June 4, 1968 E. FIELDING 3,386,368

VENTILATORS

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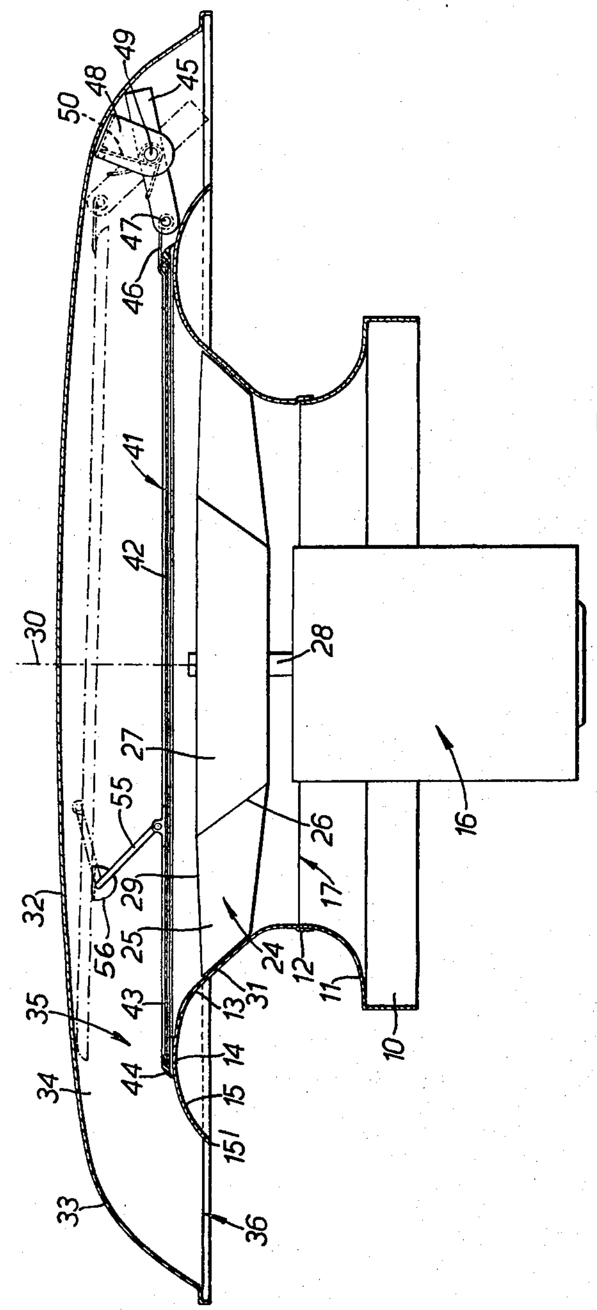

FIG. 1.

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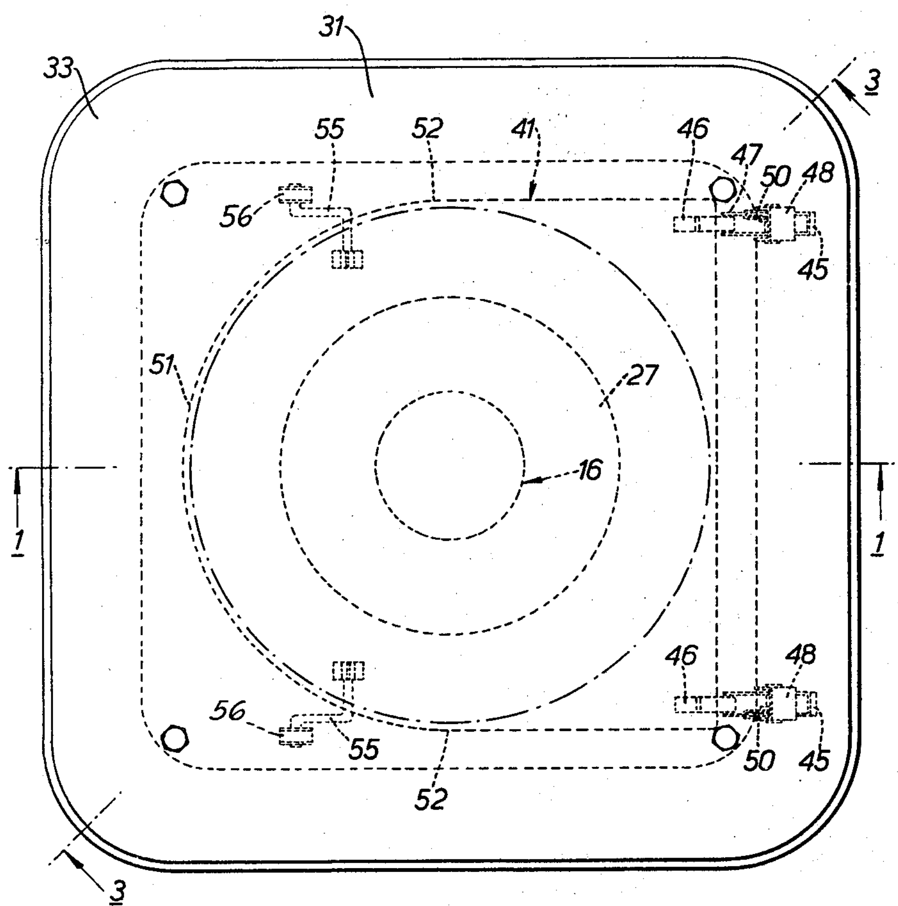

