United States Patent [19]

Ranz

[11] **3,854,844**

[45] **Dec. 17, 1974**

[54] **BLOWER WHEEL**

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[73] Assignee: **Philips Industries Inc.,** Dayton, Ohio

[22] Filed: **May 14, 1973**

[21] Appl. No.: **359,905**

Related U.S. Application Data

[62] Division of Ser. No. 106,021, Jan. 13, 1971, Pat. No. 3,737,966.

[52] **U.S. Cl.** **416/184,** 416/187

[51] **Int. Cl.** **F04d 29/28**

[58] **Field of Search** ..... 29/156.8 CF; 416/178, 187, 416/184

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Primary Examiner—Everette A. Powell, Jr.

Attorney, Agent, or Firm—Biebel, French & Bugg

[57] **ABSTRACT**

An improved blower wheel is disclosed in which the end rings are formed from flat stock material which has been partially preformed by rolling and cut to the desired length. The center disks are stamped from sheet material which may be of a different gauge than that of the end rings and formed with peripheral notches and a U-shaped crimp to engage the inner section of each of the blades. The arrangement permits selection of center disk material without regard to end ring material, provides versatility in selecting blower wheel size and eliminates production inventory balance problems which occur when the center disk and end rings are stamped from the same material.

2 Claims, 14 Drawing Figures

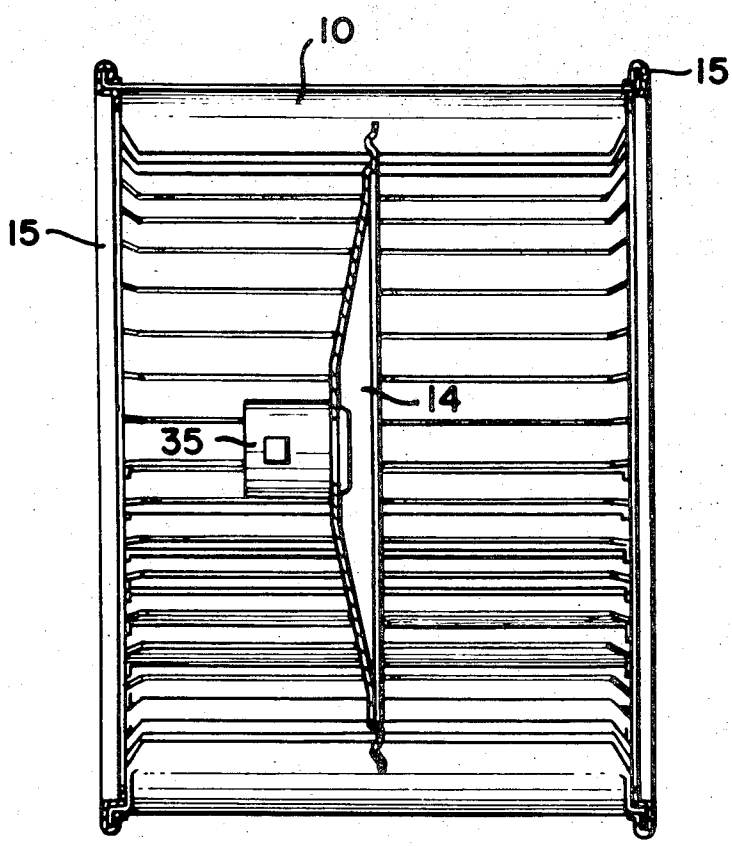


FIG-1

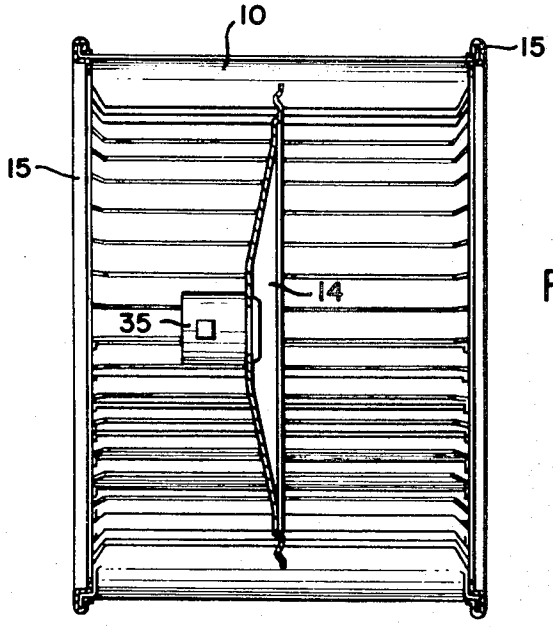


FIG-2

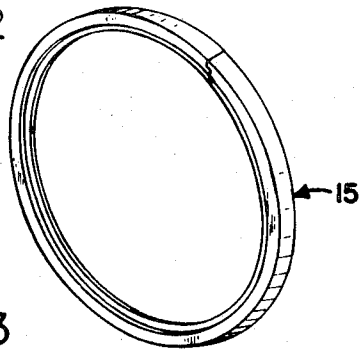


FIG-3

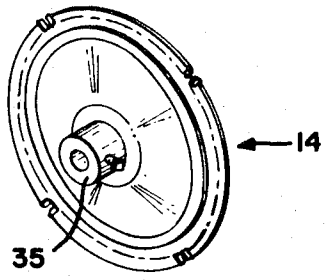


FIG-4

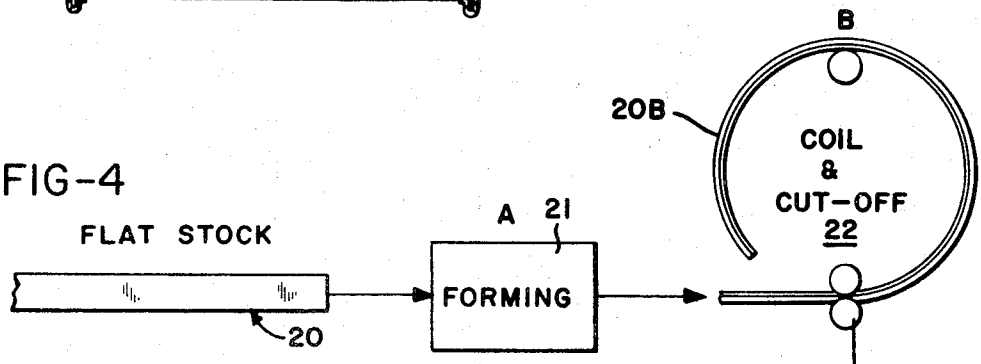


FIG-4A

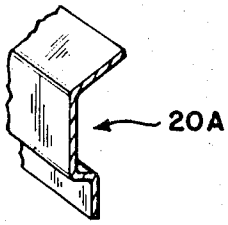


FIG-4B

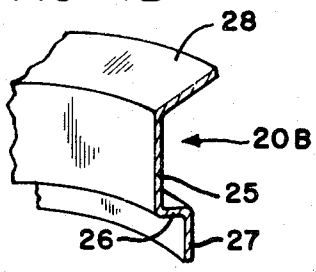


FIG-4D

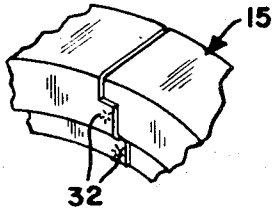


FIG-4C

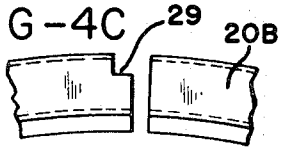


FIG-5

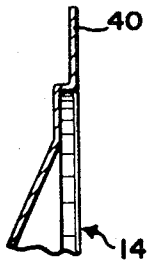


FIG-6

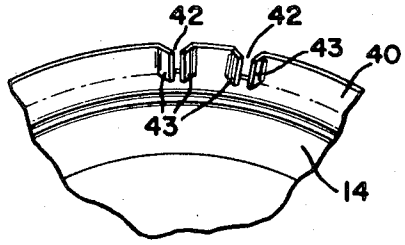


FIG-7

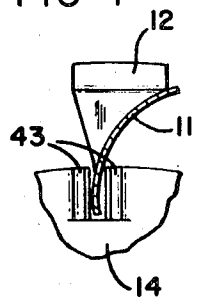


FIG-8

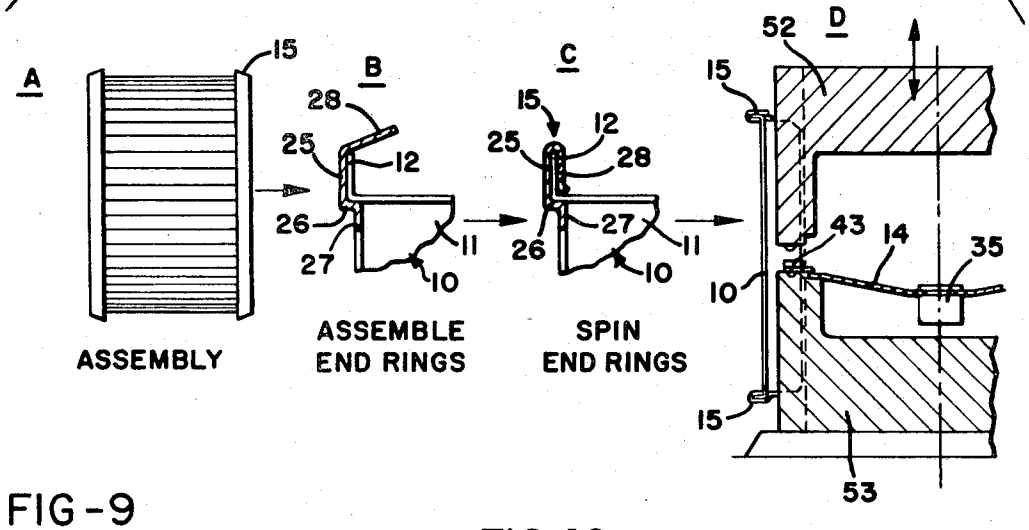


FIG-9

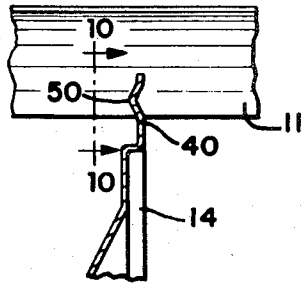
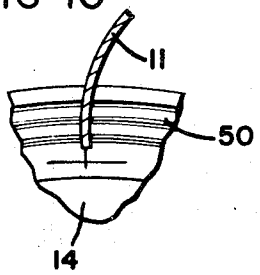


FIG-10



BLOWER WHEEL

RELATED PATENT

This application is a Division of Ser. No. 106,021 filed Jan. 13, 1971, now U.S. Pat. No. 3,737,966 issued June 12, 1973.

BACKGROUND OF THE INVENTION

This invention relates to an improved blower wheel, and specifically relates to an improvement in the blower wheels and methods disclosed in the Wilken U.S. Pat. Nos. 2,537,805, 2,651,830 and 2,821,778 and 2,852,182, all assigned to the same assignee as this application.

Blower wheels made according to the teachings of the above-identified Wilken patents have commonly employed center disks and end rings which have been stamped from the same blank of sheet metal. It has thus been a practice to stamp the center disks and the end rings at the same time out of the same blank, since the outside diameter of the center disk may be the same as the inside diameter of the end rings. This method of manufacture has proven highly advantageous in the manufacture of blower wheels, and provided two end rings and two center disks for each wheel. On belt driven blowers, the center disks were joined together in the manner shown in U.S. Pat. No. 2,537,805 to provide sufficient blade support and driving strength.

