May 14, 1968 B. O. HOWARD 3,382,792

OMNIDIRECTIONAL EXHAUST VENTILATOR

Filed Aug. 16, 1965

Fig. 1

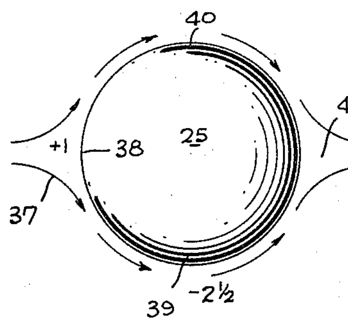


Fig. 7

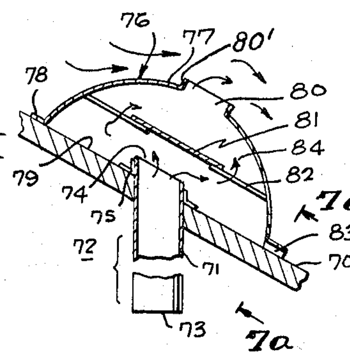


Fig. 7a

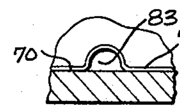


Fig. 3

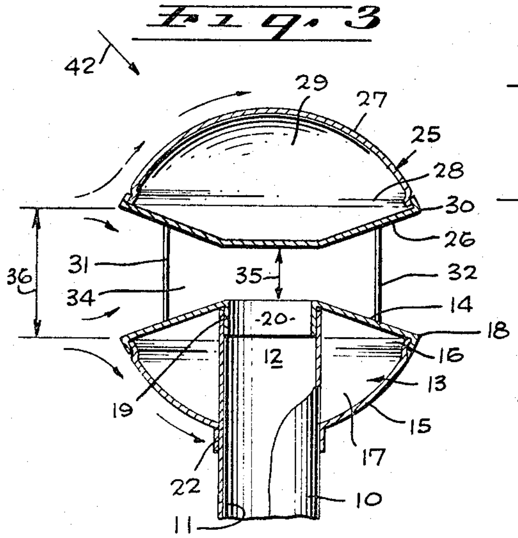


Fig. 4

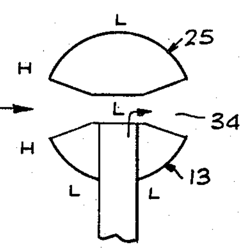


Fig. 4a

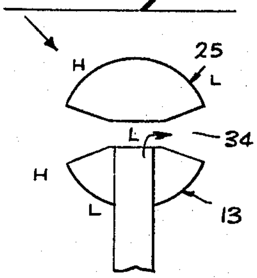


Fig. 4b

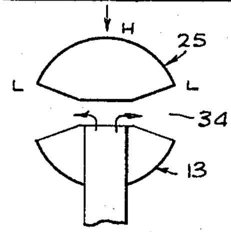


Fig. 6

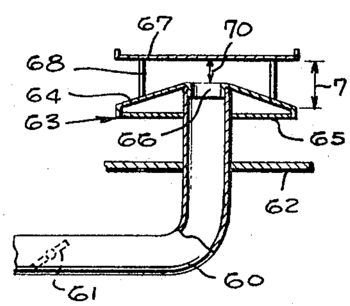


Fig. 5

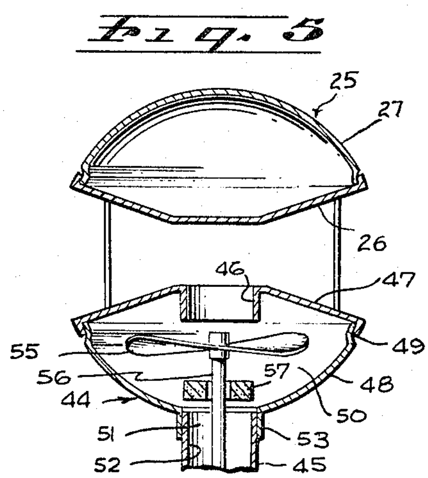
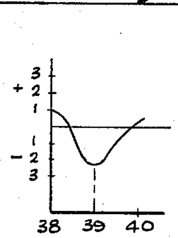


Fig. 2



INVENTOR
BEN O. HOWARD

BY
Beehler & Arant
ATTORNEYS

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OMNIDIRECTIONAL EXHAUST VENTILATOR

Ben O. Howard, 431 Homewood Road,
Los Angeles, Calif. 90049

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The invention relates to a ventilator of a stationary type useful in ventilating shops, houses, boats, house trailers and virtually any type of space or chamber from which air needs to be drawn outwardly to the atomsphere.

