July 14, 1942. C. J. KLERMUND ET AL 2,289,579

ADJUSTABLE AUTOMATIC DRAFT REGULATOR

Filed Feb. 15, 1940

Fig. 1

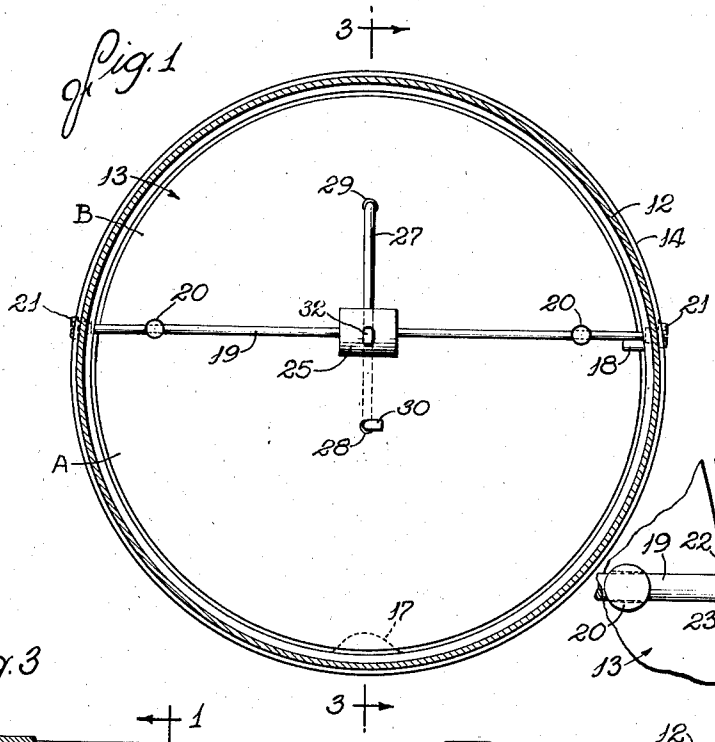


Fig. 2

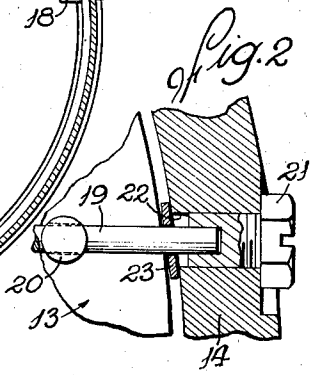


Fig. 3

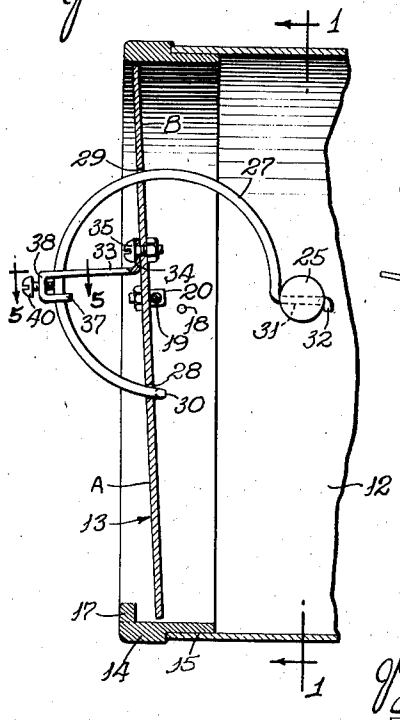


Fig. 4

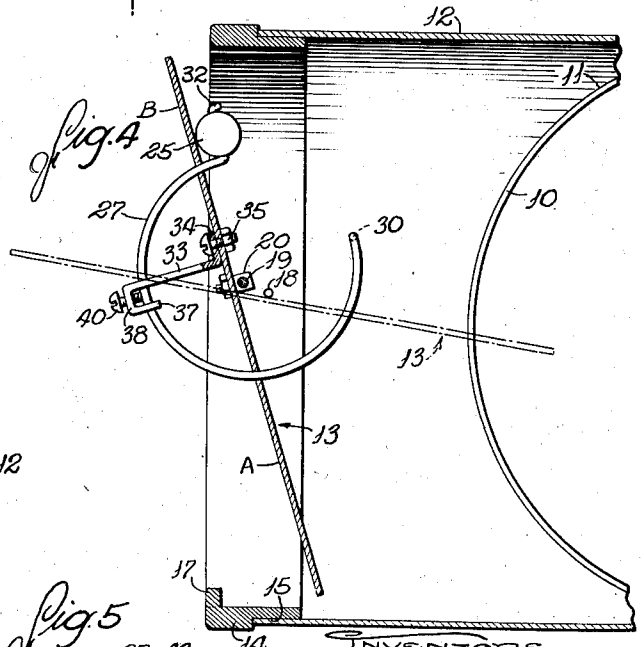
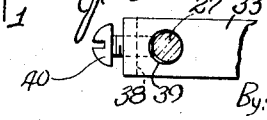