FIG. 2.

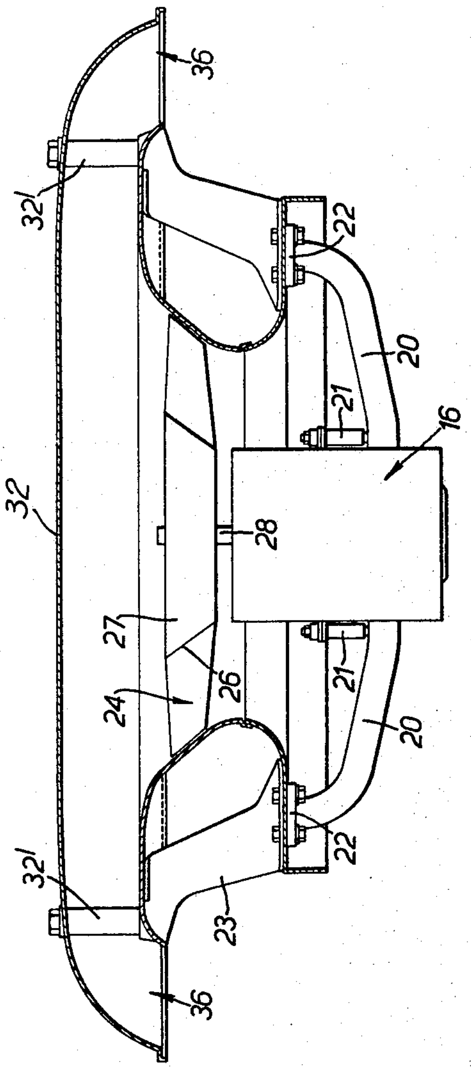

FIG. 3.

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VENTILATORS

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ABSTRACT OF THE DISCLOSURE

The disclosure relates to a motor operated discharge ventilator having a discharge fan impeller and fan casing wherein the impeller blades closely conform to the shape of a trumpet shaped discharge outlet so that in operation air leaving the trailing edges of the impeller blades has a large component of movement substantially radially outwardly of the impeller.

This invention relates to ventilators and is concerned with powered discharge ventilators of the kind including an extraction fan for promoting a flow of air through the ventilator, and for use mounted on a bounding structure (e.g. a wall or roof) of a space from which air is to be withdrawn by the ventilator.

Powered discharge ventilators are known employing an extraction fan of the axial flow type wherein the fan has a cylindrical casing closely surrounding the fan impeller and in which the air enters and leaves the impeller in a direction substantially parallel to the axis of rotation of the impeller, the air being confined and guided by the cylindrical casing both on entering and leaving the impeller.

The volume of air delivered by such a fan depends inter alia on the diameter of the impeller and this in turn governs the diameter of the casing and accordingly the overall size of the ventilator.

