Aug. 16, 1938. G. J. IRSCH ET AL 2,126,994

AUTOMATIC DRAFT CONTROLLER

Filed Nov. 14, 1934 2 Sheets-Sheet 1

FIG. 1

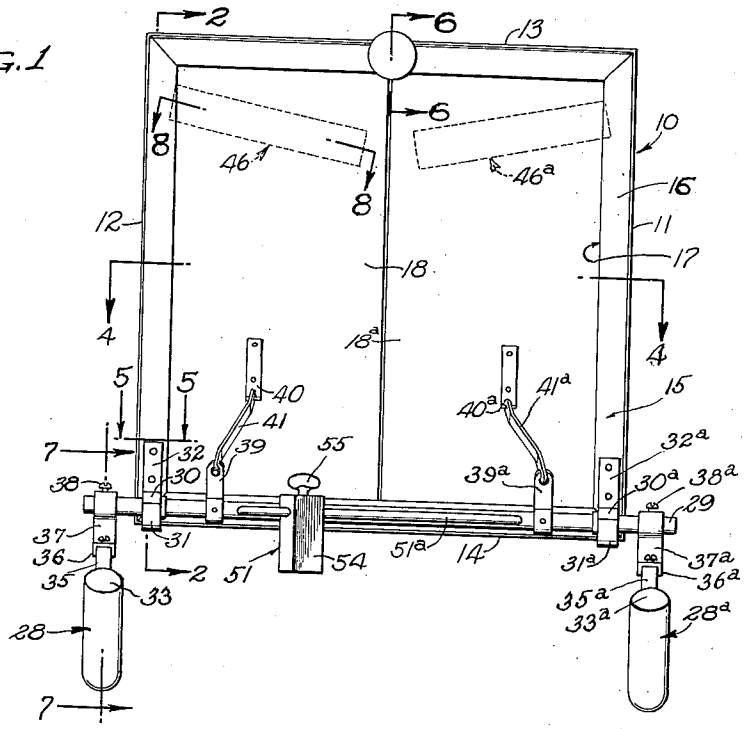



FIG. 2

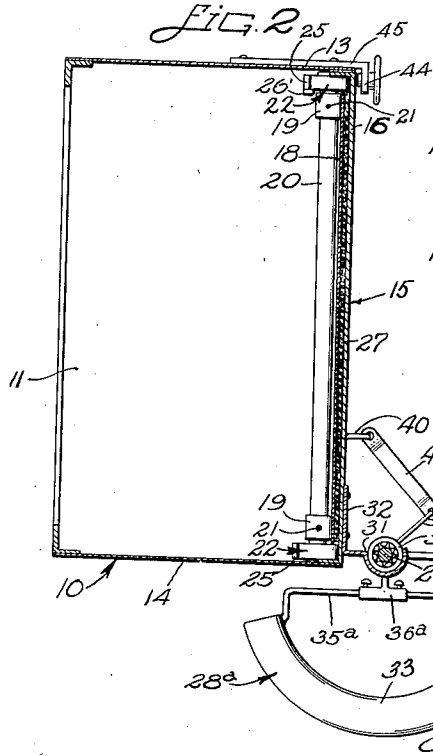
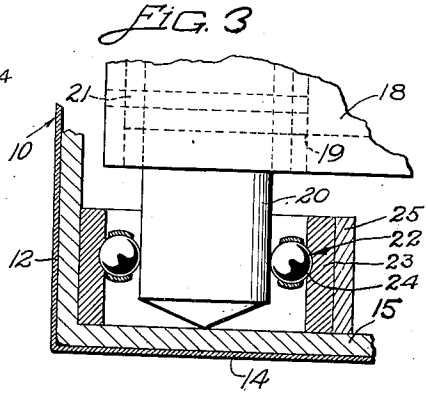



