June 18, 1935. G. J. IRSCH ET AL 2,004,947

AUTOMATIC DRAFT CONTROLLER

Filed April 11, 1932

Fig. 1

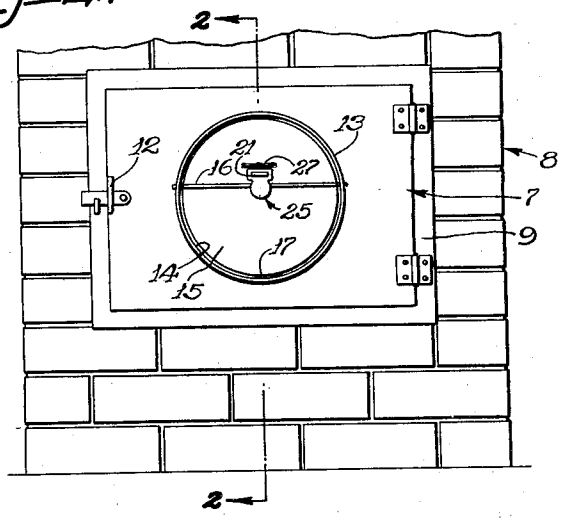


Fig. 2

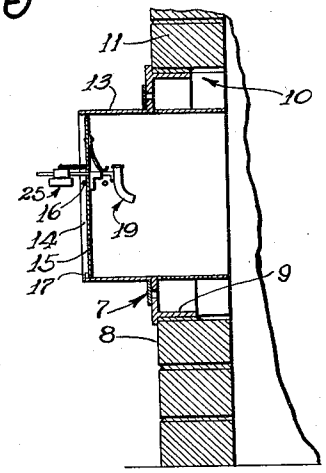


Fig. 3

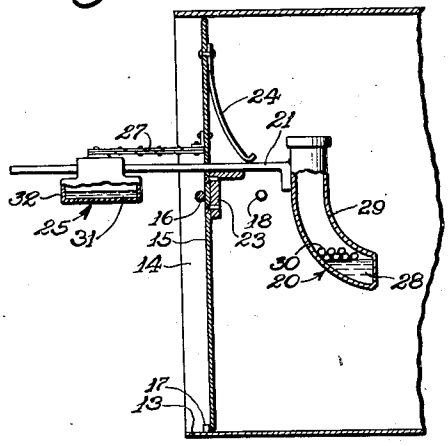


Fig. 4

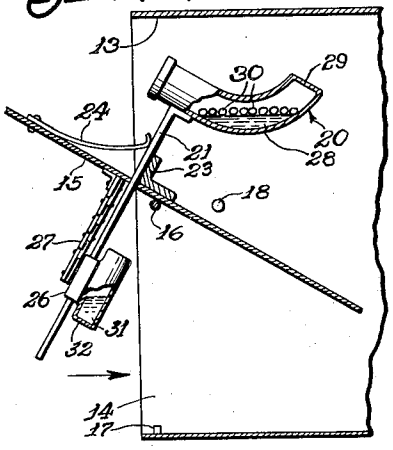


Fig. 5

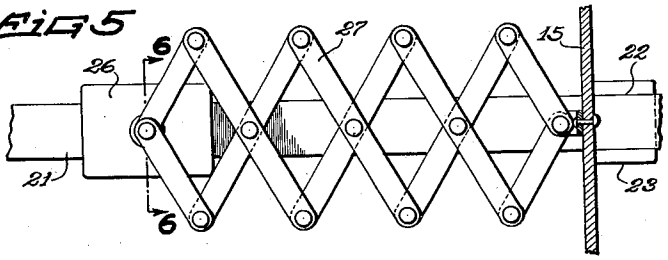
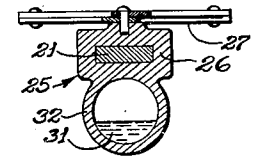


Fig. 6



Inventors
George J. Irsch
William B. Stephenson
By Chisholm, Parker & Carlson
Attorneys

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AUTOMATIC DRAFT CONTROLLER

George J. Irsch, Harvey, and William B. Stephenson, Chicago, Ill.

Application April 11, 1932, Serial No. 604,390

20 Claims. (Cl. 236—45)

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.

One of the important objects of the present invention resides in the provision of a novel suction-operable pivotal damper plate which is sensitive and accurate in operation so as to stabilize the draft regardless of the degree to which it may be opened, and which is simple and inexpensive to construct and install.

