Dec. 21, 1965 A. M. OLMSTED ET AL 3,224,668

BLOWER WHEEL WEDGED END BLADE MOUNTING

Filed Jan. 22, 1965

FIG.-2

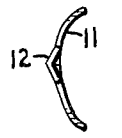


FIG.-1

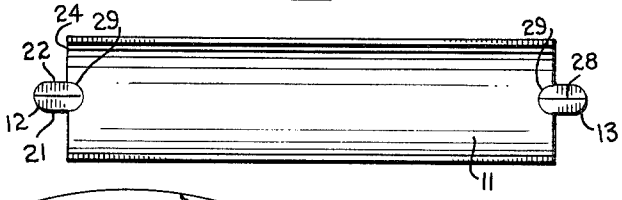


FIG.-3


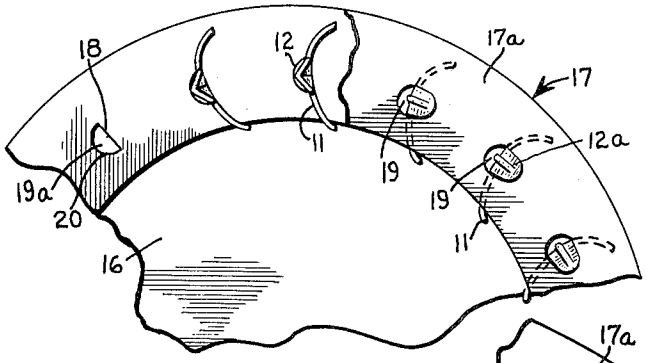


FIG.-8

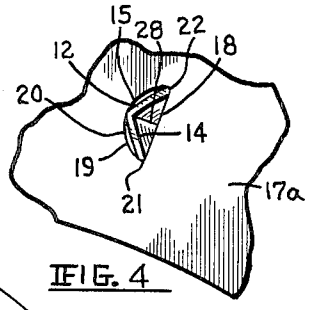


FIG. 4

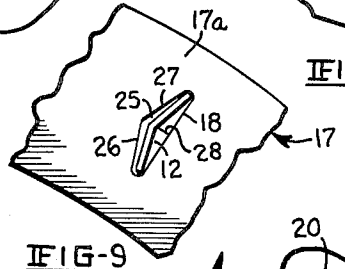


FIG-9

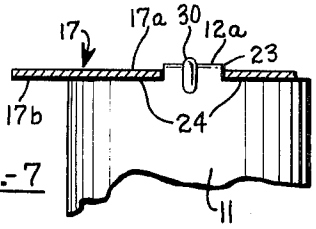


FIG.-7

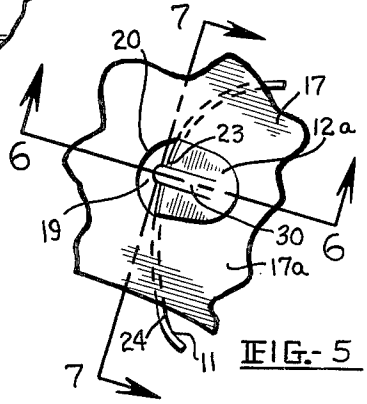


FIG.-5

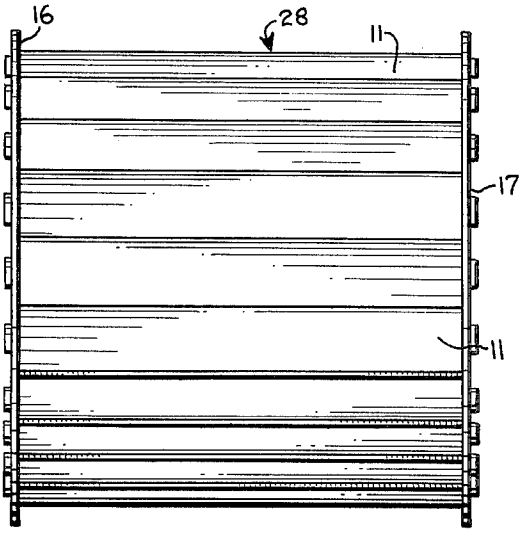


FIG.-10

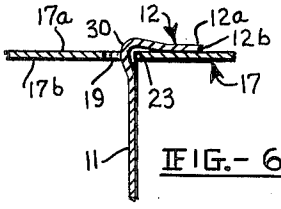


FIG.-6


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# 3,224,668
# BLOWER WHEEL WEDGED END BLADE MOUNTING