FIG. 3




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FIG. 4

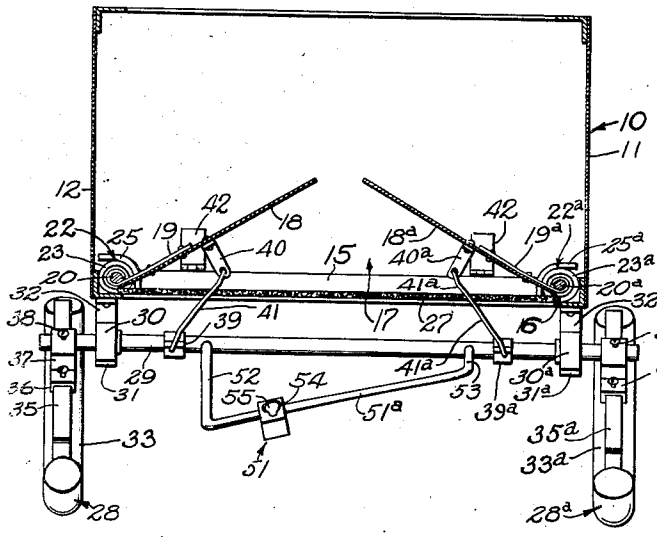



FIG. 5

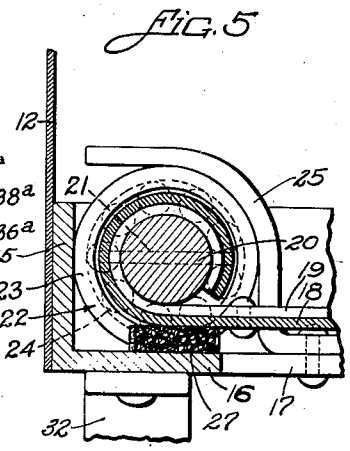



FIG. 6

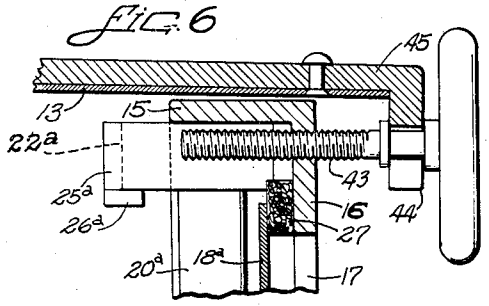



FIG. 8

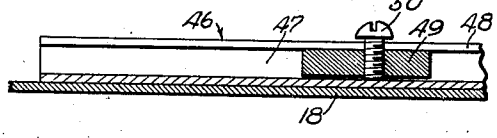
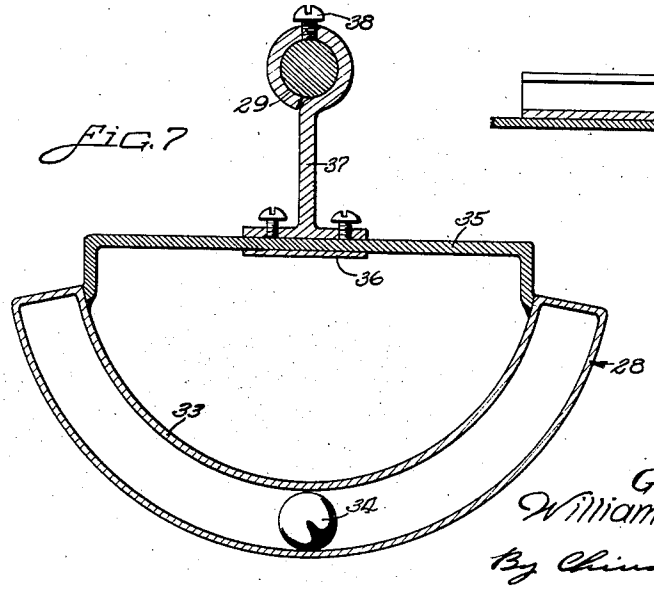



FIG. 7




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# UNITED STATES PATENT OFFICE

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## AUTOMATIC DRAFT CONTROLLER

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Application November 14, 1934, Serial No. 752,973

20 Claims. (Cl. 236—19)

The present invention relates generally to improvements in automatic draft controllers for furnaces, and has particular reference to self-closing suction-operable controllers for regulating the admission of atmospheric air into the flue gas outlet passage of the heating apparatus so as to maintain in normal operation a draft of a predetermined desired intensity in the fire box, and hence to prevent the draft from exceeding such intensity, regardless of fluctuations in the conditions tending to induce the draft.

Prior controllers of the foregoing type, particularly when intended for heavy duty installations, ordinarily comprise a hood in communication with the base of the flue gas outlet passage, and having a vertical air inlet opening, a draft door pivotal at its lower end on a horizontal axis for movement into and out of vertical position to close and open the inlet opening, and a counterweight tending to close the door. The counterweight is necessarily of substantial size since it must counterbalance not only the force of the air draft through the inlet opening, but also the vertical force created by the weight of the door. The top of the hood is spaced substantially above the upper edge of the door in order to provide an air passage of proper size and retain the desired control as the door nears its closed position.

