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2,431,647

CENTRIFUGAL FAN

Filed March 8, 1944

2 Sheets-Sheet 1

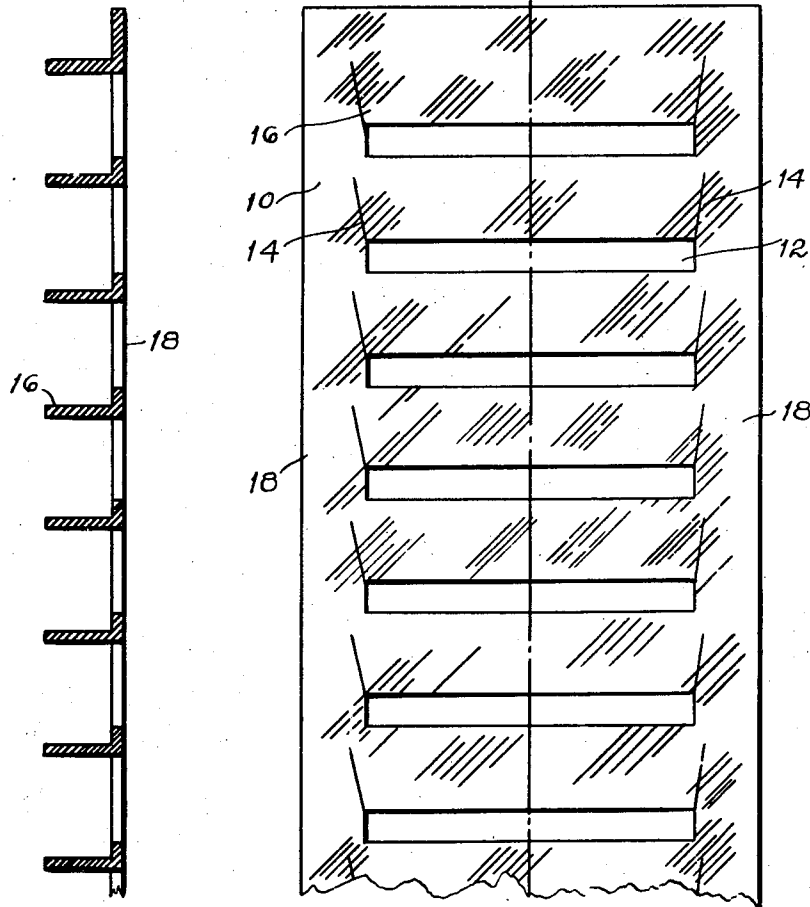


FIG. 2

FIG. 1

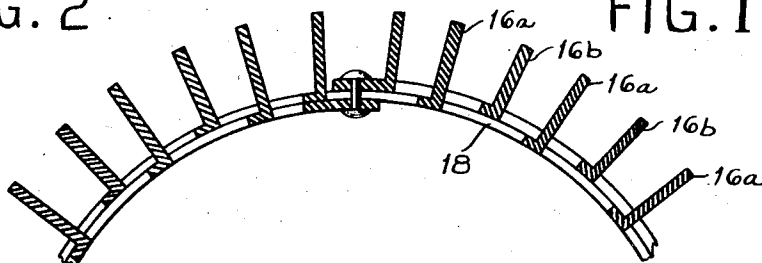


FIG. 6

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2 Sheets-Sheet 2

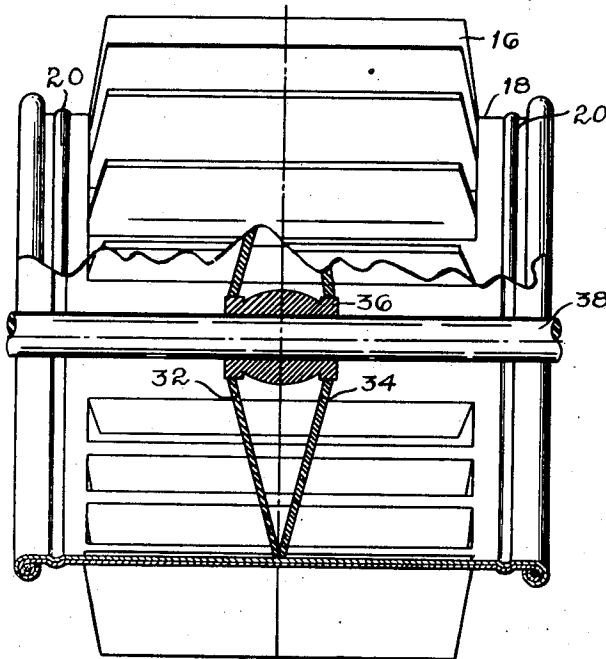


FIG. 3

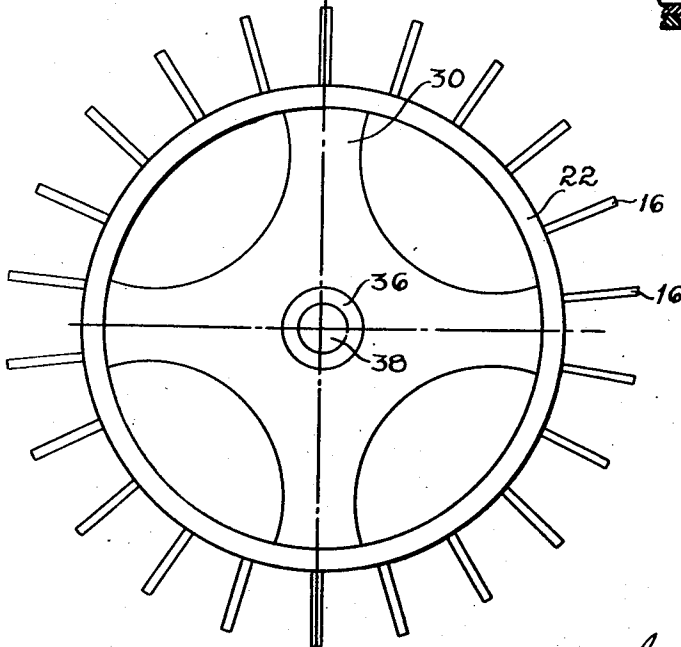


FIG. 5

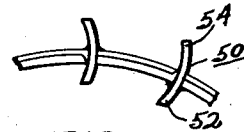


FIG. 7

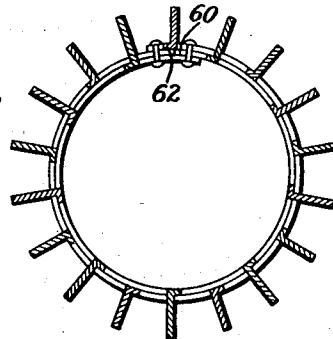


FIG. 8

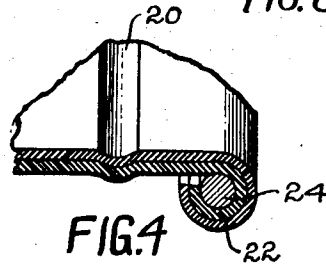


FIG. 4

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL FAN

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25 Claims. (Cl. 230—134)

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This invention relates to a fan and more particularly to a fan of the centrifugal blower type.

An object of this invention is to produce a fan of the centrifugal type from a continuous sheet of material, having louvers stamped therefrom, which sheet is wrapped into convolutions, the louvers being equally spaced to form fan blades.

Another object of this invention is to form a fan of the centrifugal type from a continuous strip of sheet metal wrapped upon itself and the margins reenforced by the formation of the metal to give the assembly rigidity.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawings,

Figure 1 is a plan view of a sheet of material having portions cut away and the sheet in readiness to be formed into louvers.

Figure 2 is a cross sectional view of the sheet shown in Figure 1 taken after the louvers or fan blades have been struck out from the plane of the sheet.

Figure 3 is a side view of the fan assembly with parts shown in section.

Figure 4 is a fragmentary enlarged sectional view showing the bead and the reenforcing rib along the margin of the fan.

Figure 5 is an end view of a modification.