Fig. 5



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ADJUSTABLE AUTOMATIC DRAFT REGULATOR

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10 Claims. (Cl. 236—45)

This invention relates to improvements in adjustable automatic draft regulators and is especially applicable to regulators of the type which operate upon the principle of admitting atmospheric air into the flue pipe or breeching which leads from a heating apparatus whereby to maintain in normal operation a draft of a predetermined intensity in the combustion chamber regardless of fluctuations in the conditions which tend to induce the draft. Regulators of this kind are often popularly referred to as "barometric" dampers apparently because in operation they are designed to respond automatically to the pressure of the outer atmosphere upon predetermined diminutions of the pressure in the flue.

An object of the invention is to provide an automatic draft regulator of the foregoing general character which is efficiently responsive in operation, simple and inexensive to construct, and which embodies novel adjustment means for obtaining optimum results under the numerous variable factors and conditions to be found in many different types of heating installations.

Another object is to provide an improved barometric draft regulator of simple form having an unusually large adjustment range and adapted in any preferred condition of adjustment to maintain the draft pressure substantially uniform even though the volume demand for air necessary to throttle the tendency of the draft toward variance may fluctuate substantially, the damper remaining uniformly effective even in the higher amplitudes of fluctuation where it is ordinarily difficult to keep the draft under control with this type of regulator.

In the attainment of this object the counterbalancing means carried by the damper valve or plate is so arranged that it functions in any preferred setting to maintain the damper plate properly sensitive to the air pressure thereagainst irrespective of the effective pressure area of the plate as it swings within the air inlet during operation.

A further object is to provide an adjustable barometric type damper which is free of parts which project beyond the perimeter thereof, but in which the adjustment means is manipulable within and remains in any position of adjustment entirely inside the area bonded by the perimeter of the damper plate, being nevertheless capable of sensitive performance in a manner heretofore requiring more complicated arrangements.

An additional object of the invention is to provide a barometric damper in which the damper plate is mounted in an improved manner insuring freedom of movement in operation.

Other objects and advantages will become apparent from the following description, taken in connection with the accompanying drawing, in which:

Figure 1 is a transverse vertical sectional view through a draft regulating device embodying the invention and showing the inner face of the damper valve or plate in elevation.

Fig. 2 is an enlarged fragmentary sectional detail view taken in substantially the same plane as Fig. 1 and showing the pivotal mounting of one end of the damper plate axis.

Fig. 3 is a longitudinal vertical sectional view through the device taken substantially in the plane of line 3—3 of Fig. 1.

Fig. 4 is a sectional view taken in substantially the same plane as Fig. 3 but showing the damper plate and the adjusting means in a different position of adjustment.

Fig. 5 is a fragmentary enlarged sectional detail view taken substantially in the plane of line 5—5 of Fig. 3.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawing and will herein describe in detail a 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.

An adjustable automatic draft regulator or barometric damper embodying the features of the invention may include a valve member or damper plate eccentrically pivoted in flow-controlling relation within an air inlet that leads preferably to the breeching or flue pipe which conducts the spent products of combustion or draft from an associated heating apparatus direct to atmosphere or to the chimney. The heating apparatus may be of any preferred type, employing solid or fluid fuel. The pivotal support for the damper plate is such that predetermined draft induced air pressure thereagainst will swing the plate open with the larger portion or segment thereof moving inwardly in the direction of the pressure to admit a controlled volume of draft-throttling air through the inlet into the flue passage. Since every heating apparatus has conditions peculiar to itself tending to affect the tendency toward fluctuation of the