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This invention pertains to the securing of blades between two circular members in a blower wheel or the like, and particularly involves the use of longitudinally extending fingers from the blades and insertion of the fingers through spaced apart holes around the circular members and the lateral expansion of the fingers across the holes to have the marginal edges of the fingers compressively engage opposite sides of the holes, this lateral expansion of the fingers being had by bending the fingers over onto a face of the circular member opposite from the face abutted by ends of the blades.

The primary object of the invention herein described and illustrated resides in the provision of means whereby a positive, secure mounting of blades may be had between two circular members, in a manner avoiding tendency of twisting of the finished wheel by one of the circular members rotating a distance greater than the other. This relative rotation is avoided in the present invention. Also, the invention provides for a continued firm pressure by the circular members against the ends of the blades.

A further important object of the invention resides in the fact that the blades, have fingers, at least one at each end thereof, which fingers may be freely inserted through holes in the two circular members in a free sliding manner without an initial force fit, and then the fingers bent over onto the outer faces of the two circular members and expanded in the holes.

A still further important object of the invention is found in the fact that an extremely rigid overall structure is had with the use of a minimum amount of material.

These and other objects of the invention will appear in the following description of one particular form as now best known to us and as illustrated in the accompanying drawing, in which:

FIG. 1 is a view in front side elevation of a blade formed in accordance with the invention;

FIG. 2 is an end view of the left hand end of the blade shown in FIG. 1;

FIG. 3 is an end view of the right hand end of the blade shown in FIG. 1;

FIG. 4 is a top plan view on an enlarged scale of a tongue inserted through a hole in one of the circular plates;

FIG. 5 is a similar view on a somewhat larger scale and showing the finger turned over onto the face of the circular member;

FIG. 6 is a view in section on the line 6—6 in FIG. 5;

FIG. 7 is a view in section on the line 7—7 in FIG. 5;

FIG. 8 is a view in end elevation of a fragmentary portion of a blower wheel partially assembled to include a ring, a back plate, and a number of blades;

FIG. 9 is a view similar to the structure shown in FIG. 4 but with a different shape hole through a ring; and

FIG. 10 is a view in side elevation of a completely assembled blower wheel.

In the present invention, the blades are formed individually and each blade 11 has a finger 12 extending longitudinally from one end and a finger 13 extending longitudinally from the other end. These blades are curved transversely, and in the operation placing this curved shape in the blade, each of the fingers 12 and 13 is deformed from its original flat shape, preferably into a wide spread V with the legs thereof, FIG. 4, indicated



by the numerals 14 and 15 forming an obtuse angle therebetween.

The blower wheel is, in a majority of constructions, formed to have a rear circular member 16 commonly referred to as a back plate having a circular contour or peripheral portion, and to have an intake end ring 17 in the nature of a flat annulus. Both the plate 16 and the ring 17 have holes punched around circumferential lines of common radius to have these holes equally spaced apart around those lines.

Each of these holes is punched to have a marginal shape where there is a straight line 18 on the leading side of each of the holes in respect to the direction of rotation of the wheel, these holes being generally designated by the numeral 19, and the ends of the line 18 are joined in one form by ends of an arcuate line 20.

Each of the holes so shaped provides an opening which will freely receive the tongue 12 therethrough, with the edges 21 and 22 of the tongue 12 in close proximity with the junctures of the ends of the line 18 with the ends of the arcuate line 20. However the tongue 12 will slide freely through the hole 19.

As will be observed, this shape of hole prevents the insertion of the finger 12 in the reverse manner. This insures that, in assembling, every blade 11 will be assembled to have its air moving side as viewed in FIG. 1 presented in the correct direction.

