United States Patent [19]

Doherty, II

[11] **3,788,207**

[45] **Jan. 29, 1974**

[54] **TOP DISCHARGE ROOF VENTILATOR**

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[22] Filed: **May 26, 1972**

[21] Appl. No.: **257,148**

[52] **U.S. Cl.** **98/42,** 98/43, 98/85, 98/116, 137/533.21, 415/157

[51] **Int. Cl.** **F04d 25/14**

[58] **Field of Search** 98/42, 43, 66, 74, 59, 79, 98/116, 85, 119; 137/533.21, 533.29, 543.23; 415/157, 158

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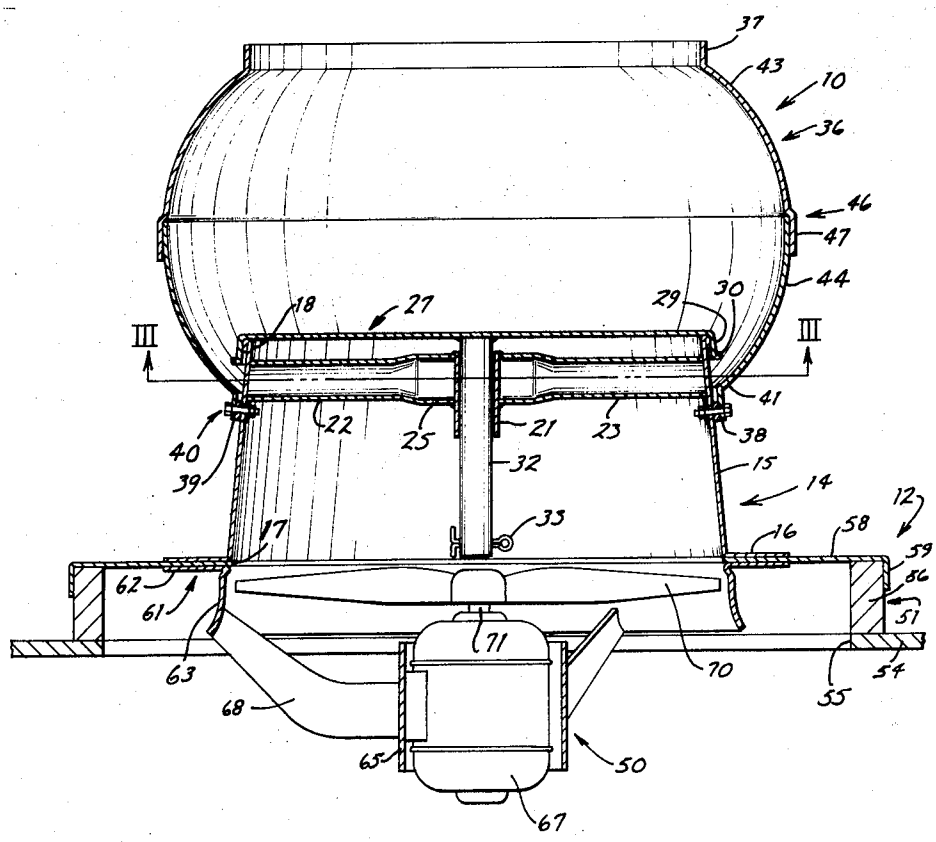
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[57] **ABSTRACT**

A roof ventilator for exhausting air includes a tapered, upstanding, hollow stack for sealed securement on a roof at an air opening therein. A hollow, upstanding and semispherical outlet bell is telescoped in close spaced radial relation over the upper end of the stack and has an open upper end. A substantially flat damper pan normally rests upon and closes the upper stack end. A mounting sleeve is fixedly supported within the stack. A hollow guide element, pendently and coaxially fixed to the damper pan, is slidably located within the mounting sleeve and carries limiting means coacting with the mounting sleeve for limiting movement of the damper pan upwardly off the upper stack end, whereby a pressure drop from the stack to the bell causes the damper pan to lift from the upper end of the stack to vent the stack into the bell.

