April 24, 1956 F. ALWARD 2,742,846

FLUE CAP

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Fig. 1.

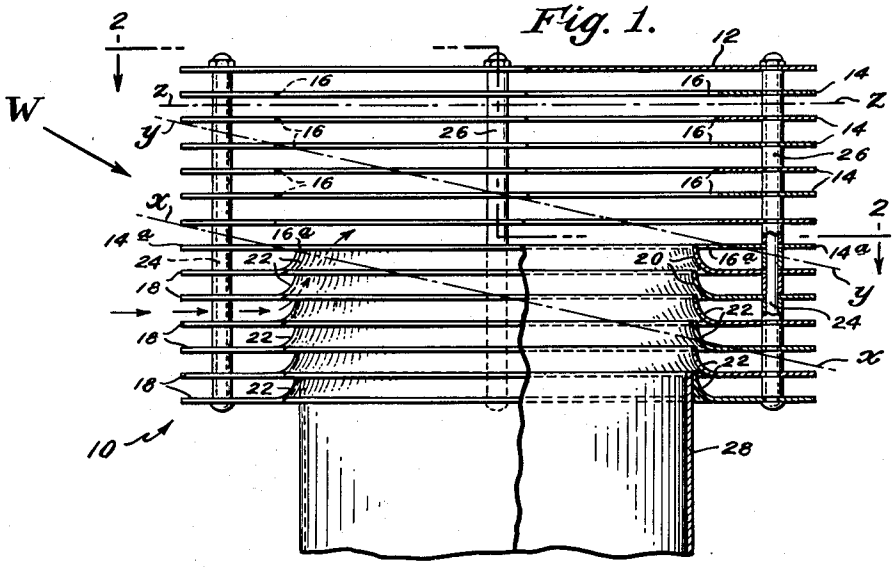
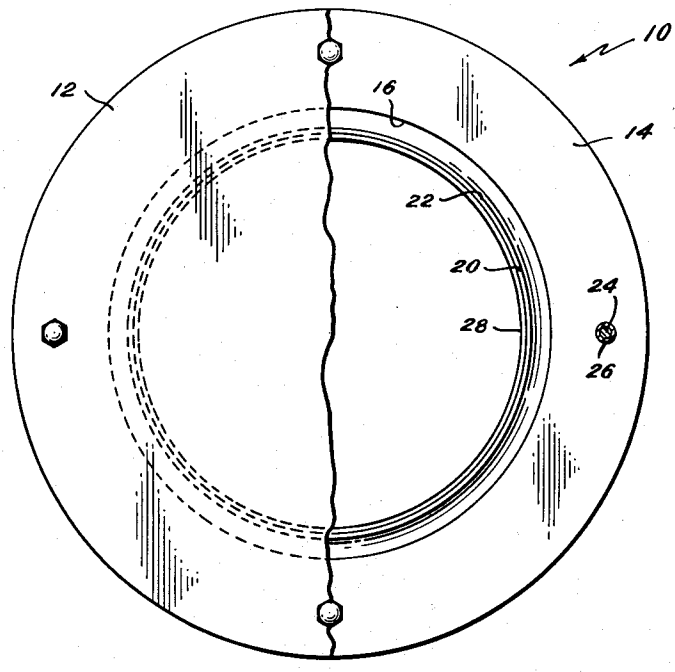


Fig. 2.



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Fig. 3.