Another object is to provide a new and improved counterweight for the damper plate which is self-adjustable in accordance with the degree of opening of the damper plate so as to counteract the tendency toward "laziness" as the damper opening is increased, and which is readily adjustable at will over a wide and finely graduated range to vary the draft intensity that the damper plate will tend to maintain in the fire box.

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

In the accompanying drawing, Figure 1 is a fragmentary front elevational view of a chimney provided with a draft controller embodying the features of our invention.

Fig. 2 is a fragmentary vertical sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a vertical axial sectional view on an enlarged scale of the draft controller, the damper plate being shown in closed position.

Fig. 4 is a view similar to Fig. 3, but showing the damper plate in an open position.

Fig. 5 is a plan view of the counterweight.

Fig. 6 is a detail sectional view taken along line 6—6 of Fig. 5.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawing 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 drawing, 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, and in the present instance is shown as built into a clean-out door 7 at the base of a chimney 8. The door 7 is hinged at one side to a rectangular frame 9 which is tightly secured in a similarly shaped opening 10 through one wall 11 of the chimney 8. Normally, the door 7 is secured in closed position by means of a hook and latch device 12.

The draft controller in its preferred form comprises a hood or casing which is illustrated as a cylindrical duct 13 mounted centrally in the door 7 and defining an opening 14 for the admission of air from the exterior into the chimney 8. Of the duct 13, the outer end extends forwardly from the door 7, and the inner end extends to a point substantially flush with the inner surface of the chimney wall 11 so as not to obstruct the flue passage through the chimney 8.

Pivotally mounted in the duct 13 in the plane of the door 7 is a damper plate 15 which is circular and of a diameter to conform closely to the interior of the duct when closed. The mounting for the plate 15 comprises a transverse horizontal shaft 16 fixed thereto preferably well above the center and journaled at its ends in opposite sides of the duct 13. Thus, the lower end of the damper plate 15 is pivotal inwardly in response to the suction of the chimney draft. The closed position of the damper plate 15 is defined by a stop 17 secured to the duct 13 in the path of the lower end of the plate. Inward movement of the lower end of the plate 15 in response to the draft is limited by means of a stop 18. It will be evident that the two stops 17 and 18 define the maximum range of pivotal movement of the damper plate 15.

A counterweight 19 is mounted on and acts in a direction to close the damper plate 15. Thus, the counterweight 19 opposes the action of the draft, and when properly selected and adjusted will establish the damper plate 15 in a balanced position in which the plate is sensitively responsive to fluctuations in the draft and operable to compensate for same by varying the effective area of the air inlet. 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 19 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 heat-

ing system. In its preferred form, the counterweight 19 comprises a main weight 20 rigidly mounted on the inner end of a slide bar 21 extending through the damper plate 15 above the pivotal axis 16. The bar 21 is slidably supported in a guideway 22 formed in the top of a bracket 23 secured to the inside of the plate 15, and is held in position by means of a leaf spring 24 anchored to the plate and engaging the top of the bar.

Adjustably mounted on the outer end of the bar 21 is a light auxiliary weight 25. In the present instance, the weight 25 is supported by a slide loop 26 from which it is suspended and which snugly receives the bar 21. A pantograph 27 anchored at its opposite ends respectively to the plate 15 and the loop 26 serves to hold the auxiliary weight 25 in position of adjustment.

Thus, the counterweight 19 may be adjusted over a wide and finely graduated range. The counterweight 19 as a whole may be adjusted relative to the pivotal axis 16 by adjusting the bar 21 longitudinally in the bracket 23. A supplemental fine adjustment may also be made by sliding the auxiliary weight 25 along the bar 21.

The counterweight 19 renders the plate 15 self-closing. The suction in the chimney tends to open the plate 15 against the action of the counterweight 19. In the initial opening of the damper plate 15 upon an increase in the intensity of the chimney draft to the predetermined value, that it is desired to maintain and that is determined by the counterforce, i. e. the physical weight and adjustment, of the counterweight 19, the air enters under a considerable velocity, and hence the plate is quite sensitive to pressure fluctuations in the chimney 8. However, as the plate 15 is caused to swing progressively toward its maximum open position, its action becomes less sensitive due to the corresponding decrease in the velocity of the incoming air. This condition is aptly described as "laziness", and unless compensated for will reduce the accuracy of the controller.

It will be noted that the air enters the duct 13 mainly from the bottom. The lower end of the damper plate 15 and the opposed lower surface of the duct 13 converge inwardly, and hence as the opening is increased tend to exert a Venturi action on the incoming air, thereby increasing the air velocity and tending to offset the developing "laziness" of the plate.