The overall projected width of the finger 12 across the legs 14 and 15 is made to be, for one particular size of blade and blower wheel, .005 to .010 inch less than the distance between the junctures of the lines referred to. Within that range of dimensions, the obtuse angle between the legs 14 and 15 is made to be such that when the portion of the finger 12 projecting through the ring 17 is bent over onto the outside face 17*a* as indicated in FIGS. 5 and 6, the V-shape of the finger 12 will be changed into a more or less flat state which requires that the edges 21 and 22 of the finger presented within the hole 19 will be carried farther apart and the finger will progressively increase in width as the finger is bent over into the portion 12*a*, those edges in fact really biting into the metal in the line junctures and be maintained in that engagement by reason of the finger 12 being bent over substantially at right angles to the portion in the hole, the bend line 23 maintaining the flat shape of the two portions of the finger, namely the portion within the hole 19 and the portion compromising the bent over length. When the fingers 12 and 13 are formed into the V-shape, there will be a slight deformation 29 in the ends of the blades at the base or root of the fingers, and this deformation tends to disappear in the bending of the fingers as above indicated.

A feature of the invention resides in a bead 30 extending longitudinally of the finger in each instance which automatically forms on the finger on the side removed from the angle apex line 28 as the finger is bent over as in FIGS. 5–7. This bead 30, in so forming, performs an important function. It extends from the blade end, through the hole 19, and along the bent over length 12*a* to approximately the outer free end portion 12*b* of the finger. In so extending, the bead 30 reinforces the bend 23 and effectively maintains the end portion 12*b* in compressive contact with the face 17*a*. There is a degree of elasticity in the bent over fingers in respect to their contacts with the ring and plate which is highly desirable as means for continuously compressively embracing the blades therebetween, thereby preventing the loosening of the blades between the ring and plate after a period of time in service.

In the process of bending the finger into the portion 12*a* over onto the face 17*a*, the end of the blade 11,

designated by the numeral 24 extending from the finger 12 on each side thereof, FIG. 7, will be brought into compressive contact with the inner face 17*b* of the ring 17. Since the blade 11 has a laterally curved shape, there will be not a straight line engagement between the edge 24, but a curved line as best indicated in FIG. 8. In other words, there is no tendency for the blade 11 to be tipped from the perpendicular to the ring 17, but will be maintained there by reason of the curved zone of bearing of the edge 24.

Each of the fingers 13 on the ends of the blades 11 opposite to the finger 12 will be inserted through the holes 19*a* in the plate 16 in exactly the same manner and they are secured by turning over the tongues 13 onto the back side of the plate 16. The holes 19*a* and 19 are of the same shape but may vary in dimensions from the holes 19 in the ring 17, with the widths of the fingers varying accordingly.

Referring to FIG. 9, a triangular shaped hole 25 is shown through the ring 17 having the straight line 18, and instead of having the arcuate line 20 interconnecting the ends of the line 18, there are the two straight lines 26 and 27 completing in effect a hole having a marginal shape of an isosceles triangle. The corners between the ends of the lines 26 and 27 adjacent to line 18 are given a radius of approximately .005 to .010 inch as one example, these dimensions being indicated for one particular size of fingers 12, and of the size of the blower wheel for instance designated as 28, may vary.

Using the triangular hole 25 in each instance, both through the ring 17 and through the plate 16, the finger 12 will have a lateral width when in the V-shape to permit the finger 12 to be inserted through the hole 25 rather freely, and by reason of the shape of the hole, the finger 12 can only be inserted in the one particular direction. The finger 12 in the form shown in FIG. 9 is likewise bent over as indicated in FIGS. 5–7. The edges 21 and 22 of the finger 12 will come into compressive engagement within the curve between the junctures of the lines 26 and 27 with the line 18.

In the use of either the hole 19 or the hole 25, the straight line 18 will be on the relatively forward side of the hole, that is on the leading side thereof in respect to rotation of the wheel.