The method of forming the center disks and end rings, as described above, has certain inherent disadvantages. In the first place, since it is necessary to cut these parts from sheet material, there is waste defined in the areas between the successive stampings and this waste area is approximately 3/4 times the square of the O.D. of the end rings. As the diameter increases the waste material increases as the square of the diameter. Further, the process always results in the production of two center disks for two end rings, and thus it becomes difficult to balance production inventory in the event that some of the end rings or some of the center disks become scrap, and over a period of time a supply of one or the other may be accumulated.

A further difficulty resides particularly in the design of direct drive blower wheels. In such devices the end of the motor is actually positioned within the blower wheel, and the two center disks are nested together to conserve axial space and to use up both disks for the wheel. Of course, the double disk thickness is desired for strength as well. This specifically again introduces production difficulties and limits the strength of the individual center disk to that defined by the gauge thickness of the end rings. For center drive blower wheels, the limiting speed at which the blower wheel can be operated is not defined so much by the strength of the end rings as it is defined by the strength of the center disk and the effectiveness of the engagement of this disk with the root of the blade.

In U.S. Pat. No. 2,496,179 a blade supporting strip is first cut to length, punched with blade slots, and then applied to a strip bending machine after the blades have been inserted in the slots and bent across the major axis of the strip to close the slots about the blades and form a ring.

SUMMARY OF THE INVENTION

The present invention is directed to a blower wheel in which the end rings are initially roll formed or otherwise curled or formed from flat strip sheet material. This permits the end rings to be made to any diameter and gauge thickness, as the formed or curled strip material can be cut to a desired length. The adjacent ends of the partially formed end rings are brought together and fastened by welding or other suitable means and then applied to the blower wheel for example in the manner taught in U.S. Pat. No. 2,537,805. The drive disk may then be formed separately of the end rings by stamping from sheet material which has a width just sufficient to accommodate the diameter of the center disks. This reduces the intervening scrap area by an amount which is the function of the square of the decrease in diameter. The center disk may be made from sheet material which has a gauge of strength sufficient so that a single disk can be used in direct drive installations, eliminating the prior necessity of using twin disks, and permitting gauge selection in accordance with anticipated stress conditions.

Preferably, the periphery of the center disk is formed with a series of blade-engaging tabs for engaging the root portions of the blades, somewhat in the manner disclosed in U.S. Pat. No. 2,852,182, with the further advantage, however, of forming the disk in the region of the tabs with a peripherally oriented V-shaped crimp so that when the tabs are pressed into engagement with the blade surfaces, the crimp has the effect of increasing the area of contact and providing stability of the blade and disk connection.

It is an object of the invention to provide a bladed blower wheel in which the end rings are formed from a continuous length of strip material by curling and are then cut to a predetermined length or diameter and joined to form a circle and attached to the blades.

Another object of the invention is the provision of a blower wheel having curled and formed end rings and one or more stamped center disks.

A further object of the invention is the provision of a bladed rotor adapted for direct drive installations in which the center disk is formed from a single sheet of material having a gauge or thickness which may substantially exceed that of the end rings.

These and other objects and advantages of the present invention will become apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section through a blower wheel made according to this invention;

FIG. 2 is a perspective of a roll-formed end ring prior to assembly;

FIG. 3 is a perspective of a stamped center disk prior to assembly;

FIG. 4 is a diagram of the method of forming the end rings in which FIGS. 4A, 4B, 4C and 4D illustrate respective stages in the forming of the end ring material;

FIG. 5 is an enlarged vertical section of a peripheral portion of the center disk prior to notching;

FIG. 6 is a detail of the center disk showing the blade notches;

FIG. 7 is an enlarged detail showing a blade in section received within a notch prior to pressing;

FIG. 8 is a diagram showing the stages of crimping the end rings and pressing the center disk tabs;

FIG. 9 is a fragmentary vertical section showing the center disk after pressing and crimping; and

FIG. 10 is a view looking along the lines 10—10 of FIG. 9.

