June 18, 1935. G. J. IRSCH ET AL 2,004,948

AUTOMATIC DRAFT CONTROLLER

Filed April 25, 1932

Fig. 1

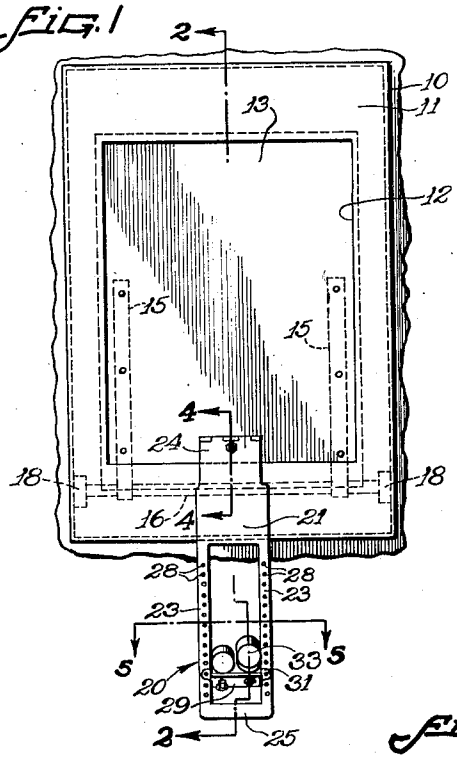


Fig. 2

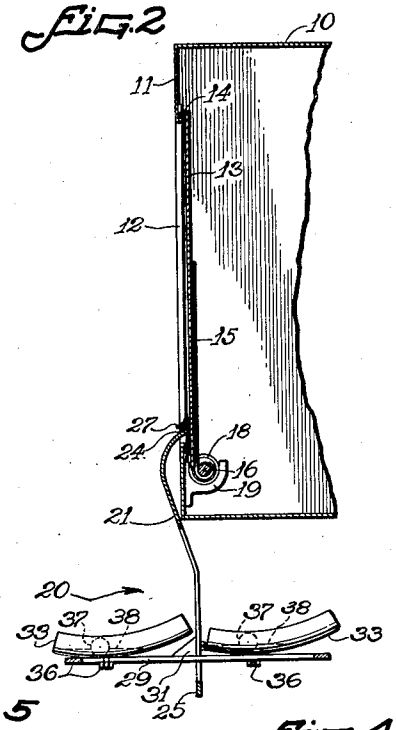


Fig. 3

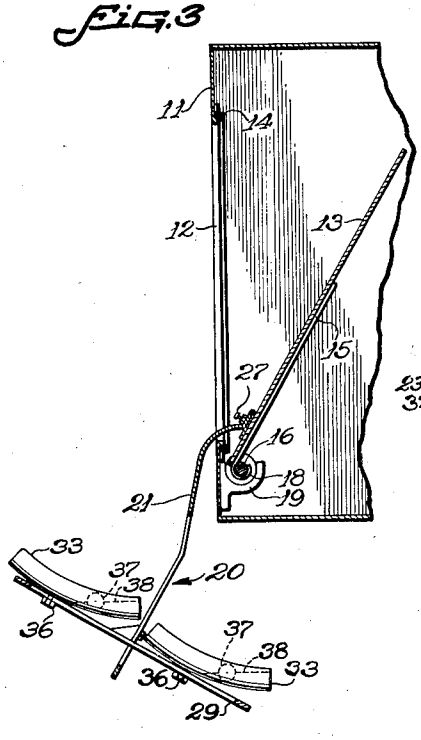


Fig. 5

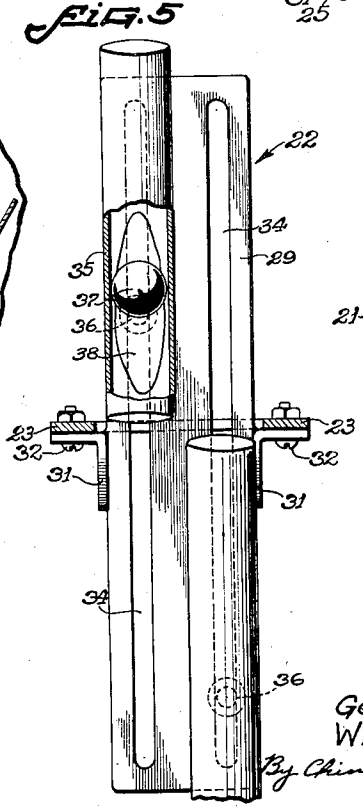
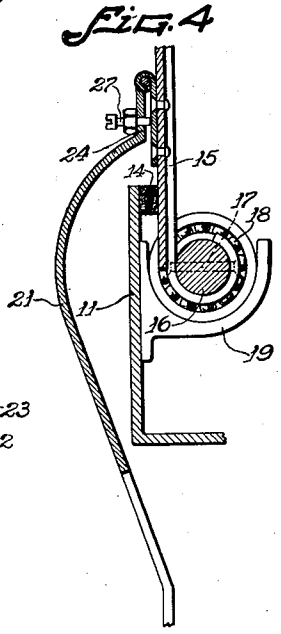


Fig. 4



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AUTOMATIC DRAFT CONTROLLER

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17 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.

An important object of the present invention resides in the provision of a novel suction-operable draft controller which is highly sensitive and accurate in operation.

A further object is to provide a new and improved counterweight for the pivotal damper plate of the controller which is accurately adjustable over a wide and finely graduated range to obtain the desired degree of balance, and particularly to adapt the controller to a large variety of chimneys and heating installations.

Another object resides in the provision of a counterweight comprising a flowing weight which is self-adjustable in accordance with the opening of the damper plate of the controller to improve the action and to partially counteract the tendency toward laziness as the plate is opened.

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 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, the damper plate being shown in closed position.

Fig. 3 is a view similar to Fig. 2, but showing the damper plate in an open position.

Fig. 4 is an enlarged sectional detail view taken along line 4—4 of Fig. 1.

Fig. 5 is a horizontal sectional view on an enlarged scale of the counterweight taken along line 5—5 of Fig. 1.

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. 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 has an outer vertical wall 11 formed with an air inlet opening 12. A door or damper plate 13 is mounted in operative relation to the opening 12. In the present instance, both the opening 12 and plate 13 are rectangular in form.

