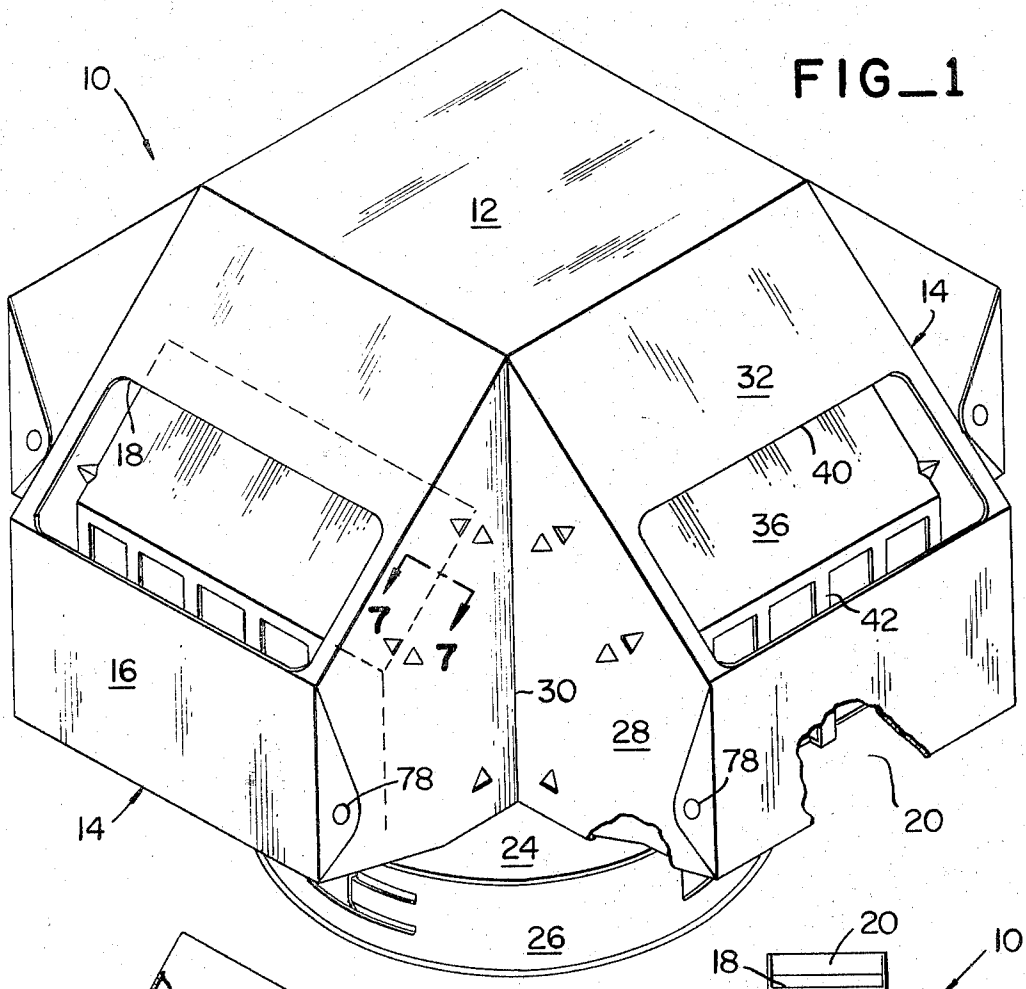
Jan. 14, 1969 R. L. STONE 3,421,429

VENTILATOR CAP WITH AIR DEFLECTORS

Filed May 1, 1967 Sheet 1 of 3

FIG_1



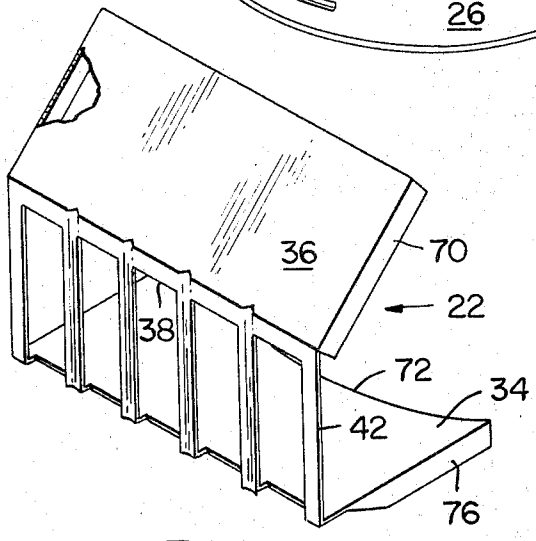


FIG_3

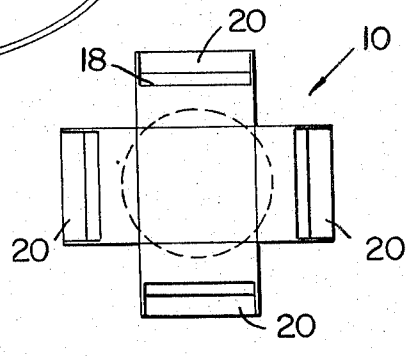


FIG_2

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VENTILATOR CAP WITH AIR DEFLECTORS

