July 21, 1959 W. W. ZINK, JR 2,895,668

BLOWER CONSTRUCTION AND METHOD OF ASSEMBLY

Filed Feb. 18, 1957

Fig. 1

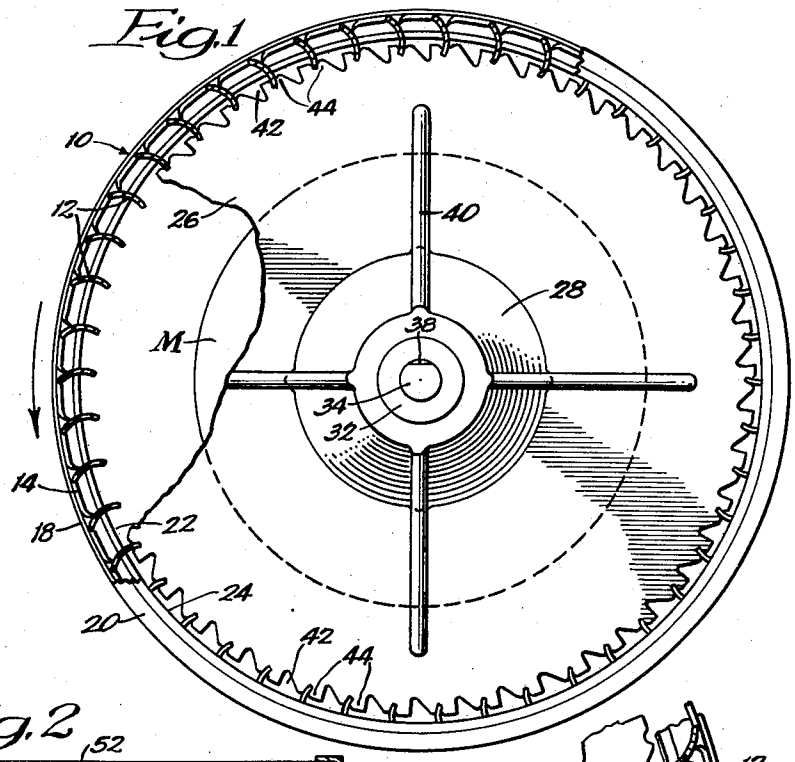


Fig. 2

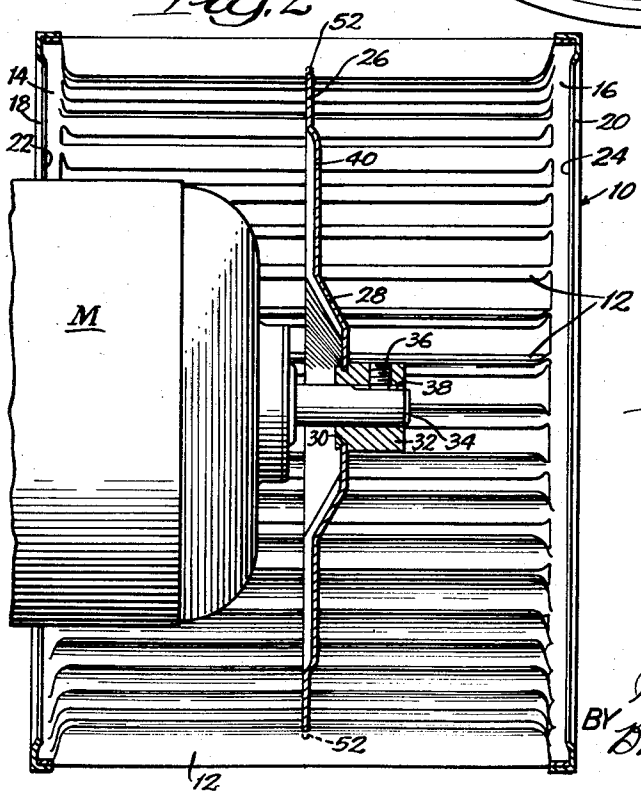


Fig. 3

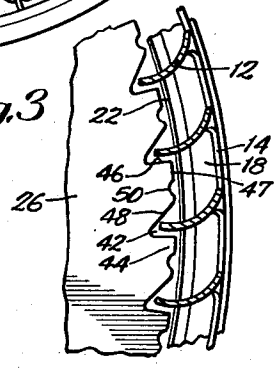
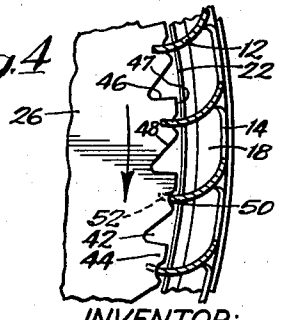


Fig. 4



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BLOWER CONSTRUCTION AND METHOD OF ASSEMBLY

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2 Claims. (Cl. 230—134)

This invention relates generally to direct drive blower wheels, and more particularly to an improved blade support plate means.

Blower wheels of the type having a multiplicity of axially-elongated blades or louvres, arranged in peripherally spaced relation between end rings to form a generally cylindrical cage unit, are well known, and are mounted for rotation about their longitudinal axes so as to draw air axially inwardly through the end rings and discharge it radially outwardly through the blades. In certain applications, it is desirable to mount such wheels for direct drive by the shaft of a motor, and to divide the blower cage into adjacent air inlet chambers for more efficient air movement by means of centrally disposed support means. Such means are conventionally rigidly secured to the motor shaft, and by various mechanical devices to the multiplicity of blades at points intermediate the end rings.

It is extremely important in the construction of such blower wheels to insure rigidity of the blades in a predetermined pitch arrangement at all operating speeds and rates of accelerations, whereby design performance and efficiency are uniformly maintained and vibration is prevented. Because of the inherently fragile structural form of the blades, and the necessity for uniformity of blade shape and pitch to insure maximum operating efficiency, it is important that the blower provide a rugged assembly capable of simple packaging without risk of accidental deformation or misalignment during handling. From the practical standpoint, therefore, the packaging of blower wheels for shipment in a reliable yet low cost manner provides a substantial economic advantage, both through a decrease in direct costs and through the minimizing of replacements.

It is the primary purpose of this invention to provide a blower wheel having a simplified and improved form of support means in combination with a cage unit, whereby a reliable and rugged assembly of simple and low cost construction is achieved.

