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FAN ASSEMBLY

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Fig. 1

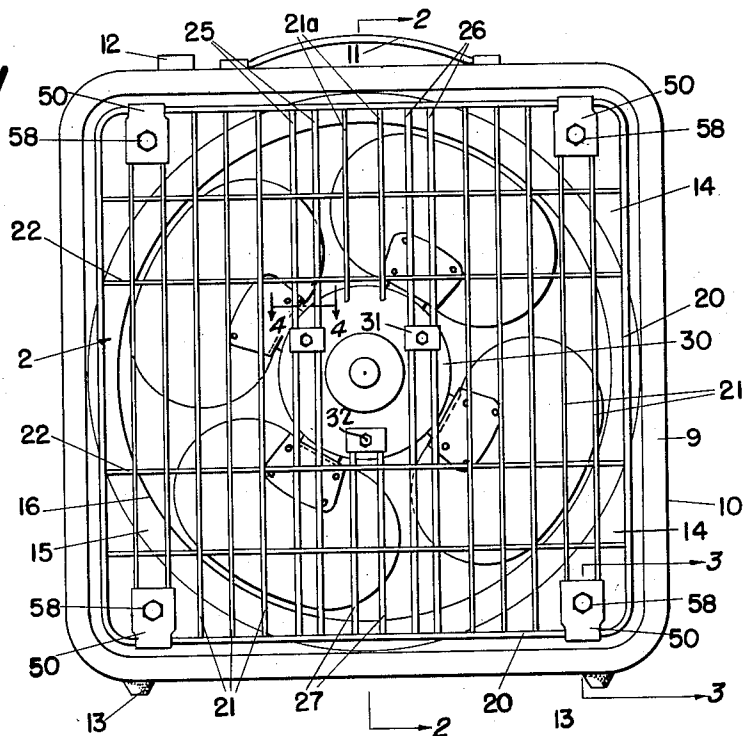


Fig. 2

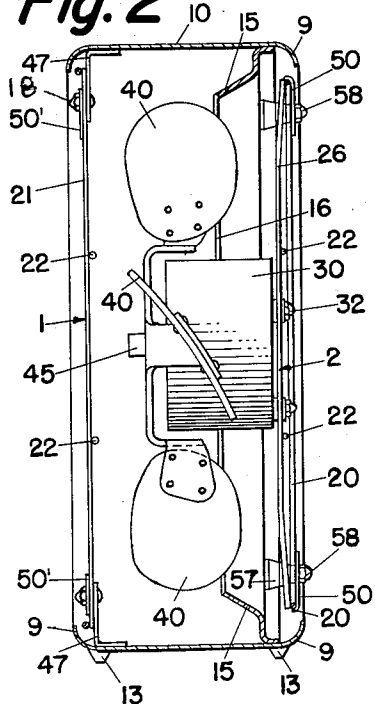


Fig. 4

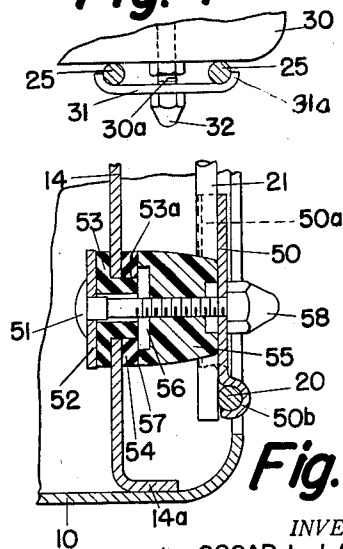


Fig. 3

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FAN ASSEMBLY

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4 Claims. (Cl. 230—259)

This invention relates to fan assembly suitable for use as a portable fan. The fan assembly can be used on the floor for circulating the air within a room or it can be positioned in a window. The fan assembly is provided with an electrically reversible motor so that the fan blades can be suitably rotated to exhaust stale air from a room or to draw in fresh air. The fan assembly is provided with a venturi ring which ensures quiet operation of the fan with maximum flow of air.

The fan assembly is simple in construction, light weight and is unusually quiet in operation. The motor and fan blade assembly are mounted in such manner that noise and vibration are reduced to a minimum as compared with prior constructions.

Further advantages and details of the invention will be apparent from the following specification and accompanying drawing wherein,

Figure 1 is an elevational rear view of the fan assembly,

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1,

Figure 3 is an enlarged sectional view taken on line 3—3 of Figure 1, and

Figure 4 is an enlarged sectional view taken on line 4—4 of Figure 1.