12 Claims, 3 Drawing Figures



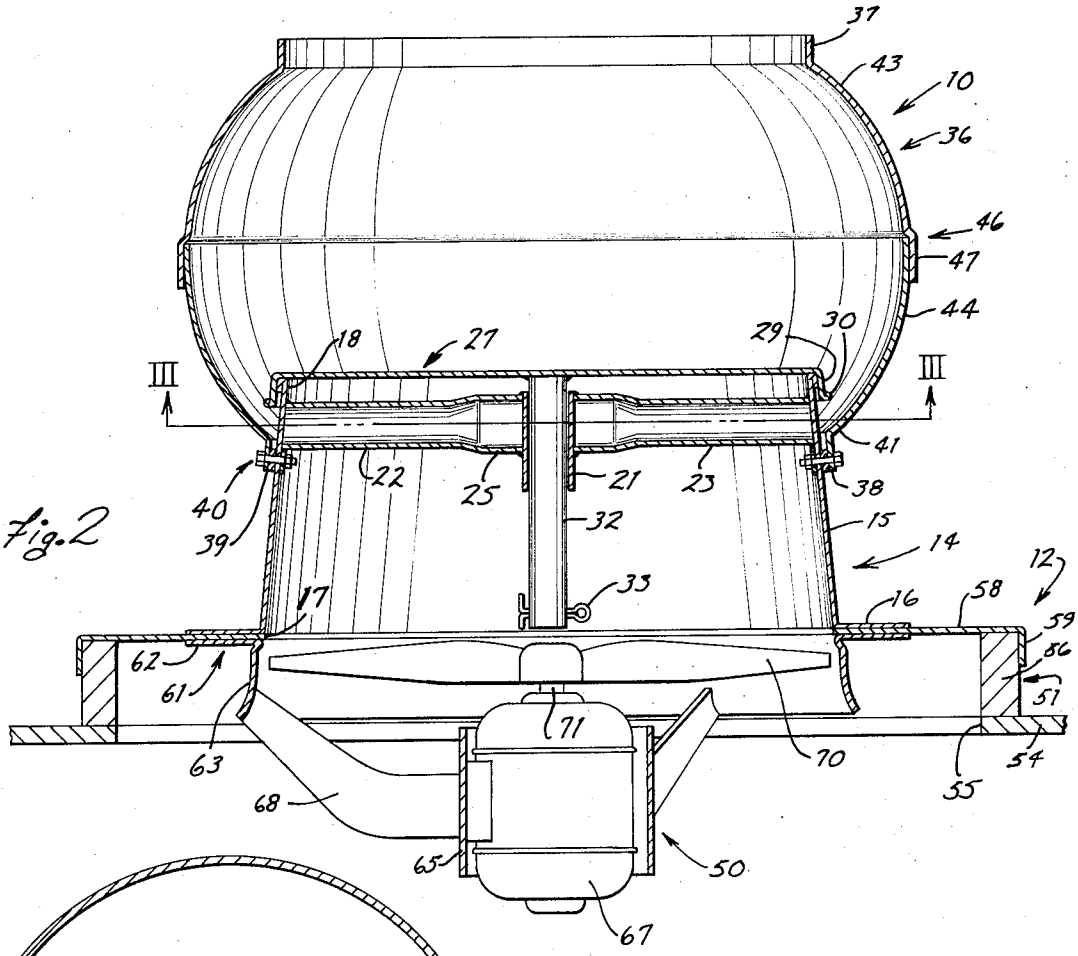


Fig. 2

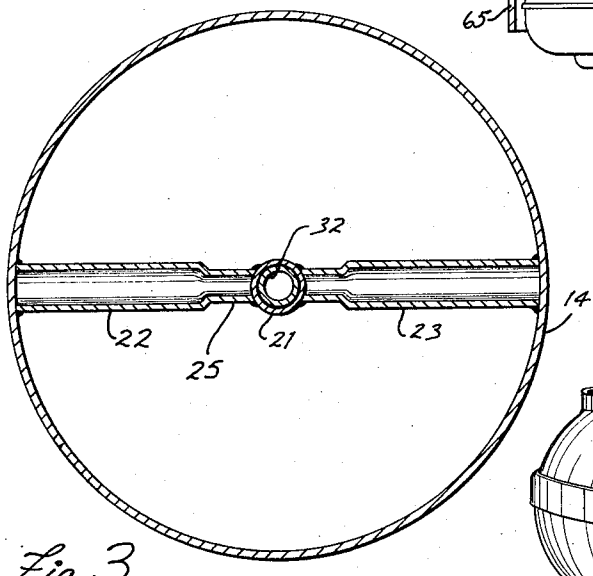


Fig. 3

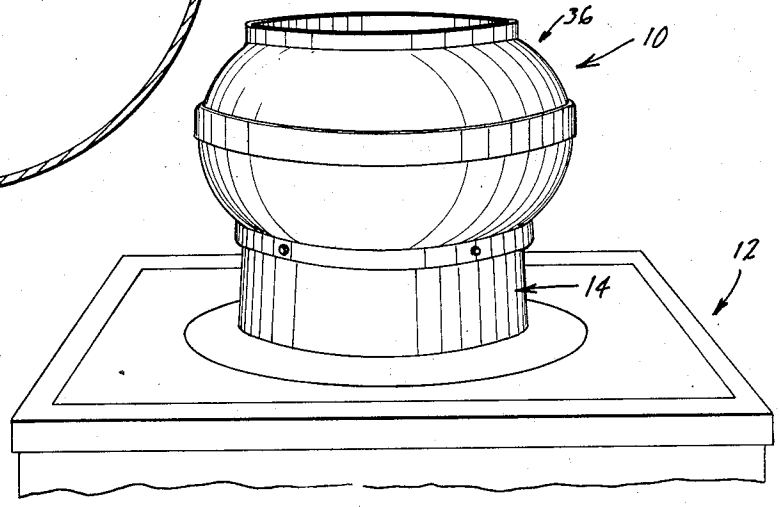


Fig. 1

TOP DISCHARGE ROOF VENTILATOR

FIELD OF THE INVENTION

This invention relates to a roof ventilator and more particularly relates to a top discharge roof ventilator.

BACKGROUND OF THE INVENTION

Prior roof ventilators have in general been relatively complex, and hence expensive in construction, particularly as to the arrangement of damper members and baffling therefor. Prior roof ventilators have frequently been of relatively high silhouette, which combined in many instances with a generally displeasing appearance, has degraded the appearance of the building on which they are mounted. The construction of such prior roof ventilator devices as in certain instances been such that portions thereof are susceptible to vibration or rattling in use and/or to deflection in moderate or high winds. Further, dampers often used on prior art roof ventilator devices have been relatively heavy, have been supported in a relatively unbalanced way and/or have been provided with friction mounting arrangements, requiring a substantial pressure drop from the building to the atmosphere in order to open, and thereby requiring the use of a closely adjacent, normally structurally coupled, exhaust fan. Frequently, there is a substantial drop in pressure, or air flow loss, across open or partially open prior art damper structures. In many instances prior upwardly opening devices have provided inadequate protection from entrance of rain, hail or the like past the damper unit, particularly where the damper is open or partially open and air flow rates are relatively low. Further, such prior constructions have often been susceptible to opening of damper members by wind, allowing back drafts into the building.

Accordingly, the objects of this invention include provision of:

1. A top opening discharge ventilator device, or exhaust valve, for discharge of air from the interior of a building structure adapted for mounting on the roof of such structure.

2. A device, as aforesaid, of low silhouette and pleasing appearance shaped to minimize wind resistance, which is structurally stable under high wind or variable wind conditions with little or no flutter, vibration, etc. and has little or no tendency to lift or change position or configuration under high wind conditions.

3. A device, as aforesaid, of simple and lightweight construction which, particularly in its exterior elements, is of substantial strength and stability of configuration and which is adapted for mounting on a roof without need for reinforcement of such roof and which indeed may be installed on an existing roof surface by a simple mopping-in operation.

4. A device, as aforesaid, which is of inexpensive construction and is manufacturable of commonly available materials in large or small quantities, in which major elements are particularly adaptable for production by a spinning operation from sheet aluminum, which is capable of being stored and shipped in a compact disassembled condition with the elements thereof in nested relation and occupying a volume not substantially exceeding the volume not normally occupied by the larger ones of such elements and which can readily be assembled by persons of little skill or experience with

manipulation of a minimal number of fastening devices and in relatively little time.