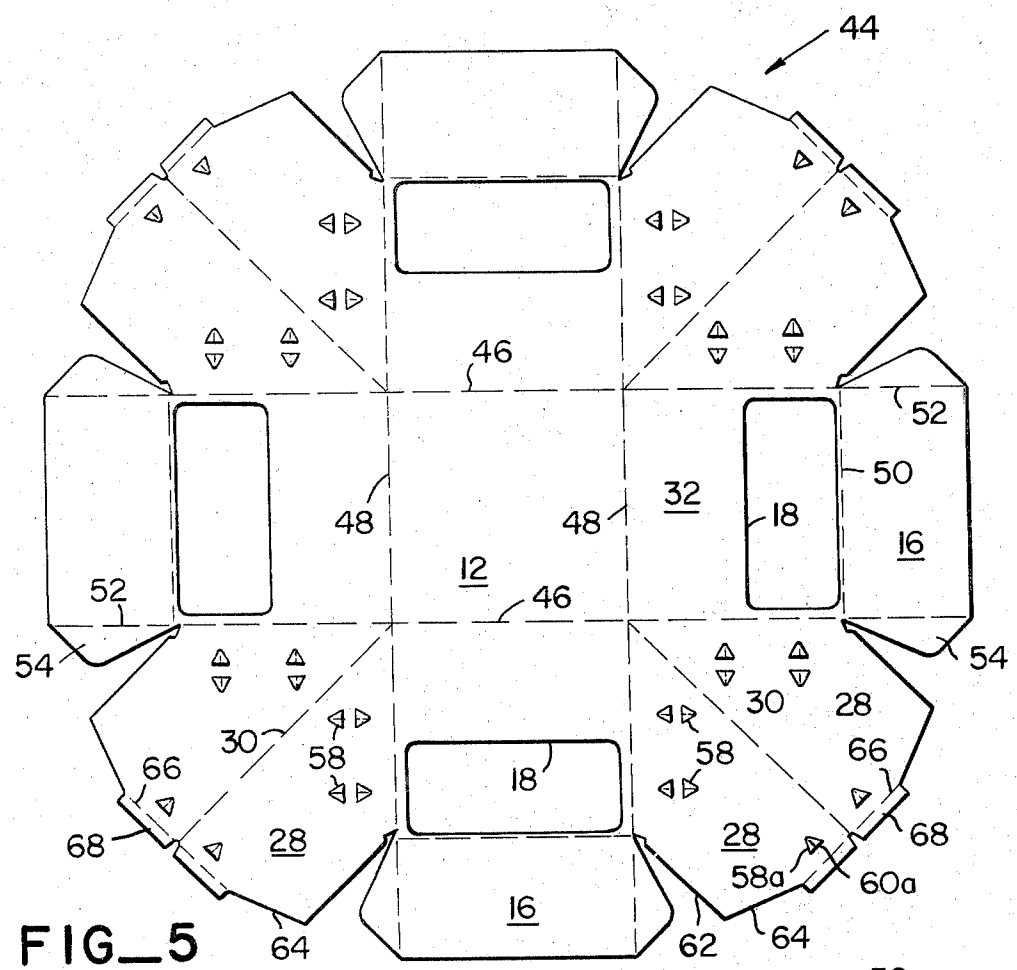

FIG_5

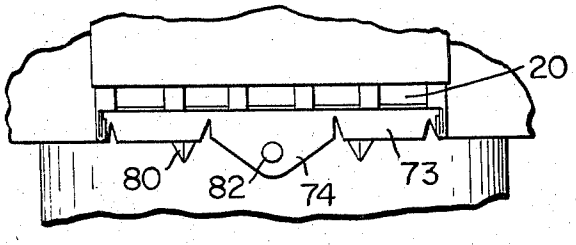

FIG_4

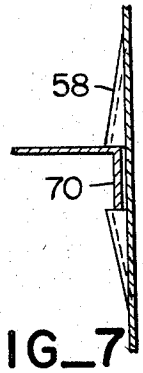

FIG_7

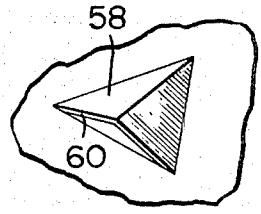

