

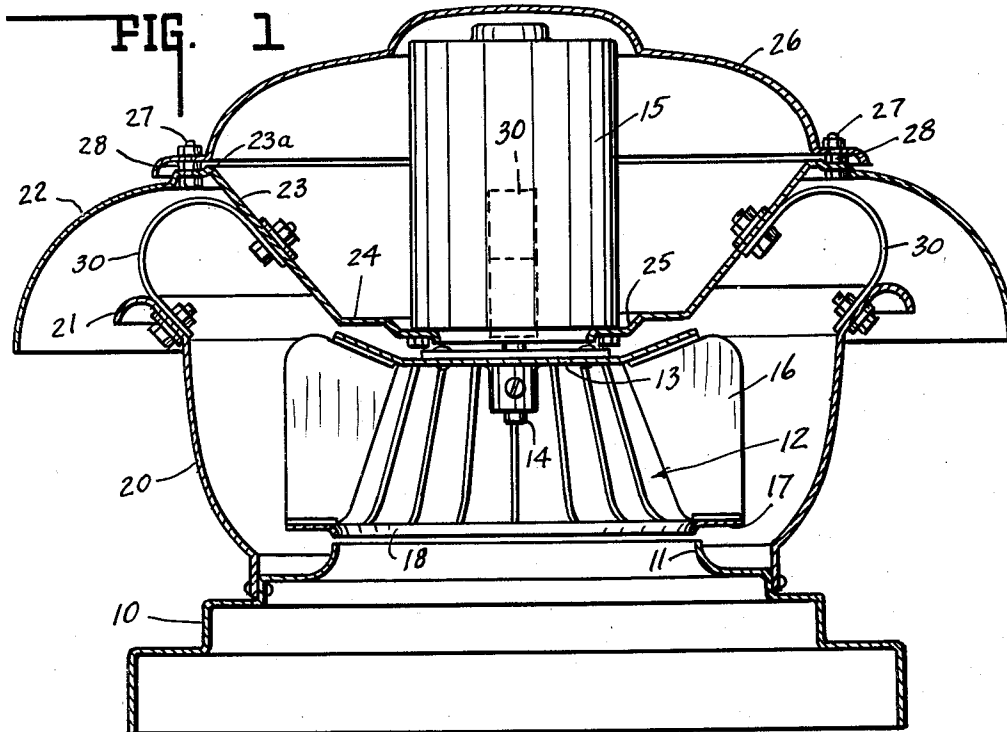
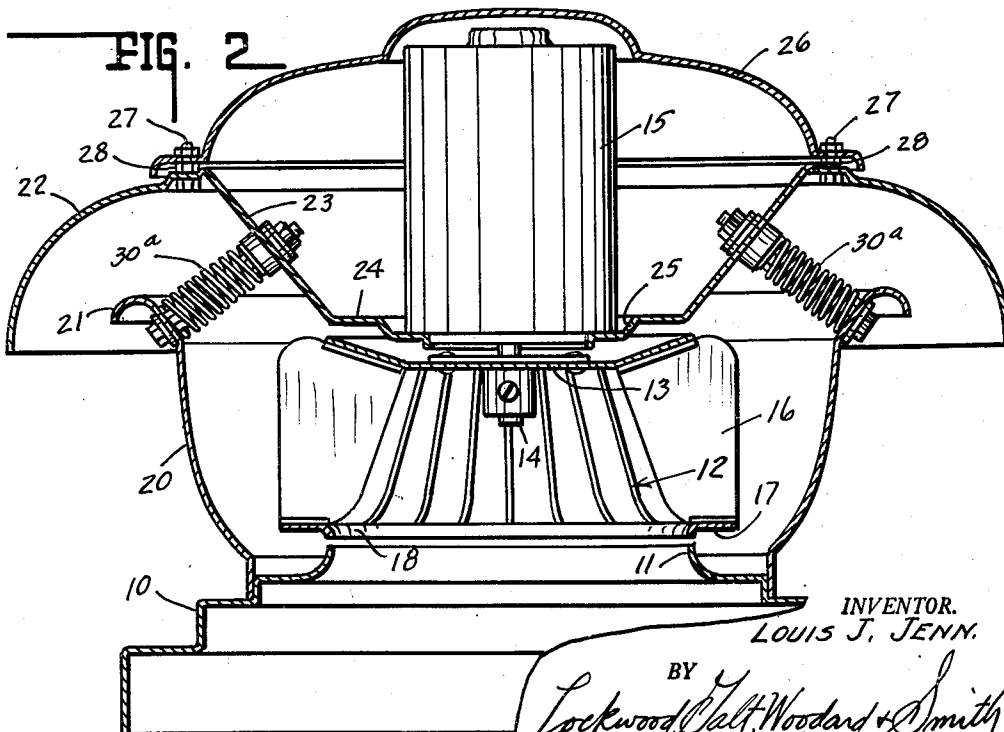
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VENTILATOR

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1

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VENTILATOR

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This invention relates to a ventilator and in particularly directed to a fan assembly adapted for mounting exteriorly of buildings where the weatherproof housing for the fan motor must not only shed rain but must also provide an unrestricted port for the egress of a fast moving stream of air propelled by the fan.