The damper plate 13 is pivotally mounted at its lower edge, and when closed is disposed against the inside of the marginal edge of the opening 12. A strip 14 of flexible material, such as felt, is secured against the inside of the marginal edge of the opening 12 to cushion the plate 13 when moved into closed position.

To provide a pivotal mounting therefor, the plate 13 has secured to its back a plurality of parallel vertical reinforcing battens or straps 15 which at their lower ends are curled about a horizontal shaft 16 and secured thereto as by means of pins 17. Opposite ends of the shaft 16 are journaled in antifriction bearings 18, preferably ball bearings, of which the outer raceways are mounted in brackets 19 welded to the inside of the wall 11 slightly below the opening 12.

A counterweight 20 is mounted on and normally acts in a direction to close the damper plate 13. Thus, the counterweight 20 opposes the action of the draft, and when properly selected and adjusted will establish the damper plate 13 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 inlet area of the opening 12. 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 20 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 20 comprises an elongated support 21 depending from the damper plate 13 below the pivot shaft 16, and a weight 22 adjustably mounted on the support 21. The support 21 is in the form of an arm secured at its upper end centrally to the lower end of the plate 13, and consists of two parallel bars 23 connected at their upper and lower ends respectively by cross members 24 and

25 to form an integral structure. The arm 21 in one position is disposed substantially in the same plane as the plate 13, but at its upper end is curved away from the front of the plate so as to provide clearance for the lower edge of the opening 12 in opening the plate.