DESCRIPTION OF PREFERRED EMBODIMENT

A blower wheel made according to the present invention is shown in FIG. 1 as including a series of sheet metal blades 10 which blades may be constructed with central curved section 11 and a radially outwardly flaired tab or end flange section 12 all substantially as shown in U.S. Pat. Nos. 2,537,805 and 2,651,830. The wheel 10 further includes a center disk 14 and a pair of identically formed end rings 15 engaged over the abutting and contiguous end flange sections 12.

The end rings are preferably formed from flat strip material 20 of indefinite length, as shown in FIG. 4. The strip material 20 may be partially preformed at a forming station 21 into an initial generally U-shaped configuration in cross section as shown at 20A in FIG. 4A. If desired, the partial forming step may be accomplished subsequent to the curling of the strip material, and this may in fact be preferred to avoid buckling during curling. It may be so formed as by rolling, stamping, die forming or by any other suitable shaping and forming process. The strip material is curled at a coiling and cutting station 22 as shown at FIG. 4B by bending across the minor axis. The strip material is coiled substantially into a circle of the intended diameter of the finished end ring as shown at 20B. If preferred the material 20B may be formed as a continuous helix. It is severed at a length which corresponds to the desired circumference of the finished end ring.

The strip material emerges from the coiling station having the configuration shown generally in FIG. 4B where it can be seen that the end ring is formed with a generally radially aligned body portion 25, an offset shoulder 26 and a downwardly or radially inwardly projecting flange 27. The upper portion of the end ring is formed with an axially directed upper flange 28. The adjacent ends of the ring are brought together and suitably joined to form a continuous circle. A preferred manner of joining the ends is as shown in FIG. 4C in which one end is notched as indicated at 29 in a notching and welding station 30, and a portion of the side 25, shoulder 26 and flange 27 are overlapped, and spot welded together as indicated at 32 in FIG. 4D. At this point, the end ring 15 is ready for assembly with the blades.

An advantage of separately forming the end rings 15 in the manner described is that the stock material 20 may be chosen of any desired material or gauge without direct relation to the material or gauge of the center disk. Further, the coiling, cutting and joining operation can be conveniently adjusted so as to permit rings of other diameters to be accurately cut and formed, thus readily providing for production changes to accommodate an increase or a decrease in the number of blades in the finished wheel. Also, the quantity of the end rings produced is not related to the quantity of the center disks.

The end rings 15 may be assembled with the blades held in position on a fixture substantially as shown in U.S. Pat. Nos. 2,651,830 and 2,821,778. During this process, the upper flange 28 is crimped downwardly into binding and encircling engagement with the blade flange portions 12 as shown progressively in FIGS. 8A, 8B and 8C.

As previously noted, the center disks 14 may be stamped from material of a desired thickness and diameter and, as shown in FIG. 1, a single center disk 14 is employed for a direct drive blower wheel. The single center disk 14 is accordingly of substantially heavier gauge than that of the end rings 15. A drive hub 35 may be attached to the center disk in the usual manner.

The present invention incorporates an improved disk construction which eliminates the need for forming the plates with a central disk-engaging aperture of the type shown in U.S. Pat. No. 2,852,182. The disk is formed with a peripheral section 40 as shown in FIG. 5 and a series of notches 42 are formed in the periphery by cutting and bending pairs of tabs 43, there being one pair of tabs 43 and one notch 42 for each blade 10. The disk is positioned with the notches 42 receiving the blades 10 as shown in FIG. 7 and the tabs 43 are pressed closed into binding engagement with the blade. During the pressing operation, a peripherally aligned generally V-shaped rib or offset 50 is formed in the flange 40 by the press sections 52 and 53 of FIG. 4D, resulting in a peripherally aligned crimp. The notch or crimp formed by the offset 50 increases the area of contact of the disk rim with the blade and thus increases the stability of the blade within the disk. The process of forming the tabs 43 by cutting and bending results in the metal being somewhat stretched. When these tabs are pressed back into engagement with the blade a good physical engagement of contact is effected.