Broadly, according to the present invention, there is provided a powered discharge ventilator including an extraction fan having an impeller and a fan casing and in which the tips of the impeller blades are closely surrounded by and conform to the shape of a trumpet mouthing portion of the casing the arrangement being such that in operation of the ventilator, air is free to leave the tips of the trailing edges of the impeller blades with a large component of movement substantially radially outwardly of the impeller. Preferably the trumpet mouthing portion forms a smooth downstream continuation of an upstream portion of the casing leading air to the fan impeller, the impeller having a means diameter greater than the diameter of said upstream casing portion immediately upstream of the impeller.

By placing the impeller in a trumpet mouthing portion of the casing one may increase the effective diameter of the impeller compared with the impeller of a conventional ventilator employing an axial flow fan having a casing of diameter equal for example to said upstream casing portion immediately upstream of the impeller and in this way the veintilator may be made to shift more air for a given speed of rotation of the impeller without increasing the overall size of the ventilator.

It has also been found that with the arrangement according to the invention the performance of the ventilator against added resistance upstream of the fan, for example by making the ventilator draw its air through a long length of ducting with bends, is improved compared with the conventional equivalent ventilator described in the preceding paragraph. It is believed that this arises, using an axial flow impeller, because the stall point on the characteristic pressure/volume curve is further removed from the zone of maximum volume of operation of the fan whereby the ventilator has a wider range of useful operation.

A still further advantage which is achieved using the arrangement according to the invention is that there is a noticeable reduction of noise compared with the conventional ventilator employing an axial flow fan and performing an equivalent duty.

The impeller employed according to the invention may be an axial flow impeller having aerofoil sectioned blades or a propeller fan impeller having sheet form blades or a mixed flow fan impeller in which the blades are developed along a conical or a spherical hub surface. The latter form of impeller makes optimum use of the regime provided for it is a ventilator according to the present invention in so far as the compound curvature of the impeller blades imparts a greater radial component of movement to the airstream and the performance against added resistance upstream is still further improved.

The fact that air escapes substantially radially outwardly of the impeller in a powered discharge ventilator according to this invention is of particular significance when the invention is applied to a powered discharge ventilator having means preventing direct whether entry through the ventilator since such means requires the airstream being discharged by the ventilator to be turned through a large angle and in an arrangement according to the invention the air is turned in part at least during its passage through the impeller.

An equivalent effect can be course be achieved using a centrifugal fan, in which case the air is turned through a full 90° when passing through the impeller.

Powered discharge ventilators employing centrifugal fans are well known. These are used where it is required to develop a high pressure to overcome resistance to the flow of air upstream of the ventilator and in accordance with the known characteristics of centrifugal fans this is achieved at the expense of the free inlet volume handled by the ventilator. Accordingly, to obtain a given volume output of air with free inlet, a bigger fan with a greater power requirement is necessary using a centrifugal fan instead of an axial flow fan and powered discharge centilators having centrifugal fans tend to take the form of large, high profile units and such unit, employed as roof extract ventilators, are often objectionable for purely aesthetic reasons.

According to a feature of the present invention the trumpet mouthing portion of the fan casing is confronted by a member presenting, towards the impeller a substantially flat co-extensive surface disposed normal to the axis of rotation of the impeller, the trumpet mouthing portion having an inner wall surface which turns through a full right angle, and said surface of said member being predeterminedly spaced from the crown of the trumpet mouthing portion, at least in use of the ventilator, so as to constrain or assist in constraining air to flow smoothly round the inner wall surface of the trumpet mouthing portion to the crown thereof without breaking away from the surface.

By this arrangement it has been found that the airstream discharged by the impeller may be turned through 90° in a very efficient manner and in a small height, and this materially assists in the production of a roof extract ventilator of low profile.

Without the flat confronting member, the airstream would break away from the inner wall surface of a trumpet mouthing turning through such a large angle and a region of turbulence would be created towards the crown of the trumpet mouthing portion. By correctly spacing the confronting member from the trumpet mouthing however it has been found that such break away may be prevented. Accordingly it is ensured that the tips of impeller blades positioned well forward in the trumpet mouthing with their trailing edges lying as close as is practical to the plane of the crown of the trumpet mouthing portion, operate wholly in a region of streamline flow so as to produce useful thrust at the optimum blade sections, i.e. those operating at the greatest radius. This enables a maximum increase, as previously discussed, of effective impeller diameter to be achieved and therefore the maximum increase of performance, again as previously discussed, compared with the equivalent conventional ventilator employing an axial flow fan.