FIG_6

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VENTILATOR CAP WITH AIR DEFLECTORS

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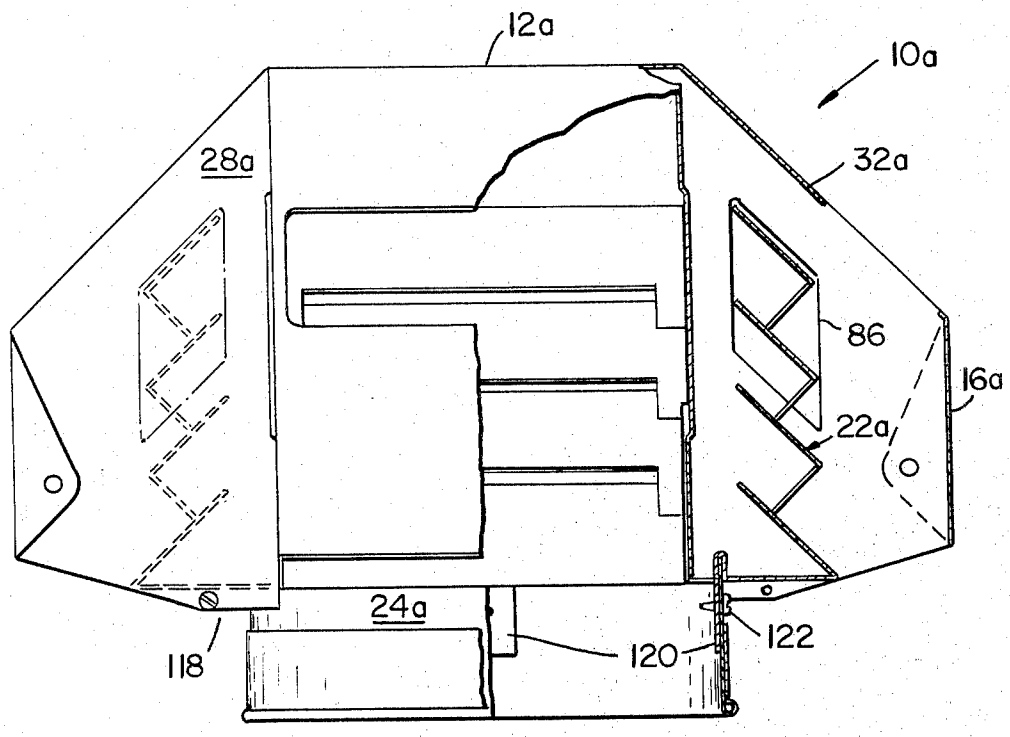