Heretofore, the problem of mounting a motor-driven fan and damping the vibrations originating in its rotating parts has been considered separately from the problem of designing a housing that effectively weatherproofs the assembly. The vibrating forces of all frequencies having components both axially of the rotating parts and radially thereof can usually be isolated by spring supports, if the spring supports are long enough and "soft" or flexible enough. If long flexible springs are employed to space the motor, which is relatively heavy, from the weather housing, the housing must be unduly large to enclose the springs and motor. The conventional method of sound and vibration isolation is by the use of soft rubber damping pads. They have been only moderately effective and have the drawbacks of deterioration and loss of resiliency of synthetic rubber in a period of years.

The primary object of this invention is an improved ventilator that is so constructed and arranged as to reduce materially the noises that emanate from the conventional ventilators.

A more specific object of this invention is an improved unitary ventilating fan assembly that is compact, is weatherproof, and effectively obviates vibration transmission.

The objects of this invention are attained by an air bowl overlaid with a hood having the form of a figure of revolution coaxial with the bowl, with the peripheral portion thereof spaced from the rim of the bowl. The central portion of the hood has a re-entrant cone joined to the fan-end of a motor affixed to the cone, a dish-shaped cowl being placed over the motor and attached to the hood. A plurality of relatively short support springs connect the rim of the bowl to the hood.

Other objects and features of this invention will become apparent to those skilled in the art by referring to the preferred embodiments of the invention described in the following specification and shown in the accompanying drawing in which:

Fig. 1 is a vertical sectional view of one embodiment of the invention, and

Fig. 2 is a vertical sectional view of a modified form of the embodiment shown in Fig. 1.

The base 10 of the fan assembly of this invention is a one piece drawn sheet metal cylinder adapted for attachment to a building structure and over an opening or duct from which air is to be exhausted. By forming the base in one piece the leakage that has characterized the two or more pieced bases is eliminated. The base 10 and other parts of the assembly may be drawn of lightweight sheet metal if desired, although other materials and methods of fabrication are not to be excluded. At the small end of the base structure 10 is formed a conical flue 11, preferably flared to provide an efficient air foil

2

for the stream of air moving upwardly, in Fig. 1, into the fan 12.

The fan 12 comprises the hub structure 13 keyed to the shaft 14 of motor 15. The particular fan illustrated in the drawings also includes blades or vanes 16 joined to the hub structure 13 and adapted to throw air radially outwardly and upwardly by centrifugal force. The lower ends of the blades are joined to the air foil ring 17, with a downwardly turned flange 18 closely spaced to the upper edge of the flue. The flange on the air foil ring is of the same diameter as the flue to provide a substantially smooth duct from the air inlet of the base into the interior of the fan, as will appear more fully hereinafter, although the fan is resiliently mounted with respect to the base and its flue.

The continuity of the smooth passage into the fan remains unbroken during operation. It will appear that a propeller type fan could be substituted for the centrifugal fan shown. In case of a propeller type fan, the ends of the propeller would inscribe a circle inside and closely adjacent the rim of the flue to minimize turbulence in the stream being pumped.

The discharge from the fan is deflected upwardly by the air bowl 20 having the form of a figure of revolution. The smaller bottom end of the bowl is riveted, welded, or otherwise attached to one step of the base so that the axis of the bowl is substantially coincident with the fan axis. The curvature of the bowl from its base to its rolled upper rim 21 is such as to minimize turbulence in the radial air stream as the air stream is deflected axially.

Overlying the bowl is the hood 22, also of the form of a figure of revolution. The hood is dish-shaped and of sufficient diameter to clear the rolled rim 21 of the bowl a sufficient distance so as not to restrict the emerging air stream. The overlying portion of the hood underhangs the rim of the bowl sufficiently to be effectively weatherproof.

According to an important feature of this invention, the central portion of the hood is provided with a re-entrant conical section 23. However, the cone is truncated at or near the plane of the bowl rim to provide a platform 24 upon which the motor may rest. Conveniently, the floor may be perforated to receive the stator through-bolts to firmly anchor the motor in place. Where the hood is drawn or spun from sheet metal, a stiffening offset bend 25 may, if desired, be formed in the floor.

