

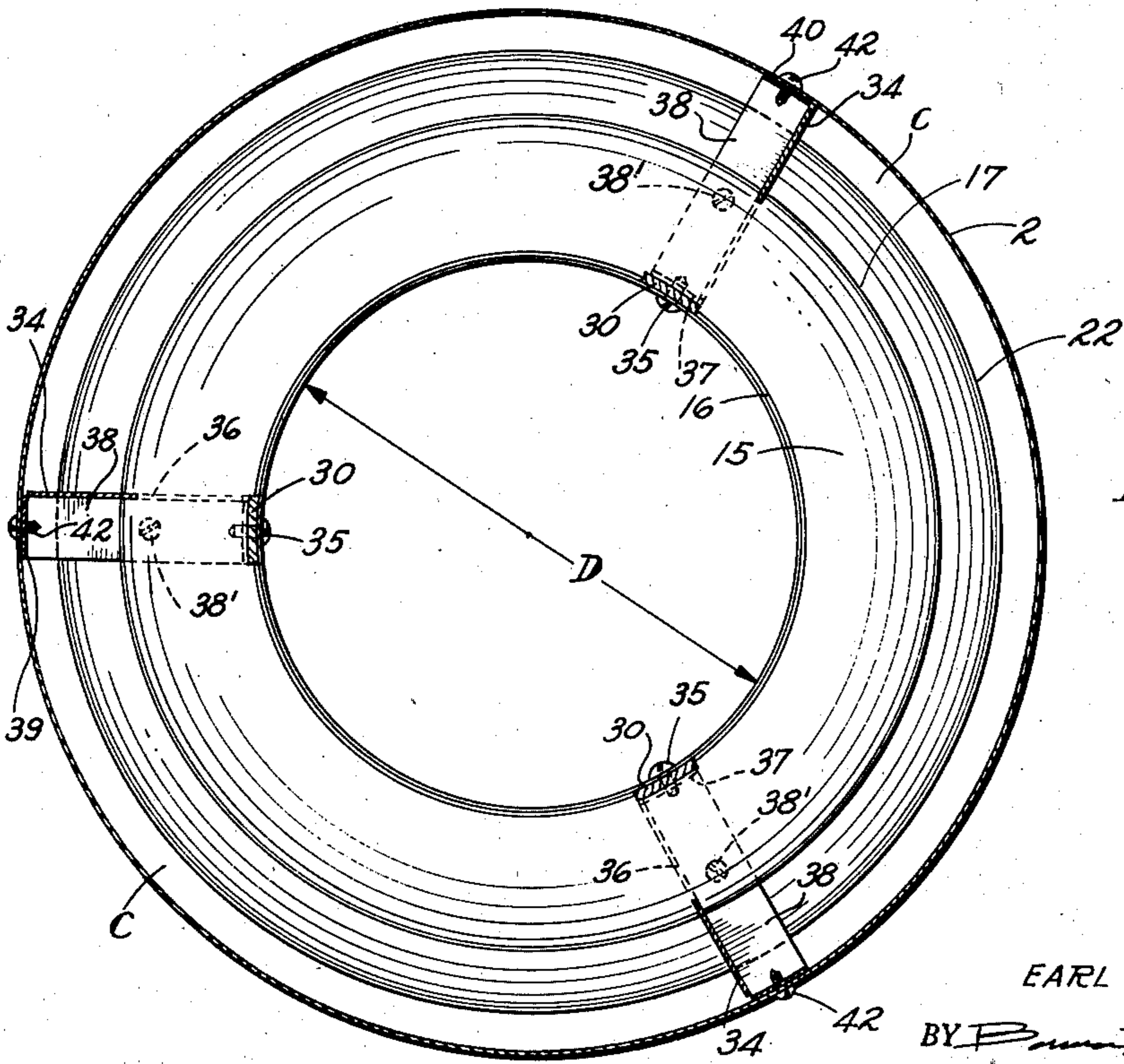
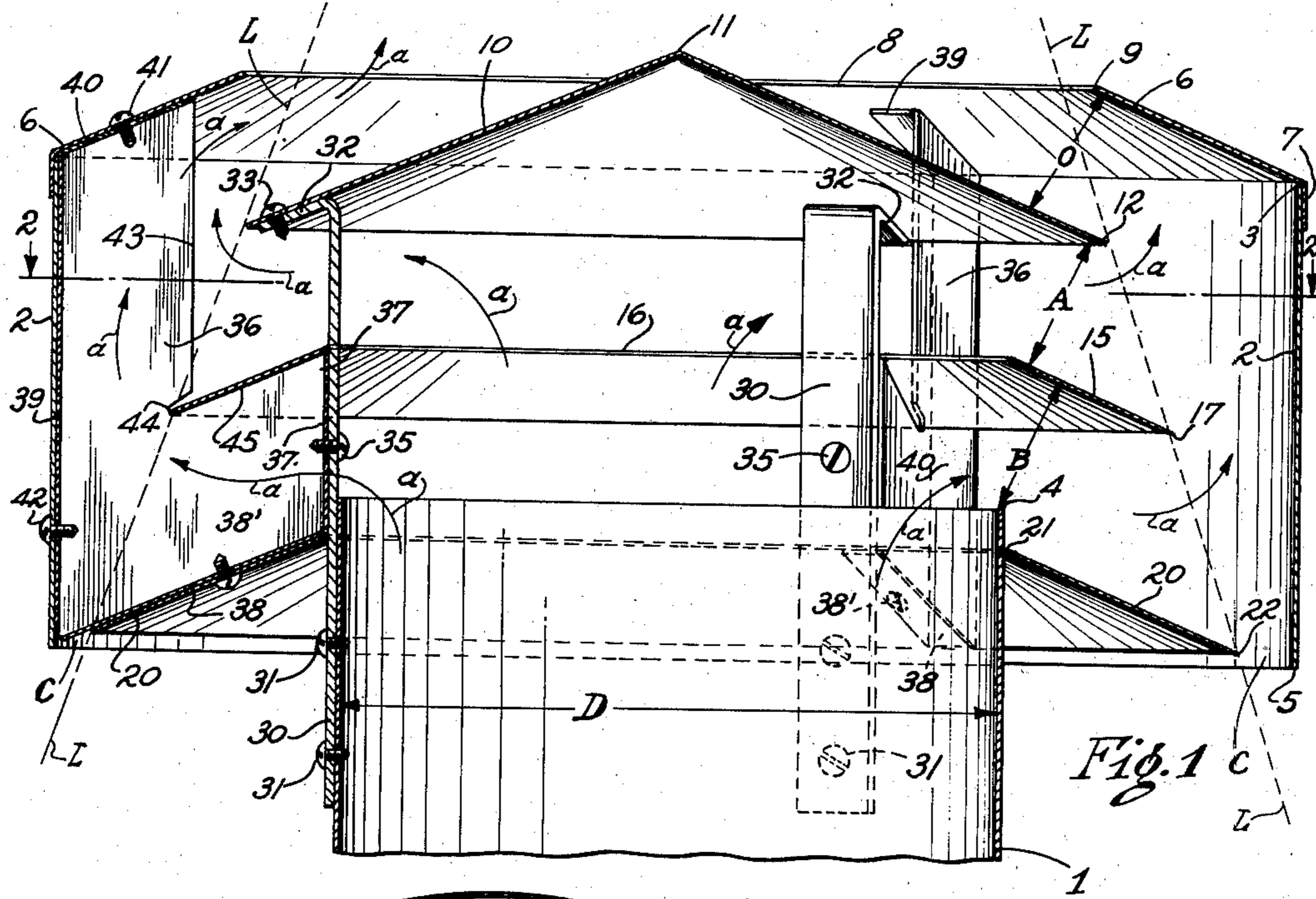
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SMOKE JACK