According to a further feature of the present invention the ventilator may include means presenting confronting surfaces one as a peripheral extension of said surface of said member and the other as a peripheral extension of the inner wall surface of the trumpet mouthing portion, said confronting surfaces together defining a confined air discharge passage for streamline flow of the extracted air the through flow area of which progressively increases to an air discharge outlet from said passage to the outside atmosphere.

By means of this feature the velocity of the discharging airstream is progressively reduced as the airstream passes through the discharge passage and the kinetic energy of the airstream is reconverted to potential energy, the static pressure in the discharge passage increasing progressively towards the outlet. Additionally, since streamline flow is maintained, the losses are kept small. By slowing the air velocity at discharge as far as is practical within the dimensional limits required for the ventilator, the loss of the kinetic energy of the discharging airstream may be kept down and the efficiency of the ventilator considerably improved.

By utilising a discharge passage defined between confronting surfaces directed radially of the axis of rotation of the impeller, the maximum increase in through-flow area of the passage with the smallest radial enlargement of the ventilator may be achieved in a ventilator of low profile.

To prevent weather entry through the air discharge outlet of the air discharge passage the air discharge outlet is conveniently offset relative to the inlet to said air discharge passage in the direction of the axis of rotation of the impeller, and in this case said confronting surfaces are gently curved between said inlet and said outlet to prevent break away of the discharging airstream therefrom.

A specific embodiment of the present invention is hereinafter described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a cross-sectional side elevation of a powered discharge roof ventilator according to the present invention, on line 1—1 in FIG. 2.

FIG. 2 is a plan view of the ventilator shown in FIG. 1, and

FIG. 3 is a cross-section on line 3—3 in FIG. 1.

The ventilator illustrated may be positioned on a flat or on a pitched roof. The ventilator comprises a base **10** which would be flashed to the roof in any known or convenient manner. The base **10** is generally rectangular in plan but with rounded corners and is of sheet metal construction in this example, opening upwardly to a circular sectioned throat portion **12** of a fan casing being connected therewith by means of a smoothly upwardly convergent transitional portion **11** of the casing. The throat portion communicates with a smoothly upwardly divergent, circular sectioned trumpet mouthing portion **13** of the fan casing which turns through a full right angle and blends at the crown **14** of the trumpet mouthing portion with a peripheral outwardly extending flange **15**. The flange **15** has an upwardly directed surface which forms a smooth peripheral extension of the inner wall surface of the trumpet mouthing portion **13** and which extends outwardly and downwardly in a gently curved fashion or, at the four corners, radially outwardly and then outwardly and downwardly in a gently curved fashion to terminate at a peripheral edge **15'** of generally rectangular contour with rounded corners.

An electric motor **16** is mounted centrally within the base **10** and extends into the throat **12** of the fan casing. The motor has a cylindrical housing which defines with the fan casing at **12** an annular through flow opening **17** which presents the minimum through flow area of the air discharge passage of the ventilator being described. The motor is supported on brackets **20** (see FIG. 3) attached at their inner ends as at **21** to the motor and at their outer ends one in each of the four corners of the base **10** as at **22**. Struts **23** are provided, one at each corner, interconnecting the base **10** with the underside of the flange **15** to support the flange **15** from the base **10**. The struts **23** are outside the fan casing.

The motor **16** drives an impeller **24**, which is a mixed flow impeller having blades **25** of aerofoil cross-section developed along the conical surface **26** of a frusto-conical impeller hub **27** carried on the motor spindle **28**.

The impeller is mounted and arranged to run with the trailing edges **29** of the impeller blades close to the plane of the crown **14** of the trumpet mouthing **13**, which plane extends normal to the axis **30** of rotation of the impeller. The tips of the blades are shaped to sweep closely a frusto-conical section **31** of the trumpet mouthing portion. The section **31** could be contiuously curved instead of being frusto-conical and the blade tips continuously curved to correspond. However for ease of manufacture of the impeller the former arrangement is preferred.

