

[54] **VENT CAP ASSEMBLY FOR EXTERIORLY LOCATED FUEL BURNING UNIT**

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FOREIGN PATENTS OR APPLICATIONS

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[52] **U.S. Cl.**..... 126/85 B, 126/312, 98/58

[51] **Int. Cl.**..... **F23I 17/02**

[58] **Field of Search** 126/85 B, 110 AA, 312, 126/307, 116 B; 98/119, 122, 48, 84, 36, 107, 58; 110/147

[57] **ABSTRACT**

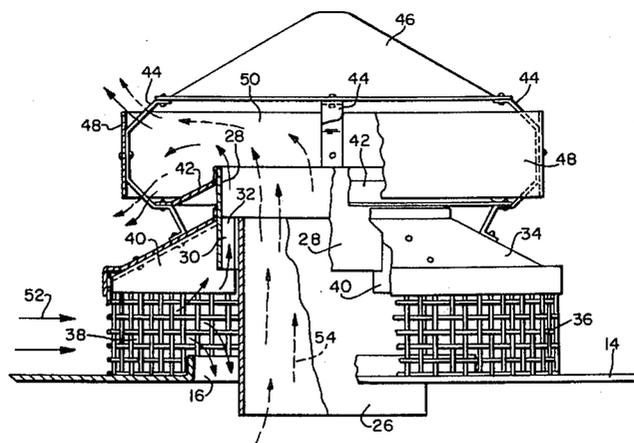
A vent cap assembly through which combustion air is delivered to the fuel burning unit, and from which flue gas exits to the atmosphere is provided with a lower space through which the combustion air is admitted through an outer annular opening in the top of the housing for the fuel burning unit, and an upper space into which flue gas is discharged from the fuel burning unit, and in which a relief passage is provided to connect the lower space and the upper space to create pressure and flow conditions between the spaces to reduce the problems encountered with varying wind velocities and directions. The upper portion of the lower space is also compartmented to stabilize flow conditions.