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SMOKEJACK

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This invention relates to smoke jacks and more particularly to means of the fixed or stationary type for controlling the draft in flues and performing other desirable functions in conjunction therewith.

For the sake of illustration but without limitation the smoke jack of my invention may be considered in the environment of a flue and the familiar types of stoves employed in dwellings, camp cabins, Nissen huts and the like. Such stoves for the many years of their wide use have chronically operated too hot or too cold, requiring endless manipulation of the draft doors or openings and dampers, all subject to and at the mercy of great and often continuous changes in the natural draft as induced by outside air movement around and adjacent the top of the flue. Down-drafts forced smoke, noxious gases and ashes into the room, and changes in the outside wind velocity alternately caused an excessive rate of combustion on the one hand or incomplete combustion on the other hand. These things have not only caused inconveniences, burning of grates and injury to the stoves and flues, but have also been detrimental to health and hazardous of the life and safety of the persons using such stoves.

It is among the objects of my invention to provide a smoke jack to regulate the flow of products of combustion from stoves, furnaces, and the like, in a safe and desirable manner and which on the one hand will prevent down-drafts and on the other hand will induce a substantially constant aid to the natural up-draft regardless of the direction or velocity of the outside wind. Another object is to provide a smoke jack that is weather-tight and sparkproof, i. e., prevents the ingress of rain etc. and inhibits the egress of sparks or burning parts or particles of fuel. Another object is to provide a smoke jack which is light-proof or "blackout proof" so that no light or glow from within the end of the flue is visible through or beyond the smoke jack. Another object is to provide a smoke jack which in its influence upon the draft through the stove or furnace and flue permits even firing, provides uniform heating, retards or eliminates the burning of grates, and preserves desirable and economical air-fuel ratios substantially free from disturbance due to changes in exterior wind or atmospheric conditions. Another object is to provide a smoke jack which will eliminate or reduce the need for compensating check drafts and down-drafts preventers or compensators. Another object is to provide a smoke jack capable of carrying out from all of the foregoing objects that is simple in design and construction, pleasing in appearance, and rugged, durable, and economical in its construction and operation. Other objects include the provision of a smoke jack capable of carrying

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out the foregoing objects that is free of moving parts and which will perform the service desired of it under widely varying conditions of operation.

Other objects will appear from the following description of a preferred form and embodiment of my invention reference being had to the accompanying drawings in which Fig. 1 is a vertical longitudinal section showing the smoke jack of my invention mounted on and associated with the top end of a flue, and Fig. 2 is a horizontal transverse section taken along the line 2—2 of Fig. 1 for convenience of illustration and arranging of the figures in the drawings.

In the preferred form of my invention shown in the drawings I have illustrated my smoke jack mounted upon and operatively associated with the upper and out-of-door end of a cylindrical flue 1 through and from which emanate smoke and other products of combustion. Ordinarily the upper end of the flue upon which the smoke jack is mounted will rise from a properly flashed roof opening, not shown, according to common practice. The smoke jack embracing my invention comprises an annular storm band 2 preferably of cylindrical form and of about twice the diameter of the flue and disposed coaxially thereof with its upper edge 3 disposed above the upper edge 4 of the flue and with its lower edge 5 disposed lower than the upper edge 4 of the flue preferably substantially as shown in Fig. 1. Overlying the upper edge of the storm band 2 in substantially fluid or weather tight relation to the upper edge 3 thereof is disposed an upper baffle 6 which rises upwardly and extends inwardly from the upper edge 3 of the storm band preferably in conical form. The upper baffle may conveniently have a lower cylindrical flange 7 overlying the upper-most portion of the storm band and forming an overlapping joint therewith and centering the parts coaxially. The upper baffle 6 has a central, preferably circular, opening 8 comprising the main exhaust opening of the smoke jack defined by the upper and inner circular edge 9 of the upper baffle 6. Overlying the open end of the flue 1 is a conical cap or canopy 10, the peak of which 11, preferably rises a little higher than the edge 9 of the upper baffle. The lower circular edge 12 of the cap 10 lies under and spaced below the upper-inner edge 9 of the upper baffle 6, preferably in under lapping relation whereby to exclude rain or weather from direct ingress into the top of the flue.