The ventilator is provided with a cowl **32** of inverted shallow-dished form which is generally rectangular in plan (see FIG. 2) but with rounded corners so as to present a peripheral edge conforming in shape to the peripheral edge of the flange **15**. The cowl is supported on four posts **32'** (see FIG. 3) one carried in each of the four corners of the flange **15** immediately over the struts **23**. The cowl has a central region which is very slightly domed for the purpose only of strengthening the structure of the cowl but which may be regarded as substantially flat, whereby a cowl of very low profile is achieved. The cowl has a peripheral edge portion **33** which is gently curved in a downward direction and the downwardly directed surface of the cowl portion **33** defines with the upwardly directed surface of the flange **15** a confined air discharge passage **34** extending radially outwardly and downwardly from an annular generally cylindrical inlet opening **35** at the crown **14** of the trumpet mouthing portion **13** and surrounding the axis **30** and an annular, downwardly directed outlet opening **36** disposed in a plane normal to the axis **30** on the side of the crown **14** remote from the central region of the cowl.

The ventilator has a damper which operates automatically to close the opening through the fan casing when the ventilator is not operating, to prevent downdraughts and to conserve heat in the building. The damper is generally indicated at **41** and comprises a lightweight plate member **42** e.g. of thin gauge metal sheet, carrying a peripheral sealing member **43** having a sealing lip **44**, the sealing member **43** resting on the crown **14** of the trumpet mouthing when the damper is closed.

When the fan is operated the plate member **42** floats upwardly on the airstream and is held thereby, pressed against the underside of the cowl. The member **42** is hinged along one edge to link means in the form of two swinging links **45** by hinge arms **46**. The arms **46** are pivoted to the links **45** as at **47** and the links are pivoted to depending brackets **48** attached to the underside of the cowl **32** as at **49**. Coil springs **50** bias the links **45** to the full line position illustrated in FIG. 1 in which the damper is closed.

Towards its opposite edge **51**, and arranged one towards each side edge **52** of the plate member **43**, the member **43** is hinged to a pair of struts **55** which are in turn hinged one each to a pair of depending brackets **56** carried on the underside of the cowl **32**. The strut hinge axis extend parallel with the hinge axes of the pivots **47** and **49** and the struts **55** themselves extend forwardly, at an angle of about 50° to the plate member **43** when the damper is closed.

In the closed position, the plate member **43** is held at a small angle to the plane containing the hinge axes of the pivots **47** and **49** and must be displaced through a position in which it lies in that plane when moving to its open position. When the shutter is closed therefore it is held closed by the struts **55** and the shutter member is locked down by an over-center snap, or toggle action since the distance between the line along which the member **43** is hinged to the struts **55** and the line along which the links **45** are hinged to the brackets **48** is fixed and it is necessary for the arms **46** to flex in order to allow the member **43** to pass through the "in-line or over-center" position of the toggle.

When the fan is operated the build up of pressure under the plate member **43** "breaks" the toggle along the line of the hinge axis of the pivots **47** so freeing the member for upward floating movement to its fully open position as shown in chain dotted outline in FIG. 1.

The springs **50** only lightly bias the member **43** to its closed position but are nevertheless sufficiently strong to "break" the toggle in the opposite direction and move the damper to its fully closed position when the fan is shut down.

The plate member **43** is moved to its open position against the action of the springs **50** and the spring force increases slightly with deflection. This is made to compensate for the decreasing angle which the struts **55** make with the plate **43** as the member **43** opens a greater component of the air thrust on the front of the plate becoming available to overcome the stronger spring action, whereby the plate member **43** remains substantially parallel to its closed position as it moves between its closed position and its fully open position. The plate member **43** presents towards the impeller a flat or substantially flat surface which is co-extensive with the trumpet mouthing portion **13** of the fan casing so as to confront the whole of the trumpet mouthing portion when in its open position, the member then lying normal to the axis **30**.