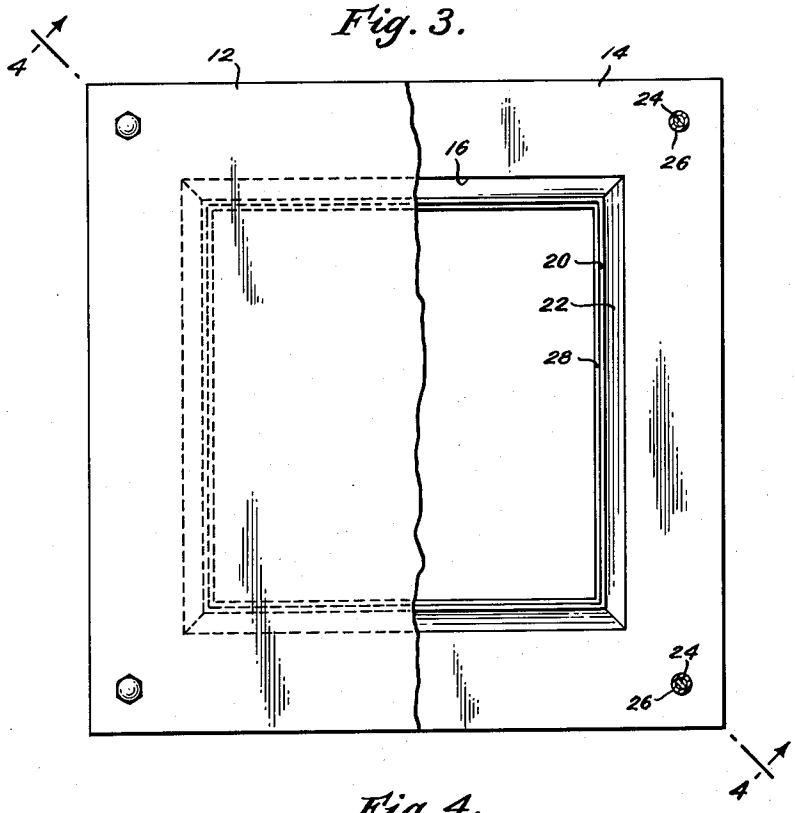
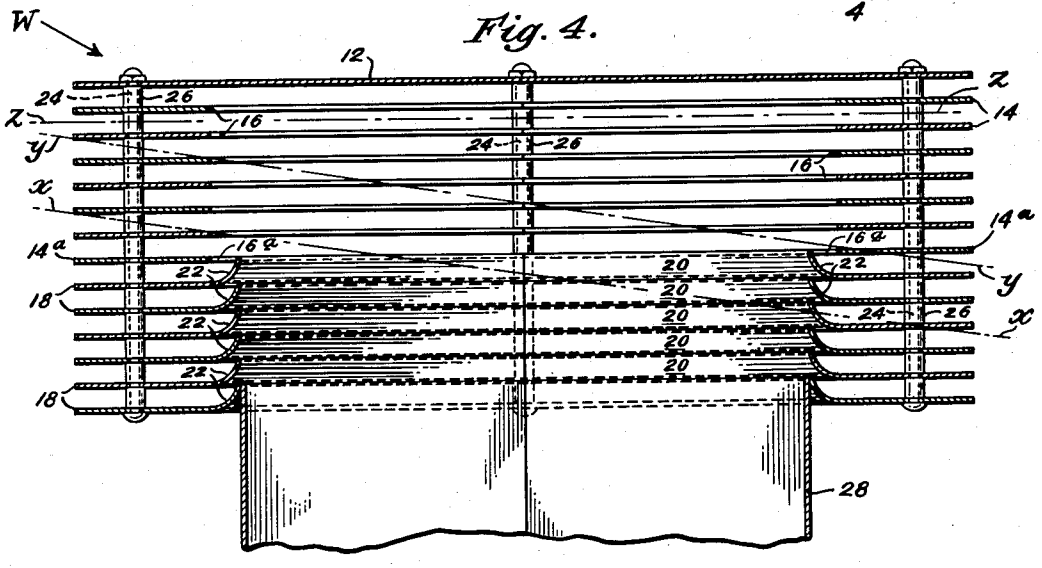


Fig. 4.