[56] **References Cited**

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7 Claims, 5 Drawing Figures



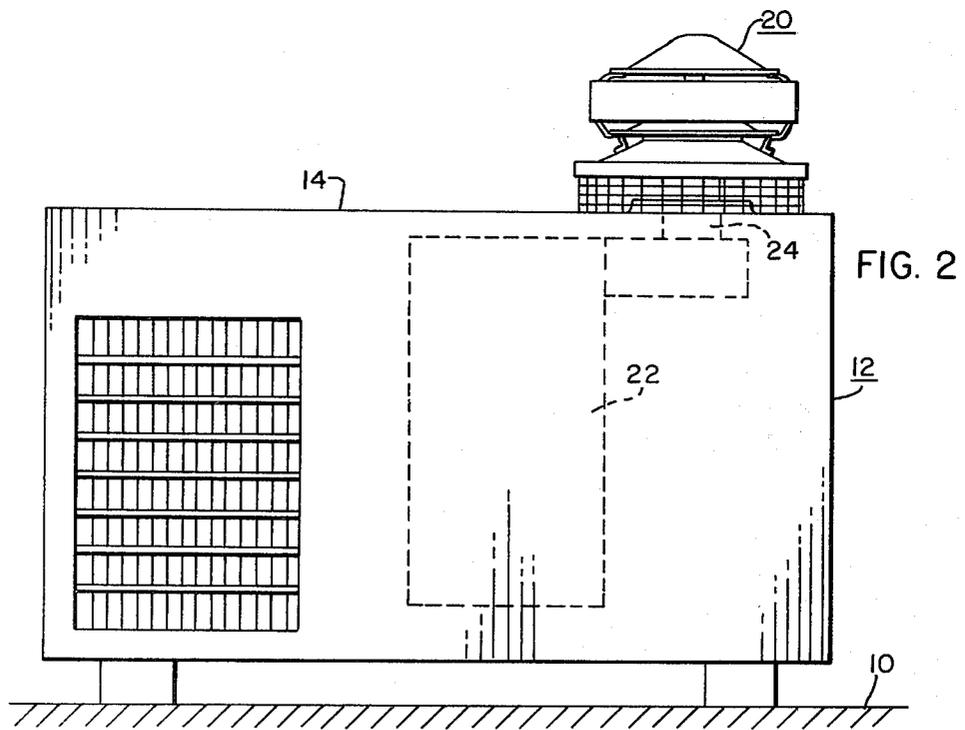
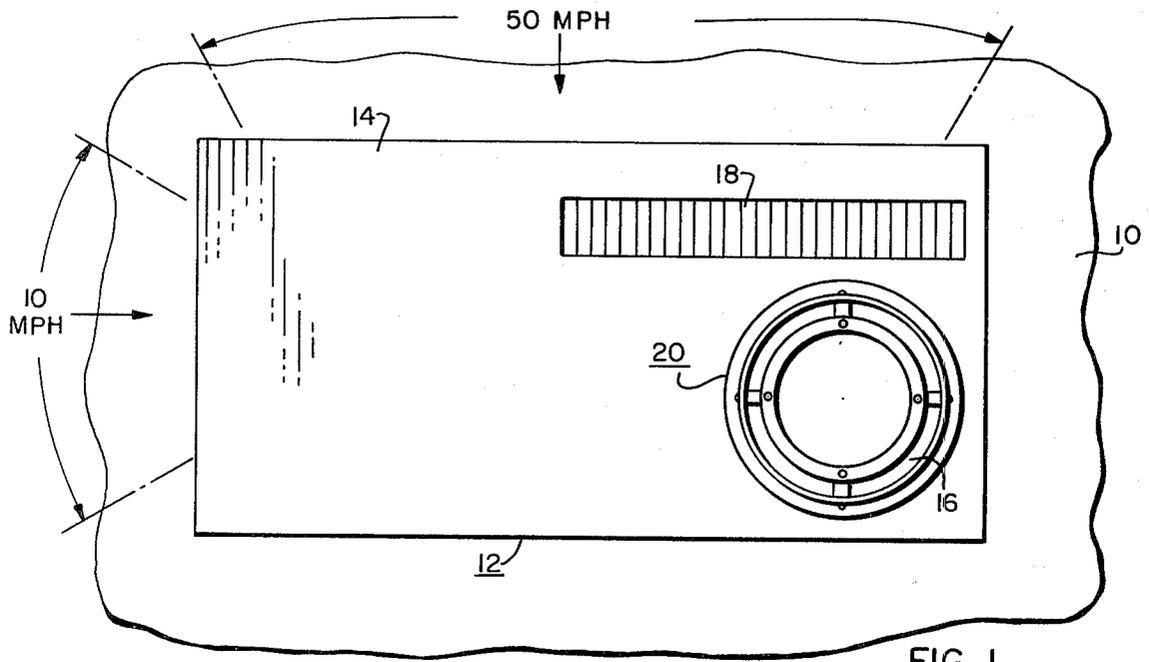