By placing the impeller in the trumpet mouthing portion **13** of the fan casing an impeller of greater effective diameter may be used compared with the case where, as in a conventional powered discharge ventilator employing an axial flow fan, the impeller runs in a cylindrical casing having a diameter equal to the throat **12**. Also the air leaving tips of the trailing edges **29** or the impeller blades is free to escape substantially radially outwardly over the inner wall surface of the trumpet mouthing portion towards the crown **14** and a proportion of the air is effectively turned into the discharge passage **34** without striking against the under surface of the non-return shutter member **43** or the underside of the cowl.

It has been found that by varying the distance of the cowl above the crown **14** of the trumpet mouthing portion and therefore the gap between the shutter member **43** and the crown when the shutter member is fully open the amount of air which can be shifted by the ventilator, all other variables being equal, can be considerably improved. When the through flow area of the inlet **35** fails to exceed the minimum through flow area at **17** by about 33% the volume output of the ventilator is reduced.

Analysis shows that by properly selecting the height of the cowl above the trumpet crown a pressure regime may be set up in the space between the trailing edges **29** of the impeller blades and the damper member **43** whereby part of the airstream is induced to flow smoothly round the trumpet mouthing portion to the crown **14** and, after striking against the under surface of the member **43**, the remainder of the airstream can be made to flow substantially smoothly in a radially outward direction towards the inlet **35** of the discharge passage **34**. In other words by properly positioning the baffle formed by the damper, in relation to the trumpet mouthing portion, the airstream may be induced to change its direction from one along the axis of rotation **30** of the impeller into one radially outwardly of said axis without the use of curved guiding surfaces to turn the air into the new direction and yet without disturbing the streamline flow of the air to an extent such as to incur significant losses in performance. The air is therefore turned efficiently in a very small height without occupying the space between the crown **14** and the cowl **31** with guides and the space may be used to house the damper means.

The height of the cowl above the trumpet crown **14** also effects the degree of expansion of the discharging airstream as it passes through the passage **34**. By properly selecting the height of the cowl above the crown **14** together with the shape of the flange extension of the trumpet mouthing and the peripheral edge region of the cowl, it may be ensured that streamline flow of air is maintained over the bounding surfaces of the passage **34** and accordingly the maximum regain of the kinetic energy of the airstream and the minimum of losses, within the dimensional limits of the passage.

The performance of the ventilator may be increased a little by lifting the cowl so that the through flow area at the inlet **35** exceeds the throat area at **17** by an amount somewhat exceeding 33%. In this case the rim of the cowl is raised in relation to the crown **14** of the trumpet and the diameter of the cowl must be increased to maintain the necessary protection against weather entry. Also by lengthening the surfaces of the passage **34** the friction losses are increased. There is therefore a compromise to be reached and for aesthetic reasons a small amount of performance may be sacrificed by keeping the diameter of the cowl as small as possible and allowing the discharging airstream to emerge through the outlet **36** at a slightly higher velocity that might otherwise be contemplated.

By raising the cowl too far the airstream may break away from the surface of the flange extension of the trumpet mouthing so creating losses due to turbulence in the passage **34**.

The ventilator may be designed to operate at a number of fan speeds, the shutter member **43** floating freely on the airstream at intermediate speeds but moving to its fully open position as shown in chain dotted outline in FIG. 1 at the maximum fan speed.

The ventilator as described may be used as a wall ventilator and mounted on a vertical wall. In this case the links **45** supporting the non-return shutter flap would be disposed at the top.

The section **31** of the trumpet mouthing portion may be formed as an impeller shroud and carried round with the impeller. The section **31** would in this case be carried at the tips of the impeller blades and run closely in a gap or recess formed between adjacent stationary sections of the fan casing. As a further alternative, the section **31** and the section of the trumpet mouthing downstream of the section **31** may be formed on and carried round with the impeller as a shroud, a whole top ring of the trumpet mouthing portion or again, the whole of the trumpet mouthing portion rotating with the impeller. The ventilator as described with reference to the drawing, using a mixed flow impeller handles more air for a given size and speed than a centrifugal ventilator and handles more air against added resistance upstream of the impeller than a ventilator employing a conventional axial flow fan.

It also operates at higher efficiency in the limited confines dictated by aesthetic considerations and lends itself to more economical construction.