5. A device, as aforesaid, including an openable damper member or valve which is of relatively lightweight, has relatively low opening friction and is capable of opening in response to a relatively small pressure drop from within the supporting building structure to the outside atmosphere, which is openable in response to the pressure created within the building by an adjacent fan or the like or, alternatively, by other remotely located means, including for example air conditioners, window fans, etc. and in which air flow loss caused by the damper or valve along or in inner action with the surrounding exterior element is minimized.

6. A device, as aforesaid, which though upwardly opening prevents entry of rain, hail or the like therethrough into the building whether the damper valve is open or closed, which provides for drainage of water due to rain or the like from the upwardly opening element thereof while minimizing or eliminating downward or sideward direction of exhausting air toward the supporting roof.

7. A device, as aforesaid, in which the damper or valve is not susceptible to opening by ambient winds, for example when exhaust air flow is small or absent.

8. A device, as aforesaid, which eliminates the need for a sealing shutter or valve within the building structure in the air flow path through the device. 9. A device, as aforesaid, in which the pressure drop required to open the damper, and the air flow through the device, is substantially unchanged despite rain or the like entering the open upper end of the device and striking the damper member.

Other objects and purposes of this invention will be apparent to persons acquainted with apparatus of this general type upon reading the following specification and inspecting the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial view of a roof ventilator device embodying the present invention and installed on the roof of a building.

FIG. 2 is an enlarged central cross-sectional view, in elevation, of the device of FIG. 1 and showing same installed in conjunction with a motor driven fan.

FIG. 3 is a sectional view substantially taken on the line III—III of FIG. 2.

SUMMARY OF THE INVENTION

The objects and purposes of the invention are met by providing a roof ventilator for exhausting air which includes a tapered upstanding hollow stack for sealed securement to a roof at an air opening therein. A hollow upstanding and semispherical outlet bell is telescoped in close spaced radial relation over the open upper end of the stack and has an open upper end. A substantially flat damper pan normally rests upon and closes the upper stack end. A mounting sleeve is fixedly supported within the stack. A hollow guide element, pivotally and coaxially fixed to the damper pan, is slidable within the mounting sleeve and carries limiting means coacting with the mounting sleeve for limiting movement of the damper pan upwardly off the upper stack end, whereby a pressure drop from the stack to the bell causes the damper pan to lift from the upper end of the stack to vent the stack into the bell.

DETAILED DESCRIPTION

The ventilator device **10** embodying the invention is adapted to be supported upon a roof structure, generally indicated at **12**, of a building.

The device **10** includes a hollow, open ended stack **14**. The stack **14** has a peripheral wall **15** which is upwardly tapered and of generally frustoconical form. A radial flange **16** extends outwardly from the lower end of the peripheral wall **15** and is adapted to be supported upon and secured to the roof structure **12**. An opening **17** in the roof structure **12** provides communication between the interior of the building covered by the roof structure **12**. The opening **17** is preferably coextensive in size and coaxial with the open lower end of the stack **14**. The upper end of the peripheral wall **15** is preferably provided with a reinforced edge **18**, in the preferred embodiment shown an outwardly rolled lip.

A hollow tubular mounting sleeve **21** is located coaxially within the stack **14** in close spaced relation to the upper end thereof. The lower end of the mounting sleeve **21** is substantially spaced from the lower end of the stack **14**. The mounting sleeve **21** is fixed to the stack by a support here comprising a pair of diametrally aligned support tubes **22** and **23** extending radially inwardly from the peripheral wall **15** of the stack to the upper portion of the guide element **21**. The tubes **22** and **23** are spaced below the upper end of the stack. The ends of the support tubes **22** and **23** are preferably secured as by welding to the stack peripheral wall **15** and mounting sleeve **21**. The radially inner ends of the support tubes **22** and **23** are preferably flattened in a vertical plane, as indicated at **25**, to provide an increased length of contact axially of the guide element **21** and thereby a more rigid securement of the support tubes to the guide element.