Figure 6 is a fragmentary sectional view showing another type of fan blade incorporating the same principle.

Figure 7 is a fragmentary view of a modification showing curved louvers or fan blades.

Figure 8 is a cross sectional view of a modification showing the convolutions made from two separate pieces.

In the past, the centrifugal type of fans or blowers have generally been made as a composite assembly having individual fan blades secured to a suitable frame structure by riveting, by welding or by interlocking portions. Other types of fans have been made from a continuous length strip of sheet metal having louvers struck therefrom and then formed into a cylindrical form of one convolution. In the manufacture of these fans the blades are too far apart for the greatest efficiency. Attempts have been made to overcome this defect by crimping or deforming the margins, so as to obtain satisfactory spacing of the blades.

In the preferred embodiment disclosed herein and in the modification, two convolutions have been used, so that one-half of the blades are

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struck out from one convolution and the other half of the blades are struck out from the other convolution, the blades from the separate convolutions being staggered, to thereby obtain the proper spacing. Instead of two convolutions being used, more convolutions may be advantageous. Some of the metal from each convolution is removed, so as to obtain the proper size of the blades, as will appear more fully from the detailed description that follows.

Referring to the drawings, the reference character 10 indicates a sheet of metal having portions 12 removed therefrom, and provided with incisions 14 forming the sides of the portions 16, which portions are in readiness to be struck out or formed into louvers or fan blades. In Figure 2 the louvers 16 have been struck out and held in spaced relation by the margins 18. In a 12 x 12" fan, anywhere from 42 to 54 fan blades may be desirable. The number of fan blades is a matter of choice, depending upon the use to which the fan is to be put and many other factors. If, for example, 48 blades are used, the blades in each convolution should subtend an angle of 15°. If 54 blades are used, the angle would be less, or slightly more than 13°. No attempt has been made to indicate dimensions and proportions in the drawings shown herein.

After the blades or louvers have been struck out, as shown in Figure 2, the continuous strip of material is wrapped into two convolutions, as shown in Figure 6. Rivets 19 may be used to hold the convolutions together while the margins are fabricated. Instead of rivets, the convolutions may be spot welded together or otherwise held in place. The thickness of the sheet metal as shown in Figures 2 and 6 is greatly exaggerated, for the sake of clearness. The louvers 16a struck out from the inner convolution should be slightly longer than the louvers 16b struck out from the outer convolution. The reason for this difference is to compensate for the thickness of the material, in that the blades extending out from the inner convolution must be longer than those extending out from the outer convolution by a distance equal to the thickness of the metal.

The margins 18 may be beaded or ribbed by a circumferential bead or rib 20. In addition thereto, the extreme outer margin may be spun or formed into a bead 22 that may or may not be reenforced by a reenforcing annular member 24. This is to give the fan rigidity. After the fan assembly and the blades have been formed, the fan assembly is preferably attached at the center of the blades to a spider mechanism 30,

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consisting of a pair of discs 32 and 34 mounted upon a hub 36 attached to a drive shaft 38.

In the preferred embodiment disclosed in the above described figures, the fan blades 16 are substantially radially disposed. This has been shown for the purpose of convenience. In Figure 7 arcuate fan blades 50 have been shown, wherein the blades are formed so as to have an inwardly projecting portion 52 and an outwardly projecting portion 54. These blades may be curved, so as to have the proper dynamic properties.

The number of blades, the size of the blades and the shape of the blades may be influenced by a number of factors. If, for example, there is no objection to a high speed fan, the blades may be farther apart than if the speed is lower. The speed of the fan may be influenced by noises. If quietness of operation is a desirable feature, it may be necessary to operate the fan at a comparatively low speed, in which event a larger number of blades would be used than if the fan rotated at a higher speed for the same delivery of air. If the fan is required to deliver air against a high static head, a larger number of fan blades would be used than if the fan were used on a lower static head.

In view of the foregoing, no definite number of blades is specified. By utilizing two convolutions, the blades may be spaced the proper distance from each other, the size of the blades may be controlled by the amount of metal that is removed from the strip and the shape may be controlled during the forming operation of the blades.