About midway vertically between the upper edge 4 of flue and the underside of the cap or canopy 10 is disposed an intermediate or center baffle 15 of frusto-conical form pitched substantially at the same inclination as are the conical surfaces of the baffle 6 and the cap 10. The

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upper edge 16 of the baffle 15 defines a circular opening disposed coaxially of the flue and in the form shown of substantially the same diameter. The center baffle 15 terminates in a lower preferably circular edge 17 of substantially greater diameter than the lower edge 12 of the cap 10, approaching the storm band more closely than the lower edge of the cap. The center baffle as arranged and shown in the drawings lies substantially transversely of the path which smoke leaving the flue in its upward and outward movement from the end of the flue would otherwise tend to take to reach the annular outlet between the cap 10 and the upper baffle 6. The lineal dimension from the inner edge 16 to the outer edge 17 of the center baffle 15 may be varied somewhat from the proportions illustrated in the drawings to modify the freedom of flow of smoke from the flue by making the smoke take a more tortuous path without altering the net minimum cross sectional area of egress from the end of the flue to the annular outlet at O. Thus the annular area measured at A between the bottom edge of the cap 10 and the top of the center baffle 15 and the annular area at B between the center baffle 15 and the top edge 4 of the flue will remain the same even though the center baffle 15 is extended inwardly to reduce the diameter of the circular opening 16. Apart from increasing the tortuousness of the path, decreasing the diameter of the opening 16 and/or increasing the diameter of the edge 17 will at a point also restrict the net cross-sectional area of the path to restrict the outflow for that reason. Where my smoke jack is to be employed in climates where unusually persistent high winds are encountered, I prefer to reduce the diameter of the opening 16 somewhat as a means of affording a permanent throttle of the flow of gases from the flue through the jack.

Lying below the upper edge 4 of the flue and somewhat above the lower edge 5 of the storm band is disposed a lower annular baffle 20 of frusto-conical form preferably pitched at substantially the same pitch as the cap and the center baffle. The upper inner edge 21 of the baffle 20 lies closely adjacent and preferably substantially tight against the outer surface of the flue fitting there against for practical purposes within the range of economically manufacturing tolerances. The lower outer edge 22 of the baffle 20 lies a little above, inwardly of and coaxial with the lower circular edge 5 of the storm band 2. Between the circular edges 5 and 22 is an annular opening C, the area of which I prefer to be substantially half of the cross sectional area D of the flue. As shown in the drawings the area within the circular opening 16 may be substantially equal to the area of the flue, and the annular area in the horizontal plan between the edge 17 and the adjacent storm band may also be substantially as great as the area D of the flue in the preferred form. In the preferred form each of the transverse annular areas A and B may be substantially equal the area D of the flue. The net transverse annular area at O may in the preferred form exceed the area D of the flue by about 30 to 40%, and the top opening 8 in the upper baffle is preferably as shown of greater area than the area of the flue, which taken with the protrusion of the cap 11 is no less effective than the area at O.

When there is little or no air movement exteriorly of the smoke jack the relative heat and density of the products of combustion will cause

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them to move generally as shown by the curved arrows $a-a$ in Fig. 1 upwardly in somewhat tortuous paths around the inner and outer edges of the center baffle and around and over the lower edge of the cap and through the area O and the upper outlet opening 8. Under these conditions the smoke jack will offer little resistance to the natural draft since the most restricted passage in the path or paths of egress for the smoke is greater than the area of the flue. When however, an outside wind moves past and across the smoke jack it tends, as is understood in the art, to produce a low pressure area to leeward of the mass of the smoke jack and flue as well as a somewhat high pressure area to windward thereof. While I am not entirely certain of all the philosophical theories and details of the movements of air and gases within and without the structure of my invention, my tests and observations lead me to believe that a transverse wind movement while tending to draw gases more rapidly through the main opening 8, also traps outside air under the baffle 20 and forces the air through the opening C to the interior of the storm band with the result that the net amount of smoke or products of combustion exhausted through the opening 8 remains substantially constant even though the whole mixture of outside air and products of combustion passing through the opening 8 increases with the increase of velocity of movement of outside air or wind.