It is an object of this invention to provide a blower wheel having a unitary support plate position within a blower cage unit, said plate having a plurality of peripheral notches defining cam teeth each adapted to engage a corresponding blade edge, wherein the cam teeth each provide a detent portion for effecting positive mechanical locking of the blades in predetermined uniform alignment.

It is another object of this invention to provide unitary support plate of the aforesaid type, wherein a central embossed hub and reinforcing rib formation is provided to insure substantial mechanical strength and rigidity for maintaining uniform blade alignment at design speeds of rotation.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this invention.

Figure 1 is a side elevational view of a direct-drive blower wheel constructed in accordance with the present invention and mounted upon a motor drive shaft, parts being broken away and in vertical cross-section to show details of construction;

Figure 2 is a vertical cross-sectional view taken transversely through the blower wheel of Figure 1; and

Figures 3 and 4 are fragmentary vertical cross-sectional views on an enlarged scale showing the camming cooperation of the support plate and the blower blades during assembly to effect positive locking engagement therebetween.

Referring now more particularly to the drawing, I have indicated generally by the numeral **10** a direct-drive blower wheel mounted for rotation by a motor M. As best seen in Figure 2, a substantial portion of the motor M is disposed within the interior of the blower wheel **10**. The blower wheel is formed as a one-piece integral unit. A flat and generally recangular length of sheet metal is subjected to a simple stamping operation to define a multiplicity of spaced blades or louvers of arcuate cross-sectional form. The stamping is then rolled into the form of a generally cylindrical cage unit, comprising axially-elongated peripherally-spaced blades **12**, each extending integrally between annular end strips **14** and **16**. A pair of reinforcing rings **18** and **20** receive the cage end strips **14** and **16**, and are fixedly secured thereto by spot-welding to insure maintenance of the cage unit in rigid cylindrical form. The radially inward edges of the reinforcing rings **18** and **20** serve to define air inlet openings **22** and **24** of slightly larger diameter than that defined by the inner axial edges of the blades **12**.