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United States Patent Office

2,742,846

Patented Apr. 24, 1956

2,742,846

FLUE CAP

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Application October 16, 1953, Serial No. 386,435

3 Claims. (Cl. 98—84)

This invention relates to flue caps and is more particularly concerned with a new and improved attachment for the outlets of flues and ventilators or the like which will effectively prevent down drafts while still permitting free escape of the air or gaseous mixture irrespective of the angle or direction of the wind.

Various expedients have heretofore been proposed for preventing down drafts in the flues of chimneys and in various ventilating pipes while simultaneously preventing the entry of rain and snow but not interfering in any way with the draft. Any attachment which can be devised necessarily interferes to some extent with the free exit of air or gas, the ideal situation apart from the down-draft problem being a completely free opening. Most attachments which have heretofore been proposed have involved moving parts with specially designed louvers which must face at all times in a predetermined direction with reference to the wind. So far as I am aware, no completely effective flue cap for this purpose has so far been devised which, while furnishing negligible interference to the free flow of the escaping gas or air, nevertheless effectively prevents down drafts, no matter which way the wind is blowing, and which requires no moving parts.

In this specification and the accompanying claims, I will term the novel device a "flue cap," it being understood that the term "flue" embraces any gas or air outlet, whether mounted on a building, motor vehicle, train, ship, airplane, or elsewhere.

With the foregoing in mind it is an object of my invention to provide a new and improved flue cap for preventing down drafts in flues, the novel cap having no moving parts and operating effectively no matter what the angle or direction of the wind.

It is a further object of the invention to provide a flue cap of the type described which is simple, rugged and enduring in construction, economical to manufacture, and which is adaptable for use on flues of any size or shape.

It is a further object of the invention to provide such a flue cap which will operate effectively while presenting a minimum obstruction to the free escape of air or gas from the flue on which it is mounted.

My novel flue cap comprises a series of relatively thin plates, preferably of metal, mounted in a vertically arranged stack in generally horizontal parallel spaced relation. All of the plates, with the exception of the uppermost, are provided with central openings which are preferably aligned with each other and which correspond generally in size with the dimensions of the flue which is to be capped and which together form a central cavity in the cap, into which open a plurality of passageways from all sides formed by the intervals between the plates. At the base of the stack of plates I preferably attach a short section of conduit or piping or other mounting portion suitable for attaching the assembly to the flue or chimney on which it is to be mounted. One or more of the lowermost plates comprise a lower plate section so shaped and proportioned, as by having one or more inner edges bordering the central openings turned upwardly, or otherwise, that no unobstructed inwardly extending straight line may be drawn from the outer edge of any plate and touching the inner edge of the next lower plate to a point below the lowermost passageway through which air is admitted from the exterior to the central cavity of the cap. The remaining plates, which may be said to form an upper plate section, have plane surfaces and the uppermost plate is solid, extending across the openings in the remaining plates to prevent entry of rain or other precipitation or down drafts from above. The upper section is composed of a sufficient number of plates, in view of their dimensions and spacing, to provide a total passage for the escape of air or gas at least equal to the capacity of the flue to be capped.

The foregoing and other objects, features and advantages of the invention will become apparent from the following detailed description of presently preferred embodiments thereof taken in conjunction with the accompanying drawings in which like numerals refer to similar parts in the several views, and in which

Fig. 1 is a front elevation with portions broken away and partly in section of a circular novel flue cap according to the invention;

Fig. 2 is a view partly in plan and partly in section of the same taken on line 2—2 of Fig. 1;

Fig. 3 is a top plan view with a portion of the upper plate broken away illustrating a modified square form of the invention; and

Fig. 4 is a sectional view of the embodiment shown in Fig. 3 taken on line 4—4 of Fig. 3.