FIG_8

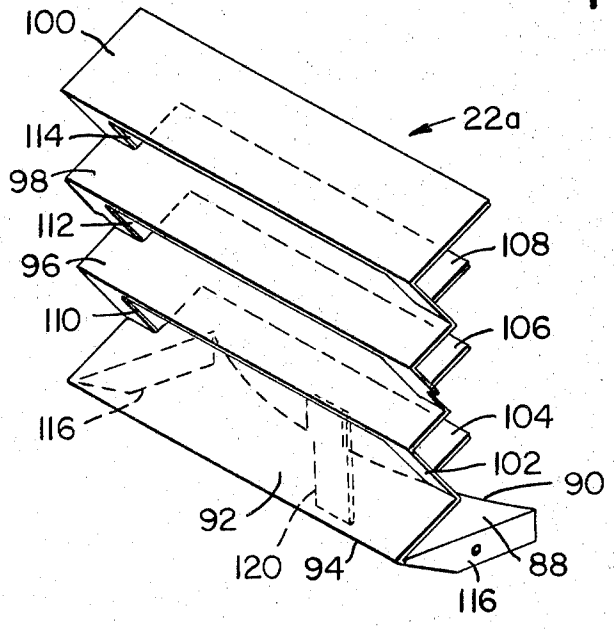

FIG_9

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United States Patent Office 3,421,429 Patented Jan. 14, 1969

3,421,429

VENTILATOR CAP WITH AIR DEFLECTORS

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Filed May 1, 1967, Ser. No. 634,987
U.S. Cl. 98—78 12 Claims
Int. Cl. F23l 17/02

ABSTRACT OF THE DISCLOSURE

A vent cap adapted for connection to vent pipes that extend above the roof level for exhausting heated gases from buildings. It comprises a central chamber having an imperforate top cover with a plurality of discharge members extending outwardly therefrom, each having upper and lower openings in sloped surfaces. The latter cooperate with internal baffle means spaced inwardly from the openings to deflect the air flow through them to provide an aspirating effect that always exceeds any back pressure within the central chamber despite the direction or force of wind on the cap.

This invention relates to an improved vent cap or top for prefabricated metal vent pipes or flues that extend from various types of heating appliances above the roof level of a building.

Vent caps must operate satisfactorily under a wide range of varying environmental conditions. A primary factor influencing its performance is the force and direction of wind on the cap which can vary due to its location on or adjacent to a roof or other structures, as well as prevailing weather conditions. In the field of vent cap development, it has long been a prime objective to provide a vent cap having satisfactory performance characteristics for all wind conditions. More specifically, the problem was to provide a vent cap capable of producing a minimum increase in the flow resistance or back pressure which decreases the flow capacity through the vent cap, while producing a maximum increase in aspiration to cause an updraft flow in the vent when winds strike the vent from all directions and at all angles up to around plus or minus 45° from the horizontal. In order for a vent cap to produce the desired aspiration in the vent pipe to which it is connected, wind must flow normal to the axes of its opening and yet the wind cannot be allowed to enter openings directly by an amount that will pack it into the cap and cause a back pressure sufficient to overcome the aspiration produced. Yet a further requirement for a satisfactory vent cap is that it should offer little or no resistance to flow from the vent when in still air. And a still further requirement is that the vent cap should prevent the entry of rain into the vent pipe as well as the ingress of birds or other foreign articles.

It is therefore an object of the present invention to provide a vent cap which fulfills the aforesaid requirements and overcomes all the problems relating to optimum operating characteristics to a degree heretofore not attained by prior art devices.

In general, my vent cap comprises a central chamber having an imperforate top portion from which extends a series of air discharge members that taper in elevation toward an end wall. Each of the air discharge members have a pair of upper and lower vertically aligned openings for air to pass into the central chamber. A baffle means within each air passage serves to deflect and control the velocity of the air stream through these openings and to produce the desired aspirating characteristics at the mouth of a stub pipe section that extends into the bottom of the chamber just above the lower walls of the air discharge members.

Another object of the present invention is to provide a vent cap having a unique structural configuration, that overcomes the aforesaid problems and accomplishes the desired operating effects with a minimum of sheet metal.

Yet another object of my invention is to provide a vent cap which has a small number of components that are relatively easy to manufacture and assemble in large quantities with automated machinery and with a minimum of manual labor.

Still another object of the present invention is to provide a vent cap that is compact and has an esthetically pleasing configuration which makes it adaptable for installation on and compatible with a wide variety of buildings.