A valve element or damper **27** has a diameter slightly exceeding that of the upper end of the stack **14**. When at rest, the damper **27** covers the upper end of the stack for closing same. The damper **27** may be somewhat upwardly convex, but is preferably flat and panlike. The damper pan **27** has a circumferentially continuous, pendant flange **29** at the circumferential edge thereof. The flange **29** is preferably sloped, substantially corresponding in taper to the stack **14**. The flange **29** extends downwardly past the reinforced upper edge **18** of the stack in snugly surrounding but freely removable relation therewith, thereby overlapping the upper portion of the stack. The flange **29** preferably terminates in a rolled reinforcing rim **30**.

A preferably tubular guide element **32** coaxially depends from the underside of the damper pan **27** and is preferably fixed thereto by welding. The guide element **32** axially slidably extends through the mounting sleeve **21**. The guide element **32** preferably substantially corresponds in length to the height of the stack **14**. A stop element **33**, here a cotter pin, extends diametrally through the lower portion of the guide element **32** for preventing unintended upward removal of the guide element **32** from the mounting sleeve **21**. The tubular elements **21** through **23** and **32** are preferably thin walled tubular aluminum stock and the damper pan **27** is preferably spun from aluminum sheet.

A weather shield member is located above the stack and, in the preferred embodiment shown, comprises an outlet bell **36** which extends upwardly from the stack **15** and is substantially semispherical, that is convexly rounded, in cross-section. The outlet bell **36** is hollow and has open upper and lower ends terminating in substantially axially extending flanges **37** and **38**, respectively. The flanges **37** and **38** assist in reinforcing the open ends of the bell. The upper flange is substantially cylindrical. The lower flange **38** surrounds the upper end of the stack in close spaced relation thereto. The lower flange **38** is preferably upwardly tapered to the same extent as the stack **14**.

The outlet bell **36** is fixed at its lower flange **38** to the peripheral wall **15** of the stack **14**, preferably removably, as by a plurality of circumferentially spaced nut and bolt connections **40**. The lower bell flange **38** is preferably spaced from the stack peripheral wall **15** by interposition therebetween of washers, or the like, carried by the bolts **40**, to afford a narrow annular drain opening **41** between the opposed surfaces of the bell and stack. Thus, rainwater entering the top of the bell **36** drains from the lower end of the bell along the outside of the peripheral stack wall **15**, through the annular drain opening **41**.

The lower bell flange **38** is spaced somewhat below the damper flange **29**, here by a distance corresponding substantially to the axial length of such damper flange. The spacing between the lower bell flange **38** and stack peripheral wall **15** is preferably substantially less than the spacing between the lower bell flange **38** and damper pan flange **29**. The radial spacing of the bell **36** from the damper pan flange **29** preferably substantially corresponds to or exceeds the axial dimension of such pan flange. Thus, with the damper pan **27** raised somewhat from its closed position of FIG. **2**, air from the stack tends to flow upwardly into the bell rather than downwardly through the drain opening **41**.

In the preferred embodiment shown, the bell **36** is constructed in two parts, a semispherical upper part **43** and a semispherical lower part **44**. The parts **43** and **44** are snugly joined, preferably at the maximum diameter **46** of the bell **36** and by means of a radially outwardly offset depending annular flange **47** on the upper part **43** which overlies the lower bell part **44** with a snug friction fit. Provision of the bell in two parts, as above discussed, facilitates formation of the bell by spinning from relatively thin aluminum sheet material and also enables the device **10** to be knocked down into a more compact package for shipping or storage.

The upper bell flange **37** is preferably substantially equal in diameter to the open upper end of the stack **15**, and hence is less in diameter than the lower bell flange **38**. The maximum diameter of the damper pan **27** including its flange and rim preferably substantially corresponds to the diameter of the lower bell flange **38**.

The location of the stop element **33** allows opening, upward movement of the damper pan **27** to a position at or near the maximum diameter level **46** of the bell **36** whereby the annular air flow zone defined between the periphery of the damper pan **27** and the interior side wall of the bell **36** is maximized with the damper pan fully opened. The annular air flow path surrounding the periphery of the damper pan **27** increases in cross section as the damper pan moves upwardly from the upper end of the stack, by reason of the increase in axial distance between the damper pan and the upper stack end and also by reason of the increased radial distance between the damper pan periphery and the radially opposed portion of the peripheral wall of the bell **36**.