Referring first to the embodiment of Figs. 1 and 2, the novel flue cap of the invention is indicated generally by the numeral **10**. It comprises a series of stacked plates, of metal or suitable substitute material, forming upper and lower plate sections of special shape, as hereinafter described. The top plate **12** is a solid disc except for mounting holes and it serves as a cover or lid for the flue cap excluding precipitation and the entry of down drafts from above. The next lower plates which comprise the balance of the upper plate section and are indicated by the numerals **14** and **14*a***, are plane and have central openings **16** and **16*a*** which are aligned with each other. The lowermost plates **18** forming the lower plate section are also provided with central openings **20** and their inner edges adjacent the openings are uniformly turned upwardly, as at **22**, the edge of the flange thus formed on the uppermost plate **18** preferably lying in the plane of the lowermost plate **14*a*** of the upper plate section. The intervals between the plates form air passageways between the interior and exterior of the cap.

It will be noted that the central openings in the plates **14** and **14*a*** are slightly larger than the openings **20**. As a matter of principle, it is only necessary that the opening in the plate **14*a*** be somewhat larger than the opening in the next lower plate in order to leave a ring-like aperture between the turned up edge **22** and the inner edge of the plate **14*a*** for the passage of air. The opening **16** in the remaining plates **14** might be of any suitable size so long as the critical formula mentioned below is adhered to. As a matter of convenience and economy of manufacture I prefer to make all the plates **14** and **14*a*** identical in size.

The plates **12**, **14**, **14*a*** and **18** are held in a vertical stack in spaced apart generally horizontal and parallel relation by a series of bolts or the like **24**, the several plates being separated by spacers **26**. Evidently the several plates may be mounted in position by any other suitable means such as by depending projections on successive plates welded to the next lower plate.

At the base of the two plate sections, there is affixed, by welding or otherwise, a pipe or conduit section **28** or other connecting element or mounting portion which is of suitable size and shape for attaching the novel flue cap to the particular flue.

As indicated by the broken line *x*—*x*, it is impossible to draw an unobstructed straight line at any level of the flue cap which touches the outer edge of a plate and the inner edge of the next lower plate and which will terminate at a point below the lowermost air passageway into the interior of the cap which, in this embodiment, is defined by the opposing surfaces of the two lowermost plates **18** and their respective flanges. Such a line thus must impinge above the top of the pipe extension **28**. In fact, in the particular construction shown, this line impinges upon the turned up flange **22** of the plate **18** which is the third from the bottom of the stack. Any line drawn below the line *x*—*x* must immediately hit one of the up-turned flanges **22** and cannot pass unobstructed into the center of the flue cap. Similarly, any line above the line *x*—*x*, as the line *y*—*y*, for example, which passes unobstructed into the central cavity of the cap, impinges upon the inner edge of a still higher plate than that hit by the line *x*—*x*, in this case upon the plate **14***a*.

The importance of the foregoing geometrical arrangement becomes apparent if one supposes a very narrow downwardly inclined external current of air striking the flue cap as indicated by the arrow W in Fig. 1. Such a current would, without any special flue cap, produce a down draft in the pipe extension **28**. It will be evident from the geometry of my novel cap that the continuing downward movement of any infinitely narrow current of air produced by the wind W, after passage into the flue cap, is limited to the angle of the line *x*—*x*. Thus if we assume such an infinitely narrow current of air (comparable to a straight line) impinging upon the novel flue cap at any level on the left-hand side of Fig. 1, clearly it is impossible for such a current of air to pass through one side of the cap into the center with any remaining downward component sufficient to cause a down draft. Such an inclined current of air, for example, striking between the plate **14***a* and the next lower plate (or between any of the plates below such next lower plate) will be turned upwardly by the upwardly directed flanges **22**, as indicated by the arrows. Similarly, any downwardly inclined current of air arriving at the flue cap on the left-hand side at or above the line *x*—*x* and at the same or a steeper angle will at once be straightened at least to the angle *x*—*x* by passage between the plates **14** and, at this angle, it cannot pass down the pipe **28** since it will, upon arriving at the opposite side of the flue cap, strike an up-turned flange **22** and either be directed upwardly within the flue cap or outwardly between the flanges **22** to the exterior.

