Dec. 4, 1934. W. VAN RIJSWIJK 1,983,201

ROTARY BLOWER BLADE

Filed March 7, 1932

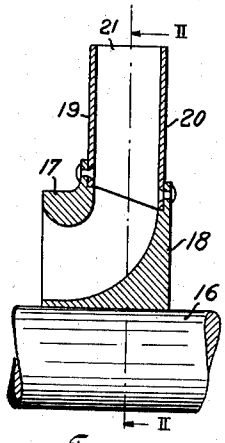

Fig. 1

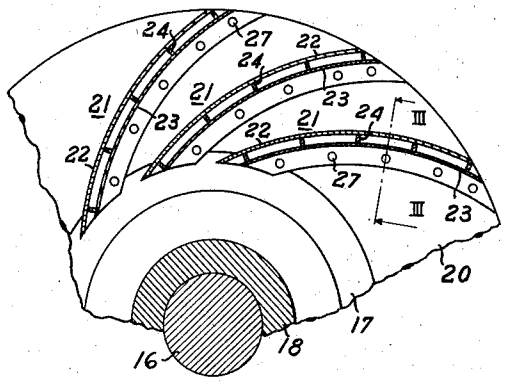

Fig. 2

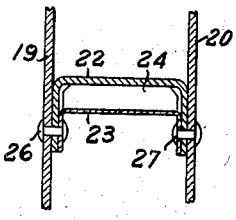

Fig. 3

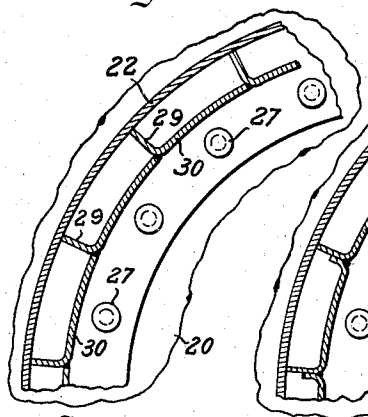

Fig. 4

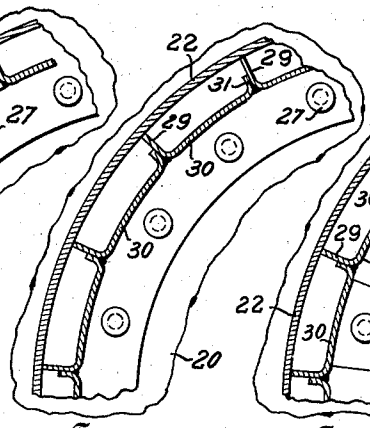

Fig. 5

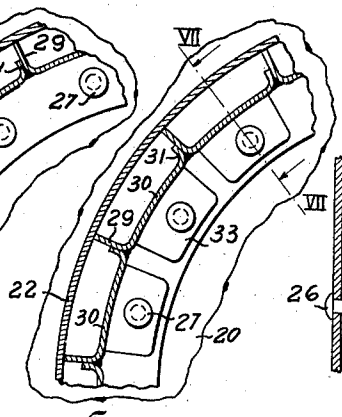

Fig. 6

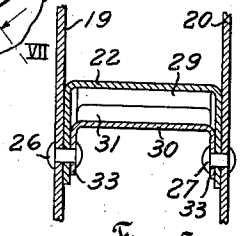

Fig. 7

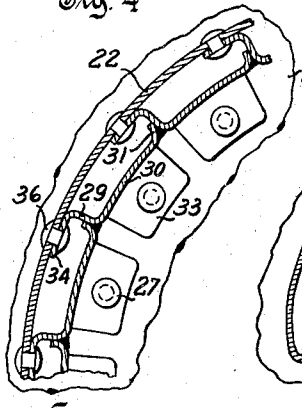

Fig. 8

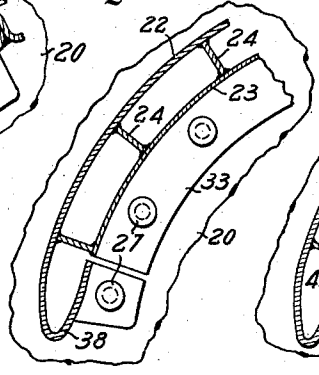

Fig. 9

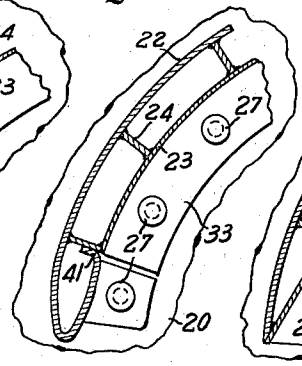

Fig. 10

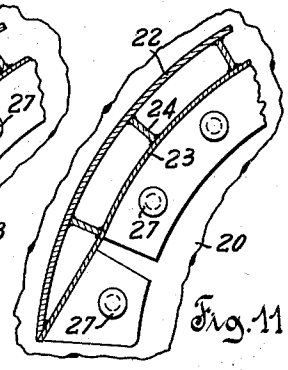

Fig. 11

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ROTARY BLOWER BLADE

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Application March 7, 1932, Serial No. 597,158
In Germany March 7, 1931

5 Claims. (Cl. 230—134)

This invention relates to improvements in impeller wheel constructions for rotary blowers or compressors and particularly to impeller blade constructions for such wheels.

The blades of the impeller wheels of rotary blowers or compressors are stressed by the centrifugal forces which are produced, particularly when the rotating speed of such blowers is changed. Such stresses may cause bending of the blades or, because such stresses are transmitted to the disks between which the blades are held, may cause deformation of the disks. To avoid such bending of the blades, the blades were heretofore made of sufficient thickness to provide a mass of material which would withstand the bending stresses. Thickening of the blades avoids bending thereof, but increases the weight and hence the centrifugal forces produced to such degree that the disks had to be greatly strengthened and the amount of fastening between the blades of the disks had to be increased, which again increased the centrifugal forces produced by each blade during rotation thereof.