In many instances it will be desired to use the device **10** for venting a building maintained at a slight pressure above exterior atmospheric pressure, as by input ventilation fans, air conditioning or the like. Particularly in such instances, the stack flange **16** may simply be placed upon the surface of the roof of the building in coaxially surrounding relationship with a vent hole therein, corresponding to the hole **17** shown in FIG. **2**. Thereafter, the flange **16** may be secured to the roof as desired and then covered with a conventional roof sealing membrane, not shown, to prevent leakage of water radially inwardly along the lower surface of the flange **16** and into the opening **17**.

However, in other instances it may be desired to install the device **10** in direct conjunction with an exhaust fan or the like, such as generally indicated as **50**. Particularly in such instances it may be desired to mount the device **10** on a raised roof deck portion, as generally indicated at **51**. To this end, the roof **54** of the building is here disclosed as including an enlarged exhaust opening **55** surrounded by an upstanding laterally closed barrier **56**, of any conventional nature such as a square or rectangular enclosure of wood, sealed by any convenient means to the roof deck **54**. A carrier plate **58** is fixed to and supported upon the barrier **56** by any convenient means and may be provided with an integral, or separate, depending sealing and locating flange **59**. The exhaust fan unit **50** may be of any conventional nature and here is illustrated as including an annular mounting rim **61** having a radial portion **62** fixed by any conventional means to the underface of carrier plate **58** and further having a dependent support portion **63**. A motor mounting member **65** carries an upstanding conventional electric motor **67**, preferably in coaxiality with the device **10**. A plurality of radial arms **68** support the motor mounting member **65** on the rim **61**. A fan blade **70** is loosely located within the support portion **63** below the device **10** and is secured to the shaft **71** of the motor **67** for rotation therewith in a conventional manner for impelling air from the area below the roof **54** up and out through the device **10**.

OPERATION

Portions of the device **10** are, when disassembled, readily nested for storage or shipping. In a preferred nesting arrangement, the inverted upper bell portion **43** is substantially fully nested within the lower bell portion **44**. The inverted stack **15** is then nested substantially within the inverted upper bell portion **43**. The damper pan **27** is nested rightside up within the inverted stack **14**, the damper guide element **32** being received in the inverted mounting sleeve **32**. The resulting nested assembly does not substantially exceed the height of its longest element.

The device **10** is readily assembled, for example from such a nested condition, by securing the lower bell portion **44** over the narrow upper end of the stack **14** in the position of FIG. **2** via the nut and bolt connections **40**. The spacers or washers **39** are disposed between the bell and stack to provide annular drain opening **41**. Thereafter, the guide element **32** of the damper pan may be dropped downwardly into the mounting sleeve **21** and the cotter pin **33** may be placed on the guide element **32**, the damper pan **27** resting atop the stack **14**. Finally, the flange **47** of the upper bell portion **43** is frictionally fitted over the open upper end of the lower bell portion **44** as shown in FIG. **2**.

To install the assembled device **10** on a roof or the like, the stack flange **16** is placed upon the surface, here as shown in FIG. **2** the surface **58**, upon which it is to be supported, in coaxiality with the exhaust hole **17** therein. The stack flange **16** is then secured by any convenient means, not shown, such as nails, screws or the like, to the supporting surface **58** and a suitable waterproofing membrane may be applied over the flange **16** and the adjacent portion of the supporting surface **58** in sealed relation therewith. If desired, a waterproofing adhesive or the like may be used between the flange **16** and surface **58** to provide additional water sealing and/or securement of the device **10** to the roof. As stated, the device **10** may be installed either on a built-up deck, as shown in FIG. **2**, or on the surface of the roof and with or without an adjacent exhaust fan unit **50**.

In operation, with the device **10** in its rest condition shown in FIG. **2**, and thus with a zero or substantially zero pressure drop from within the stack to within the bell, the damper pan **27** is seated on the upper end of the stack. This closes the upper end of the stack against entry of drafts, rain or the like and makes unnecessary provision of an auxiliary shutter or the like within the building to close the opening into the stack.