Other objects, advantages, and features of my invention will become apparent from the following detailed description presented with the accompanying drawings, in which:

FIG. 1 is a view in perspective of a vent cap embodying the principles of the present invention;

FIG. 2 is a plan view in a reduced scale of the vent cap shown in FIG. 1;

FIG. 3 is a view in perspective of the baffle member for the vent cap of FIGS. 1 and 2;

FIG. 4 is a fragmentary view in elevation showing a lower portion of the vent cap of FIGS. 1–3;

FIG. 5 is a plan view of a flat pattern of sheet material for use in making the vent cap of FIGS. 1 and 2;

FIG. 6 is an enlarged view in perspective of an upset projection utilized on the vent cap of FIGS. 1–5;

FIG. 7 is an enlarged view in section taken along line 7—7 of FIG. 1;

FIG. 8 is a view in elevation and partially in section showing a modified form of vent cap embodying the principles of the present invention; and

FIG. 9 is a view in perspective of the baffle member for the vent cap of FIG. 8.

Referring to the drawing, FIG. 1 shows a vent cap **10** embodying the principles of the present invention which, in a typical installation, is attached to a gas vent pipe from a heating appliance such as a gas furnace, stove, water heater or the like, extending just above the roof level of a building and thus exposed to all environmental wind and raid conditions. The overall configuration of my vent cap, including the location and size of its openings combined with internal air flow directing means spaced from these openings cooperate to produce highly effective operating characteristics under all weather conditions. In broad terms, my vent cap comprises a central chamber with an imperforate top portion **12** from which extend a plurality of air discharge members **14**. Each of the latter taper in elevation toward an outer end wall **16**, and above and below the latter are upper and lower openings **18** and **20** through which wind can enter through or exit from a discharge member depending on its direction and slope relative to the cap. Within each discharge member **14** is a baffle unit **22** which directs the wind entering the cap so that aspiration is produced which always exceeds any back pressure created within the central chamber.

In the embodiment of FIG. 1, air discharge members **14** are disposed relative to each other at right angles and each has an upper opening **18** and a lower opening **20** at their lower ends. They are fixed to a cylindrical pipe stub section **24** which extends upwards into the central body a short distance above the lower ends of the air discharge members **14**. This stub section has some suitable clamping band **26** at its lower end to connect it to a vent pipe extending from a building. Each of the air

discharge members **14** has parallel side walls **28** which extend outwardly from a vertical right angle intersection **30** forming the junction with the side wall of an adjacent air discharge member. At their outer ends each pair of side walls are connected together by a transverse vertical end wall **16**. An upper portion **32** extending between the side walls of each air passage member slopes downwardly from a side of the top portion **12** of the central chamber, and it has a rectangular shaped opening **18** adjacent the top edge of the end wall **16**. Similarly, a bottom wall **34** on each air discharge member extends radially outwardly from the stub pipe section **24** and forms a rectangular opening **20** adjacent the bottom edge of the end wall **16**. The latter opening on the bottom side of each air discharge member is somewhat smaller than the top opening **18** on its upper sloped portion **32**.

The baffle unit **22**, as shown in FIG. 3, is fixed within each air discharge member **14** that also extends between the side walls **28** and provides a means for controlling the flow of air in, out and through the vent cap. This unit has a sloped upper deflector member **36** that is substantially parallel to and spaced downwardly from the sloped upper portion **32** of the air discharge member **14**. The lower edge **38** of the deflector **36** is almost directly below the lower edge **40** of the upper portion **32** and extending downwardly from it is a grille portion having a plurality of spaced apart vertical bars **42**. Thus, wind which comes through an upper opening **18** either horizontally or at an angle of 45° is deflected either upwardly or downwardly by the baffle surface **36** in each air discharge member. The upwardly deflected wind flows across the top of the stub pipe end with the central chamber and then out one or more of the other air discharge openings without being restricted, while downwardly deflected wind flows more directly out a bottom opening **20**. Simultaneously, the wind also flows over other openings of the cap **10** which are oriented at different angles so that it produces an aspirating effect in the vent pipe.