Referring to the drawing, the fan assembly consists of an outer substantially rectangular symmetrical metal casing 10 which is U-shaped in cross-section, as shown in Figure 2. A carrying handle 11 is provided at the upper flat side of the casing and four rubber feet 13 are located on the opposite bottom side to support the fan assembly on any supporting surface where it is to be used. The casing 10 is provided at its front and rear sides with inwardly turned flanges 9, as shown in Figure 2, which surround the periphery of the casing and define rectangular axially aligned openings in the front and rear of the casing.

A venturi ring 15 is secured to the rear of the casing 10 by means of flat extensions 14 which are integral therewith and extend adjacent the inner wall of the casing 10 on all four sides. The extensions 14 are provided with flange portions 14a which are suitably spot welded to the adjacent portions of the casing. The venturi ring 15 defines a circular passage between the front and rear openings of the casing and is positioned so as to have its axis coincide with the central axis of the casing. The venturi ring 15 is positioned so as to have its narrow or tapering suction end directed inwardly of the casing 10, as shown in Figure 2. The larger or intake end of the venturi ring is positioned adjacent the rear opening of the casing 10 as shown in Figure 2. The diameter of the intake end of the venturi ring is slightly smaller than the maximum diameter of a complete circle which can be inscribed within the inner walls of the casing.

Protective detachable grills or guards 1 and 2 are provided, respectively, at the front and rear openings of the casing. The grills are formed of spaced vertical wires 21 and horizontal wires 22 which are welded at their intersecting contacting portions and at their ends to a rec-

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tangular continuous wire member 20 thereby forming a rigid unitary structure. The front grill is retained by bolts 18 which are carried by flanges 47 attached to the frame member 10 as shown in Figure 2.

The rear grill 2 may be provided with two pairs of spaced vertical wires 25 and 26 and an intermediate pair of vertical wires 27 which are positioned on the inner face of the grill and spot welded to the intersecting wires thereof. These vertical wires may be slightly greater in diameter than the other wires of the grill. A motor 30 provided with spaced threaded bolts 30a at its rear portion is adapted to be retained on the spaced wires 25, 26 and 27 by means of U-shaped plates 31 having rearwardly bent flange 50a embracing the pairs of wires having openings through which the bolts 30a are passed and retained by nuts 32, as shown in Figure 4. It will thus be evident that the motor 30 is securely supported on the rear grill 2. The inner portions of the vertical wires 21a of the grill and the portions of the vertical wires 27 are cut off so as to provide clearance for the rearwardly extending portions of the motor 30. A fan blade assembly having preferably four propeller type blades 40 is mounted for rotation on the motor shaft. The motor is preferably of the electrically reversible type so that by suitably actuating switch 12 the direction of rotation of the fan blades may be reversed, thereby reversing the axial flow of air through the casing. The motor shaft 45 is positioned so that the fan blades rotated thereby are mounted for rotation coaxially with the venturi ring to proper air therethrough.

It will be seen by referring to Figure 2 that the motor and fan assembly are entirely supported within the casing and that the assembly is of less axial extent than that of the casing so that no part of the fan unit extends beyond the walls of the casing. The fan unit is positioned on the grill so that the motor shaft extends centrally and axially of the venturi ring 15. The fan blades 40 are mounted so that they are positioned immediately forwardly of the converging or suction portion 16 of the venturi ring 15 so as to produce the maximum rate of air flow when the fan is rotated to produce a stream of air forwardly of the casing through the front grill 1.

The rear grill 2 is mounted on the casing 10 by means of threaded carriage bolts 51, as shown in Figure 3. The threaded end of the bolt is passed through an opening in retaining plates 50, having side flanges 50a which are adapted to engage spaced vertical wires of the grill. The lower end 50b of the plates 50 is folded about the outer continuous wire member 20 of the grill. A threaded acorn nut 58 is applied to the threaded end of bolt 51 and turned to securely engage plate 50 against the grill wires. A generally cylindrically shaped spacer 55, preferably made of molded plastic material, is positioned between plate 50 and the flange portion 14 extending from the venturi ring 15. The spacer is bored axially to permit the carriage bolt 51 to pass therethrough. A resilient ring washer 54 made of rubber, or the like, is positioned on the inner face of the spacer 55. The inner end of the spacer 55 is undercut or dished at 56 so that one face of the washer 54 is supported on the reduced surface 57 of the spacer 55. The other face of the washer 54 is in contact with the flange 14. A cylindrical bushing made of resilient material, such as rubber, is provided with a shoulder portion 53 which engages the other face of the flange portion and has a cylindrical extending portion 53a which passes through an opening provided in the flange 14 and nests into the central opening of washer 54. A metal ring washer 52 is provided beneath the head of the bolt 51 which is supported on the outer portion of the bushing 53. Upon suitably tightening acorn nut 58 it will be seen that the grill will be securely retained at each of its four corners to the flange portion 14 of the

venturi ring. The resilient washer and bushing assembly previously described provides a resilient mount for the rear grill 2 on which the motor and fan assembly are mounted so as to reduce any vibration or noise which may be transmitted to the rear grill 2 and fan casing when the fan is operated.

