May 28, 1968 W. H. WENTLING 3,385,511

BLOWER

Filed Aug. 19, 1966

FIG-1

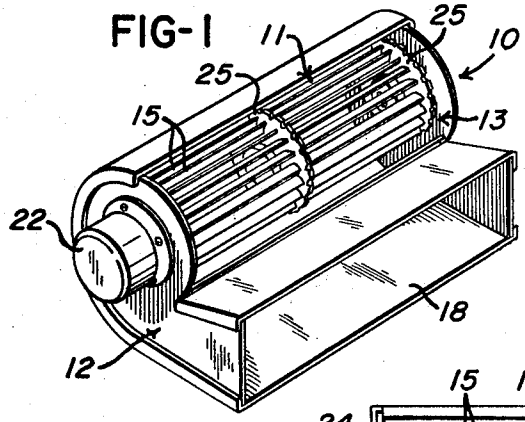


FIG-3

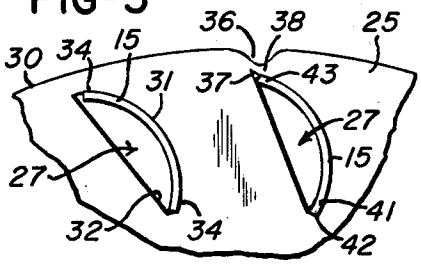


FIG-2

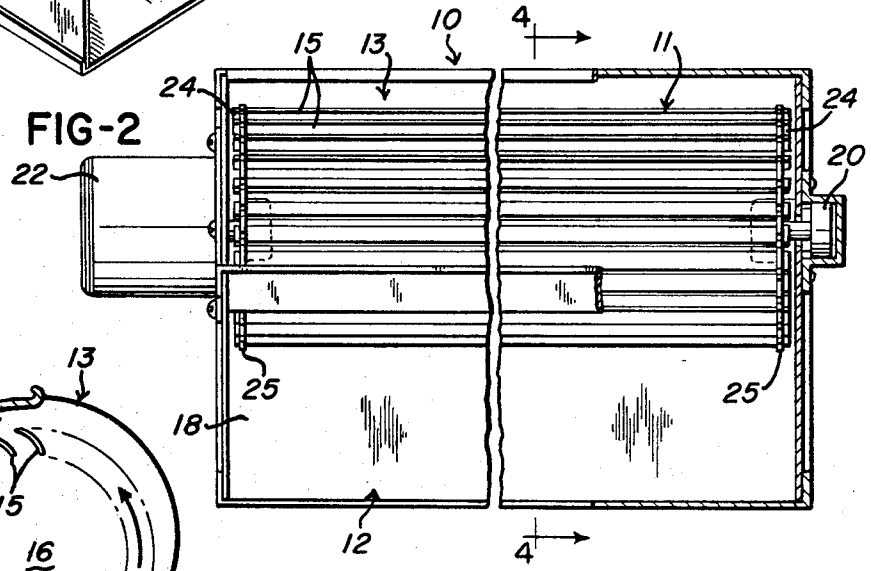


FIG-4

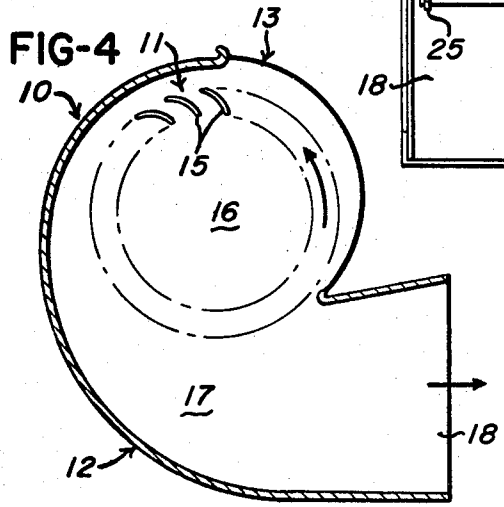


FIG-5

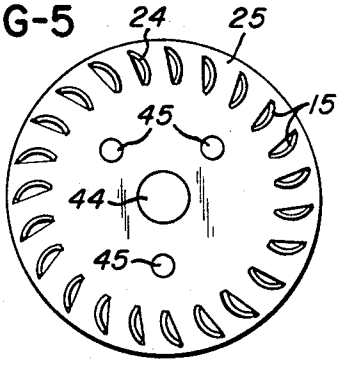


FIG-6

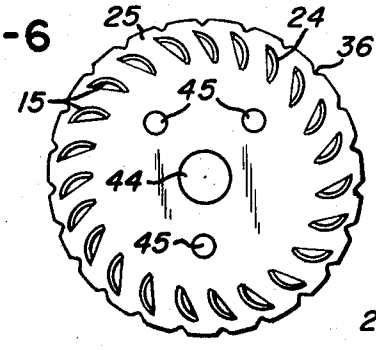
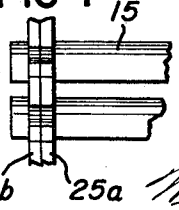


FIG-7



INVENTOR.
WILLIAM H. WENTLING

BY

Marechal, Bicbel, French & Bugg
ATTORNEYS

United States Patent Office 3,385,511 Patented May 28, 1968

3,385,511

BLOWER

William H. Wentling, Dayton, Ohio, assignor to The Lau Blower Company, Dayton, Ohio, a corporation of Ohio

Filed Aug. 19, 1966, Ser. No. 573,564
5 Claims. (Cl. 230—134)

ABSTRACT OF THE DISCLOSURE

Apparatus and method of securing sheet metal blades of a blower wheel to sheet metal end disks. Closed openings or slots are cut in the end disks and blades inserted therein followed by a deformation of the outer periphery of the disk to lock the blade rigidly in the slots.