The unique construction of the vent top **10** may be further described with reference to FIGS. 5 to 7. The central chamber with its outwardly extending air discharge members **14** may be made as a unitary bonnet-like structure from a single blank **44** of sheet metal material which is cut and scored, as shown in FIG. 4. Aluminum is a preferred material because it is durable, resists corrosion and is relatively easy to cut and form. This blank is made to accommodate a pair of parallel horizontal bend lines **46** and a pair of intersecting vertical bend lines **48** that are spaced the same distance apart. These lines along which the metal can be scored and then bent in the same direction define the square top portion **12** between their intersections. Extending from the sides of this top portion are the areas for the upper sloped portions **32** each with a portion removed to form an upper rectangular shaped opening **18**. Spaced near the outer edge of each of the latter openings is a transverse bend line **50** which connects the upper portion **32** with a portion adapted to form an end wall **16**. Extending outwardly from a pair of bend lines **52** forming the side edges of these end wall portions are a pair of triangular tab portions **54** which are used during the assembly of the top **10**. Located between the outwardly extending upper portions **32** on the blank **44** are areas thereon for pairs of side wall members **28**. Each such area is separated by a diagonal bend line **30** extending from a corner of the central top area **12** which makes an angle of 45° with both the horizontal and vertical bend lines at that junction and becomes the line of intersection between each pair of adjacent air discharge members.

When the blank **44** is formed, each side wall member **28** is punched and upset at predetermined locations to produce two pairs of retaining members **58** which project inwardly from the side walls **28** for holding the baffle unit **22** in place. Each of these latter members, as shown in FIG. 6, is punched along a narrow slit and then is pushed inwardly to form an integral triangular shaped projection whose edge **60** extends outside the plane of the sheet material. The retaining members **58** of each pair thereof are spaced apart an equal amount, and the pairs themselves are spaced farther apart and also an equal distance from a horizontal or vertical bend line. A fifth retaining projection **58***a* is located near the outer end of each side wall **28** and is positioned with its inwardly projecting straight edge **60***a* lying along a line perpendicular to the diagonal bend line **30** between adjoining side walls **28**. Each side wall has one outer edge **62** which is parallel to a diagonal bend line **30** and to the similar outer end edge of the adjacent side wall. Another edge **64** forming a sloping bottom of each side wall extends from the outer edge **62** at an angle of greater than 90°. Spaced outwardly from each of the five retaining members **58***a* of adjoining side walls **28** and parallel to their projecting straight edges are aligned bend lines **66** for a pair of spaced apart flange portions **68**. The latter also serve to retain the baffle unit **22** when it is installed within the air passages of the bonnet.

The baffle unit **22** may also be stamped out of sheet metal, such as aluminum, and formed into the desired shape, as shown in FIG. 3. Generally, it includes as an integral unit the sloped deflecting member **36** and the spaced apart bars **42** extending from the lower edge thereof, as previously described. In cross section the bars are preferably curved slightly to give them added strength. At each end of the deflector portion **36** is a narrow flange **70** having a width which enables it to fit snugly between two pairs of side wall retaining projections **58** thereby helping to secure the baffle unit in place in an air discharge member **14**. The bottom wall **34** of the discharge member is actually a portion of the baffle unit **22** which is integral with and extends inwardly at a right angle to the vertical bars **42**. The inner edge **72** of the bottom wall **34** is curved to conform with the curvature of the stub pipe section **24**, and extending downwardly from this curved inner edge are a pair of relatively narrow width flange members **73** separated by a triangular shaped flange **74**. As shown in FIG. 4, the latter flange members are utilized in positioning and attaching each baffle unit **22** to the stub pipe section **24**. At the ends of each bottom wall **34** are a pair of turned down flange members **76** which serve in securing each baffle unit **22** to the bonnet **44**, as will be described below.