It is also clear that external currents of air striking the flue cap at a less steep angle than that of the line *x*—*x* will pass between the several plates and will have even less of a tendency to cause any down draft. Horizontal air currents will, of course, pass directly between the upper plates **14** as indicated by the line *z*—*z* and during their passage out the other side will draw with them air or gases coming up into the flue cap from the pipe **28**. Any portions of such currents passing between the inwardly flanged plates **18** will be turned upwardly within the flue cap and the remainder will be diverted exteriorly of the inner section of the cap.

A particular advantage of the construction of my novel cap is that any flow of air around its exterior in any direction, particularly around the outer sides of the curved flanges **22**, tends to draw the air or gas from within, thus inducing or increasing the desired up-draft within the flue on which it is mounted. A similar effect is also caused by any flow of air past the outer edges of the plates **12**, **14**, **14***a* or **18** that does not pass between them into the interior of the cap.

In view of the fact that the geometry of the flue cap is symmetrical in all directions, the flue cap will operate no matter from which direction the wind is coming and there is no need for moving parts to turn the novel device with the wind. I have found that a flue cap as illustrated in Figs. 1 and 2 will operate with great effectiveness on the flues of chimneys where adjacent structures, hills or trees may produce downwardly directed air currents and likewise it will operate with unusual effectiveness as a cap for ventilators which merely serve the purpose of exhausting air from within buildings. The flue cap, according to the invention, is also adaptable and highly effective for use on ventilators or flues of moving trains, motor vehicles, ships, boats, or aircraft, etc., operating with great effectiveness whether or not the vehicle is in motion and requiring no orientation with respect to the wind.

Another embodiment of the invention is illustrated in Figs. 3 and 4 in which the plates of the previous embodiment are shown as non-circular, in this case rectangular or square in configuration with square central openings. The plates, flanges, bolts and openings all function identically as in the previous embodiment and have therefore been given the same numerals. The reference lines, *x*—*x*, *y*—*y* and *z*—*z*, and a supposed wind current striking at the angle W have again been presumed and it will be found that the same geometrical considerations prevail and the flue cap operates as effectively as before. The sectional view of Fig. 4 has been taken along the diagonal line **4**—**4**, this representing the extreme condition with respect to the presumed line *x*—*x*.

As to the number and spacing of the specially shaped apertured plates **14** and **18** needed to accomplish the purposes of the invention, some general rules can be stated. In the first place, configuration of the lower plate sections must be such that no line similar to the line *x*—*x* can be drawn which impinges below the inner edge of the flange of the lowermost plate which marks the bottom of the lowest air passageway from outside into the central cavity of the cap. In the embodiments shown and described the result is accomplished by turning upwardly the inner flanges on the requisite number of lower plates **18**. An engineer skilled in the art can readily compute the number, spacing, dimensions and configuration of plates **18** which will be required, once having been given the cross-sectional area of the flue pipe **28** and the distance between the inner and outer edges of the plates.

The minimum number of plates **14** which should be mounted above the plates **18** likewise can be determined as a practical matter, if not with mathematical exactness. As already stated, if down drafts were non-existent, the ideal flue opening would be an unobstructed hole the size of the flue. In the present invention I have provided a flue cap which achieves the desirable results of eliminating the down drafts and providing a covering against the elements while at the same time departing to the least possible extent from the ideal condition of an unobstructed hole. It, therefore, will be evident that the minimum number of plates **14** required is such, in view of their dimensions and mutual spacing, as to provide passages permitting the escape of air or gases very nearly as freely as if section **28** were uncapped, the diameter of section **28** being substantially the same as that of the flue to be capped. In practice I have found that the number of upper plates and their spacing should probably define a total passageway considerably in excess of the theoretical minimum, this to accommodate some additional volume of air which enters the device all along one side whenever there is an external draft. A flue cap with somewhat less than the theoretical minimum number of plane plates **14**, although operating imperfectly, nevertheless in some conditions might perform the primary function of the invention, namely, to prevent down drafts. Elimination of all or substantially all of the plates **14** would produce substantial inter-