It is to be seen, therefore, that by employing a hole having a straight edge marginal portion, the deformed fingers are always required to be inserted through the holes to properly position the curvature of the blades. In this respect, the lines 18 must be so aligned around the ring 17 and the plate 16 to provide for the proper presentation of the blades 11 around the wheel. By so doing, the maximum possible effectiveness of the wheel may be had for any given curvature of the blades. That is, the maximum flow of air as the case may be is had for that particular blade shape, and likewise by the presentation of that curvature of the blades, the noise level may be controlled for that particular blade shape.

While the use of a single finger on each end of each blade is entirely sufficient for structural strength in small diameter blower wheels, additional fingers may be employed at each end of the blades where the structure is increased in size and greater strength is required accordingly.

While the finger portions 12*a* may be preferably left in the turned over conditions, they may of course be fixed to the ring and plate by any suitable means, such as by welding, soldering, brazing, and the like, or may even be maintained by placing a circular band thereover (not shown) as is done in many cases.

Therefore, while we have described our invention in this particular form, changes may be employed without departing from the spirit of the invention, and we therefore do not desire to be limited to this precise form beyond the limitations which may be imposed by the following claims.



We claim:

1. In a blower wheel, an interconnection of a blade end with a blade carrying member, comprising
a blade;
a finger extending integrally from an end of the blade;
a blade carrying member having a hole therethrough;
said hole being defined by a straight side wall and a wall receding from each end of the straight wall forming corners therewith;
said finger having been deformed longitudinally;
said finger extending by a length adjacent said blade through said hole to extend beyond by a portion, said length having side edges extending into said corners;
said finger portion extending at approximately a right angle to its said hole length through a bend over said straight wall into contact with said member to one side of said hole; and
said bend maintaining said finger hole length under tension tending to flatten out its deformation and retain said finger edges in compressive lateral engagement with said walls in said corners.

2. The structure of claim 1, in which
said blade end is compressively held by said bend against a face of said member opposite to the face over which said finger portion extends.

3. The structure of claim 1, in which
said receding wall is transversely arcuate.

4. The structure of claim 1, in which
said receding wall has two faces angularly disposed one each toward the other from opposite ends of said straight wall, the two faces intersecting in a line spaced from and intermediate the said ends of the straight wall.

5. The method of forming a connection between a holding member and a fan blade, which comprises
punching a hole through the member defined by an encompassing wall, one segment of which is flat and forms corners at each end thereof with the remainder of the wall;
forming a blade to have a straight end and a longitudinally deformed finger extending therefrom with side edges having an overall dimension thereacross less than that of said flat wall segment;
inserting said deformed finger through said hole with the finger side-edges presented toward said corners and an end portion of the finger extending from said hole;
holding said blade straight end against said member; and
bending said finger at approximately a right angle over said flat wall onto said member, thereby stressing said finger and flattening it a major degree and increasing the tongue width forcing said side edges into compressive engagement in said corners with said hole wall, and pulling said blade end compressively against said member.

6. The method of forming a blower wheel, which comprises forming two circular plates each with
a common number of holes therethrough and on common circumferential lines therearound;
punching each of said holes to have a straight side thereof merging through acute angles into the remainder of the hole encompassing wall;
forming a plurality of blades each having opposite straight ends;
forming a finger to extend longitudinally from each blade end, the finger being formed into approximately V-shape with diverging legs terminating in side edges of the finger;
said fingers each having a lateral width across said side edges to permit entry of the fingers through said holes;
inserting the fingers through said holes and abutting said blade straight ends respectively against said two plates;

bending portions of said fingers extending from said holes sharply over said hole flat sides onto said plates;

said bending flattening said fingers to a major degree driving said leg side edges into said angles and compressively engaging those side edges against the hole wall forming said angles; and

flattening said finger portions against said plates.

7. The method of claim 6 in which

said holes are punched to arcuately shape said encompassing wall.

8. The method of claim 6, in which

said hole is punched to have said encompassing wall



be two flat walls completing an isosceles triangle with said straight side.

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MARK NEWMAN, *Primary Examiner.*