A support plate **26** is disposed substantially centrally within the cage **12**. The plate **26** is outwardly dished at its center top portion to provide a generally frusto-conical embossment **28**, terminating in a central aperture **30**. A mounting hub **32**, having an annular groove and abutment shoulder adapted to receive the central edge of the plate **26** in force-fitted and locked relation, is fixedly but removably mounted at the end of the motor drive shaft **34**. A set screw **36** cooperates with a suitable flat portion **38** of the motor drive shaft **34** to permit axially adjustable and nonrotatable attachment.

A plurality of supplemental reinforcing ribs **40** extend radially outwardly from and beyond the embossment **28**, and cooperate therewith to provide strengthening means for insuring the rigidity and generally planar form of the plate **26** in parallel alignment with the cage reinforcing rings **18** and **20**.

The plate **26** is formed at its periphery with a multiplicity of circumferentially spaced notches **42** which serve to define uniformly-spaced cam teeth **44**, is of generally triangular shape, having a radial or right angular leading edge **46**, the forward direction of rotation being indicated by the arrow on Figure 1, a generally flat or tangential outermost edge **47**, and a sloping or inclined trailing edge **48** (see Figures 3 and 4). The outermost edges of the teeth **44** are formed with a groove or detent **50**, of substantially smaller radial depth than the notches **42**, and adapted to cooperate with shallow grooves or slots **52** formed at the inner axial edges of the blades **12** midway between their ends. It is particularly important that the teeth edges **48** be inclined sufficiently to enable positive camming engagement within the slots **52** of the blades **12**. An angle of from about 30° to about 45° relative to a tangent at the detent **50** is required.

It is essential that the diameter of the plate **26**, as defined by the outermost edges of the teeth **44**, be less than the diameter of the ring openings **22** and **24**, and greater than the diameter defined by the inner axial edges of the blades **12**. It is further necessary that the number and circumferential size of the teeth **44** correspond to the

number and pitch or arcuate form of the blades **12**, so that the relatively deep notches **42** may be aligned with the blades **12** and the plate **26** inserted loosely and axially in a sliding manner within the cage unit.

It will be apparent that the entire blower wheel **10** comprises only two main parts; namely, the unitary cage unit integrally providing the blades **12**, and the single support plate **26**. In order to effect assembly, the plate **26** is inserted into the cage through one of the inlet openings and slid axially to a position substantially centrally therein. Upon rotation of the plate **26** relative to the blades **12**, in the direction of the arrow in Figure 4, blade slots **52** will engage and effect a camming cooperation with the teeth edges **48**. Because of the inherent nature of the sheet metal from which the blower blades are formed, and their forwardly-concave arcuate cross-sectional form, sufficient resilience is provided to permit a radial compression or axial turning of the blades **12** as the slots **52** ride upwardly along the teeth edges **48**. When the blades cam over onto the outermost top edges of the teeth **44**, the blade slots **52** will snap into the detents **50** in a resilient manner (see Figure 4) thereby effecting a positive and tightly locked engagement with the plate **26**. The relatively shallow angle of the teeth cam edges **48**, as compared with the steep leading edges **46**, permits the blades **12** to readily turn or deform in a resilient manner upon camming rotation of the plate **26**, and thereby slide upwardly until the slots **52** drop into locking engagement within the detents **50**. The steep leading edges **46** serve as a positive stop or abutment against which no camming action can be effected. The side edges of the detents **50** are also sufficiently steep to preclude any sliding out of the blades **12** once they are engaged therein, thereby insuring a rigid lock under all design speeds of rotation and rates of acceleration.