Although forced ventilating means are always effective for exhausting stale air from a chamber of any kind, any type of forced ventilation requires an appreciable amount of equipment, moving parts to be installed and serviced and the attendant expense. For that reason natural ventilation is made use of to a very great extent even though in many instances it is relatively inadequate. Some of the inadequacies arise from the fact that ventilators are too small to pass a sufficient volume of air outwardly. More frequently the trouble lies in the fact that outer portions of the ventilators are poorly designed for their intended purpose, namely passing air outwardly to the atmosphere against a variety of atmospheric conditions which may involve wind blowing in the wrong direction, currents and turbulence caused by surrounding structures and, on occasions, a disadvantageous temperature differential. The most common impediment to good natural draft ventilation is the presence of wind blowing in one direction or another. To overcome the disadvantageous effect of wind some ventilators are provided with vanes employed for the purpose of orienting an adjustable ventilator hatch so that the opening is always downwind irrespective of which direction the wind may be blowing. This of course requires a mechanism involving moving parts which can on occasion get stuck. Especially even though the ventilator hatch is directed downwind it is really designed to take advantage of the movement of air and often on the contrary is of such design that eddy currents of air generated by the wind actually block the free flow outwardly from the ventilator. On shipboard some use is made of ventilating funnels but these are strictly directional and need to be turned in the proper direction depending upon, in part, the progress of the ship, and in part upon the direction of the prevailing wind. If such ventilators are set in the wrong direction they work in reverse and fail to serve as a proper ventilating media.

On still other occasions where stationary or relatively stationary ventilators are employed they must be roofed over or otherwise protected from rainfall and dirt. Some use has been made of rotating spheres and rotating vanes of various kinds which tend to shield the ventilating opening. Most vanes of the type currently employed have a tendency to impede the free flow of air and minimize the full effect of the ventilating system.

It is therefore among the objects of the invention to provide a new and improved stationary type of ventilator which is capable of performing effectively irrespective of which way air may be circulating about it, and without necessity for any adjustment to accommodate the direction of circulation of air.

Another object of the invention is to provide a new and improved stationary type of ventilator which works equally effectively irrespective of the direction of air circulation and which at the same time is so arranged that rain and dirt cannot find its way into the outlet opening.

Another object of the invention is to provide a new and improved stationary type ventilator of such construction that air in motion about the outlet is made use of to greatly accelerate the ventilating effect.

Still another object of the invention is to provide a new and improved stationary type multidirectional ventilating device capable of being used on a stationary structure or upon a moving vehicle, the device being of such design as to always assure a markedly improved ventilating effect.

Still another object of the invention is to provide a new and improved multidirectional stationary type ventilating device which works with equal effectiveness whether used in upright or horizontal position or in fact in any desired position, which is relatively inexpensive to build, easy to install, capable of being constructed of virtually any available inexpensive sheet material, and which at the same time is attractive in appearance, or which can be cast, or molded of synthetic plastic resin material.

With these and other objects in view, the invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a plan view of a typical ventilator embodying the invention and showing the pressure pattern resulting from air flowing about it in one direction.

FIGURE 2 is a graph of the pressure pattern produced by the air flowing about the device as pictured in FIGURE 1.

FIGURE 3 is a longitudinal view substantially cut away showing one form of the invention.

FIGURES 4, *4a*, and *4b* are side sectional views showing different wind conditions.

FIGURE 5 is a longitudinal sectional view showing a slightly modified form of the invention.

FIGURE 6 is a longitudinal sectional view of still another form of the invention.

FIGURE 7 is a longitudinal sectional view of the invention in still another form.

FIGURE *7a* is a fragmentary cross-sectional view on the line *7a* of FIGURE 7.

In a device chosen for the purpose of illustration there is shown a stationary type ventilator comprising an outflow pipe section **10** having a passageway **11** therethrough terminating in an outlet opening **12**. An inner hollow body **13** has an outer wall forming a substantially outwardly projecting surface **14** and an inner wall comprising a projecting surface **15** facing in an opposite direction from the surface **14**. On those occasions where the body is constructed of sheet material, it may be built in two sections, one forming the surface **14** and the other forming the convex surface **15** which when assembled and connected along a seam **16** forms a space **17**. At the seam **16** is a rounded edge **18** which extends circumferentially around the body. A flange **19** defining a hole **20** coincides with the outlet opening **12**, the flange **19** being fastened to the outflow pipe section **10** in some appropriate manner as for example by solder. A solder or weld line **22** fastens the central portion of the wall forming the convex surface **15** to the outflow pipe section **10**.