In previous fan assembly constructions, it has been the practice to support the motor on brackets which extend laterally from the motor. These brackets being relatively heavy and of substantial dimensions obstruct air flow and produce undesirable beating or purring noise. This noise is caused by the proximity of the relatively heavy motor mount members to the blades. As an individual blade proceeds through its revolution, it passes first through an area where the flow of air is relatively unimpeded, and there is built up over the surface of the blade what we can call a normal pressure distribution. As the blade passes the motor mount member, it finds itself in an area in which the velocity of the air being fed to it is sharply reduced and approaches zero. The pressure distribution over the blade's surface abruptly assumes a new pattern, with two results: first, the blade is sharply flexed, a situation which can under certain circumstances be dangerous from a structural and fatigue standpoint; secondly, the recurring creation of a partial vacuum followed by the regular relief of this vacuum obviously fulfills the requirements for the excitation of noise. This difficulty is overcome by the present invention by using a motor mount of many small members provided by the spaced wires of the grill so that the air interruption is more or less uniformly distributed.

The present construction wherein the motor is mounted on a plurality of small spaced wire members of the grill eliminates the undesirable noises produced by conventional motor mounting. By mounting the motor on the openly spaced wires of the grill, the interruption of the air stream is uniformly distributed over substantially the entire grill area and is not localized as in previous constructions so that objectionable harsh beating or purring noise is eliminated.

Furthermore, additional advantages are obtained in my fan assembly by positioning the fan blades adjacent the inner suction end of the venturi ring or immediately adjacent and clear of the inner end of the venturi ring. In previous constructions the fan blades are located far upstream from the venturi. First, with the fan blades located so far upstream from the venturi, air will be thrown from the tips outward against the juncture between the venturi diaphragm and the casing; secondly, the air on the suction side of the fan has poor flow characteristics as it passes through a wire grill, past a heavy motor mount member, and through a square chamber of large cross section on its way to the fan blades so that the flow of air to the blades will be severely restricted. It can be seen that the blades, located as they are with a high pressure area downstream and a low pressure area upstream, cannot operate very efficiently. Furthermore, the swinging of air by the blades up to the corners inside the casing results in noise. This is especially the case when a four-bladed fan is used in order to absorb additional horsepower. The arrangement of the venturi in the present construction so that it acts as an air flow guide on the suction side of the fan, with the entire profile of the fan blades substantially but not necessarily entirely clear out of the venturi, produces greater rate of air flow and thus results in greater fan efficiency.

Furthermore, by mounting the motor directly on the grill as previously described and in turn mounting the grill by resilient mounts supported by the frame member, vibration is reduced to a minimum and to such remarkable extent that it is possible to use a solid steel spider and hub with no need for a vibration absorbing rubber hub necessary in fan construction of this type.

From the foregoing description it will be apparent that

the present fan assembly is simple in construction and economical to assemble. The fan is extremely efficient and quiet in its operation.

I claim:

1. A fan assembly comprising a rectangular casing, said casing having axially aligned front and rear rectangular openings, a venturi ring positioned in said casing having its axis aligned with the central axis of the casing, the larger intake end of said venturi ring being positioned adjacent the rear opening of the casing and its reduced converging suction end extending inwardly of the casing, flange portions connected to said venturi ring, said flange portions being connected to the inner sides of the casing for retaining the venturi ring within the casing, a rectangular open-wire grill retained adjacent the said front and rear rectangular openings of said casing and of substantially coextensive area, said grills being formed of a plurality of regularly spaced vertical and horizontal wires connected at their ends to a peripheral rectangular wire frame member and to each other at their intersecting contacting portions, a motor positioned axially within the casing and supported on the medial portion of the said rear grill, a fan blade assembly carried on the shaft of said motor having a plurality of rotatable fan blades, said motor and fan blade assembly being positioned entirely within said casing, said fan blades being positioned coaxially of said venturi ring and adjacent the suction end thereof, said motor being reversible for rotating the fan assembly in selected opposed directions, said rear grill being retained by said flanges connected to the venturi ring by bolts passing therethrough, said bolts being supported in yieldable bushings to minimize vibration during operation of the fan assembly.