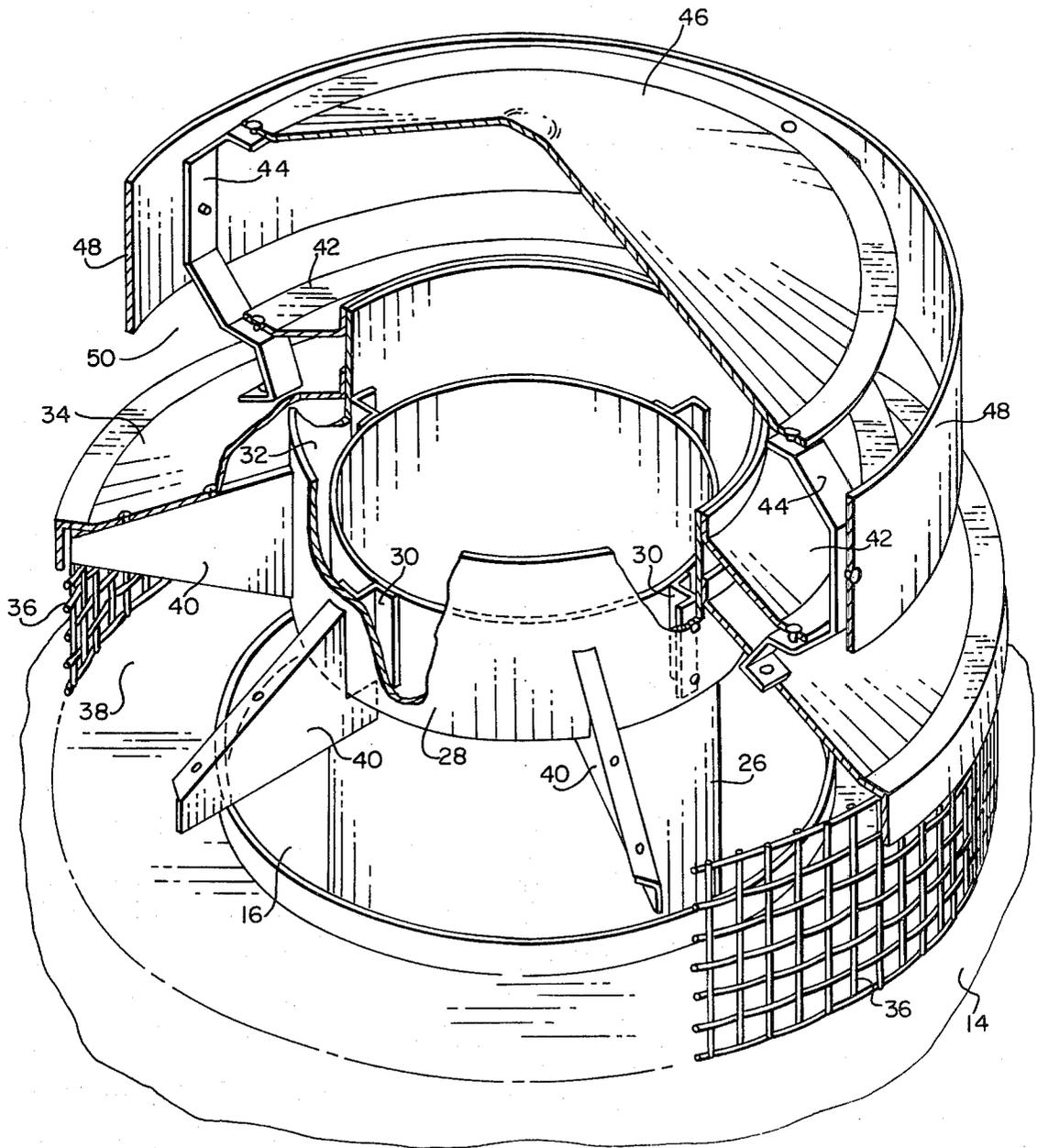
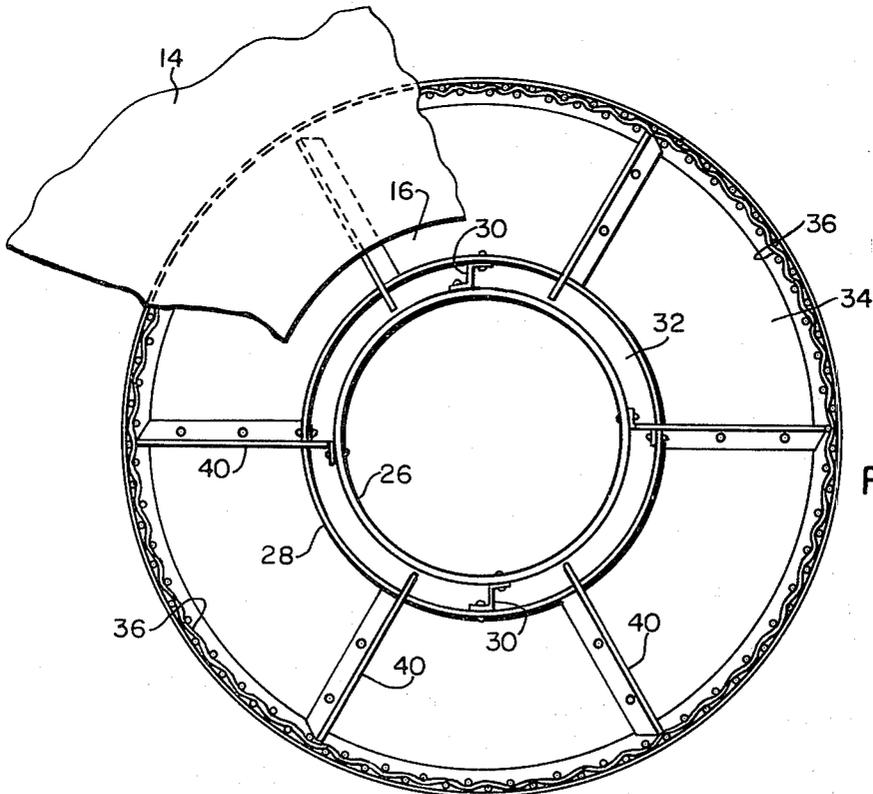
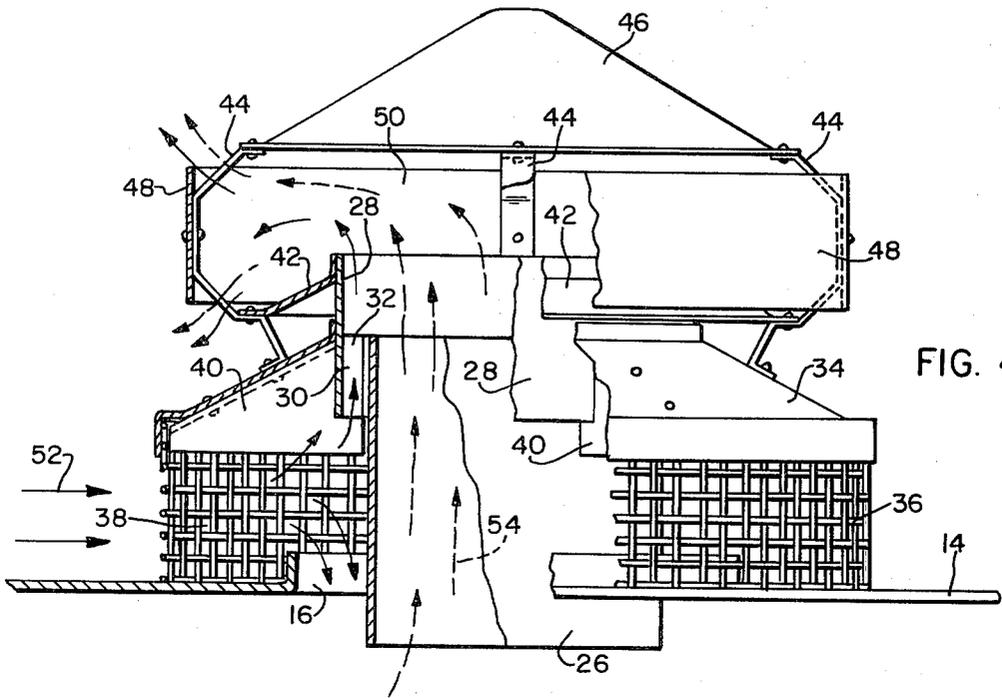