An outer hollow body **25** is constructed of one sheet metal portion forming an inwardly substantially convex surface **26** and another sheet metal portion forming an outwardly substantially convex surface **27**. The sheet metal portions are joined along a seam **28** forming a hollow space **29** within the body. The body moreover adjacent the seam **28** is in the form of an annular rounded edge **30**.

Stanchions like the stanchions **31** and **32** hold the outer hollow body **25** in position over the inner hollow body **13**.

Constructed as shown there is a passageway **34** formed between the surface **14** and the surface **26** which has a center depth **35** substantially less than an outside depth **36**. The structure accordingly resembles a venturi or in fact a multidirectional venturi with the throat at the center, and the enlarged inlet and outlet at diametric extremities irrespective of the direction of air flow past the device.

As an example of the effect produced by the configuration disclosed reference is made to FIGURES 1 and 2. On the assumption that a current **37** of air produced by any means impinges upon a point **38** of the annular body **25** producing a pressure at the point **38** of one inch of water at the chosen velocity, there will be a sufficient increase in velocity at the points **39** and **40** to generate a negative pressure of about −2.5 inches of water. As the current of air passes and converges on the side diametrically opposite the point **38** at about the area **41** there will remain a negative pressure of about −.4 inch of water. In the graph of FIGURE 2 pressure is plotted in a vertical direction in inches of water against a distance in a horizontal direction from the initial point of impact.

A comparable effect takes place at the outlet opening **12** at the center where the velocity of the air current **37** is greatly increased causing the creation of a negative pressure at the outlet opening capable of drawing air outwardly through the passageway **11**. The ventilating effect produced in this fashion will increase depending upon the increase in velocity of the current of air. This will be true whether the current is the result of wind or whether it is the result of movement of a vehicle upon which the ventilator is mounted.

Reference to FIGURES 4, *4a*, and *4b* will be helpful in explaining the ventilating action resulting from wind approaching from relatively different directions. For example in FIGURE 4 let it be assumed that the wind direction as shown by the arrow is horizontal. Passage of wind is generally shown by the arrows. In this form of the device there will be high pressure generated at the locations marked H and low pressure at the locations marked L.

When under other circumstances as in FIGURE *4a* the wind direction is in a downwardly oblique path as shown by the arrow. High pressure areas are indicated by the letter H and low pressure areas by the letter L. In this instance there will be some suction generated through the passageway **11** by venturi action similar to that generated in FIGURE 4 but most of the suction generated is due to the fact that the opening between the outer hollow body **25** and the inner hollow body **13** communicates with the low pressure area which is around the sphere perpendicular to the direction of the wind.

In the example of FIGURE *4b* the wind may be assumed to be approaching vertically downwardly as indicated by the arrow. In this instance there is no venturi effect since air does not pass through the passageway **34**, as in the case of FIGURES 4 and *4a*. In this instance air within the passage **34** travels entirely outwardly with respect to the passageway **11**, traveling to the low pressure area surrounding the composite device at a location perpendicular to the direction of the wind.

Although the reason for generating suction in the passageway **11** differs in the different instances, nevertheless in all wind conditions it will be apparent from the explanation that the ventilator functions to draw air outwardly through the passageway **11**.

In the form of device of FIGURE 5 substantially the same structural relationship is employed except that in this instance the outflow of pipe section of two parts, namely an inner part **45** and an outer part **46**, the outer part in fact being struck as a flange from a wall forming a substantially outwardly projecting surface **47**. Another wall forming an inwardly directed substantially convex surface **48** is joined to the wall forming the surface **47** along a seam **49** thereby to create a space **50**. The part **45** of the pipe section terminates in an opening **51** whereby a passageway **52** communicates with the space **50** and through the space **50** and the opening

formed by the flange **46** to the atmosphere. A flange **53** is employed to mount the inner hollow body **44** upon the part **45** of the pipe section.

In this form of device there is provided an inertia fan **55** on a shaft **56** which is mounted by appropriate means (not shown) in the part **45** of the pipe section. By making use of an inertia fan a more steadily continuing outward flow of air is maintained through the pipe section under circumstances where there may be a variation in the velocity of air flow past the device on the outside, whether created by gusty winds or a change in the speed of a vehicle upon which the device may be mounted. If desired a motor winding **57** may be provided on the shaft **56** to drive the fan as a vent fan. When not in use as a motor the winding acts as a fly wheel to improve the inertia effect.

In the form of device of FIGURE 6 a somewhat more simple version of the invention is shown. A vent pipe **60** containing a damper **61** extends through a wall **62** of some appropriate structure. At the outer end of the vent pipe is a body **63** consisting of a wall forming an outwardly projecting surface **64**. A flat wall **65** closing the opposite side of the body **63** may be employed for added strength. The body may be fastened to the vent pipe by appropriate conventional means as for example by soldering. The vent pipe **60** terminates in an outlet opening **66** at the center of the surface **64**. A canopy **67** is supported by stanchions **68** spaced outwardly relative to the outlet opening **66**. The canopy **67** is formed and located appropriately so as to provide a center depth **70** substantially less than a depth **71** around the periphery.