Rain entering the open upper end of the bell **36** runs down the interior sidewalls thereof and exits through the narrow annular drain **41** and then runs down along the exterior of the stack **14**. Winds of relatively high velocity do not tend to shift or move the damper pan **27** from its closing relationship with the stack, the damper pan being well shielded from such winds by the bell, the closest open portion of the bell being the narrow annular drain slot **41**. Though of relatively light gauge material, the tapered configuration of the stack **14** and rounded configuration of the bell **36** substantially strengthens same and, particularly in the case of the bell, reduces resistance to wind flow therearound. Further, the configuration of the stack and bell has substantial mechanical stability and resistance to vibration and hence is substantially free of flexing and noise production even in high steady or pulsing winds.

In view of the light weight and low mounting friction of the damper pan **27**, a relatively low pressure drop from the stack **14** to the bell **36**, for example in the nature of a fraction of a pound per square inch is sufficient to raise the damper pan **27** from the upper end of the stack. Raising the damper pan **27** opens the upper stack end and provides venting air flow upwardly out of the building through the stack **14**, past the pan **27** and out the open upper end of the bell. Despite the downwardly directed flange **29** on the damper pan **27**, a great majority of air flow out the upper end of the stack is smoothly directed, even at relatively low damper pan openings and air flow rates, radially outwardly and then smoothly upwardly by the outwardly and upwardly curving peripheral wall of the lower bell portion **44**. Little, if any, significant portion of exhaust air flow passes downwardly through the narrow and rather restrictive annular drain slot **41**. Air flow continues in a smoothly curved manner upwardly into the upper bell half **43** and out the upper end thereof.

As increasing pressure drops from the interior of the stack to the interior of the bell, the damper pan **27** rises increasingly greater distances from the upper end of the stack, thus providing an increasingly greater cross-section air path between the damper pan and the upper

stack end an lower bell peripheral wall. As relative pressure in the stack **14** increases, the damper pan **27** eventually reaches its maximum height, corresponding to the maximum bell diameter, that is, the region **46** of the bell whereat the radial spacing between damper pan and the bell wall (and hence the air flow path cross-section) is maximized.

Even when the damper pan **27** is in a partially or fully opened conditon (which can be achieved in the inventive device **10** with a relatively small pressure drop across the pan and a low air flow rate), rain or the like falling into the open upper end of the bell does not tend to enter the stack. More particularly, the damper pan whether open or closed, radially overlies the open upper end of the stack and thus prevents vertical rain fall from entering the stack. Further, the surrounding side walls of the bell prevents wind driven rain or the like, falling on a slope, from entering the vertical space between the damper pan and the stack.

The upper surface of the damper pan is preferably flat as shown, or if desired may be somewhat upwardly convex, so that rain water falling thereon will tend to drain off therefrom at its peripheral edge. Thus, the relationship of damper pan height to air pressure in the stack is not influenced by a buildup of rain water or the like atop the damper pan. Further, the high heat conductivity of the damper pan tends to prevent any build up of ice or the like thereon, particularly when venting heated air from the building interior. The high heat conductivity of the stack **14** tends to keep the annular drain opening **41** open for removal of snow, sleet or the like in the form of water.

Upon reduction of the air pressure in the stack **14** to a level equal or substantially equal to that in the bell, the damper pan falls, guided by sliding motion of guide element **32** in the mounting sleeve **21**, to the top of the stack for closing same again.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrated purposes, it will be recognized that variations or modifications of the disclosed apparatus including the rearrangement of parts, lie within the scope of the present invention.

I claim:

1. A roof vent device for exhausting air, comprising in combination:

an upstanding hollow stack for mounting on a roof at a vent opening, said stack having open upper and lower ends;

a hollow upstanding outlet bell fixed with respect to said stack, said bell having an open lower end telescoped over the upper end of said stack and an open upper end, the diameter of said bell intermediate the ends thereof substantially exceeding the diameter of the ends thereof;

a damper pan normally closing the upper end of said stack and located within said bell;

means guiding said damper pan for substantially coaxial movement away from the stack in response to a pressure drop from said stack to said bell so as to exhaust air from said roof opening through said stack and bell.