flue draft and thus the intensity of the air pressure impulses against the damper plate, means including a counterweight and a carrier therefor are provided for adjusting the responsiveness of the damper plate to maintain the draft uniform at the pressure which will secure optimum heating efficiency. In the present instance, the counterweight carrier is preferably mounted in movable bearing engagement with the damper plate and with a stationary guiding member which may have means for locking the carrier in adjusted position. All parts of the adjustment means remain entirely within an area defined by the perimeter of the damper plate in any position of the latter, thus assuring freedom for wide range swinging movement of the plate and avoiding objectionable protruding parts such as are found in some prior attempts allegedly endeavoring to secure similar results in operation.

In the exemplary form of the invention shown in the drawing, the automatic draft regulator is mounted to control the entry of atmospheric air through an aperture 10 in a flue pipe or breeching 11 (Fig. 4) forming a passage through which the products of combustion are led from a heating apparatus (not shown) directly to atmosphere or to a chimney. In general, the regulator may include a stub pipe or tubular air inlet 12 which is suitably connected to the flue pipe 11 in closing relation to the aperture 10 on a preferably horizontal axis. Flow of air through the inlet 12 is controlled by a damper valve in the form of a disk or plate 13 pivotally mounted upon an eccentric or chordal horizontal axis preferably at the mouth of the inlet. The larger portion or segment of the damper plate lies in overbalanced relation below the pivotal axis so that the normal tendency of the plate is to assume a generally vertical position.

In the present instance the damper plate 13 is preferably circular in shape and is supported in substantially closing relation within an embordering frame 14 which may be formed as a ring-shaped casting having an internal diameter affording just enough clearance for free swinging movement of the damper plate. An external annular rabbet groove 15 in the frame 14 enables snug reception of the mouth margin of the inlet pipe 12. By adjusting the angular position of the embordering frame 14 relative to the inlet 12, the plate axis can be set perfectly horizontal regardless of the angle to the horizontal of the flue pipe axis. The fully closed position of the damper plate 13 may be defined by an upstanding stop lug 17 cast integral with the inside face of the lowest portion of the embordering frame 14, while a stop pin 18 may be secured to project from the inner face of the frame adjacent to the plate axis for limiting the fully open position of the plate (dot dash outline of Fig. 4).

Improved means for mounting the damper plate and facilitating assembly thereof with the embordering frame 14 may comprise an axis shaft or rod 19. The latter extends in chordal relation across the inner face of the damper plate and is engaged in loose slidable bearing relation by a pair of spaced transversely apertured bearing stud 20 secured in alinement upon said inner face. The opposite ends of the bearing rod 19 are journaled for free rotation at opposite sides of the embordering frame 14 (Figs. 1 and 2). The journal for at least one end of the axis rod may comprise a socket bolt 21 threaded into an aperture 22 in the frame 14. Proper clearance between the perimeter of the damper plate 13 and the embordering frame 14 may be maintained by spaced disks 23 loosely mounted upon the axis rod 19. As a result of the free rotatable mounting of the axis rod 19 and the loose slidable bearing engagement of the bearing studs 20 therewith, free "floating" or swinging movement of the damper plate is doubly assured. It may be noted that because the axis rod 19 lies adjacent to the inner face and slightly offset from the plane of the damper plate 13, there is a tendency of the larger segment of the plate to swing inwardly. For convenience, the larger and smaller segments of the damper plate may be referred to as A and B, respectively.

An important feature of the invention resides in the improved adjusting means by which the damper plate 13 can be accommodated to a wide range of draft requirements. Herein such means includes a counterweight 25 which is supported adjacent to the inner face of the smaller segment B at one end of a slender one piece carrier 27. This carrier is mounted upon the damper plate and is selectively movable to vary the spacing between the counterweight and the segment B. The adjusting means is adapted to alter the center of mass of the plate to supplement or diminish the inertia or resistance of the latter to draft-induced air pressure tending to swing the plate open.

