

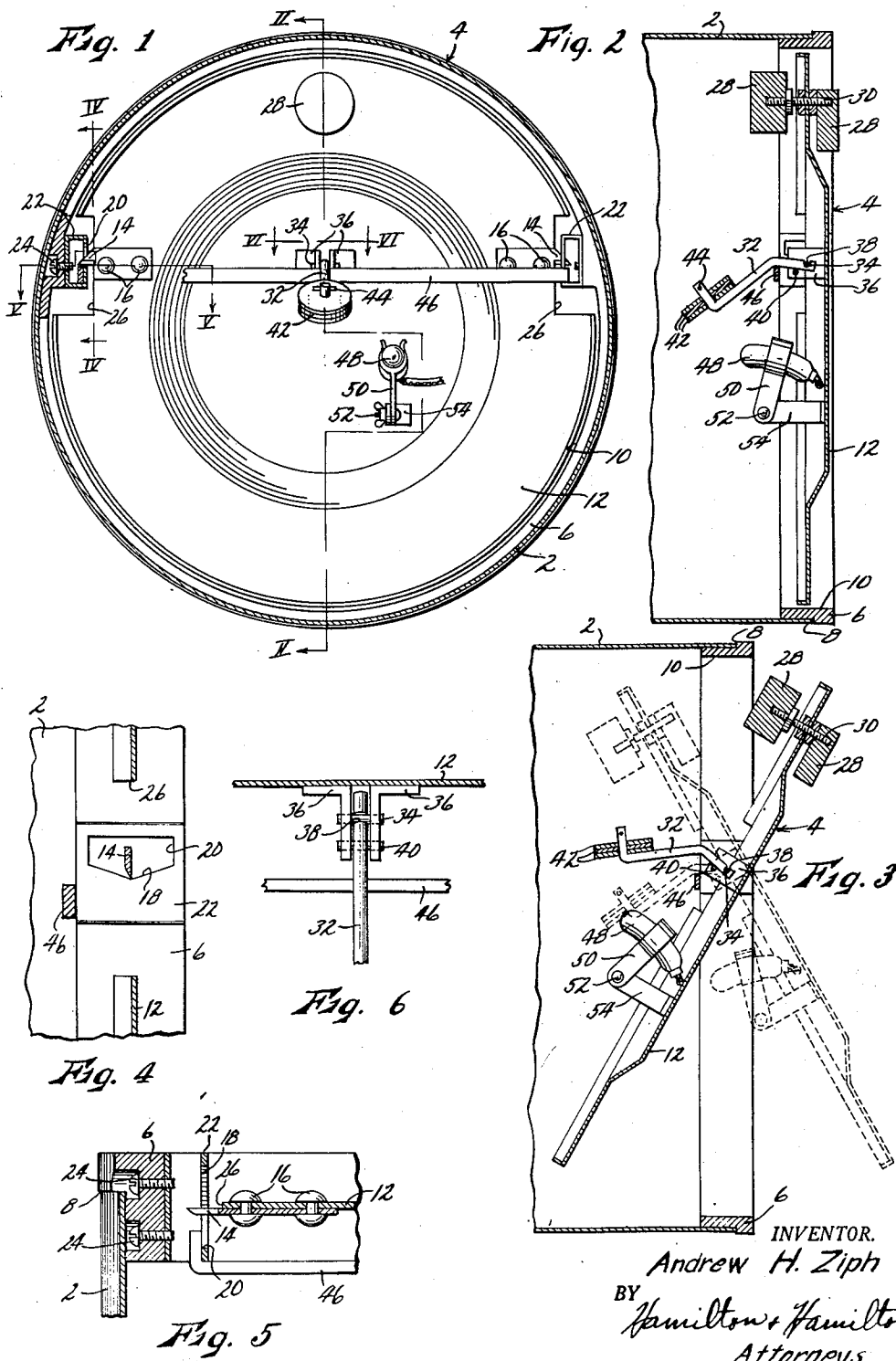
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A. H. ZIPH

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DRAFT REGULATOR WITH DOWNDRAFT SAFETY MEANS

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INVENTOR.
Andrew H. Ziph
BY
Hamilton & Hamilton
Attorneys.

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DRAFT REGULATOR WITH DOWNDRAFT SAFETY MEANS

Andrew H. Ziph, St. Joseph, Mo., assignor to Walker Manufacturing and Sales Corporation, St. Joseph, Mo., a corporation of Missouri

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1 Claim. (Cl. 236—45)

This invention relates to new and useful improvements in draft regulators for combustion apparatus, and has particular reference to draft regulators of the "barometric" type which, once set for the desired draft pressure, will automatically maintain the desired draft despite variations of the natural or stack draft. In general, this type of draft regulator utilizes a draft-relieving opening in the flue or stack connection of the combustion apparatus, and a damper operable to regulate said opening and movable responsively to variations of the stack draft to admit greater or smaller quantities of air.