If the wind passing the smoke jack has an upward inclination, as is often incident to a slope of the roof below it, a greater rarefaction tends to be produced about the opening 8, but correspondingly a greater pressure tends to be created below at least part of the opening C. Thus these effects tend to balance each other and tend to keep substantially constant the aid to the natural draft in the flue. If the wind is so inclined with respect to the smoke jack and the flue as to tend more or less to enter the upper opening 8 and tend to induce a down-draft in the flue, i. e., to build up a pressure within the storm band tending to impair the natural draft, then the inclination of the cap and the center and lower baffles tend to spill any such excess of air or air and gases downwardly and out through the opening C. That is to say, that wind movement which tends to build up pressure above the smoke jack and rarefaction below it while possibly retarding the movement of smoke through the upper opening 8 correspondingly tends to increase the out-flow of gases and/or air and gases through the lower opening C. In this connection I have indicated by the broken lines L in Fig. 1 that I prefer that the edges 12, 17 and 22 of the cap and baffles therebelow be preferably aligned to lie respectively in concentric circles in the surface of a steep cone whereby to facilitate flow to and through the lower opening C and/or spilling of air and/or gases out of the lower opening C under such conditions as those last above described.

With the parts proportioned substantially shown in Fig. 1 and made of sheet metal or galvanized sheet metal as is common practice in the art, I have found, that my smoke jack tends to increase the natural draft through the flue about 5 to 10% when the outside air movement is substantially horizontal and at the rate from about 4 to 6 miles per hour. In the temperate zone this rate of air movement is generally found even on so called quiet days or in so called still air. My smoke jack however, whether for the reason mentioned above or from reasons now

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unknown to me, operates in such a manner that as outside air movement increases up to as much as 30 or 40 miles per hour that even this greatly increased wind velocity will not tend to increase the natural draft through the flue substantially more than about 20%. Similarly, if the wind velocity increases even up to hurricane speed, my smoke jack prevents anything like proportionate increase in velocity of movement of gases through the flue. My observations have been that even these very high wind velocities will not tend to increase the velocity of flue gases more than about 20% to 25% above the unaided natural draft.

Thus my smoke jack tends to maintain a substantially constant and desirable aid to the natural draft through the flue throughout a wide range of wind velocities and directions, tending always to aid the natural draft in a desirable way and amount, never tending to obstruct or impair the natural draft and always tending to hold the movement of flue gases within a desirable and substantially constant range.

To secure the several operational parts in the desired relation to each other and to provide compact and economical means for making and assembling and/or removing and replacing some or all of the parts, I provide preferably three main braces or struts 30 spaced circumferentially and extending longitudinally of the jack and flue. Each of the braces 30 preferably lie exteriorly of the upper end of the flue and may be secured thereto by such means as metal screws 31. Each of the braces 30 passes upwardly interiorly of the inner edge 21 of the lower baffle 20 which edge may be notched for that purpose if the size of the struts 30 be thick enough to space the edge 21 substantially away from the outer surface of the flue. The upper ends 32 of the struts 30 are turned back at a re-entrant angle as shown in Fig. 1 and underlie the lower and outer parts of cap or canopy 10 which is secured thereto and supported thereby by such means as metal screws 33. Intermediately the ends of the struts or braces 30, gusset plates 34 are securely attached by such means as metal screws 35 and each gusset 34 has supporting engagement with the storm band and the baffles 6, 15, and 20. The gussets are preferably made of sheet metal, each having a main flat or body part 36 extending longitudinally of the smoke jack and lying in radial planes therewithin. Each gusset has an interior turned edge or flange 37 which lies against each of the struts 30 and receives the screw or attaching means 35, and each gusset has a lower turned edge 38 which lies co-extensively with the upper surface of the lower baffle 20 to which it is fixedly secured as by attaching means or screws 38'. The gussets also have their outer and upper most edges turned as at 39 and 40 which edges co-extend with the storm band 2 and upper baffle 6 respectively, and are joined in fixed relation thereto by attaching means such as the metal screws 41 and 42 respectively. As will appear most clearly in Fig. 1 the main body parts 36 of each of the gussets is cut back to an upper narrowness along the edge 43 and is notched at 44 to secure the outer edge 17 of the middle baffle, and is cut along the line 45 to underlie and support the middle baffle in its desired angle and conical disposition as shown in Fig. 1. The interior edge 16 of the middle baffle may be notched as may be necessary or desirable to accommodate the struts 30, where the interior edge 16 is desired to form a