In the preferred embodiment and the modification, the louvers have been shown as extending at right angles with respect to the adjacent marginal portion. The blank could be so severed and formed as to form angularly or spirally disposed blades or louvers.

Although the disclosure herein shows the convolution as being integral and made from a single strip of metal properly severed, the convolutions within the purview of the invention could be made from separate pieces 60 and 62, as shown in Figure 8, to accomplish the same result.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described our invention, we claim:

1. A centrifugal type fan assembly including a pair of continuous convolutions consisting of ribbed marginal portions, and a plurality of fan blades integral with the marginal portions, alternate blades being integral with one convolution and the remaining blades integral with the other convolution, the blades being spaced apart to form an air channel between each adjacent blade.

2. A centrifugal type fan assembly including a pair of continuous convolutions, each convolution consisting of ribbed marginal portions and a plurality of fan blades integral with said marginal portions, the blades of the marginal portions of one convolution being staggered with respect to the blades of the marginal portions of the other convolution, the blades of the two convolutions being substantially identical and spaced

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apart to form an air channel between each adjacent blade.

3. A centrifugal type fan assembly including a plurality of convolutions, each convolution consisting of reenforced marginal portions and a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being spaced apart and integral with different convolutions, all the spaces between adjacent blades forming air channels.

4. A centrifugal type fan assembly including a plurality of convolutions, each convolution consisting of marginal portions terminating in marginal reinforcing beads and a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being spaced apart and integral with different convolutions, all the spaces between adjacent blades forming air channels.

5. A centrifugal type fan assembly including a plurality of convolutions, each convolution consisting of marginal portions terminating in marginal reinforcing beads, a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being spaced apart and integral with different convolutions, all the spaces between adjacent blades forming channels, and annular members engaging the margins for reinforcing the same.

6. A centrifugal type fan assembly including the combination of a plurality of continuous convolutions, each convolution consisting of marginal portions and a plurality of fan blades integral with the marginal portions, adjacent fan blades being spaced apart and integral with different convolutions, all the spaces between adjacent blades forming channels, with reinforcing means for reinforcing the margins of the convolutions.

7. A centrifugal type fan assembly including a pair of convolutions, each convolution consisting of a pair of marginal portions one along each edge of the convolution, a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being equally spaced apart and integral with different convolutions, all the spaces between adjacent blades forming air channels, and reenforcing members engaging the marginal portions of at least one of the convolutions for imparting rigidity to the fan assembly.

8. A centrifugal type fan assembly including a pair of convolutions, each convolution consisting of a pair of marginal portions one along each edge of the convolution, a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being equally spaced apart and integral with different convolutions, all the spaces between adjacent blades forming air channels, and a pair of circular members engaging the marginal portions of one of the convolutions for reenforcing the convolutions.

9. A centrifugal type fan assembly including a pair of convolutions, each convolution consisting of a pair of marginal portions one along each edge of the convolution, a plurality of substantially identical shaped fan blades integral with and extending between the marginal portions, adjacent blades being equally spaced apart and integral with different convolutions, all the spaces

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between adjacent blades forming air channels, and a pair of wire-like rings for reenforcing the margins of the convolutions.

10. A centrifugal type fan assembly including a pair of convolutions, each convolution consisting of a pair of marginal portions one along each edge of the convolution, a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being equally spaced apart and integral with different convolutions, all the spaces between adjacent blades forming air channels, the marginal portions of at least one of the convolutions forming a bead, and a pair of wire-like hoops enclosed by said beads to reinforce the convolutions.

11. A centrifugal type fan assembly including a pair of convolutions, each convolution consisting of a pair of marginal portions one along each edge of the convolution, a plurality of substantially identically shaped fan blades integral with and extending between the marginal portions, adjacent blades being equally spaced apart and integral with different convolutions, all the spaces between adjacent blades forming air channels, and reenforcing means associated with the marginal portions of the convolutions for reenforcing the same.