The principal object of the present invention is the provision of a draft regulator of the type described wherein the damper also opens responsively to a higher pressure within the stack, whereby to vent air to the atmosphere air passing down the flue to the combustion apparatus. This condition is commonly known as a "downdraft" and is dangerous since it interferes with proper combustion and may in some cases blow out the flame. This object is accomplished generally by the provision of a damper door which is counter-balanced to remain normally closed, but will swing in one direction to relieve and regulate a normal or "updraft," and in the opposite direction to relieve a downdraft.

Another object is the provision, in a draft control device of the character described of means whereby counterweights may be added or subtracted to vary the draft pressure required to swing the door open in the direction of an updraft, whereby to regulate said updraft to any desired level, but wherein said added counterweights are automatically rendered inoperative whenever the door swings to its closed position or to its downdraft regulating position, whereby not to interfere with the normal closed position of the door.

Other objects are simplicity and economy of structure, efficiency and dependability of operation, and adaptability for use with various types of combustion equipment.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

Fig. 1 is an inside elevational view of a draft regulator, embodying the present invention,

Fig. 2 is a sectional view taken on line II—II of Fig. 1, showing the damper door closed,

Fig. 3 is a view similar to Fig. 2, showing the damper door pivoted as for a normal updraft in solid lines, and pivoted as for a downdraft in dotted lines,

Fig. 4 is an enlarged fragmentary sectional view taken on line IV—IV of Fig. 1,

Fig. 5 is an enlarged fragmentary sectional view taken on line V—V of Fig. 1, and

Fig. 6 is an enlarged fragmentary sectional view taken on line VI—VI of Fig. 1.

Like reference numerals apply to similar parts throughout the several views, and the numeral 2 applies to a horizontal pipe adapted to be interconnected at one end to the flue pipe or stack connection, not shown, of a

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combustion apparatus, and carrying the draft regulator, designated generally by the numeral 4, at its opposite end. Said regulator includes an open cylindrical ring 6 inserted frictionally into pipe 2, said ring having a rearwardly facing external peripheral shoulder 8 which limits the insertion of said ring into said pipe. The inner diameter of said ring defines an air inlet and outlet opening 10, which is normally substantially closed by a generally planar circular damper door 12. Said door is pivotally supported in said opening by a pair of knife-edged bearing members 14 fixed respectively to opposite edges of the door by means of rivets 16. The knife edges of said bearing members are horizontal and coaxial, lying substantially in the plane of the door. Each bearing member is supported pivotally in the V-shaped lower edge 18 of a window 20 formed in a bracket 22 which is secured to ring 6 by means of screws 24 (see Figs. 1, 4 and 5). Door 12 is notched at 26 to accommodate the bearing brackets.

The door axis defined by bearings 14 divides the door 12 into an upper minor segment and a lower major sector. It is apparent that if a normal updraft condition exists, so that a sub-atmospheric pressure exists in the flue, then the higher pressure on the outer surface of the lower major segment will cause said lower segment to swing inwardly as shown in solid lines in Fig. 3. On the other hand, if an abnormal downdraft condition exists, then the flue pressure will be positive, and will tend to swing the lower segment of the door outwardly, as shown in dotted lines in Fig. 3. The pivotal axis of the door is disposed well above its geometric center and also its center of gravity, so that the door is normally urged by gravity to its vertical or closed position as shown in Fig. 2. The excess weight of the lower door segment over the upper segment is partially counter-balanced by a pair of weights 28 secured to the upper door segment by any suitable means such as screw-rod 30. The lower door segment must retain sufficient excess weight to cause the door to close by gravity as described, but must at the same time be closely enough balanced that it will swing open at the minimum draft it may be desired to regulate.

Adjustment of the regulator to provide different drafts is accomplished by mechanism best shown in Figs. 2 and 6. A lever arm 32 is pivoted at one end on a pin 34 which is mounted rigidly between a pair of brackets 36 fixed to the inner surface of door 12. Pin 34 is preferably coaxial with the knife edges of bearing members 14, and engages in a notch 38 formed in the upper edge of lever 32. Said lever extends inwardly from the door and is supported adjacent pivot pin 34 by a pin 40 also fixed in brackets 36. Adjacent its free end, lever 32 has a plurality of washers 42 mounted thereon and retained by a pin 44 or the like inserted transversely through the lever. Said washers act as counterweights resisting inward swinging of the door, and hence by adding or subtracting washers, the draft pressure required to swing the door inwardly may be adjusted. For example, if more washers are added, the regulator will permit a greater draft pressure to build up before the door will swing inwardly to admit air to prevent the draft from becoming still greater. However, since the opening of the door is substantially proportioned to the draft pressure, the regulator will, once properly set, function to maintain the desired draft despite variations in the stack draft, by opening or closing to admit greater or smaller quantities of air.