One of the objects of the present invention resides in the provision of a novel suction-operable draft controller which does not require the hood to be substantially larger than the area of the inlet opening, and which therefore is more compact and smaller in size for a given capacity than prior controllers, and adapted for installation in numerous positions that would otherwise be inaccessible.

Another object is to provide a new and improved automatic draft controller mounted for pivotal movement on a generally vertical axis so that the counterweight is not required to overcome the weight of the door, and hence can be comparatively light.

A further object is to provide novel means for adjusting the axis of the door.

Various general objects of the present invention reside in the provision of a novel suction-operable draft controller which is highly sensitive and accurate in operation, and which is accurately adjustable over a wide and finely graduated range to obtain the desired degree of balance.

Further objects and advantages will become apparent as the description proceeds.

In the accompanying drawings, Figure 1 is a front elevational view of a draft controller embodying the features of our invention.

Fig. 2 is a vertical sectional view of the draft controller taken along line 2—2 of Fig. 1.

Fig. 3 is a fragmentary vertical sectional view of one of the supports for the doors.

Fig. 4 is a horizontal sectional view taken along line 4—4 of Fig. 1 and showing the door in open position.

Figs. 5 and 6 are enlarged sectional detail views taken respectively along lines 5—5 and 6—6 of Fig. 1.

Fig. 7 is a vertical sectional view on an enlarged scale of one of the counterweights taken along line 7—7 of Fig. 1.

Fig. 8 is a fragmentary sectional view taken along line 8—8 of Fig. 1 and showing an auxiliary weight for the door.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that we do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, the draft controller may be mounted to admit atmospheric air at any desired point to the outlet passage for the products of combustion between the chimney and the heating apparatus. In its preferred form, the draft controller comprises a hood or casing 10 which is mounted in communication with the chimney draft passage (not shown) and which preferably is rectangular in shape with side walls 11 and 12 and top and bottom walls 13 and 14. A shallow rectangular frame 15 is mounted in the front of the hood 10 and in closely fitting relation to the walls 11 to 14, and is formed with an internal flange 16 along its front marginal edges and defining an air inlet opening 17.

Mounted within the frame 15 and in operative relation to the air inlet opening 17 is a suitable damper. In the present instance, the damper comprises two generally vertical and horizontally juxtaposed doors 18 and 18a mounted at their outer side edges on generally vertical axes for simultaneous swinging movement either inwardly or outwardly to open or close the opening 17. Since the two doors are alike in construction, the door 18 will be specifically described, and the cor-

responding parts of the door 18a will be identified by the same reference numerals with the subscript "a".

To provide it with a pivotal mounting, the door 18 has secured to its back a plurality of parallel horizontal reinforcing battens or straps 19 which at their outer ends are curled about a vertical shaft 20. The outer marginal portion of the door 18 is curled about the shaft 20 and the straps 19 and is secured thereto by means of pins 21. Upper and lower anti-friction bearings 22 are mounted in the frame 15 back of the flange 16 to support the ends of the shaft 20. Preferably, each bearing 22 is of the ball type, and comprises an outer raceway 23 for a series of balls 24 in direct engagement with the shaft 20, and a strap 25 bolted to the frame 15 for holding the raceway in position. The raceway 23 for the lower bearing 22 rests on the bottom of the frame 15. In the upper bearing 22, the raceway 23 is supported by an underlying flange 26 on the strap 25. The lower end of the shaft 20 is pointed, and bears against the bottom of the frame 15 to relieve the bearings 22 of vertical thrust.

When the door 18 is closed, it is disposed against the inside of the marginal edge of the opening 17. A strip 27 of flexible material, such as felt, is secured against the inside of the flange 16 to cushion the door 18.

Counterweight means is operatively connected to the doors 18 and 18a, and normally acts in a direction to close the opening 17. Thus, the counterweight means opposes the action of the draft, and when properly selected and adjusted will establish the doors 18 and 18a in a balanced position in which they are sensitively responsive to fluctuations in the draft and operable to compensate for same by varying the effective inlet area of the opening 17. It will be evident that for a definite force counterbalancing the chimney draft, a predetermined draft will be maintained in the fire box.

The counterweight means is adjustable so that the draft intensity to be maintained may be varied as necessitated by the particular characteristics and requirements for maximum efficiency of the heating system. In its preferred form, the counterweight means comprises two suspended counterweights 28 and 28a fixed on a horizontal rock shaft 29. The opposite ends of the shaft 29 are journaled in ball bearings 30 and 30a which are mounted in upwardly opening curved portions 31 and 31a on the lower ends of two depending arms 32 and 32a bolted to the side members of the frame 15. The counterweights 28 and 28a are located respectively adjacent the bearings 30 and 30a.