2. The device of claim **1** in which said bell is substantially semispherical, having convexly outwardly curved sidewalls extending radially outwardly from said ends thereof toward the intermediate portion thereof, said stack being of upwardly tapered frustoconical form and extending for a minor portion of its length into the interior of said bell to a level below said intermediate bell portion, said guiding means including limit means limiting movement of said damper pan away from said stack to a level approximating the maximum diameter of said bell.

3. The device of claim **2** in which the diameter of said damper pan approximates that of the upper end of said stack, said damper pan having a dependent perimetral flange adapted to overhang said upper end of said stack and being disposed in close radially spaced relation to the exterior face of said stack for assisting in centering said damper pan on said stack as said damper pan is closed and preventing entry of foreign material into said stack when said damper pan is closed, said damper pan resting upon the upper end of said stack when closed.

4. The device of claim **3** in which the lower portion of the curved sidewall of the bell is spaced downwardly from and radially outwardly from said flange of said damper pan, said lower portion of said bell peripheral wall extending upwardly and outwardly in curved spaced relation past said flange for deflecting air passing between said damper pan and the upper end of said stack smoothly outwardly and upwardly through said open upper end of said bell.

5. The device of claim **4** in which the open lower end of said bell is fixed in radially outwardly spaced relation to said stack, whereby rain entering the upper bell end exits at the lower bell end along the outer face of said stack, the minimum spacing of said damper pan from the wall of said bell substantially exceeding the minimum spacing of said bell from said stack whereby to minimize air flow from said stack downwardly along the peripheral wall of said stack out of said bell.

6. The device of claim **1** in which the diameters of said damper pan and the open upper end of said top bell are approximately equal, the diameter of said bell intermediate its ends substantially exceeding the diameter of said damper pan for providing ample cross sectional area for relatively high volume and low velocity air flow in an annular zone between said damper pan and the peripheral wall of said bell.

7. The device of claim **6** in which the upwardly facing surface of said damper plate is substantially flat for preventing accumulation of rain water thereon, whereby said pressure drop is substantially uniform despite varying weather conditions.

8. The device of claim **1** in which said bell comprises a bowl-like lower bell portion and a bowl-like upper bell portion removably securable thereto by means including an overlapping flange, said overlapping flange being located substantially at the maximum diameter of said bell, said bell portions and stack being compactly nestable when disassembled, said stack and bell portions being dimensioned to allow inverted reception of said upper bell portion in said lower bell portion and inverted reception of said stack in said upper bell portion, said pan being nestable therewith.

9. The device of claim **1** wherein said means quiding said damper pan comprises a guide element coaxially fixed to and dependent from said damper pan, a hollow sleeve coaxially located within said stack adjacent the upper end thereof, arms fixed to the peripheral wall of said stack and extending inboard thereof, said arms fixedly carrying said sleeve therebetween, said arms and sleeve being spaced below and adjacent said

damper pan when said damper pan rests upon the top of said stack.

10. The device of claim **9** in which the length of said guide element approximates the height of said stack, said guide element having means adjacent the lower end thereof for coacting with the lower end of said sleeve to limit upward movement of said damper pan to a height corresponding to the maximum diameter of said bell.

11. The device of claim **1** in which said stack is upwardly tapered and substantially frustoconical in form, said bell having a dependent flange at the open lower end thereof, said flange tapering in substantial parallelism to said stack and lying in close spaced relation thereto for defining an annular water drain opening therebetween for said bell, a plurality of fastening devices connecting said flange to said stack for supporting said bell, said fastening devices being distributed around the periphery of said stack, washerlike elements on said fastening devices disposed between said flange and said stack for maintaining said drain opening.

12. A roof vent device for exhausting air, comprising the combination:

an upstanding hollow stack adapted to be secured in sealed relation on a roof for venting an opening therethrough and having open upper and lower ends;

a hollow weather shield fixed with respect to said stack, said weather shield having an open lower end overhanging the upper end of said stack, an open upper end above said stack and a widened intermediate portion;

a damper pan normally closing the upper end of said stack and located within said weather shield;

means guiding said damper pan substantially coaxially upwardly from the stack to a full open position adjacent the widened intermediate portion of said weather shield in response to an increasing pressure drop from said stack to said weather shield, for maximizing exhaust air flow from said roof opening upwardly through said weather shield.

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