane.

Referring now to FIG. 1, 10 represents the entire assembly consisting of end vane holder plates 11 and 12, on either end with spider springs 13 and 14, the entire mechanism being fastened to bearing plates 15 and 16, which is carried on shaft 17. The remainder of the assembly of the blower consists in connecting the shaft to a motor drive and providing a housing for the blower so that there can be a direction provided for the discharge of the air current generated by the high speed rotating vanes. Reference to U.S. Pat. Nos. 3,260,442 and 3,397,463 will indicate the manner of use of the impeller in appliances.

The invention, of course, in the instant case is in the novel structure of end plate and in FIGS. 2 through 6 we have illustrated in detail the mechanism on which the end assembly depends.

In FIG. 2, 20 represents a circular disk having its axis at 21, with a central circular opening 22, and circumferentially placed holes for connection 23, 24 and 25. These are placed at the apexes of an equilateral triangle. The outer circumference of the vane holder plate carries a plurality of teeth 26, 27, 28 and 29 etc., defining openings 30, 31, 32, 33 etc. The openings are crescent shaped, at least on one side to match the curvature of the impeller blade to be fitted therein.

In FIG. 3 is shown the spider spring which consists of a disk 40 having its center at 41 and having a centrally located opening 42 therein. Holes 43, 44, 45 are centrally placed on an equilateral triangle, centered on 41, so as to match the holes 23, 24 and 25 of the end vane holder plate. The circumference of the disk carries a sequence of springs, which are springs because of the natural elasticity of the metal constituting the disk. That is each of the springs relies for its holding force upon the natural elasticity of the metal of which the disk is formed. Thus, the sequence of springs 46, 47, 48, 49, 50 etc., are all alike and correspond in number to the vane holder end plate and in particular to the number of crescent shaped slots in the vane holder end plate. Each spring consists of a radially outwardly extending portion 60 and a circumferentially directed end portion 61 to form a detent for the engagement of a member. It is important in the dimensioning of the spring to place the element 60 and 61 so that the detent 61 essentially engages the crescent shaped side of the slot in the vane holder plate. This will be better understood by reference to the succeeding figures, showing how the entire impeller is assembled.

Thus, reference to FIG. 5, which is partially in section, illustrates the principle by which the spider spring 40 is mounted on the vane holder plate 20 and how the spring 60 with its detent head 61 is oriented with respect to slot 30, for example.

It will be noted by inspection of the adjacent slot, carrying spring 62 and detent 63, that blade 64 is inserted into the slot, and when fully inserted, it is flush with the outer periphery of the end vane holder plate 20. This is shown in connection with spring 66 and detent 67 and vane 68.

In FIG. 6 we have shown the variant involving the use of the vane holder plate and the spider spring arranged positively to engage the vanes. Thus, the vane holder plate 80 is formed with slots 81, 82, 83, 84, 85 etc., therein. The slots 81 are characterized by having a straight side 81', and a curved side 81'', and a peripheral projection 81'''. In this assembly the spider spring 90 with its individual spring elements 91 having the terminal detent 92 is, as in the previous embodiment, mounted so as to overlap the slot openings. This is shown in slots 86 and 87 where the vanes have not been indicated. With the insertion of vane 100 the spring is pushed back and its normal tension engages the vane positively and the vane itself is

fitted under the edge or peripheral projection of vane holder plate. In this manner there is positive engagement and holding of the vane in place.

FIG. **8** shows a vane in plan view to indicate the manner in which either a hole or groove can be formed therein to provide for engagement by the detent portion of the spider springs. Thus, the vane **110** has a curvature which is given to it in an extrusion or rolling operation and it preferably is formed with a groove **101** therein. The purpose of the groove, of course, is to provide a point wherein the vane can be engaged by the spring. It is perfectly appropriate to place holes in the vane at points where it is expected to have the vane engaged by the spring, but inasmuch as the use of the holes and their placement with quite good levels of tolerance so that the engagement can be made is such that it should be apparent that the vane formed with the groove is the preferred version.

With this end assembly it should be apparent that an operation of putting together a blower or air impeller is a relatively simple matter. Reference to FIG. **7** will indicate briefly the mechanics of so doing. Thus, the jig **120** is provided with an arcuate rest **121** to match the circumference of the vane holder plate. The vane holder plate is held in place by a sequence of outwardly extending projections of the jig which engage the teeth thereof. With most of the circumference of the vane holder plate exposed the blades of the rotor are fitted into the slots provided. The partially assembled impeller with the plurality of vane holder plates holding the vanes in position is then turned to a position to expose the vacant slots; projections on the jig fit between the blades of the impeller; additional plates are fitted in place in the remaining slots of the vane holder plate and the task is thus completed.

With the assembly of the air impeller or squirrel cage blower the remainder of the task of attaching this device to a motor to assemble a blower in a housing is carried out to suit the designer.

We have found sheet steel an appropriate material of construction but for light appliances and most applications is advantageous to use sheet aluminum and aluminum alloys.

In recapitulation it should be noted that the advantages of the structure, particularly of the spider spring, flow from the nature thereof. Thus, the detent portions of the spring which are radially oriented with respect to the center make it possible by adjusting the position of the spring to a slightly lagging position with respect to the end vane, to have the detent essentially contact the slot in the curve when the vane is slipped in place and firm engagement is accomplished. Upon rotation of the impeller the firmness of the engagement is increased by virtue of the fact that the direction of rotation is the curved edge of the vane toward the point of the detent. Any tendency of the centrifugal force to develop is in the direction to transmit the force from the detent to the vane to the arcuate portion of the slot.

What we claim is:

1. An impeller for an air-blowing device comprising an axis a part thereof serving as a shaft, bearings on said shaft and aligned therewith and mounted on said bearings, vane holder plates, symmetrically aligned vertically to said shaft and axially disposed, each of said vane holder plates being joined with a spider spring, said spider spring extending a detent to the level of a slot in the vane holder plate, and vanes inserted in said slots, positively engaged by the detent of said spider spring.

2. A combination in accordance with claim **1**, in which the vane carries a recess for positive engagement by said detent.

* * * * *