The arm 21 is pivotally adjustable on the damper plate 13 so as to adjust the relative angular relation of the counterweight 20 as a whole. To this end, the cross member 24 constitutes a leaf hinged at its upper edge to the plate 13. A set screw 27 is adjustably threaded through the leaf 24 for engagement with the plate 13 to effect the desired angular adjustment of the arm 21.

To provide means for adjusting the weight 22 longitudinally of the arm 21, the bars 23 are formed along their length with regularly spaced holes 28. The weight 22 comprises a supporting base 29 which extends transversely of the arm 21 through the space between the bars 23. Braces 31 on the base 29 are adapted to be secured to the bars 23 by means of bolts 32 extended selectively through certain of the holes 28 at the desired point of adjustment.

To render the weight 22 adjustable transversely of the arm 21, it comprises two constituent weights 33 secured to the base 29 for adjustment respectively along two parallel longitudinal slots 34. In the present instance, each weight 33 comprises an elongated curved tube 35 having a stud 36 intermediate its ends extending through the associated slot 34 and adapted to be secured in any desired position of adjustment.

The counterweight 20 renders the damper plate 13 self-closing. The suction of the draft tends to open the plate 13 against the action of the counterweight 20. It will be evident that the counterweight 20 is accurately adjustable over a wide and finely graduated range. Thus, the counterweight 20 is adjustable as a whole angularly to the damper plate 13 by turning the set screw 27. Obviously, if the arm 21 is adjusted into the plane of the plate 13, the counterweight 20 will tend to balance the plate 13 in closed position, while if the arm is adjusted outwardly at an angle to the plate, the counterweight will weigh down the plate to resist a substantial draft before the plate will open in response to the draft suction. The weight 22 is adjustable as a whole along the arm 21 to vary its net effect in the different angular positions of the damper plate 13.

A fine adjustment adapted to satisfy widely different requirements is available by adjusting the constituent weights 33 jointly or relatively to each other along the base 29. If the two weights 33 are positioned respectively at opposite ends of the base 29, the damper plate 13 will be very sensitive to the draft in and near its closed position, and hence will open easily and close gently without slamming. If the weights 33 are located side by side on the inner end of the base 29, the plate 13 will not close completely, and the closing action of the weight 22 on the plate is greatly reduced. Conversely, if the two weights 33 are located side by side on the outer end of the base 29, the closing action of the weight 22 will be at its maximum, and will hold the plate 13 in closed position against a suction of substantial force. It will be evident that the weights 33 may be adjusted into any one of a large number of relative positions. The wide and fine adjustment of the counterweight 20 is important because of the many prevailing sizes of chimneys and the widely varying characteristics of different heating installations, as well as the different specific requirements of a particular installation.

In the initial opening of the damper plate 13, 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 20, the air enters under a considerable velocity, and hence the plate is very sensitive to pressure fluctuations in the draft. However, as the plate 13 is caused to swing progressively toward its maximum open position, it becomes less sensitive to changes in the draft, i. e. becomes lazy. While the effect of the counterweight 20 as a whole increases as the damper plate 13 opens, the weights 33 are automatically self-adjustable to reduce the rate of increase so as to render the plate 13 more sensitive and accurate when open a substantial distance, thereby overcoming any lazy tendencies. Thus, the weights 33 comprise heavy iron or steel balls 37 in the sealed tubes 35, and preferably also a body of mercury 38 for supplementing the balls and floating same. As a result, the weights 33 are sensitive floating or live weights as distinguished from less sensitive dead or inert weights. The changing effect of the counterweight 20 is clearly illustrated in Figs. 2 and 3.

The tubes 35 are curved to control the action of the balls 37 and the mercury 38. It will be evident that as the radius of each tube is increased, the tube will tend to become straighter, so that the flowing weight therein will end to move more rapidly and be more likely to bang against the ends of the tube. Conversely, as the radius of each tube is decreased, the weight will tend to move more slowly and to stay more in one place, thus becoming less sensitive. We have found that satisfactory results can be obtained with a tube radius of from eight to fourteen inches, and prefer to use a radius of approximately twelve inches.