The counterweight 28 comprises a closed upwardly curved tube 33 substantially semi-circular in form. A heavy metal ball 34 is disposed in the tube 33, and is adapted to roll therein upon rotation of the shaft 29. Bridging the ends of the tube 33 is a bar 35 which extends slidably through a guide 36 on the lower end of a depending arm 37. The upper end of the arm 37 is curled about the shaft 29 and rigidly secured thereto as by means of a set screw 38. The two counterweights are substantially alike in construction, and hence the corresponding parts of the counterweight 28a are identified with the same reference numerals with the subscript "a".

Secured at their lower ends to the shaft 29 are two generally vertical crank arms 39 and 39a. Preferably, each arm is curled about and pinned to the shaft. Two outwardly extending horizontal arms 40 and 40a are secured respectively to the front of the doors 18 and 18a over the arms 39 and 39a. The associated sets of arms 39 and 40 and 39a and 40a have universal pivot connections at their free ends respectively with the ends of two links 41 and 41a.

It will be evident that the doors 18 and 18a and the counterweights 28 and 28a are constrained to move in synchronism. As the doors 18 and 18a swing inwardly in response to an increase in the draft above a certain point, the shaft 30 will be rocked in a counterclockwise direction to swing the counterweights 28 and 28a upwardly and outwardly. Conversely, as the draft decreases, the counterweights are swung in the reverse direction. Hence, the controller tends to seek a position of balance and serves to compensate fluctuations in the draft. Since the doors 18 and 18a are mounted on substantially vertical axes, the weight of the door need not be overcome by the counterweights 28 and 28a. The latter therefore can be comparatively light and hence afford a sensitive and accurate control.

In the initial opening movement of the doors 18 and 18a, the air enters under a considerable velocity and hence the doors are sensitive to pressure fluctuations. However, as the doors are caused to swing progressively toward their maximum open position, they tend to become less sensitive to changes in the draft, i. e. to become lazy. While the closing force exerted by the counterweights 28 and 28a increases as the doors 18 and 18a open, the balls 34 and 34a roll along the tubes 33 and 33a to reduce the rate of increase so as to render the doors more sensitive and accurate when open a substantial distance, thereby overcoming any lazy tendencies.

The controller is adjustable to adapt same for different installations and for different operating conditions. It will be evident that each of the counterweights 28 and 28a may be adjusted transversely of the shaft 30. If the two counterweights 28 and 28a are both adjusted into their outermost positions, a heavy closing action will be obtained. If the counterweights are both adjusted into their innermost positions, they may actually tend to open the doors 18 and 18a. Any desired intermediate adjustment within the wide range defined by these limits may obviously be obtained.

As a further means of adjustment, the assembly of the frame 15 and the doors 18 and 18a is adjustable at its lower end about a horizontal axis. Thus, the assembly may be tilted when it is desirable to have the weight of the door influence or modify the action of the counterweight means. For this purpose, two hinges 42 serve to connect the bottom section of the frame 15 to the bottom wall 14 of the hood 10. An adjusting screw 43 (Fig. 6) is threaded through the upper section of the frame and is rotatably anchored in a depending lug 44 on a bracket 45 mounted on the top of the hood 10. When the frame 15 is adjusted inwardly out of vertical position, a corresponding angular adjustment of the counterweights 28 and 28a through the doors 18 and 18a, the arms 40 and 40a, the links 41 and 41a, the arms 39 and 39a and the shaft 29 is also effected.

Auxiliary counterweights 46 and 46a may be provided respectively on the doors 18 and 18a for lending an additional adjustable weight to the doors when the door assembly is tilted. Each auxiliary counterweight preferably comprises an

elongated guide member 47 mounted on the rear or inner surface of the door parallel and adjacent to the upper edge, and defining a T-slot 48 in which a weight 49 is slidably disposed. A clamp screw 50 is adjustably threaded through the weight 49 and extends out of the slot for manual manipulation.

An additional auxiliary counterweight 51 is also provided to supplement the counterweights 28 and 28a. The counterweight 51 may be mounted on the intermediate portion of the shaft 29, and in its preferred form, comprises an elongated guide bar 51a extending forwardly from the shaft 29 at an acute angle and having legs 52 and 53 secured to the shaft. A weight 54 is slidably mounted on the bar 51a, and is adapted to be secured in position of adjustment by means of a set screw 55.