FIG. 3





VENT CAP ASSEMBLY FOR EXTERIORLY LOCATED FUEL BURNING UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention pertains to the art of vent cap assemblies for fuel burning units of the type normally installed exteriorly of the building being served by the unit.

2. Description of the Prior Art

The closest prior art of which applicants are aware is the previous commercial vent cap assembly used with fuel burning units of the type noted. Such a vent cap assembly included the upper and lower spaces, but they were devoid of means placing these spaces in open communication for purposes of relief between the spaces, and were devoid of means separating the upper part of the lower space into separate compartments, as well as having different dimensional relationships.

Examples of prior art patents relating to building ventilator structures generally, but which have some superficial resemblances to the present invention, particularly in respect to countercurrent air flow, are U.S. Pat. Nos. 186,054; 757,348; 760,092 and 2,163,077.

SUMMARY OF THE INVENTION

In accordance with the invention, the vent cap assembly thereof is adapted for installation in overlying relation to an opening on the top surface of a fuel burning unit of the type normally installed exteriorly of a building being served by the fuel burning unit, and accordingly is subject to variable wind directions and velocities. The assembly includes a central flue pipe connected to receive flue gas from the fuel burning unit, a lower skirt around the flue pipe with the lower edge of the skirt being spaced above the surface on which the assembly is installed to define therewith a first lower space which underlies the skirt and into which ambient air for combustion is admitted and then flows downwardly through the annular opening defined between the flue pipe and the boundary of the opening in the top surface, an upper cone-shaped cap spaced above the top end of the flue pipe to define the top of an upper and second space into which flue gas is discharged from the top end of the flue pipe, and relief passage means placing the first and second spaces in direct communication at at least a plurality of locations closely adjacent the periphery of the flue pipe. Additionally, in the preferred embodiment the upper part of the first and lower space is separated into compartments which are downwardly open to the remainder of the lower space and which serve to stabilize air flow conditions under certain velocity and wind direction conditions.

DRAWING DESCRIPTION

FIG. 1 is a plan view of a vent cap assembly on one type of fuel burning unit according to the invention and showing sectors in which particular wind velocities and directions provide the most difficult flow conditions;

FIG. 2 is an elevational view of the fuel burning unit and vent cap assembly;

FIG. 3 is a partly broken isometric view of the vent cap assembly according to the invention;

FIG. 4 is a partly broken elevational view of the assembly; and

FIG. 5 is a bottom view of the assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, one type of unit to which the invention is particularly applicable is a unit which typically provides either heating derived from a gas fired fuel burner unit, or cooling derived from a self-contained mechanical refrigeration system. The unit is usually installed on a roof top of a building or on a slab at the side of a building being served by the unit and duct means (not shown) are connected for the passage of the heated air between the building and the unit. In the showing of FIGS. 1 and 2 it is assumed that the unit is installed on a roof top 10 and it basically includes, for purposes of description of this invention, an outer cabinet 12 including a top wall 14 having a circular opening 16 adjacent one corner of the top surface, and another rectangular opening 18 which functions as the refrigeration system condenser outlet. The vent cap assembly according to the invention is generally designated 20 and is mounted over the opening 16 through which combustion air is delivered to the fuel burning unit 22 (shown in dash lines in FIG. 2) and from which flue gas is discharged through a central passage 24 into the vent cap assembly.

As shown in FIGS. 1 and 2, the vent cap assembly 20 is mounted over the opening 16 located in the corner portion of the top surface and adjacent to the condenser outlet 18. Part of the difficulty experienced with the prior art vent caps is believed to stem from the fact that the vent cap is to be made symmetrical in design so that it can accommodate winds from various directions, but is usually installed in a location on the top surface 14 of the housing which is not centered on that top surface. The result is that with certain wind velocities from certain directions the prior art vent cap functions satisfactorily, while with certain other velocities and from certain other directions flow conditions arise in which it is possible that the flue can become pressurized to a value which is higher than the pressure in the space from which combustion air is drawn into the fuel burning unit 22. This can result in insufficient air flow to supply oxygen to the fuel burning unit or in extreme cases a reverse air flow. We have found that with the particular unit illustrated, the severest difficulties have been experienced with wind directions and velocities as indicated by the arrows in the segments adjacent the one end and the one side of the unit. It will be appreciated of course that less severe difficulties may be experienced with other wind velocities and directions than those shown in FIG. 1. The invention is concerned with the provision of a vent cap assembly as installed on a fuel burning unit of this type which functions to provide flow and pressure conditions for the combustion air and flue gas under the varying wind velocities and directions which permit satisfactory operation of the fuel burning unit.