ference with the free flow of escaping air or gases and consequently the advantages according to the invention could not be attained. In view of their dimensions, their spacing should be such as to comply with the rule already stated as to the maximum permissible angle of the line *x—x* or a similar line. Likewise, I have found that excellent results can be obtained when the radius of the central openings in the plate **14** is approximately equal to the radius of a flange **22**. In any event the lowest of the plane plates **14***a* should have an opening whose radius is at least equal to about this amount to permit passage of air between it and the uppermost plate **18**.

While I have herein disclosed and described presently preferred embodiments of the invention, it will nevertheless be understood, as above indicated, that the same is susceptible of numerous modifications and changes nevertheless within the scope of the appended claims. Thus the number, dimensions, spacing and configuration of the various types of plates may be altered within the limits indicated while adhering to the principle of operation. Furthermore, the shape of the plates as circular, square or otherwise, is unimportant so long as at the extreme of any dimensions the limiting angles hereinabove set out are observed. Particularly with respect to the shape of the one or more components forming the lower plate section, it is clear that equivalent shapes performing the same function may be substituted for the upturned flanges **22**, as for example tilting these plates inwardly and upwardly or providing curved portions at different areas from the extreme inner edges. Accordingly, the invention is not limited by the specific embodiments herein disclosed and described but only by the proper scope to be given the appended claims.

I claim:

1. A flue cap comprising a series of plates and mountings holding said plates in generally horizontal, parallel spaced relation, all but the uppermost of said plates having generally aligned openings corresponding generally in area to the cross-sectional area of the flue to be capped and forming an internal cavity in said cap, said plates defining between their opposing surfaces a series of air passageways between said cavity and the exterior of said cap, a sufficient number of the lowermost plates having their inner edges turned upwardly so that no unobstructed inwardly extending straight line may be drawn touching the outer edge of any plate and the inner edge of the next lower plate and reaching a point below the lowermost air passageway between said cavity and the exterior of said cap, the remaining plates having substantially plane surfaces, said cap having a portion at its bottom for attaching it to a flue.

2. A flue cap comprising a series of plates, and mountings holding said plates in generally horizontal,

parallel spaced relation, said plates forming upper and lower plate sections, all but the uppermost of said plates having central openings corresponding generally in area to the cross-sectional area of the flue to be capped and forming an internal cavity in said cap, said plates defining between their opposing surfaces a series of air passageways between said cavity and the exterior of said cap, a sufficient number of individual plates of the lower plate section having inwardly and upwardly projecting portions whose upper edges extend at least as high as the plane of the bottom surface of the individual plates next uppermost so that no unobstructed inwardly extending straight line may be drawn touching the outer edge of any plate and the inner edge of the next lower plate and reaching a point within said cavity below the lowermost air passageway between said central cavity and the exterior of said cap, the plates of the upper section having substantially plane surfaces, said lower section having a mounting portion for attaching said cap to a flue.

3. A flue cap comprising a series of plates, said plates having aligned mounting holes, and mounting elements fitting said holes and spacers thereon holding said plates in generally horizontal, parallel spaced relation, said plates forming upper and lower plate sections, all but the uppermost of said plates having central openings corresponding generally in area to the cross-sectional area of the flue to be capped and forming an internal cavity in said cap, said plates defining between their opposing surfaces a series of air passageways between said cavity and the exterior of said cap, a sufficient number of individual plates of the lower plate section having inwardly and upwardly projecting portions whose upper edges extend at least as high as the plane of the bottom surface of the individual plates next uppermost so that no unobstructed inwardly extending straight line may be drawn touching the outer edge of any plate and the inner edge of the next lower plate and reaching a point within said cavity below the lowermost air passageway between said central cavity and the exterior of said cap, the plates of the upper section having substantially plane surfaces.

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