The finished blower wheel may then be removed from the fixture of FIG. 8D and painted if desired, and is then ready for use. It is within the scope of the present invention to use the teachings herein for the purpose of making indirect driven wheels. For this purpose a pair of the center disks 14 are preferably employed and butted fact-to-face in the manner shown in FIG. 1 of U.S. Pat. No. 2,852,182. Alternatively, single disks may be employed of a desired gauge, as the production of the center disks is not numerically related to the production of the end rings. Economy in manufacture is achieved by reason of the reduction of sheet material in the stamping of the center disks, as compared to the case where the center disks and end rings are stamped from the same sheet of material.

The method of forming end rings from strip material and applying to peripherally spaced blades may be incorporated on single inlet types of blower wheels in which only one end ring is used. On such wheels, the other end is closed by the drive disk.

In addition, since the end rings in accordance with the present invention are formed without the necessity for generating a scrap area, the method may be used to construct a blower wheel in which no center disk is used. Where the end rings are stamped, it is uneconomical to manufacture a blower formed with stamped end rings only, without providing some use for the material remaining after the end rings are stamped. A blower wheel formed without a center disk may be peripherally supported on rollers which engage the outer circumference of one or more of the rings.

It is not necessary, in accordance with the present invention, to preform the strip material 20 prior to curling and/or cutting. For example, the strip material 20 may be curled into a circle or a spiral and then deformed, if a channel-shaped section is desired, or may

be cut and the adjacent ends joined to form a circle and then may be placed or stamped to conform to a desired cross-sectional configuration.

The present invention is not limited to the manufacture of blower wheels which employ contiguous blade tabs and end rings in accordance with the teachings of the above-identified U.S. Pat. Nos. 2,537,805 and 2,852,182. There are presently being used other forms of blower wheels in which a series of individual blades are joined to or otherwise supported on a peripherally continuous end ring support. An example of one such arrangement is one in which the individual blades are formed at their ends with tabs which extend through slots formed in the end rings. An additional example resides in the expanded type of metal plate construction as shown in U.S. Pat. No. 2,242,586 in which the crimped ends of the blades are encircled and retained within an end ring structure. The method of the present invention may be used with advantage to form the end ring structure of these forms. It is also not essential that the end ring be crimped onto the blade or that the blade be formed with end ring engaging tabs. Thus, the ends of the blades may be formed flat and butt welded to a radial surface of an end ring constructed according to the method of this invention.

While the preferred embodiment of the invention is described in terms of a sheet metal blade, it is within the scope of the invention to use blades formed of material other than metal, such as plastic. It is desirable, but not essential, that the end rings themselves be formed of strip sheet metal.

While the method herein described, and the forms of apparatus for carrying this method into effect, constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise method and forms of apparatus, and that changes may be made in either without departing from the scope of the invention.

What is claimed is:

1. A direct drive bladed blower wheel comprising a pair of roll-formed sheet metal end rings formed of strip material, said end rings each having ends which are overlapped and welded to form a continuous ring, a series of generally axially aligned and peripherally spaced blades having ends supported on said end rings, a single sheet metal center drive disk received axially within said blades and having a series of peripheral tabs defining slots engaging and supporting each blade at a location axially spaced between said end rings, the gauge thickness of said drive disk being substantially greater than that of said end rings.

2. The blower wheel of claim **1** further comprising means in said tabs at said disk slots defining a peripheral crimp having a V-shape at the region of tab engagement with said blades for increasing the area of contact of said disk with said blade and providing torsional stability of said disk in said wheel.

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