In this way, the plate **26** is mechanically locked in a centrally disposed position within the cage unit, so as to effect a rigid and uniform support of the blades **12**, and to separate the cage into adjacent but separated air inlet chambers. The present invention thereby achieves an extremely simple two-piece construction of rugged yet low cost parts. It will be apparent that this construction achieves a substantially simplified and improved mode of manufacture for direct-drive blower wheels of the double-inlet type. In addition, since the blades **12** are maintained in predetermined axial alignment at their ends by the rings **18** and **20**, the cammed support plate **26** serves to automatically set the angle of pitch of the blades in a peripherally uniform and accurate manner, and without the necessity for any additional parts or structure. It will be apparent that by selecting support plates of various diameters for a given size of cage unit, or by employing different cage units having various blade widths, or by changing both factors, the blade pitch angle and hence the blower operating characteristics may be readily and simply adapted for numerous applications.

Changes may be made in the construction and arrangement of the parts of my blower construction and method of assembly without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical improvements which may be reasonably included within their scope.

What I claim as new and desire to obtain by Letters Patent of the United States is:

1. A drive blower wheel assembly, comprising a generally cylindrical cage unit of unitary one-piece construction having a plurality of axially-elongated peripherally-spaced blades extending integrally between parallel end rings, said end rings defining co-axial air inlet openings of larger diameter than the inner diameter of said cage unit defined by the inner axial edges of said blades, a single unitary support plate positioned within said cage between the ends of said blades, said plate having a plurality of peripheral notches defining cam teeth, each of said teeth having leading and trailing edges relative to the direction of wheel rotation and a generally tangential outermost edge therebetween, said leading edge forming a steep angle relative to said outermost edge to provide abutment means and said trailing edge forming a shallow angle relative to said outermost edge to provide cam means, each of said teeth outermost edges having a detent groove, the outer diameter of said plate defined by the outermost edges of said teeth being smaller than the diameters of said air inlet openings but greater than said inner diameter of the cage unit, and the diameter across said plate between said notches being smaller than said cage unit inner diameter defined by said blades, whereby said blades may be initially loosely axially received within said notches to resiliently deform and slide radially outwardly along said teeth cam means upon rotation of said support plate rearwardly relative to said cage unit, each blade axial edge being disposed in a corresponding tooth detent groove to effect a positive mechanical locking of said blades in predetermined supported positions.

2. A drive blower wheel assembly, comprising a generally cylindrical cage unit of unitary one-piece construction having a plurality of axially-elongated peripherally-spaced blades extending integrally between parallel end rings, said end rings defining co-axial air inlet openings of larger diameter than the inner diameter of said cage unit defined by the inner axial edges of said blades, a single unitary support plate positioned within said cage between the ends of said blades, said plate having a plurality of peripheral notches defining cam teeth, each of said teeth having leading and trailing edges relative to the direction of wheel rotation and a generally tangential outermost edge therebetween, said leading edge forming a steep angle relative to said outermost edge to provide abutment means and said trailing edge forming a shallow angle relative to said outermost edge to provide cam means, each of said teeth outermost edges having a detent groove, the outer diameter of said plate defined by the outermost edges of said teeth being smaller than the diameters of said air inlet openings but greater than said inner diameter of the cage unit, and the diameter across said plate between said notches being smaller than said cage unit inner diameter defined by said blades, whereby said blades may be initially loosely axially received within said notches to resiliently deform and slide radially outwardly along said teeth cam means upon rotation of said support plate rearwardly relative to said cage unit, each blade axial edge being disposed in a corresponding tooth detent groove to effect a positive mechanical locking of said blades in predetermined supported positions, said support plate having a central embossed portion and cooperating radial rib portions to maintain planar rigidity and uniform blade alignment of the assembly.

References Cited in the file of this patent

UNITED STATES PATENTS

2,392,113	Anderson	Jan. 1, 1946
2,470,966	Abbott et al.	May 24, 1949
2,537,805	Wilken	Jan. 9, 1951