This invention relates to blowers and components thereof which are constructed from sheet metal, and particularly to apparatus and methods of securing the end plates and intermediate support disks to the blades of a blower wheel or the like.

In manufacturing centrifugal and tangential blower wheels, it is necessary that the blades be easily and quickly secured to the end ring, end plates, and intermediate supporting disks so that they can be manufactured inexpensively. However, this connection must provide maximum rigidity and freedom from failure at very high speeds of the blower wheel to be acceptable. In the past, the blades have been welded to the end plates or a portion of the blades have been deformed after passing through the end plates. In some instances, a portion of the end ring or backplate is deformed around a flange or projection on the blade and thus lock the same together. Also, in the past it has been impossible to secure the intermediate disks to the blades in the same manner that the end rings or plates have been secured thus requiring two distinct and separate operations.

Accordingly it is an important object of this invention to provide an improved apparatus and method of interconnecting the blades and the end rings, end disks, or intermediate support disks of a blower wheel to provide maximum rigidity to the wheel and the capability of being assembled in minimum time.

Another object of this invention is to provide an improved connection between the sheet metal blades and supporting members of a blower wheel which allows the intermediate support disks to be spaced at any desired intervals along the length of the blades and which allows each of these support disks to be secured in place in the same manner as the end plates, and further permits the use of very simple blade configurations which are uniform in cross section from end to end and have simple square cut ends.

A further object of this invention is to provide a blower wheel having improved connecting means between the blades and end supporting disks which provide maximum rigidity and permit any number of the disks to be mounted along the length of the blower wheel, and further to provide such a connection which does not require any welding operations and a minimum of metal deforming operations to thus reduce the cost of manufacture.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings:

FIG. 1 is a perspective view of a typical blower assembly in accordance with the present invention;

FIG. 2 is an enlarged front view partially broken away of the blower assembly shown in FIG. 1;

FIG. 3 is an enlarged fragmentary view showing the manner in which the support disks are deformed;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is an end view of the blower wheel before the outer periphery thereof is deformed;

FIG. 6 is a view similar to FIG. 5 showing the blower wheel after the outer periphery of the disk has been deformed; and

FIG. 7 is another embodiment of the invention wherein two support disks are mounted adjacent each other.

Referring to the drawings wherein a preferred embodiment of the invention is shown, FIG. 1 illustrates a typical blower assembly **10** which utilizes a blower wheel **11** constructed in accordance with the invention. This blower assembly **10** is substantially as shown in U.S. Patent No. 3,251,540, issued May 17, 1966, and assigned to the assignee of this invention. It must be understood that this is only one of many blowers and other uses of the invention as set forth herein, and the blower assembly **10** is described to set forth one environment in which the invention can be used if operated as follows:

The air flows into the blower housing **12** through the inlet **13**, and is drawn between the individual blades **15** and into the interior chamber **16** of the tangential blower wheel **11**. The blower wheel **11** subsequently forces the air from the chamber **16** into a curved expansion cone **17** created between the blower wheel **11** and the housing **12** for converting the velocity pressure to static pressure. The air then flows through the outlet duct **18** which defines the large end of the expansion cone **17** with the associated equipment, e.g., an air conditioner. The blower wheel **11** is supported in the housing **12** by the bearing assembly **20** at one end and the drive motor **22** at the other end for high speed rotation in the usual manner.

The elongated blower wheel **11** includes a plurality of circumferentially disposed blades **15** each of which has its opposite end portions **24** and central portions secured to one of the end or center support plates **25** in accordance with this invention. Each blade **15** is made of sheet metal and appropriately curved, as shown in FIGS. 5 and 6, to provide the conventional scooping effect to draw the air into the central chamber **16** of the blower wheel **12** and then force this air between the blades **15** on the opposite sides thereof and through the outlet duct **18** of the blower assembly.

The end and center support plates **25** of the invention have carefully defined slots **27** (FIG. 3) cut therein and spaced inwardly a preset distance from the outer periphery **30** of the plates **25** at a preset angle. Each of these slots includes a curved edge **31** having a radius of curvature substantially identical to the curvature of the blades **15** so that each blade is held snugly against the edge **31** in the assembled position. The length of this edge **31** is slightly greater than the width of a blade **15** when measured along its curvature for reasons to be explained hereinafter.