Turning now to FIGS. 3-5 the assembly includes an open-ended central vent pipe 26 adapted for connection at its lower open end to the flue pipe 24 of the fuel burning unit, an outer, concentric shorter pipe 28 mounted to the upper portion of the vent pipe 26 by means of standoff brackets 30 so that an annular relief passage 32 is defined between the inner and outer pipes.

A frusto-conical shaped skirt 34 is suitably secured to the circumference of the outer pipe 28 and is mounted

at a location with its lower edge spaced upwardly from the top surface 14 of the cabinet 12 when the assembly is installed on the cabinet. A wire mesh screen 36 is secured to the depending flange of the skirt 34 to serve as a barrier against the admission of birds and debris into the first space generally designated 38 which is defined between the lower surface of the skirt 34, the top surface 14 of the cabinet, and the outwardly facing surfaces of the pipes 26 and 28. A plurality of generally triangular-shaped baffles or fins 40 are mounted to the underside of the slope portion of the skirt 34 and separate the upper portion of the space 38 into a series of separate, downwardly-open compartments in the currently preferred embodiment. As illustrated, six fins are the currently preferred number, although eight fins have also been found to function satisfactorily but increase the cost of the assembly. Fewer fins may also function satisfactorily on the whole although it would be expected that there would be a lesser degree of stabilization of the air flow in the lower, first space 38.

An intermediate level, frusto-conical shaped skirt 42 of lesser diameter than the lower skirt 34 is secured to the upper rim of the outer pipe 28. Four equally spaced spacer brackets 44 fastened both to the outside surface of the lower skirt 34 and the under surface of the intermediate skirt 42 extend from there outwardly and upwardly and then inwardly as best seen in FIGS. 3 and 4 to support both a top cone 46 and a windshield 48. The space 50 defined at the upper end of the vent pipe 26, and underlying the cone 46, and within the bounds of the wind shield or guard 48 encircling the second space receives the flue gas discharged from the fuel burning unit through the vent pipe 26.

The general direction of flow of the ambient air admitted into the lower first space 38 is indicated by the solid line arrows 52 in FIG. 4. The general flow pattern of the flue gasses is indicated by the dash line arrows 54. It is here noted that precise information on pressure conditions and flow through a vent cap assembly of the character with which this invention is concerned is difficult to determine with any precision. Accordingly, the description of the flow patterns and pressure conditions following is based on belief and observation and is not intended to be a representation that what is believed to be happening is in fact happening. However, it is known that the arrangement according to the invention functions better than the prior art structures known to applicants and is considered to satisfactorily solve problems previously experienced.

The ambient air admitted into the first, lower space 38 from any direction flows in part through the opening 16 and the outer surface of the vent pipe 26. The flue gas from the fuel burning unit 22 flows upwardly through the vent pipe 26 and exits into the second space 50 underlying the top cone 46. Under at least some of the more critical wind velocities and directions, if not in all cases, there is additional flow of ambient air from the lower space 38 to the upper space 50 through the direct communication passage 32 defined between the vent pipe 26 and the outer pipe 28. It has been found that parts of this relief passage 32, up to about one-half of the area of the passage, may be blocked and satisfactory results still obtained. However, it is currently believed preferably from both an economic and functional standpoint to use substantially the entirety of the passage provided between the two pipes with the particular dimensional relationships

illustrated in the drawing. The ambient air which passes up through the relief passage 32 of course mixes with the flue gas in the second space 50 and is exhausted through those gaps defined between the upper edge of the guard 48 and the lower edge of the top cone 46, as well as through the gap defined between the lower edge of the guard 48 and the outer circumferential edge of the intermediate skirt 42.