To overcome the tendency toward increase of the centrifugal forces, the weight of the several portions forming an impeller wheel must be kept as low as possible consistent with sufficient strength to operate without disturbance at the required speeds. Impeller wheel blades were heretofore generally made of a single piece of metal having apertures therethrough to decrease the weight of the blade without decreasing the strength thereof or were made of several metal plates fastened together in such manner as to leave a space between the blades. A decrease in weight is thus obtained without any material sacrifice of strength, but such blades are very expensive to construct. In addition to the expense of construction of such blades made of a plurality of plates, it was found necessary to attach the edges of the several plates forming each blade separately and at different points to the disks of the impeller wheel. Such construction is, however, objectionable for various technical reasons.

It is, therefore, among the objects of the present invention to provide a blade construction for rotary blowers or compressors in which the blade is very light but highly resistant to bending stresses and is easy and cheap to construct.

Another object of the invention is to provide a blade construction for rotary blowers or compressors in which the blade is formed of a plurality of sheet-metal portions so arranged and joined as to provide sufficient strength to resist bending thereof.

Another object of the invention is to provide a blade construction for rotary blowers or compressors in which the blade is formed of a plurality of sheet-metal portions with some of the portions extending at right angles to the operating surface of the blade to strengthen the same.

Another object of the invention is to provide a blade construction for rotary blowers or compressors in which the blade is formed of a plurality of sheet-metal portions, one of the portions forming an operative surface and the other portions reinforcing the operating surface and forming a substantially smooth inoperative surface for the blade.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is a radial cross-sectional view of a portion of an impeller wheel for a rotary blower or compressor showing the arrangement and cooperation of the several portions of the structure forming one impeller wheel.

Fig. 2 is a vertical cross-sectional view taken through Fig. 1 on the plane II—II and showing the arrangement of the blades between the disks forming a portion of the impeller wheel.