12. A blower wheel, comprising in combination, an inner blade member, and an outer blade member mounted around the inner member, each of the blade members having laterally extending curved vanes and air spaces therebetween the vanes of the outer member projecting through the spaces of the inner member, the pitch and radii of adjacent blades being the same.

13. In a blower, a circumvoluntary blade member, comprising, a plurality of laterally extending integral vanes and spaces therebetween, some of the vanes projecting through some of the spaces between other vanes and providing air channels between adjacent vanes.

14. In a blower, a circumvoluntary blade member, comprising, a plurality of laterally extending integral vanes and spaces therebetween, some of the vanes projecting through some of the spaces between other vanes and providing air channels between adjacent vanes, the area of each vane being greater than the area of the channel opening adjacent thereto.

15. In a blower, a circumvoluntary blade member, comprising, a plurality of laterally extending integral vanes and spaces therebetween, some of the vanes projecting through some of the spaces between other vanes and providing air channels between adjacent vanes, all of the vanes being generally parallel and evenly spaced apart.

16. In a blower, a circumvoluntary blade member, comprising, a plurality of laterally extending integral vanes and spaces therebetween, some of the vanes projecting through some of the spaces between other vanes and providing air channels between adjacent vanes, all of the vanes being generally parallel and evenly spaced apart, the area of each vane being greater than the area of the channel opening adjacent thereto.

17. A blower wheel, comprising in combination, a first blade member having a plurality of laterally extending integral vanes and spaces therebetween, and a second blade member substantially concentric with and mounted on the first blade member, the second blade member also having a plurality of laterally extending integral spaced vanes, the vanes of the second member projecting through the spaces of the first mem-

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ber and being generally parallel thereto providing air channels between adjacent vanes.

18. A blower wheel of the type defined in claim 17 and further characterized by the second blade member being substantially identical in size and shape with the first blade member.

19. A blower wheel, comprising in combination, a first blade member having a plurality of laterally extending integral vanes and spaces therebetween, and a second blade member substantially concentric with and mounted on the first blade member, the second blade member also having a plurality of laterally extending integral spaced vanes, the vanes of the second member projecting through the spaces of the first member and being generally parallel thereto providing air channels between adjacent vanes, the area of each vane being greater than the area of the channel opening adjacent thereto.

20. A blower wheel of the type defined in claim 19 and further characterized by the second blade member being substantially identical in size and shape with the first blade member.

21. A blower wheel, comprising in combination, a first blade member having a plurality of laterally extending integral vanes and spaces therebetween, and a second blade member substantially concentric with and mounted on the first blade member, the second blade member also having a plurality of laterally extending integral spaced vanes, the vanes of the second member projecting through the spaces of the first member and being generally parallel thereto providing air channels between adjacent vanes, the aggregate area of the vanes being greater than the aggregate area of the channel openings.

22. A blower wheel, comprising in combination, a first blade member having a plurality of laterally extending integral vanes and spaces therebetween, and a second blade member substantially concentric with and mounted on the first blade member, the second blade member also having a plurality of laterally extending integral spaced vanes, the vanes of the second member projecting through the spaces of the first member and being equidistant between the vanes thereof providing air channels between adjacent vanes.

23. A blower wheel, comprising in combination, a first blade member having a plurality of laterally extending integral vanes and spaces therebetween, and a second blade member substantially concentric with and mounted on the first blade member, the second blade member also having a plurality of laterally extending integral spaced vanes, the vanes of the second member projecting through the spaces of the first member and being equidistant between the vanes thereof and generally parallel thereto providing air channels between adjacent vanes.

24. A blower wheel, comprising in combination, a first blade member having a plurality of laterally extending integral vanes and spaces therebetween, and a second blade member substantially concentric with and mounted on the first blade member, the second blade member also having a plurality of laterally extending integral spaced vanes, the vanes of the second member projecting through the spaces of the first member and being equidistant between the vanes thereof providing air channels between adjacent vanes, the area of each vane being greater than the area of the channel opening adjacent thereto.

25. A blower wheel of the type defined in claim 24 and further characterized by the second blade

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member being substantially identical in size and shape with the first blade member.

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