It will also be noted that as the plate 15 is swung from its closed position in Fig. 3 into the position shown in Fig. 4, the center of gravity of the counterweight 19 shifts outwardly relative to the pivotal axis 16, thereby lightening the plate and tending to partially offset the developing laziness.

One of the important features of the present invention resides in a counterweight 19 which is automatically deformable to lighten the damper plate 15 as the latter is moved progressively toward its open position, and which is sensitive, quick in action and effective to accurately offset the normal tendency toward "laziness" and thus maintain the draft accurately at the desired intensity regardless of wide fluctuations in the internal and external conditions of the heating apparatus. To this end, the main weight 20 is "live" and "flexible", and preferably comprises a heavy floating mass 28 enclosed in a suitable container 29. In the present instance, the mass 28 consists of a body of mercury which is highly sensitive to changes in position. Heavy solids, such as iron balls 30, may be floated on the surface of the mercury to supplement the latter and in the instance of large installations to temper the action of the mercury.

The container 29 is shown in the form of a closed tube which is secured at its upper end to the bar 21, and which is curved to extend downwardly and inwardly away from the plate 15. This shape causes the level-seeking mass 28 to undergo a substantial shifting of its weight, not only through a change in surface level but also through a bodily transposition to another part of the tube 29 as clearly illustrated in Figs. 3 and 4, so as to effect a material and quickly responsive change in the effective weight of the damper plate 15 consistent with the requirements of the draft.

The auxiliary weight 25 comprises a body of mercury 31 in a tubular container 32 secured to the loop 26 longitudinally of and underneath the bar 21.

We claim as our invention:

1. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted in said inlet on a transverse axis having a horizontal component, a container mounted on said plate and in spaced relation thereto at one side of said axis, and a body of mercury partially filling said container, said container and said body constituting a weight tending to close said plate against the action of the draft, said body by reason of its level-seeking property flowing automatically in said container in response to pivotal movement of said plate to modify the center of gravity of said weight relative to said plate.

2. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted in said inlet on a transverse axis having a horizontal component, a container on said plate at one side of and extending generally transversely of said axis, and a free moving mass comprising a solid weight, said mass partially filling said container and being shiftable therein transversely of said axis in response to pivotal movement of said plate.

3. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a transverse horizontal axis in said inlet, and a counterweight mounted on said plate, said counterweight acting in a direction to close said plate and comprising a container, a body of mercury in said container and shiftable therein upon pivotal movement of said plate, and a mass of metal balls floating on said mercury.

4. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a transverse horizontal axis in said inlet, a support extending inwardly from said plate above said axis, an elongated downwardly inclined container on the free end of said support, and a weight of level-seeking material partially filling said container, said support, said container and said material constituting a counterweight tending to close said plate against the action of the draft.

5. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a transverse horizontal axis in said inlet, a support extending inwardly from said plate above said axis, a tube suspended at one end from said support and being curved downwardly and away from said plate, and a body of mercury partially filling said tube.

6. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a transverse horizontal axis in said inlet, a sup-

port extending inwardly from said plate above said axis, a tube suspended at one end from said support and being curved downwardly and away from said plate, and a body of mercury in said tube, said support, tube and mercury constituting a counterweight, and said support being adjustable on said plate to shift the center of gravity of said counterweight transversely of said axis.

7. A draft controller comprising, in combination, an air inlet, a plate movably mounted in said inlet, a guide on said plate, a weight slidably mounted on said guide, and a pantograph connected at one end to said plate and at the other end to said weight for locating said weight yieldably in different positions of relative adjustment along said guide, said weight including a confined mass of a level-seeking substance.

8. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted in said inlet, a guide bar normal to said plate and longitudinally adjustable thereon, a weight slidably adjustable on said bar, a second weight mounted on said bar for adjustment therewith, and a pantograph parallel to said bar and connecting said plate and said first mentioned weight in any selective position of relative adjustment.

9. An automatic draft controller comprising, in combination, a damper opening, a damper movably mounted in said opening and adapted to open in response to the suction of the draft, and a counterweight mounted on said damper and acting in a direction tending to close said damper, said counterweight comprising a mass of level-seeking material self deformable in response to the opening movement of said damper to decrease the effective force of said counterweight.