Fig. 3 is a sectional view of a portion of an impeller wheel taken on the plane III—III of Fig. 2, i. e., at right angles to the length of the blade and showing the manner in which one embodiment of a blade construction according to the present invention is secured to the disks.

Fig. 4 is a sectional view of a portion of a blade structure taken on a plane through the longitudinal center line of a blade and showing a fragment of one of the disks together with the means for fastening the blade construction to such disk.

Fig. 5 is a view similar to that shown in Fig. 4 of a modified embodiment of a blade structure.

Fig. 6 is a view similar to that shown in Fig. 4 but showing another modified embodiment of a blade structure.

Fig. 7 is a view similar to that shown in Fig. 3, i. e., a view taken at right angles to the longitudinal axis of a blade, on the plane VII—VII of Fig. 6.

Fig. 8 is a view similar to that shown in Fig. 4 of another modified embodiment of a blade structure.

Fig. 9 is a view similar to that shown in Fig. 4, but showing particularly the construction of a blade at the end thereof.

Fig. 10 is a view similar to that shown in Fig. 9,

but illustrating a modified form of construction for the end of a blade, and

Fig. 11 is a view similar to that shown in Fig. 10 of another modified form of construction for a blade end.

Referring more particularly to the drawing by characters of reference, the reference numeral 16 designates the shaft of a rotary blower or compressor on which are mounted a plurality of impeller wheels each comprising a plurality of hub portions 17 and 18 to which are secured substantially annular disks 19 and 20 having a plurality of blades 21 arranged therebetween and secured thereto. The blades are generally arc-shaped as may be seen in Fig. 2. The hub portion 17 of each of the wheels is formed to provide an inlet for the fluid to be operated on by the blower and the hub portion 18 is secured on the shaft 16 in nonrotatable engagement in any suitable manner.

In one embodiment of the invention, the blades 21 are each formed by a pair of substantially U-shaped channel portions 22 and 23 which fit into each other and are spaced from each other by spacing members 24 extending between the channels 22 and 23 and substantially at right angles to the surfaces thereof. The spacers are fixedly secured to one of the channels as by welding and abut against the other channel when the channels are secured in the proper relation to each other between the disks to form a blade. The channels are attached to the disks by means of rivets 26 and 27 passing through the flanges of both channels and through the disks 19 and 20 respectively. When assembled between the disks, each of the blades thus forms a substantially integral hollow member having the surface portions of the channels reinforced and held from each other by the spacers 24.

In the embodiments shown in Figs. 4 and 5 the channel 23, shown in Fig. 3 as forming the rear side of the blade, is divided into a plurality of portions bent to provide a portion 29 extending substantially at right angles with the channel 22, and performing the function performed by the spacers 24 in the embodiment shown in Figs. 2 and 3, and a portion 30 extending substantially parallel with the channel 22. The several portions 29 are secured to the rear surface of the channel 22 in a suitable manner and the portions 30 extend substantially into contact with each other to form a substantially smooth and continuous surface for the rear of the blade. The portions 30 are also preferably secured on the flanges of the channel 22 as by welding and the entire blade structure is then mounted between and attached to the disks 19 and 20 by the rivets 26 and 27. The ends of the portions 30 may be bent as shown in Fig. 5 and may then be attached to the adjacent portion 29 as by welding, thus forming a greatly strengthened and more nearly integral blade structure than that illustrated in Fig. 4. Any tendency toward the formation of eddies, in the operating medium handled by the blower, in passing between the blades of a wheel which might be present in the structure shown in Fig. 4 is checked or entirely prevented by the structure shown in Fig. 5.

To secure even greater rigidity than is possible by the structure shown in Fig. 5, the several sections forming the rear blade and severally comprising the portions 29, 30, 31 are provided with flange portions 33 extending at right angles with the portion 30 and in contact with the flanges of the front channel 22 and the rear blade sections by the same rivets as shown in Fig. 7. In the embodiment shown in Figs. 6 and 7, it is not necessary, though desirable, that the rear blade portions 29 be attached to the channels 22 and that the portions 29 and 31 of the adjacent sections be joined.