Another advantage is that the shallow, frustoconical impeller operating wholly within the mouth of the trumpet allows a single plate, damper member to be used seating on the trumpet flange.

This is an advantage over centrifugal constructions.

Yet another advantage of the construction as described and illustrated is that it facilitates the form of construction in which the impeller is mounted directly on the motor shaft downstream of the motor, so promoting a very squat and unobtrusive outline for the ventilator above the surface of the roof in contrast with the centrifugal design in which the motor is usually mounted inside the weather hood downstream of the impeller.

The cowl **32** in the construction of ventilator described with reference to the accompanying drawings may alternatively be circular in plan and likewise, the peripheral edge **15'** of the flange **15** may be circular whereby the cowl and the flange have the cross-sectional shape shown in FIG. 1 in all radial planes through the axis **30**.

Instead of being carried on the pillars **32'**, the cowl may be hinged to the fan casing so that it may be swung back complete with the damper means to expose the fan motor unit for servicing.

I claim:

1. In a powered discharge ventilator adapted to be mounted on a building structure, an extraction fan motor (**16**) having a bladed impeller (**25, 26, 27**) and a fan casing having an air inlet end and an air outlet end (**10–15**), said fan being mounted in said casing to rotate said impeller therein, and discharge air from the building,

the improvement comprising the combination of

said casing including a trumpet mouth portion extending generally axially of said impeller at the outlet end thereof and flaring radially outwardly to extend generally radially thereof remote from said outlet end to form a surface turning generally through a right angle;

with said impeller being mounted within said outwardly flaring trumpet mouth portion and having blades, the tips of which closely match and conform to the shape of said flaring trumpet mouth portion to provide for axial and radial components of air movement over the blade tips, the downstream edges of said impeller blade presenting the largest radial distance of said impeller blades, whereby, in operation of the ventilator, air will be dispersed radially as well as moved axially, so that air leaving the tips of the trailing edges of the impeller blades will have a large amount of movement radially outwardly thereof imparted thereto.

2. A ventilator as claimed in claim **4** wherein said confronting surfaces are so shaped and disposed in relation to each other that in operation of the ventilator a sheath of air adjacent the peripheral extension of the inner wall surface clings to and flows smoothly along said wall surface so as to turn through sustantially a full right angle along said trumpet mouth without any great loss of energy while that body of air which detaches itself from said wall surface impinges on said generally flat member and flows radially outwardly therealong in all directions.

3. A ventilater as claimed in claim **1** including a generally flat member spaced from the trumpet mouthing portion of the fan casing and presenting a substantially flat co-extensive surface disposed generally normal to the axis of rotation of the impeller, the trumpet mouthing portion having an inner wall surface which turns through a full right angle; and said surface of said member being predetermindly spaced from the crown of the trumpet mouthing portion, to constrain air to flow smoothly round the inner wall surface of the trumpet mouthing portion to the crown thereof without breaking away from the smoothly round surface.

4. A ventilator as claimed in claim **3** including means presenting confronting surfaces, one as a peripheral extension of said surface of said member and the other as a peripheral extension of the inner wall surface of the trumpet mouthing portion; said confronting surfaces together defining a confined air discharge passage for streamline flow of the extracted air the through flow area of which progressively increases to an air discharge outlet from said passage to the outside atmosphere.

5. A ventilator as claimed in claim **4** wherein said air discharge outlet is offset relative to the inlet to said air discharge passage in the direction of the axis of rotation of the impeller and said confronting surfaces are gently curved between said inlet and said outlet to prevent break away of the discharging airstream therefrom.

6. A ventilator as claimed in claim **4** wherein said generally flat member is a cowl of inverted shallow-dished form, said one of said confronting surfaces being formed by the underside of the cowl and said other of said confronting surfaces being formed by an outwardly directed flange portion on the downstream end of the fan casing.

7. A ventilator as claimed in claim **4** wherein said generally flat member is formed by a damper plate mounted for movement between a closed position in which it seats on the trumpet mouthing portion of the fan casing and a fully open position in which it lies against the underside of the cowl.