We claim as our invention:

1. An automatic draft controller comprising, in combination, a hood having a vertical wall formed with an air inlet opening, a damper plate for closing said opening, antifriction roller-bearings supporting said plate at its lower end for pivotal movement about a horizontal axis into and out of closed position, a depending arm pivotally mounted at its upper end on said plate, said arm extending substantially below said plate, means for adjusting the angular position of said arm relative to said plate, and a weight on the free end of said arm.

2. An automatic draft controller comprising, in combination, a hood having a vertical wall formed with an air inlet opening, a damper plate for closing said opening, a depending arm pivotally mounted at its upper end on said plate, means for adjusting the angular position of said arm relative to said plate, a member adjustable longitudinally of said arm and extending transversely thereof, and two weights independently adjustable on said member, each of said weights comprising a closed container and a confined shiftable weight in said container.

3. An automatic draft controller comprising, in combination, a hood having a vertical wall formed with an air inlet opening, a damper plate for closing said opening, antifriction bearings supporting said plate for pivotal movement

about its lower end into and out of closed position, a depending arm pivotally mounted at its upper end on said plate, means for adjusting the angular position of said arm relative to said plate, a member adjustable longitudinally of said arm and extending transversely thereof, and two weights independently adjustable on said member.

4. An automatic draft controller comprising, in combination, a hood having a vertical wall formed with an air inlet opening, a pivotal damper plate for closing said opening, a depending arm pivotally mounted at its upper end on said plate, means for adjusting the angular position of said arm relative to said plate, a member adjustable longitudinally of said arm, and two weights independently adjustable on said member.

5. An automatic draft controller comprising, in combination, means defining an air inlet opening, a damper plate pivotally mounted in operative relation to said opening, a counterbalancing arm hinged to said plate and extending across the pivotal axis of said plate, means for adjusting the angular position of said arm relative to said plate, and a weight adjustably mounted on said arm.

6. An automatic draft controller comprising, in combination, means defining an air inlet opening, a generally vertical damper plate pivotally mounted at its lower end on a horizontal axis in operative relation to said opening, a counterbalancing arm mounted on said plate and depending therefrom below said axis, a support on said arm, two constituent weights mounted on said support for independent adjustment transversely of said axis, said weights being adjustable into different relative positions, each weight comprising a closed curved tube, an iron ball freely movable in said tube, and a body of mercury for floating said ball in said tube.

7. An automatic draft controller comprising, in combination, means defining an air inlet opening, a generally vertical damper plate pivotally mounted at its lower end on a horizontal axis in operative relation to said opening, a counterbalancing arm mounted on said plate and depending therefrom below said axis, a support on said arm, two constituent weights mounted on said support for independent adjustment transversely of said axis, said weights being adjustable into different relative positions, each weight comprising a container and a heavy metal ball freely movable in said container.

8. An automatic draft controller comprising, in combination, means defining an air inlet opening, a pivotal damper mounted on a horizontal axis in operative relation to said opening, and a counterweight for said damper, said counterweight comprising a support having two parallel guides extending transversely of said axis and when said door is closed extending horizontally across said axis, and two similar independent weights slidably mounted side by side on said support for adjustment respectively along said guides transversely of said axis and into position at one or the other side or respectively at opposite sides of said axis.

9. An automatic draft controller comprising, in combination, means defining an air inlet opening, a damper plate pivotally mounted to close said opening, and a counterweight mounted on said damper plate for movement therewith and tending to pivot said plate in a direction to close said opening, said counterweight comprising a closed generally tubular container extending generally transversely of the pivotal axis of said plate, a large iron ball freely movable in said container, said ball being slightly less in diameter than said container, and a body of mercury in said container for floating said ball, said ball and mercury being movable under the influence of gravity imparted in response to the pivotal movement of said plate to modify the action of said counterweight on said plate.