The rear blade sections shown in Figs. 4 to 7 inclusive may also be provided with a portion 34 bent parallel with the surface of the channel 22 and secured thereto as by rivets 36, as shown in Fig. 8. Due to the above construction it is possible to attain greater security of attachment of the sections forming the rear of each blade with the channel 22 forming the front thereof than is possible in the embodiments previously described, and hence it is possible to secure a more rigid construction.

The ends of the blades are closed to avoid the formation of eddy currents or other disturbances thereby within the medium operated upon by the blower as would be the case if the blade ends remained open. The ends of the channel 22 may be bent over as shown at 38 in Fig. 9, a portion of the flanges at the end of the channel being secured to the disks by the rivets 26 and 27. In such construction each of the rivets at the ends of the blades must be of sufficient length to pass through three thicknesses of metal in addition to the metal of the disks. Under some circumstances the above construction may be undesirable and one of the thicknesses of metal may be omitted without the sacrifice of security in the fastening of the blade and the disks by securing the bent-over end 38 of the channel 22 on the channel 23 and on one of the spacers 24 as shown at 41 in Fig. 10.

The bending-over of the ends of channel 22 may be avoided as shown in Fig. 11, thus avoiding the possibility of stressing the material of channel 22 to or beyond its elastic limit, by cutting the flanges of channel 23 and bending the ends of the channel to meet the surface of channel 22, the ends of the two channels then being joined as by welding. The two channels 22 and 23 forming each blade are then attached to the disks as shown in Fig. 3.

Although but a few embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. An impeller wheel for rotary blowers or compressors comprising hub portions, disks secured on said hub portions and extending in spaced relation therefrom, a plurality of blades arranged between said disks and extending substantially radially thereof, the surfaces of each of said blades being formed of a plurality of substantially U-shaped members nested one within the other in spaced relation, means arranged between and joining the U-shaped members, and means common to both the U-shaped members for securing the same to said disks.

2. An impeller wheel for rotary blowers or compressors comprising hub portions, disks secured on said hub portions and extending in spaced relation therefrom, a plurality of blades arranged between said disks, each of said blades being formed of a plurality of substantially U-shaped members nested one within the other in spaced relation, one of the U-shaped members being

divided into a plurality of portions having the web portions thereof individually attached to the other of the U-shaped members to maintain the spacing between the members, the portions extending into proximity with each other to form substantially smooth and continuous surfaces for said blades, and means common to both the U-shaped members for securing the same to said disks.

3. An impeller wheel for rotary blowers or compressors comprising hub portions, disks secured on said hub portions and extending in spaced relation therefrom, a plurality of blades arranged between said disks, each of said blades being formed of a plurality of substantially U-shaped members nested one within the other in spaced relation, one of the U-shaped members being divided into a plurality of portions separately attached to the other of the U-shaped members, the adjacent web portions of the U-shaped members being joined to form substantially smooth and continuous surfaces for said blades, and means common to both the U-shaped members for securing the flange portions of the same to said disks.

4. An impeller wheel for rotary blowers or compressors comprising hub portions, disks secured on said hub portions and extending in spaced relation therefrom, and a plurality of blades arranged between said disks and connected therewith, each of said blades being formed of a plurality of substantially U-shaped members nested one within the other in spaced relation, the ends of the web of one of the U-shaped members extending into contact with the ends of the web of the other U-shaped members and being joined therewith.

5. An impeller wheel for rotary blowers or compressors comprising hub portions, disks secured on said hub portions and extending in spaced relation therefrom, and a plurality of blades arranged between said disks and connected therewith, each of said blades being formed of a plurality of substantially U-shaped members nested one within the other in spaced relation, one of the U-shaped members being bent over at the ends thereof to close the space therebetween.

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