We claim as our invention:

1. An automatic draft controller comprising, in combination, a hood having an opening in a vertical plane, a vertical frame mounted in said opening for pivotal movement at its lower end about a horizontal axis and having an inner marginal flange defining a draft inlet opening, means for angularly adjusting said frame, two horizontally swinging doors pivotally mounted in opposite sides of said frame to control the effective area of said inlet opening, and counterweight means tending to close said doors.

2. An automatic draft controller comprising, in combination, a hood, a swinging frame mounted in said hood for angular adjustment into and out of vertical position about a horizontal axis and having a draft inlet opening, means for angularly adjusting said frame, two horizontally swinging doors pivotally mounted in said frame on generally vertical axes to control the effective area of said opening, and counterweight means tending to close said doors.

3. An automatic draft controller comprising, in combination, a hood open at one end to define a rectangular opening in a substantially vertical plane, a rectangular frame fitting closely within the open end of said hood and having an inner marginal flange defining a rectangular draft inlet opening, means for pivotally supporting the lower end of said frame, means for adjusting said frame selectively into different fixed generally vertical angular positions, two doors located side by side within said frame and adapted to engage the inside of said flange to close said opening, means for rotatably supporting the outer side edges of said doors within said frame for swinging movement inwardly from said opening about generally vertical axes, and counterweight means operatively connected with said doors and tending to urge the latter into closed position.

4. An automatic draft controller comprising, in combination, a hood defining an air inlet opening, two independent doors pivotally mounted in said hood for simultaneous swinging movement on separate axes into and out of position to close said opening, a horizontal rock shaft mounted on said hood, crank means operatively connecting said shaft to said doors, and counterweight means mounted on said shaft and tending to rock the latter in a direction to effect the closing of said doors.

5. An automatic draft controller comprising, in combination, a wall defining an air inlet opening, two generally vertical shafts journaled respectively in opposite sides of said opening, two generally vertical doors located side by side in said opening and secured at their outer side margins respectively to said shafts for swinging movement, and unitary gravity responsive counterweight means mounted on said wall and being operatively connected to both of said doors to swing said doors in positive synchronism toward closed position.

6. An automatic draft controller comprising, in combination, a means defining an inlet opening in a substantially vertical plane, a door mounted for swinging movement on a generally vertical axis to control said opening, and gravity responsive counterweight means suspended from said first mentioned means for angular adjustment about a horizontal axis and operatively connected to said door and tending to urge the latter into closed position.

7. An automatic draft controller comprising, in combination, a hood, a frame fitting within said hood and having a draft inlet opening, means for pivotally supporting said frame for swinging adjustment about a generally horizontal axis extending transversely of said opening, a door mounted in said frame for swinging adjustment about a generally vertical axis for controlling said opening and counterweight means operatively connected to said door.

8. An automatic draft controller comprising, in combination, a hood, a frame fitting within said hood and having a draft inlet opening, means for pivotally supporting said frame for angular adjustment about a generally horizontal axis, a door mounted in said frame for swinging adjustment about a generally vertical axis for controlling said opening, a weight adjustable on said door transversely of said vertical axis, and counterweight means operatively connected to said door.

9. An automatic draft controller comprising, in combination, a wall formed with an inlet opening, a draft door mounted in operative relation to said opening, means for supporting said door for swinging movement about a substantially vertical axis, a horizontal rock shaft supported in fixed relation to said wall, a crank connection between said door and said shaft to effect rotation of said shaft upon swinging movement of said door, and a counterweight fixed on said shaft and adapted to exert a rotational torque thereon in a direction to close said door, said counterweight comprising a depending bracket fixed on said shaft and having a generally horizontal guide, an upwardly curved tube, a generally horizontal guide bar connected to said tube and slidably disposed in said guide member, and a weight freely movable in said tube in response to gravity.

10. An automatic draft controller comprising, in combination, a wall formed with an inlet opening, a draft door mounted in operative relation to said opening, means for supporting said door for swinging movement about a substantially vertical axis, a horizontal rock shaft supported in fixed relation to said wall, an arm on said door, a crank arm on said shaft, a link pivotally connecting the free ends of said arms, and a counterweight fixed on said shaft and adapted to exert a rotational torque thereon in a direction to close said door, said counterweight comprising a depending bracket fixed on said shaft, an upwardly curved guide adjustably mounted on said bracket, and a rolling weight freely movable in said guide in response to gravity.