The straight edge **32** is cut into the plates **25** to interconnect the ends **34** of the curved edge **32**, as shown in FIG. 3, to form the slot **27** into which a blade **15** can be easily slipped since the curved edge **31** is slightly longer than the corresponding dimension of the blades. While it is important that the edge substantially accommodates the curvature of the blade **15** so that the blade configuration is not changed materially during assembly. Thus the edge **31** is desirably curved although it could be a combination of two or more curved or straight edges. The particular shape of the straight edge **32** is not an important part of the invention and, as a matter of fact, the edge **32** is made straight only to give the slots **27** sufficient width so that a punch can be made with sufficient strength to withstand the forces generated in punching thousands

of these slots. Thus, the straight edge could be curved toward the blade **15** or away from the blade to facilitate the punching operation.

Once the blades **15** are placed into the slots **27**, the depressions **36** are deformed into the outer peripheral edge of the end and intermediate plates adjacent the outermost apex **37** of the slots **27** causing a portion **38** of the metal of the support plates **25** to be forced into this apex to lock the blade in position. Since the plates **25** and the blades **12** are made of relatively thin sheet material, e.g. sheet metal, the lowermost edge **41** of the blade **15** cuts into the innermost apex **42** of the slot **27** whereas the deformed portion in the outermost apex **37** is cut by the outer edge **43** of the blade to thus rigidly lock the blade in position.

The alignment between the depressions **36** and the outermost apex **43** thus becomes an important consideration in locking the blades in position. The depression **36** must be sufficient to force the portion **38** into the slot **27** so that pressure is applied in a plane tangential to the end of the blade to lock the same in position. In some cases, it might be desirable to make two or more depressions in the outer periphery to effect the necessary locking.

This deforming operation can be accomplished by placing the end plates in an appropriate fixture by use of the central aperture **44** and the three assembly openings **45**. The blades are then placed in the position in the slots **27**, and the depressions **36** formed while the entire assembly is mounted on a fixture. The depressions may be formed individually or simultaneously, by an appropriately shaped tool which is driven into the end plates **25**.

Any number of these support disks **25** can be utilized along the length of the tangential blower wheel to obtain the necessary rigidity of the wheel. In this connection, it has been found that the rigidity of the wheel is much greater than other expedients now in use to interconnect the end plates and blades. As shown in FIG. 7, it is possible to use two or more of the support plates *25a* and *25b* adjacent each other to provide additional strength as might be required for a driving connection to the wheel, or for any other reason. The embodiment shown in FIG. 7 is identical to that described above except that the support plates *25a* and *25b* are placed adjacent to or in close proximity to one another. It is also within the scope of the invention to use any number of the support plates **25** along the length of the blower wheel as required to obtain the desired rigidity.

While the invention has been shown in a tangential blower wheel, it could be used in a double or single inlet blower wheel wherein the central portion of one or more of the end plates is removed to provide an inlet to the blower wheel. Furthermore, the particular blade angle and curvature shown can be modified without departing from the scope of the invention as required in constructing a centrifugal blower wheel of various types. It is also possible to use this connecting device in combination with other means of fastening the blades to center disks and end rings, for example, the invention could be utilized

to form the center disk of a double inlet centrifugal blower wheel whereas the end rings are spun over the ends of the blades in a conventional manner.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A blower wheel comprising, a plurality of sheet metal parallel blades arranged in parallel spaced relation and adapted to impart movement to the air, at least one sheet metal end disk member having a plurality of completely closed slots near but spaced inwardly from an outer continuous periphery of said disk member, each said slot having a configuration larger than the cross-section of each said blade, said slot having one edge complementary to the curvature of said blade, each said blade being received in one of said slots with said blade being closely accommodated by said one edge, said sheet metal disk member continuous periphery having a portion of its outer periphery aligned with each said slot, and each said portion of said continuous outer periphery being deformed inwardly to force the sheet metal adjacent said slots inwardly to reduce the size of said slot and lock each of said sheet metal blades to said disk member.

2. A blower wheel as defined in claim **1** wherein the other edges of said slots is a straight edge joining said one edge at its opposite ends to define an apex of said slot at each of said opposite ends, said sheet metal blades being tightly forced into said disk members adjacent said opposite end of said slots after said portion is deformed.

3. A blower wheel as defined in claim **1** wherein one of said disk members is provided at each end of the blower wheel.

4. A blower wheel as defined in claim **1** wherein at least two of said disk members are placed adjacent and in contact with one another to add additional strength to the blower wheel.

5. A blower wheel as defined in claim **1** wherein one of said disk members is provided at each end of said blades and at least one of said disk members is provided intermediate said ends to provide rigidity along the length of said blades.

References Cited

UNITED STATES PATENTS

2,125,697	8/1938	Swingle et al.	230—134.5
2,473,185	6/1949	Weiss	103—115
2,496,179	1/1950	Schwurz	230—134.5
3,156,408	11/1964	Whitenack	230—134.5

FOREIGN PATENTS

623,149	5/1949	Great Britain.
876,624	9/1961	Great Britain.

HENRY F. RADUAZO, *Primary Examiner.*