2. A fan assembly comprising a rectangular casing, said casing having axially aligned front and rear rectangular openings, a venturi ring positioned in said casing having its axis aligned with the central axis of the casing, the larger intake end of said venturi ring being positioned adjacent the rear opening of the casing and its reduced converging suction end extending inwardly of the casing, flange portions connected to said venturi ring, said flange portions being connected to the inner sides of the casing for retaining the venturi ring within the casing, a rectangular open-wire grill retained adjacent the said front and rear rectangular openings of said casing and of substantially coextensive area, said grills being formed of a plurality of regularly spaced vertical and horizontal wires connected at their ends to a peripheral rectangular wire frame member and to each other at their intersecting contacting portions, a motor positioned axially within the casing and supported on the medial portion of the said rear grill, a fan blade assembly carried on the shaft of said motor having a plurality of rotatable fan blades, said motor and fan blade assembly being positioned entirely within said casing, said fan blades being positioned coaxially of said venturi ring and adjacent the suction end thereof, said motor being reversible for rotating the fan assembly in selected opposed directions, said rear grill being mounted on bolts connected to the venturi ring, said bolts being surrounded by yieldable bushings to minimize vibration of the fan assembly.

3. A fan assembly comprising a rectangular casing, said casing having axially aligned front and rear rectangular openings, a venturi ring positioned in said casing having its axis aligned with the central axis of the casing, the larger intake end of said venturi ring being positioned adjacent the rear opening of the casing and its reduced converging suction end extending inwardly of the casing, flange portions connected to said venturi ring, said flange portions being connected to the inner sides of the casing for retaining the venturi ring within the casing, a rectangular open-wire grill retained adjacent the said front and rear rectangular openings of said casing and of substantially coextensive area, said grills being formed of a plurality of regularly spaced vertical and horizontal

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wires connected at their ends to a peripheral rectangular wire frame member and to each other at their intersecting contacting portions, said grill being provided with a plurality of pairs of spaced vertically extending wires for supporting a motor thereon, a motor positioned axially within the casing and supported on the medial portion of the said rear grill, bolts extending from the said motor rearwardly of the casing adjacent said pairs of spaced vertically extending wires, retaining plates supported on said spaced wires provided with openings through which said bolts pass, nuts for securely fastening said bolts against said plates, a fan blade assembly carried on the shaft of said motor having a plurality of rotatable fan blades, said motor and fan blade assembly being positioned entirely within said casing, said fan blades being positioned coaxially of said venturi ring and adjacent the suction end thereof, said motor being reversible for rotating the fan assembly in selected opposed directions, said rear grill being retained by said flanges connected to the venturi ring by bolts passing therethrough, said bolts being supported in yieldable bushings to minimize vibration during operation of the fan assembly.

4. A fan assembly comprising a rectangular casing, said casing having axially aligned front and rear rectangular openings, a venturi ring positioned in said casing having its axis aligned with the central axis of the casing, the larger intake end of said venturi ring being positioned adjacent the rear opening of the casing and its reduced converging suction end extending inwardly of the casing, flange portions connected to said venturi ring, said flange portions being connected to the inner sides of the casing for retaining the venturi ring within the casing, a rectangular open-wire grill retained adjacent the said front and rear rectangular openings of said casing and of substantially coextensive area, said grills being formed of a plurality of regularly spaced vertical and horizontal wires connected at their ends to a peripheral rectangular wire frame member and to each other at their intersecting contacting portions, a motor positioned axially within the casing and supported on the medial portion of the said

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rear grill, a fan blade assembly carried on the shaft of said motor having a plurality of rotatable fan blades, said motor and fan blade assembly being positioned entirely within said casing, said fan blades being positioned coaxially of said venturi ring and adjacent the suction end thereof, said motor being reversible for rotating the fan assembly in selected opposed directions, the corner portions of said rear grill being retained by a threaded carriage bolt, the head portion of the carriage bolt being passed through a cylindrical yieldable bushing, said bushing having an enlarged circular shoulder portion and an extending cylindrical body portion of reduced diameter, said body portion being passed through an opening in the flange portion of the venturi ring and said shoulder portion of the bushing being in face contact with said flange portion, a yieldable washer ring having an opening of a diameter to permit the body portion of the said bushing to pass therethrough and nest therein, said washer ring being in contact with the end of a cylindrical spacer, said spacer being of a length to extend adjacent the rear grill, said spacer being coaxially bored to permit said carriage bolt to extend therethrough and present the threaded end thereof adjacent the outer periphery of said rear grill, a retaining plate supported on said grill and provided with an opening for passing the threaded end of the bolt therethrough, a nut received by the threaded end of said carriage bolt and tightened thereon to securely retain the bushing and spacer assembly.

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