The assembly of the vent top **10** can be accomplished with relative ease and in large quantities at a high production rate by a few simple manufacturing steps. First, the bonnet in the flat sheet form **44** is stamped and scored as previously described, and the baffle unit **22**, shown in FIG. 3, may be similarly stamped from sheet material. The bonnet blank **44** is now placed in a press with the appropriate die and is formed into its cruciform shape. The baffle units **22** which are also bent into their final shape by suitable means, as shown in FIG. 3, are inserted and secured within each air discharge member **14** of the bonnet. The flanges **70** at the ends of the baffle unit deflector portion **36** fit between the pairs of retaining projections **58**, and the bottom plate bears up against the retaining projection member **58***a*. Now, the outer flange **68** on each side wall member **28** is folded up and over the turned down flange **76** on the baffle unit bottom wall **34**. The triangular tab portions **54** at the ends of the end walls are now folded alongside the side walls **28** and are secured thereto by a small rivet **78**. The bonnet **44** with the baffle unit **22** in place is now attached to the pipe stub section **24**. A series of outwardly extending and circumferentially spaced apart upset projections **80** are provided in the stub section **24**, as shown in FIG. 4, to position the bonnet on the stub section so that the upper end of the latter extends into the bonnet only the prescribed amount. Generally, it is preferred that the end edge of the stub pipe section lies in a plane approximately midway between the top and bottom ends of the vertical bars **42** on

the baffle unit **22** which also places it slightly below a horizontal plane through the center lines of the end walls **16**. The narrow flanges **73** on the curved edges **72** of the baffle members **22** thus are retained by the projections **80** as the bonnet is connected. A fastener, such as a rivet **82**, is then placed through each of the larger flanges **74** and the stub section to permanently attach the bonnet thereto. At the lower end of the stub section, the means for securing the vent cap to the end of a vent pipe may be the band attaching device **26**, which is shown in FIG. 1.

Another vent cap **10***a* embodying the principles of my invention is shown in FIGS. 8 and 9. Here, a bonnet section is made from a flat sheet in almost the same manner as with the vent top **10**. Thus, it has a square top portion **12***a* and portions extending from the side walls **28***a* thereof that form the sloping upper walls **32***a* and end walls **16***a* of four projecting air discharge portions **14***a*. Here, the side walls are slightly different in that no upset projections are utilized. Instead, each side wall **28***a* has an area **86** in the shape of a parallellogram that projects outwardly from its outer surface and forms a similarly shaped recess on its inside surface to retain a baffle unit **22***a* of a somewhat different configuration.

The baffle units **22***a* for my modified vent cap **10***a*, as shown in FIG. 8, may be made from suitable sheet metal material which is cut and then bent to the proper shape. It comprises a bottom portion **88** having a curved inner edge **90** adapted to fit the curvature of a stub pipe section **24***a* which extends into the bonnet. A first deflector portion **92** is attached to a straight outer edge **94** of the bottom portion **88** and is bent back at an angle thereto of around 45°. The baffle unit **22***a* is formed in essentially an accordion-like configuration by three additional deflector portions **96**, **98** and **100** which are parallel to and spaced upwardly from the first deflector portion. These four vane-like deflector portions are connected together by webs **102** formed from the ends of three intermediate portions **104**, **106** and **108**, the webs being bent substantially at right angles to the deflector portions and forming narrow rectangular openings **110**, **112** and **114** between each web pair. At the ends of the bottom portion **88** of each baffle unit **22***a* are a pair of downwardly extending flanges **116** which may be readily secured to the lower ends of the side walls **28***a* in each air discharge portion **14***a* by means of a suitable fastener, such as a rivet or screw **118**. When so attached, the upper ends of the upper two parallel, sloped deflector portions **98** and **100**, which are slightly longer than the others, are retained in the recesses **86** of the side walls **28***a*. An auxiliary tab **120** is also provided near the center of the curved inner edge **90** of each baffle unit **22***a*. This latter tab fits over the upper edge of the stub pipe section and extends downwardly inside it to a lower point where it may be fastened thereto by a sheet metal screw **122** or some other fastener.