11. An automatic draft controller comprising, in combination, a wall formed with an inlet

opening, a draft door mounted in operative relation to said opening, means for supporting said door on a substantially vertical axis for free swinging movement by impingement thereon of air flowing through said opening, a horizontal rock shaft supported in fixed relation to said wall, a crank connection between said door and said shaft to effect rotation of said shaft upon swinging movement of said door, and a counterweight fixed on said shaft and adapted to exert a rotational torque thereon in a direction to close said door.

12. An automatic draft controller comprising, in combination, means defining an air inlet opening, a draft door pivotally mounted in operative relation to said opening, and an oscillatory counterweight operatively connected to said door and tending to move the latter into position to close said opening, said counterweight comprising an arcuate guide curved generally about the axis of oscillation, and a heavy metal ball closely conforming in diameter to said guide and adapted to roll therein.

13. An automatic draft controller comprising, in combination, means defining an air inlet opening, a draft door pivotally mounted on a generally vertical axis in operative relation to said opening, and a counterweight oscillatory about a generally horizontal axis and operatively connected to said door and tending to move the latter into position to close said opening, said counterweight comprising a member curved transversely of said horizontal axis, and a heavy metal roller adapted to roll along said member.

14. An automatic draft controller comprising, in combination, means defining an air inlet opening, a draft door pivotally mounted in operative relation to said opening, a horizontal shaft, an oscillatory counterweight fixed on said shaft and operatively connected to said door, said counterweight comprising a tube curved generally about said shaft, and a weight movable in said tube in response to gravity, and an auxiliary counterweight mounted on said shaft, said auxiliary counterweight comprising a horizontally projecting rod extending at an angle to said shaft, and a weight adjustable along said rod.

15. An automatic draft controller comprising, in combination, means defining an air inlet opening, two doors disposed side by side in operative relation to said opening and being pivoted about generally vertical axes in synchronism into and out of position to close said opening, a generally horizontal rock shaft, two crank means operatively connecting said shaft respectively to said doors, and a plurality of independently adjustable counterweights mounted on said shaft and tending to rotate the latter.

16. An automatic draft controller comprising, in combination, means defining a single air inlet opening, two separate doors pivotally mounted side by side for independent swinging movement on parallel axes into and out of position jointly to close said opening, each of said doors controlling a portion of said opening, and a single adjustable counterweight mechanism positively connected under all conditions of adjustment to both of said doors in all positions of said swinging movement and tending to swing said doors conjointly and in positive synchronism into closed position.

17. An automatic draft controller comprising, in combination, a hood, a frame fitting closely within said hood and having a draft central inlet opening, means for pivotally supporting said frame for angular adjustment into different operative positions about a generally horizontal axis, a door mounted in said frame for swinging adjustment about a generally vertical axis perpendicular to said first mentioned axis for controlling said opening, and a counterweight mounted on said hood independently of said door and having an operative connection with said door, said counterweight tending to urge said door into closed position.

18. An automatic draft controller comprising, in combination, a hood having an opening, a swinging frame mounted in operative relation to said opening for pivotal adjustment into different operative positions on an axis transverse to the path of air flow through said opening and having a draft inlet opening, said frame being adapted substantially to close said first mentioned opening except for said draft inlet opening in all operative positions of adjustment, means for angularly adjusting said frame about said axis and for holding said frame in adjusted position, damper means pivotally mounted in said frame about an axis perpendicular to said first mentioned axis and also transverse to said path of air flow to control the effective area of said inlet opening, and counterweight means tending to close said damper means, the adjustment of said frame permitting support of said damper means in different operative positions.

19. An automatic flue draft controller comprising, in combination, a wall defining a natural draft air inlet opening in direct communication with the atmosphere, two separate doors independently mounted side by side on generally vertical axes for swinging movement into and out of position to close said opening, and gravity responsive counterweight means mechanically connected jointly to both doors and tending to swing said doors in positive synchronism with said counterweight means and with each other toward closed position.

20. An automatic draft controller comprising, in combination, a hood, a frame fitting within said hood and having a draft inlet opening, screw means for pivotally supporting said frame for tilting adjustment into different operative positions about a generally horizontal axis extending generally transversely of said opening, a door mounted in said frame for swinging adjustment about a generally vertical axis for controlling said opening, and counterweight means operatively connected to said door and tending to urge said door pivotally in one direction.

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