The space in the cone may be covered with the cowl 26 suitably concaved to accommodate the adjacent end of the motor. The cowl is fastened to the hood with bolts 27 and offset washers 28 to provide a ventilating opening between the cowl and the hood. The rim of the cowl is rolled as shown to provide a water shed for the motor housing.

It will also be observed that the hood is provided with a flange 23a adjacent the point where bolts 27 connect the cowl to the hood. This flange serves as a drip ring to prevent any water that might conceivably leak through the bolted connection from flowing down the inner face of the hood to the motor. It should also be observed that the slight space between the adjacent portions of the cowl and hood provides a ready exit for the sound waves from within the motor compartment to a point outside thereof.

The motor, its fan, and the hood with its re-entrant cone are supported as a unit from the rim of the air bowl, a plurality of springs 30 being spaced along the inner circumference of the rim. The springs may be of the coil type shown at 30a in Fig. 2 or of the arcuate flat leaf type shown at 30 in Fig. 1.

The leaf spring is curved to form a U and the flat ends thereof are bolted face-to-face against the inner surface of the bowl rim on the one hand, and against the opposed

conical surface of the re-entrant cone on the other hand. It has been found that such an arcuate-shaped spring, although short and relatively stiff, effectively prevents the transmission of vibratory forces from the fan assembly to the bowl and its base. While it is not yet completely understood just why such short, stiff springs are effective in damping both axial and radial vibrations, it is believed that the explanation is embodied in the fact that the two components of motion imparted to one end of the spring changes the moment of the spring as its radius is changed. As the radius of the spring decreases, for example, its stiffness increases, whether the movable end travels radially or axially with respect to the center of rotation of the fan and rotor mass. It will be observed that the line through the ends of the spring is at an angle of approximately 45° with respect to said center of rotation so that radial and axial motion of the movable end produces like deflections of the spring.

In Fig. 2, the coil spring 30a is likewise joined normal to the opposed parallel surfaces of the bowl rim and cone at an angle of 45° midway between a radial and axial line. It may be found with motors of different dynamic characteristics that the angle of the right-cone 23 may be changed somewhat and the spring angle correspondingly changed to provide optimum damping for that motor.

One of the principal advantages of the spring supports shown in the drawing is that the ultimate travel of the spring is limited and the displacement of the ring 18 of the fan with respect to the flue is kept at a minimum. With short vibratory travel of the fan, the distortion of the inlet air passage is kept at a minimum and noise carried by turbulence in the inlet air column is minimized. While the bowl and hood housing for the fan of this invention is compact, the spring supports incorporated therein provide effective damping of vibrating forces and noise from the fan. The assembly is weathertight and is easy to service. By removing the cowl 26, access to the motor 15 is readily obtained.

Disclosure of the two embodiments of this invention shown in Figs. 1 and 2 are for the purpose merely of illustrating the principles of the invention and are not to be construed as limitative thereof. Many modifications may be made to these embodiments without departing from the spirit of the invention. The contour of the air bowl 20 and hood 22, with its re-entrant cone 23, may

be modified, for example, without changing the operation of the device. If the centrifugal fan 12 is replaced by a propeller-type fan, the truncated floor 24 will be spaced more closely to the flue, and the propeller blades of the fan will be made to revolve immediately adjacent and above the opening of the flue. While the vibratory forces of such a blade are somewhat different than those of the centrifugal blade, the bowl-to-cone spring suspension effectively isolates those forces.

The invention claimed is:

1. In a fan assembly, a motor having a shaft, a fan blade on the shaft of the motor, a sheet metal truncated cone coaxial with the motor and attached at the small end of the cone to the fan-end of the motor, an air bowl in the form of a figure of revolution substantially coaxial with said motor, an annular hood depending from the large end of said cone and overlying in spaced relation the rim of said bowl, and a plurality of flat U-shaped suspension springs extending from the rim of the bowl to the surface of said cone and attached to said bowl and cone respectively, the points of attachment of the springs being on a line at an angle to the axis of said motor.

2. An exhaust fan assembly comprising an air bowl with an air inlet opening at one end, a dish-shaped hood spaced from and overlying the other end of the bowl in weatherproof relation, said hood having a re-entrant conical portion coaxial with the bowl, a motor having a shaft coaxial with the re-entrant cone and affixed to the cone, a fan keyed to the motor shaft and in concentric relation with said air inlet opening, and spaced springs connecting the rim of the bowl and the opposed wall of the cone, said springs each comprising a single U-shaped leaf of resilient material.

3. An exhaust fan assembly as defined in claim 2 wherein the ends of each of the springs are so mounted that a line drawn through them is at an angle of approximately 45° with respect to the axis of said motor.

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