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circle somewhat smaller than the circle defined by the outer faces of the struts. Although the edge 43 is shown spaced considerably away from the edge 12 of the cap 10, these edges may lie more closely adjacent. In all events the gussets 34 not only function structurally as above described but preferably contribute to the aerodynamics of the device by inhibiting circumferential currents within the storm band.

The smoke jack constructed, as above described, need contain only forms and shapes separately known in the sheet-metal working arts, and can be made readily and economically by means familiar to sheet-metal workers. Employing the struts and gussets above described, as I prefer, with quick attachable screws securing the baffles, storm band and cap facilitates assembly on the job wherever it is desirable or economical to do so.

While I have illustrated and described a preferred form of my invention and expressed my best understanding of the manner in which the advantages and results are obtained, various modifications, changes and improvements will occur to those skilled in the art within the teachings, practices, and precepts of my invention, and I do not care to be limited in the scope of my patent to the preferred form and embodiment of my invention herein illustrated and described, nor to any particular theory of the operation thereof or in any manner other than by the claims appended hereto.

I claim:

1. A smoke jack adapted to be associated with and supported by the open top end of a flue comprising a right conically formed cap with its apex disposed substantially in the axis of the flue and with its base edge of greater diameter than the flue, an annular storm band having a cylindrical part coaxial of the flue and extending from below the end of the flue to above the base edge of said conical cap and radially spaced from the edge of said cap and from said flue, said storm band also comprising an upper intumed inclined portion substantially paralleling the conical surface of said cap and spaced therefrom and defining a central circular opening coaxial of said flue and above the base edge of said cap, the apex of said cap protruding through said opening, a middle baffle of frusto-conical form disposed substantially midway between the end of the flue and said cap and having its surface inclined substantially parallel to the surface of said cap and having a circular opening coaxial of said flue and having its outer edge spaced from said storm band, a lower baffle of frusto-conical form pitched like said cap and said middle baffle having its inner upper edge substantially contacting the outer surface of said flue below the open end thereof and having its lower outer edge spaced from said storm band above the lower edge thereof and defining an annular opening therebetween of an area about one half the area of the area of said flue, vertical struts supported by the upper end of said flue and spaced circumferentially thereabout and having bent ends supporting said cap, and gussets having planar body parts lying in vertical radial planes outwardly of said struts and having bent edge portions secured to said struts and secured to said storm band and said lower baffle and securing same in assembled relation, said gussets also having notched edges supporting said middle baffle.