Constructed in this fashion when there is an air flow created between the surface **64** and the inside surface of the canopy **67** increases in the velocity at the center opposite the opening **66** thereby creates a negative pressure and outflow from the vent pipe **60**.

In the form of invention of FIGURES 7 and *7a* the ventilator is shown mounted flush with the surface of a roof **70**. The roof is shown on a slope, as being the more critical type of installation, but the angle of the roof is not of primary significance and the ventilator would operate as efficiently upon a horizontal roof as long as air moves parallel to the roof surface. Air movement in this case also may either be wind or movement generated by actual movement of the ventilator.

A pipe section **71** extends upwardly from a chamber **72** being ventilated to the exterior, the pipe being provided with an inlet opening **73** and an outlet opening **74**. A seal **75** is provided at the junction of the roof **70** with the pipe section **71**. A dome indicated generally by the reference character **76** surmounts the outlet opening **74**. Although the dome is shown as a partial sphere it is important only that a central portion **77** be spaced at a substantial distance from the surface of the roof **70** and that its perimeter **78** be located adjacent the surface of the roof at a substantial distance from the pipe section **71**. In this relationship and assigning the reference character **79** to the surface of the roof **70** which lies within the perimeter **78** as a surface element, the distance between the surface elements diminishes progressively from that at the central portion **77** where it is a maximum to that at the perimeter **78** where it is zero. Although a dome shape has been shown in hemispherical form a frusto-conical shape or other appropriate shapes are operative.

A vent opening **80** surrounded by an outwardly extending flange **80′** is located in the central portion **77** and is substantially in alignment with the outlet opening **74** along a line drawn perpendicular to the surface of the roof **70**. A rain shield **81** secured by a spider **82** to the dome **76** is preferably slightly larger in area than the outlet opening **74** and covers the outlet opening so that rain cannot enter the pipe section **71**.

On the low side of the dome **76** there is provided a drain hole **83** to permit any water entering through the vent opening **80** to flow out along the surface of the roof.

In this form of device as long as wind blows parallel to the surface of the roof, in the direction of the arrows indicated, a low pressure area will be generated adjacent the vent opening **80**. For the same reasons as defined in the first described forms of the invention this will cause air to pass upwardly from the chamber **72** in the direction of the arrows shown in the vent pipe and thence into a space **84** within the dome, around the rain shield **81** and ultimately outwardly through the vent opening **80**. Although there may be some diminution of low pressure effectiveness caused by the drain hole **83** the area of the drain hole is not large enough to cause any marked change in the ventilating action, and the flow of air inward through the drain hole is not sufficient to permit the rain water to drain out. In this form of device, if desired, the same inertia fan may be used as was described in connection with FIGURE 5.

Since the geometry of the elements making up the spherical form of the ventilator and the spaced relationship is fixed and permanent, ventilating action can always be depending on whenever there is air movement relative to the device. Movement, of course, may be the result either of wind or movement of the device itself, as for example air movement created when the device is mounted on a moving vehicle and the vehicle moved relative to the air. Air speed is not critical and ventilation will be successful at a great variety of different speeds.

While the invention has herein been shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. An exterior omnidirectional ventilator for an interior chamber comprising a first surface element in one plane forming an exterior portion of said chamber, an orifice section forming part of said first surface element

and having an outlet opening therein in communication with said chamber, a second surface element comprising a substantially hemi-spheroidal imperforate dome over said orifice section and providing a space between itself and said orifice section, the perimeter of said second surface element being coincident and forming a junction with the perimeter of said orifice section, said second surface element having a single centrally located opening therein comprising a vent, said vent being located at substantially the center of said dome, said vent having a substantially annular rim lying in a plane parallel to the plane of said junction, the distance between said surface elements being one diminishing at an increasing rate in all radial directions from the vent outwardly and toward said perimeter.

2. An exterior omnidirectional ventilator according to claim **1** including an outwardly extending flange on the second surface element surrounding said vent opening, said flange having a rim lying in a plane parallel to the plane of said junction.

3. An exterior omnidirectional ventilator for an interior chamber according to claim **1** wherein said first surface is a substantially plane surface and is parallel to said annular rim, and wherein the single centrally located opening forms the outermost portion of said dome.

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ROBERT A. O'LEARY *Primary Examiner.*

M. A. ANTONAKAS, *Assistant Examiner.*