It is noted that the volumes of the first space 38 and the second space 50 are generally comparable. This is currently believed to be the preferable arrangement for superior flow conditions. The upper portion of the lower space 38 is separated into downwardly open compartments by the fins 40 as noted before. The function of these fins or baffles is for what we call stabilizing the flow in the lower space 38 and is believed to accomplish this by breaking up any tendency of air under certain velocity and direction conditions from creating a swirling flow.

The relief passage arrangement basically permits equalization of pressure between the lower and upper spaces 38 and 50 it is believed. This avoids a condition which has occurred with prior art vent cap assemblies in which with a strong high velocity wind sweeping across the top surface 14 of the cabinet, air flow in a direction opposite to the direction of the wind can be observed closely above the top surface 14. Such a condition results in starving of the combustion air supply to the fuel burning unit. This reverse flow phenomenon has not been observed under the same wind velocity and direction conditions with the vent cap assembly of the invention and has overcome the condition of starving the combustion air supply.

What is claimed is:

1. A vent cap assembly for overlying an opening on the top surface of a housing for a fuel burning unit of the type normally installed exteriorly of a building being served by the unit, and accordingly being subject to variable wind directions and velocities, comprising:
 - a central flue pipe extending through said opening on the top surface and having its lower end connected to receive flue gas from said fuel burning units;
 - a frusto-conical lower skirt around said flue pipe, the lower edge of said skirt being spaced upwardly from the top surface of said housing to admit ambient air for combustion purposes to a first space underlying said skirt, said first space being in open communication with the annular opening defined between said flue pipe and the boundary of said opening in said top surface;
 - an upper cone-shaped cap spaced above the top end of said flue pipe to define the top of a second space into which flue gas is discharged from the top end of said flue pipe; and
 - relief passage means placing said first and second spaces in direct communication.
2. A vent cap assembly according to claim 1 including:
 - guard means encircling said second space to inhibit the direct horizontal passage of air through said space from one side to the other.
3. A vent cap assembly according to claim 1 including:
 - means separating the upper portion of said first space into a plurality of downwardly-open separate compartments spaced circumferentially around said first space.

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4. A vent cap assembly according to claim 1 wherein: said relief passage means encircles the entirety of said flue pipe in the form of an annular passage.

5. A vent cap assembly according to claim 3 wherein: said means forming said separate compartments in the upper portion of said first space comprises a series of generally vertically-disposed fins in that portion of said first space above the lower edge of said skirt, said fins including radially inner end portions underlying the bottom open end of said relief passage means.

6. In combination:

a fuel burning unit in a housing adapted for installation exteriorly of a building the housing having a top surface with an opening therein to admit combustion air downwardly through an outer annular portion of said opening to said fuel burning unit, and to discharge flue gas upwardly through a central portion of said opening, and a vent cap assembly mounted on said top surface and overlying said opening in said top surface, said vent cap including: an open-ended central flue pipe extending through said opening on the top surface and having a lower end connected to receive flue gas from said burner

unit;

a lower, frusto-conically shaped skirt encompassing said flue pipe with the lower edge of said skirt being spaced upwardly from the top surface of said housing to admit ambient air for combustion purposes to a first space underlying said skirt, said first space being in open communication with the annulus defined between said flue pipe and the boundary of said opening in said top surface;

an upper, cone-shaped cap mounted above the upper end of said flue pipe to define a second space therewith to receive flue gas;

wind guard means encircling said second space to inhibit the direct horizontal passage of wind through said second space; and

relief passage means connecting said first space to said second space to promote equalization of pressures in said spaces.

7. In the combination of claim 6:

a plurality of generally vertically-disposed, radially-extending, fin means separating the upper part of said first space into a corresponding number of downwardly open chambers underlying said skirt.

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