In order to prevent the variable weight represented by washers 42 from affecting the normal closed position of the damper door, means are provided for removing this weight from the door when said door is closed, or swung outwardly in its downdraft position. This means comprises a bar 46 extending horizontally behind door 12

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substantially at the level of the door axis, the ends of said bar being welded or otherwise fixed in bearing brackets 22. Said bar is so positioned that when the door is closed as in Fig. 2, or swung outwardly as for a downdraft as shown in dotted lines in Fig. 3, lever 32 will be supported on said bar, removing the weight of washers 42 from the door. However, at the first inward swinging of the door toward its updraft position, as shown in solid lines in Fig. 3, pin 40 lifts lever 32 away from bar 46, and washers 42 are then supported by the door and act as counterweights as previously described.

The door will of course swing outwardly as previously described in the event of a downdraft, venting air from the stack to relieve the downdraft. The relief cannot be complete, however, since at least some downdraft pressure is necessary to hold the door open, and in some cases the capacity of the door to vent air may be insufficient. A downdraft may still be dangerous, therefore, if it exceeds a certain magnitude, since there would be the possibility that the burner flame could be snuffed out, and if a downdraft of such magnitude should persist for more than a certain length of time, since there would be danger that even if the flame were not extinguished, poor or incomplete combustion would result.

Provision is therefore made of means operable by the damper door movement to shut off the burner of the combustion apparatus if a downdraft should exceed a predetermined amount, and should persist for a predetermined length of time. This means includes a tilt-responsive switch 48 mounted on the inside surface of the damper door. As shown, said switch is of the type comprising a closed, elongated tube with a pair of contacts sealed in one end thereof and a small pool of mercury or other conducting fluid therein. When the tube is tilted in one direction with the end thereof carrying the contacts lowermost, the mercury pool engulfs and electrically interconnects the contacts, thereby closing the switch. When the tube is tilted in the opposite direction, the mercury pool runs away from the contacts and thereby opens the switch. The switch is mounted in a clip 50 secured by clamp bolt 52 to a bracket 54 fixed to door 12. As shown, the switch is so positioned that with the damper door closed, or in its updraft position, the switch will be closed. By means of a suitable electric circuit not here described, this permits the burner to remain in operation. If the door moves a sufficient distance in a downdraft direction to tilt switch 48 in the opposite direction, the switch will open. By means of a suitable switching circuit not here described, the opening of the switch will, after a predetermined time delay, cause the burner to be shut off. Clamp bolt 52 may be loosened and the angularity of clip 50 relative to the door may thus be adjusted. In this manner, the degree of downdraft required to shut off the burner

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may be changed. It will be noted also that the tube of switch 48 is curved, being upwardly convex. This provides that once the door has swung far enough in one direction to open the switch, it must swing a substantial distance in the opposite direction before the switch will again close. This prevents the switch from assuming a "balance" position wherein a slight rocking movement thereof would cause a rapid alternate turning off and on of the burner. It will of course be understood that the lead wires to switch 48 must be flexible so as not to interfere with the movement of the door.

Although I have shown a specific embodiment of my invention, it is apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention as defined by the scope of the appended claim.

What I claim as new and desire to protect by Letters Patent is:

A draft regulator comprising a frame ring defining an air inlet and outlet opening, said frame being adapted to be inserted in an opening to the flue pipe of a combustion apparatus, a damper door pivotally mounted in said ring on a horizontal axis lying substantially in the plane of the door and above the center thereof whereby to divide said door into a lower major segment and a minor upper segment, whereby the door will normally remain closed by gravity, and the lower segment will be swung inwardly toward the flue side of the frame by a negative pressure updraft in the flue, and outwardly toward the opposite side of the frame by a positive pressure downdraft in the flue, a lever pivoted to said door coaxially with the pivotal axis of said door and extending inwardly from the plane thereof, a weight carried at the free end of said lever, a support member fixed to said frame whereby to engage and support said lever when said door is closed or pivoted outwardly, and a lift member fixed to said door and operable to engage and elevate said lever from said support member when said door is pivoted inwardly.

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