10. In an automatic draft controller, in combination with a chimney having an air inlet opening and a clean-out door closing said opening, said controller comprising, in combination, a horizontal cylindrical duct mounted in and opening through said door, a circular plate pivotally mounted on a horizontal axis in said duct, said axis being above the center of said plate, a guide bracket mounted on the inside of said plate above said axis, an elongated supporting bar extending adjustably through said plate and slidably disposed in said bracket, spring means tending to hold said bar in position of adjustment, an elongated tube secured at one end to the inner end of said bar, and curving downwardly and inwardly away from said plate, a body of mercury and a mass of metal balls partially filling said tube, and an elongated tube partially filled with mercury and slidably mounted on the outer end of said bar.

11. In an automatic draft controller, in combination, an air inlet opening and a door closing said opening, said controller comprising, in combination, a horizontal cylindrical duct mounted in and opening through said door, a circular plate pivotally mounted on a horizontal axis in said duct, a guide bracket mounted on the inside of said plate above said axis, an elongated supporting bar extending adjustably through said plate and slidably disposed in said bracket, spring means tending to hold said bar in position of adjustment, an elongated tube secured at one end to the inner end of said bar, and curving downwardly and inwardly away from said plate, a body of mercury partially filling said tube, and a mass of iron balls floated on said mercury.

12. In an automatic draft controller comprising, in combination, an air inlet, a hood mounted in said inlet, a circular plate pivotally mounted on a horizontal axis in said hood, an elongated supporting bar extending adjustably through said plate, a casing secured to one end of said bar, a deformable weight in said casing, and a weight adjustably mounted on the other end of said bar.

13. In an automatic draft controller comprising, in combination, an air inlet, a horizontal cylindrical duct mounted in said inlet, a circular plate pivotally mounted on a horizontal axis in said duct, an elongated supporting bar extending adjustably through said plate, an elongated tube secured at one end to the inner end of said bar, and curving downwardly and inwardly away from said plate, a mass of mercury and iron balls partially filling said tube, and a weight on the outer end of said bar.

14. A draft controller comprising, in combination, an air inlet, a plate movably mounted in said inlet, an elongated guide support mounted on and extending away from said plate, a weight mounted on said support for linear adjustment toward and from said plate, and an extensible frictionally fixed mechanical connection between said plate and said weight and extending parallel to said support, said connection serving to hold said weight yieldably in different selective positions of adjustment along said support.

15. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a transverse generally horizontal axis in said inlet, a container mounted on one side of said plate, a body of mercury partially filling said container, a second container mounted on the other side of said plate, and a body of mercury partially filling said second container, the body of mercury in each container flowing automatically to shift its position in its container in response to pivotal movement of said plate.

16. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a traverse horizontal axis in said inlet, and a counterweight mounted on said plate, said counterweight acting in a direction to close said plate and comprising a container, a body of mercury partially filling said container and being automatically shiftable therein toward said plate in response to opening pivotal movement of said plate to modify the change in the center of gravity of said counterweight resulting from movement of said counterweight as a whole with said plate.

17. A draft controller comprising, in combination with a flue gas passage having an air inlet opening, a duct mounted in registration with said opening, a plate pivotally mounted in said duct on a transverse axis having a horizontal component, and a counterweight mounted on the inside of said plate for movement therewith, and tending to move said plate in a direction to close said opening against the action of the draft, said counterweight comprising a plastic mass automatically self deformable under the action of gravity in response to pivotal movement of said plate into different angular positions to modify the effect of said mass on the center of gravity of said counterweight relative to said axis.

18. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted in said inlet on a transverse axis having a horizontal component, and a counterweight mounted on said plate for movement therewith, said counter-

weight having a level seeking mass automatically self deformable under the influence of gravity in response to the pivotal movement of said plate into different angular positions to modify the effect of said mass on the center of gravity of said counterweight relative to said axis.

19. A draft controller comprising, in combination, an air inlet, a damper plate movably mounted in said inlet for varying the effective opening therethrough in response to variations in the draft, and a counterweight opposing the movement of said plate by the draft, said counterweight comprising an elongated guide supported on and extending away from one side of said plate, a weight mounted on said guide for adjustment toward and from said plate, and a pantograph anchored relatively to said plate and connected to said weight to hold the latter frictionally in different selective positions along said guide.

20. A draft controller comprising, in combination, an air inlet, a plate pivotally mounted on a transverse horizontal axis in said inlet, and a counterweight mounted on said plate, said counterweight acting in a direction to close said plate and comprising a container, a body of mercury in said container and shiftable therein upon pivotal movement of said plate, and a mass of solid weight material floated by said mercury.

GEORGE J. IRSCH.
WILLIAM B. STEPHENSON.