8. A ventilator as claimed in claim **3** wherein said generally flat member is spaced from the crown of the trumpet mouthing portion, by an amount such that the through flow area of the opening between the crown and the confronting member exceeds the minimum through flow area for air in the fan casing upstream of the trailing edges of the impeller blades by about 33%.

9. A ventilator as claimed in claim **1** wherein said trumpet mouthing portion, in the region of said impeller, forms a frusto-conical section, said frusto-conical section blending smoothly with an outwardly curved section of the trumpet mouthing portion immediately downstream of the tips of the trailing edges of the impeller blades.

10. Ventilator as claimed in claim **1** including a damper plate (**41**) mounted for movement between a closed position (FIG. 1–full line) in which said plate bears against the trumpet mouth of said casing to close off the air passage therethrough communicating with said fan, and an open position (FIG. 1–dash dot line) in which said plate is spaced from the axial termination of said casing; means mounting said damper plate for movement between said portions,

the improvement wherein said damper plate mounting means includes a structural member (**32**) spaced from the axial termination of said trumpet mouth; a first bracket (**56**) extending from said member toward said casing;

a link (**55**) rotatably mounted in said bracket at one end thereof and secured to said plate at the other end; said bracket being spaced from the axis of said fan and said link being mounted on said plate at a distance different from the axial spacing of said bracket so that said link will be included with respect to said axis, as well as with respect to a plane perpendicular thereto; and means moveably securing (**45, 46, 47, 48, 49**) at least one aditional point on said plate to said structural member (**32**) said movably securing means being resilient in a radial direction with respect to said fan.

11. Ventilator as claimed in claim **10** including spring means (**50**) biasing said plate mounting means to hold the plate in closed (FIG. 1–full line) position.

12. Ventilator as claimed in claim **10** wherein said movable securing means includes a second bracket (**48**) depending from said structural member (**32**); a second link (**45**) connected to said bracket, said second link (**45**) extending in a direction inclined with respect to the axis of said casing as well as with respect to a plane perpendicular thereto; and a flexible interconnection (**46**) between said plate and one of said links (**45, 55**), said flexible interconnection permitting resilient deformation in a radial direction.

13. Ventilator as claimed in claim **12** including spring means biasing at least one of said links (**45, 55**) in a direction towards said casing to thus bias said damper plate towards closed position against said trumpet mouth.

14. Ventilator as claimed in claim 10 wherein said structural member is a cowl (32) covering the trumpet mouth opening of said fan casing, said damper plate (41) when in fully open position, bearing against said cowl (32).

15. A discharge ventilator having a casing firmed with a mouth portion for discharge of air therefrom; a closure means to close said mouth portion and prevent backdrafts;

a structural member located in spaced relationship from said mouth portion mounting said closure means for movement between a closed position, in which said closure means bears against said mouth portion, and an open position in which said closure means is spaced from said mouth portion, resilient means biasing said closure means in closed position, and support link means having one end mounted on the closure means at spaced locations thereof, said support means having their other end mounted on said structural member, said support link means being mounted on the structural member by a distance which is less than the length of the links plus the distance between said spaced mounting locations on said closure means to provide an over-center snap action tending to maintain said closure means in closed position.

16. Discharge ventilator as claimed in claim 15, wherein said resilient means are spring means of sufficient strength to overcome said snap action in the absence of discharge of air from said mouth portion, whereby said closure means will be closed, and held closed by snap action, except upon discharge of air outwardly from said mouth portion.

17. Discharge ventilator as claimed in claim 15, at least one of said links yieldingly interconnecting said structural member and said closure means to permit said closure means to pass through the in-line position under pressure of discharge of air from said mouth portion.

18. Discharge ventilator as claimed in claim 15, wherein said structural member is a bridge member spanning said mouth portion; brackets are provided secured to said bridge member; and said link means comprising support links having one end of said support links mounted on said brackets; said brackets being located diametrically opposite with respect to said mouth portion, and said links being of equal effective length, whereby said closure means, when in open position, will be parallel to said closure means when in closed position.

19. Discharge ventilator as claimed in claim 15, said mouth portion being formed as a flaring, trumpet-shaped mouth; and fan means disposed within said mouth portion to discharge air therefrom in a direction towards said closure means.

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