10. An automatic draft controller comprising, in combination, means defining an air inlet opening, a damper plate mounted to close said opening, and a pivotally adjustable counterweight mounted on said damper plate for movement therewith and tending to move said plate in a direction to close said opening, said counterweight comprising a container and a flowing weight in said container, said weight being freely movable under the influence of gravity imparted in response to the movement of said plate to modify the action of said counterweight on said plate.

11. An automatic draft controller comprising, in combination, means defining an air inlet opening, a generally vertical damper plate pivotally mounted on a horizontal axis in operative relation to said opening, a counterbalancing member hinged to said plate and depending below the pivotal axis thereof, means for adjusting the angular position of said member relative to said plate, and a weight including a level-seeking mass on said member, said mass in seeking different horizontal levels under the influence of gravity upon movement of said plate into different angular positions being self-shiftable transversely of said axis and relatively to said member to modify the action of said weight on said plate.

12. An automatic draft controller comprising, in combination, a wall formed with an inlet opening, a pivotal damper plate for closing said opening, and a counterbalancing means for said plate, said means comprising an elongated arm pivotally secured at one end to said plate, the free end of said arm extending across the axis of rotation of said plate and substantially beyond one end of said plate, said arm being angularly adjustable from a position in the plane of said plate into different angular relations to said plate, and a weight adjustably mounted on said arm.

13. An automatic draft controller comprising, in combination, means defining an air inlet opening, a damper plate pivotally mounted on a horizontal axis in operative relation to said opening, an elongated depending counterbalancing arm secured at its upper end to said plate, and extending below said axis, said arm being formed with a longitudinal slot, a support mounted on said arm and extending transversely thereof through said slot, means for adjustably securing said support in different positions along said arm, said support being formed with two parallel longitudinal slots, and two independent weights mounted on said support for adjustment respectively along said last mentioned slots, said weights being adapted to be located side by side or in any staggered relation within the limits of said last mentioned slots, said arm, support and weights constituting a counterweight tending to pivot said plate in a direction to close said opening.

14. An automatic draft controller comprising, in combination, a hood having a generally vertical wall formed with an air inlet opening, a damper plate pivotally mounted in operative relation to

said opening, a depending counterbalancing arm connected at one end to said plate for movement therewith, the other end of said arm extending below the pivotal axis of said plate and being angularly adjustable relative to the plane of said plate, a cross member on the lower end of said arm, and weight means mounted on said cross member for adjustment transversely of said axis selectively into position at either side or at both sides of said arm.

15. An automatic draft controller comprising, in combination, means defining an air inlet opening, a generally vertical damper plate pivotally mounted at its lower end on a horizontal axis in operative relation to said opening, a counterbalancing arm mounted on said plate and depending therefrom below said axis, a guide member mounted on the free end of said arm and extending generally transversely of said axis, and a weight supported by said guide member to move freely along said guide member generally transversely of said axis under the influence of gravity imparted in response to the pivotal movement of said plate, whereby the counterbalancing effect of said weight is modified for different angular positions of said plate.

16. An automatic draft controller comprising, in combination, means defining an air inlet opening, a generally vertical damper plate pivotally mounted at its lower end on a horizontal axis in operative relation to said opening, a counterbalancing arm mounted on said plate and depending therefrom below said axis, an elongated curved generally horizontal guide member mounted on the free end of said arm and extending generally transversely of said axis, said member being longitudinally concave upwardly, and a solid weight supported by said guide member for free rolling movement along said member generally transversely of said axis under the influence of gravity imparted in response to the pivotal movement of said plate, whereby the counterbalancing effect of said weight is modified for different angular positions of said plate.

17. An automatic draft controller comprising, in combination, means defining an air inlet opening, a generally vertical damper plate pivotally mounted at its lower end on a horizontal axis in operative relation to said opening, a counterbalancing arm mounted on said plate and depending therefrom below said axis, a generally horizontal elongated container mounted on said arm below said axis and extending generally transversely of said axis, and a body of mercury freely mounted in said container and adapted to seek different levels upon movement of said plate into different angular positions, whereby the counterbalancing effect of said body of mercury is modified.

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