2. A smoke jack adapted to be associated with

and supported by the open top end of a flue comprising a conically formed cap with its apex disposed substantially in the axis of the flue and with its base edge of greater diameter than the flue, an annular storm band having a cylindrical part coaxial of the flue and extending from below the end of the flue to above the base edge of said conical cap and radially spaced from the edge of said cap and from said flue, said storm band also comprising an upper inturned inclined portion substantially paralleling the conical surface of said cap and spaced therefrom and defining a central circular opening coaxial of said flue and above the base edge of said cap, the apex of said cap protruding through said opening, a middle baffle of frusto-conical form disposed between the end of the flue and said cap and having its surface inclined substantially parallel to the surface of said cap and having a circular opening coaxial of said flue and having its outer edge spaced from said storm band, and a lower baffle of conical form pitched similarly to said cap and said middle baffle having its inner upper edge substantially contacting the outer surface of said flue below the open end thereof and having its lower outer edge spaced from said storm band above the lower edge thereof and defining an annular opening therebetween for the passage of air and smoke therethrough, the outer edges of said cap and said middle and lower baffles lying substantially in the surface of a steep cone the axis of which substantially coincides with the axis of said flue and the apex of which lies beyond the apex of said cap.

3. A smoke jack adapted to be associated with the open top end of a flue comprising a conically formed cap overlying the open end of the flue with its apex disposed substantially in the axis of the flue, an annular storm band having a cylindrical part coaxial of the flue and extending from below the open end of the flue to above the lower part of said conical cap and radially spaced from the peripheral edge of said cap and said flue, said storm band also comprising an upper inturned inclined baffle substantially paralleling the conical surface of said cap and spaced therefrom and defining a central circular opening coaxial of said flue and above the lower part of said cap, a middle baffle of frusto-conical form disposed between the end of the flue and said cap and having its surface inclined substantially parallel to the surface of said cap and having a circular opening coaxial of said flue and having its outer edge spaced from said storm band, a lower baffle of conical form inclined substantially parallel to the surface said cap and said middle baffle and having its inner upper edge substantially contacting the outer surface of said flue below the open end thereof and having its lower outer edge spaced from said storm band and above the lower edge of said storm band and defining an annular opening there-between, gussets having planar body parts lying in vertical radial planes outwardly of said flue and having bent edge portions secured to said storm band and said upper and lower baffles, said gussets also have an upwardly facing notched edge supporting said middle baffle, and means carried by said flue supporting said gussets and said cap.

4. A device of the class described adapted to be associated with and supported by the open top end of a flue comprising a conically formed cap with its apex disposed substantially in the axis of the flue and with its base edge of greater

diameter than the flue, an annular storm band having a cylindrical part coaxial of the flue terminating in a lower circular edge disposed below the end of the flue and extending to above the base edge of said conical cap and radially spaced from the edge of said cap and from said flue, said storm band also comprising an upper inturned inclined portion substantially paralleling the conical surface of said cap and spaced therefrom and defining a central circular opening coaxial of said flue and above the base edge of said cap, a middle baffle of frusto-conical form disposed between the end of the flue and said cap and having its surface inclined substantially parallel to the surface of said cap and having a circular opening coaxial of said flue and having its outer edge spaced from said storm band, and a lower baffle of frusto-conical form pitched similarly to said cap and said middle baffle having its inner upper edge substantially contacting the end of said flue and having its lower outer edge spaced from said storm band adjacent the lower edge thereof and defining an annular opening therebetween of approximately half the area of said flue for the passage of air and smoke therethrough, the outer edges of said cap and said middle and lower baffles lying substantially in the surface of a steep cone the axis of which substantially coincides with the axis of said flue and the apex of which lies beyond the apex of said cap.

5. A smoke jack adapted to be associated with the open end of a flue comprising an upright conical cap overlying the end of the flue and spaced therefrom with its apex higher than its base edge, spaced frusto-conical baffles disposed below the edge of said cap and lying generally parallel therewith, the base edges of said baffles along with the base edge of said cap lying in the surface of a reference cone whose axis is aligned with the axis of the flue and whose apex lies above the apex of said cap, the inner edge of the lowermost of said frusto-conical baffles engaging the upper end of said flue, and a cylindrical storm band disposed coaxially of said flue having its lower circular edge terminating near the base edge of the lowermost of said baffles and without said cone, and a conically formed baffle resting on the upper edge of said storm band and lying inwardly therefrom substantially parallel with said cap with its inner edge also terminating without said cone, the space between said storm band and the base edge of the lowermost of said baffles being less than the area of the flue.

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