The vent cap **10***a* operates in a similar manner to the cap **10**, with its baffle unit **22***a* serving to deflect and discharge wind entering any opening and discharging it efficiently without causing back pressure and also preventing the influx of rain. Both vent caps, according to my invention, function so that no matter what direction the wind blows it will always be oriented with more openings which cause aspiration than openings into which wind can enter and cause a back pressure at the mouth of the stub pipe. To a large degree this is due to my unique arrangement of a plurality of radially extending air discharge members **14** each with its upper and lower openings **18** and **20**. The upper openings are somewhat larger than the lower openings so that wind striking the vent cap at angles as much as 45° below the horizontal will for the most part pass upwardly and out the upper openings without restriction and without packing the central chamber to create a back pressure. Similarly, winds up to 45° above the horizontal will enter the upper openings **18** and be deflected downwardly by the baffle unit **22** which effectively reduces the size of the upper openings, this deflected air being easily exhausted out the bottom openings **20**. As the wind on the vent cap passes over some openings and through other openings the combination of these openings plus the baffle unit provides the desired aspiration which increases the updraft in the pipe to which the cap is connected. With either of the embodiments already described, the amount of air which is able to get into the central chamber is never enough to exceed the aspirating effect that is produced by air flowing over the vent cap.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A vent cap adapted for instalaltion on a metal vent pipe extending from the roof of a building, comprising:

a bonnet forming a central chamber including an imperforate horizontal top portion having a plurality of straight sides;

a plurality of air discharge members extending outwardly from said straight sides of said top portion, each providing a series of upper and lower openings to said central chamber;

each of said air discharge members including a downwardly sloping upper wall adjacent said upper opening, a bottom wall adjacent said lower opening, a pair of vertical side walls between said upper wall and said bottom wall and an end wall between said upper and lower openings;

baffle means in each said air discharge member for deflecting air that enters directly through one opening, out other openings and for preventing the influx of rain;

and a stub pipe section extending into said central chamber to a level above said bottom wall.

2. The vent cap as described in claim **1** having a generally cruciform configuration with a square shaped top portion and four air exhaust members extending outwardly from the sides thereof.

3. The vent cap as described in claim **1** wherein said upper opening is larger than said lower opening in each said air discharge member.

4. The vent cap as described in claim **1** wherein each said baffle means includes at least one deflector plate spaced inwardly from and substantially parallel to said downwardly sloping upper wall.

5. The vent cap as described in claim **1** wherein each said baffle means includes means having a curved inner edge forming said bottom wall, and flange means extending downwardly from said inner edge and fastened to said stub pipe section.

6. The vent cap as described in claim **1** wherein said baffle means comprises a single deflector plate spaced inwardly from said sloping upper wall and similarly sloped with respect to a vertical axis of said cap; a series of spaced apart vertical bars extending downwardly from said deflector plate; and a lower horizontal portion forming a said bottom wall and secured to said stub pipe section.

7. The vent cap as described in claim **6** including a series of retaining members projecting inwardly and arranged in spaced apart pairs on said side walls and end flanges on said deflector plate secured between said pairs of retaining members.

8. The vent cap as described in claim **6** wherein the lower edge of each said deflector plate in each said air discharge member is substantially in the same horizontal plane as the top edge of said end wall and also in substantially the same vertical plane as the top edge of said upper opening.

9. The vent cap as described in claim **1** wherein said

baffle means comprises a series of substantially parallel deflector plates spaced apart to provide narrow horizontal openings and including an uppermost deflector plate spaced downwardly from and substantially parallel to said sloping upper wall in each said air exhaust member; and a lower portion forming said bottom wall and including means securing it to said stub pipe section.

10. The vent cap as described in claim **9** including means forming recessed areas in said side walls of each said air discharge member for retaining the ends of some of said deflector plates.

11. A vent cap adapted for installation on a metal vent pipe extending from a heating appliance, comprising:

a bonnet-like cover formed from a single piece of sheet metal material and a square imperforate top portion and four scoop-like air discharge means extending from the sides thereof, said sheet material being bent along lines diagonally oriented with respect to said top portion and formed inwardly to have a right angle bend at each corner of said top portion extending perpendicular thereto and thereby forming side walls for said air discharge means, an end wall portion at the outer end of each said air discharge means having end flanges folded back and secured to said side walls and a sloping top portion between said side walls having an opening adjacent said end wall;

a stub pipe section extending upwardly below said bonnet;

a baffle unit retained within each said air discharge means of said bonnet for deflecting incoming air away from the upper end of said stub pipe section and to prevent the influx of rain into said cap;

and means on each said baffle unit forming a bottom wall and including means for securing it to said stub pipe section.

12. The vent cap as described in claim **11** wherein the upper edge of said stub pipe section is in a plane above said bottom wall portions.

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U.S. Cl. X.R.

98—82