In the preferred form, the carrier 27 may be formed of suitable gauge non-corroding metallic rod or wire stock bent to arcuate shape and is arranged to extend through the damper plate so that it can be manipulated from the front thereof to shift the counterweight in an arcuate path into any selected adjusted position. For this purpose the damper plate 13 is formed with a pair of spaced apertures 28 and 29 located in the segments A and B, respectively, at opposite sides of the axis rod 19 and on the vertical diameter of the plate. The aperture 29 is preferably formed at approximately the vertical center of the segment B. The arcuate carrier 27 is of a length to extend in slidable bearing engagement through both of these apertures and a generous sector thereof projects from the front of the damper plate for engagement to facilitate shifting of the carrier circumferentially to project or retract the counterweight 25. The limit of weight-projecting movement of the carrier is defined by a right angle stop finger 30 formed at its free end to engage the inner face of the plate segment A (Fig. 3), while the opposite or retracting movement is limited by engagement of the weight 25 with the plate segment B (Fig. 4).

To gain the greatest possible range of movement for the counterweight 25 without unduly increasing the diameter of the carrier 27, the weight is preferably mounted upon an outwardly radial end projection or arm 31 upon the carrier. The counterweight may conveniently be formed of a suitably proportioned piece of non-corroding metallic bar or rod stock diametrically bored to fit over the arm 31 to which it may be clinched by bending over the adjacent extremity of the arm, as indicated at 32.

Side play or wobbling of the carrier and counterweight assembly is prevented by additional guiding or bearing means which in the present instance comprises a member 33 in the form of a rigid arm projecting perpendicularly from the front face of the segment B adjacent to the pivotal axis of the damper plate and adapted at its

outer end to receive the carrier 27 slidably. In a practical form, the guide arm 33 may be fashioned from a flat metallic strip having a foot 34 at its inner end secured to the segment B by means of a stove bolt 35'. At its outer end the arm 33 is shaped in substantially U form to provide an inwardly extending spaced flange 37 parallel to the main body of the arm and connected thereto by a web 38. Suitably dimensioned alined bearing apertures 39 (Fig. 5) in the flange 37 and the opposed portion of the arm body slidably receive the carrier 27.

To secure the carrier 27 in any position of adjustment relative to the damper plate 13, a locking means may be provided on the guide arm 33 such as a locking screw 40 threaded through the web 38 and bearing endwise against the opposed side of the carrier.

In operation, after the most efficient draft intensity or pressure has been determined for the particular heating apparatus with which the regulator is associated, the position of the counterweight 25 is selectively adjusted by longitudinal movement of the carrier 27 to establish an inertia or resistance to opening of the damper plate 13 equivalent to the desired draft pressure. In any such position of adjustment the carrier 27 is secured immovably by the locking screw 40. Any fluctuations tending to increase the draft pressure and thereby create a greater than predetermined adjusted draft-created pressure differential between the areas at opposite faces of the damper plate 13 cause the outer atmosphere to force the damper plate open sufficiently to admit proportionate draft-throttling inflow of atmospheric air through the inlet 12 into the flue pipe 11.

The farther the counterweight 25 is spaced from the plate segment B, the more will its mass supplement the mass of the plate segment A to resist the entrance of atmospheric air. Conversely, the closer the counterweight is moved toward the segment B so as to reduce its mass-supplementing effect, the less will be the air resistance of the segment A. At one point where the counterweight is relatively close to the segment B, the center of mass of the counterweight will, in the quiescent state of the damper plate, be vertically above the axis rod 19 where the counterweight is in perfect balance and leaves merely the unassisted inertia of the damper plate for air-flow resistance. As the counterweight is brought toward abutment with the segment B from the perfectly balanced relationship, its effect is to diminish the inertia of the damper plate and increase the normal tendency toward tilting of the segment A so that a very low draft pressure can be maintained. In fact, it has been found in practice that a uniform low draft can be successfully maintained of a pressure equivalent to the height of a column of water as low as .02 inch in height.

It may be noted, that improved uniformity of reaction has been experienced with the present novel arrangement throughout the range of movement of the damper plate 13. It is particularly free of any tendency toward "laziness" or sluggishness in the more sharply tilted positions from the vertical where the area subjected to air pressure is proportionately decreased. This advantageous result apparently attains from the constant counterbalancing effect of the guiding arm 33 and the decrease in the counterbalancing effect of the counterweight 25 as it swings with the damper plate closer toward a vertical position over the axis rod 19. In fact, when the damper plate is tilted to a point where the counterweight 25 swings forward beyond the vertical position it actually supplements the air pressure, and the combined mass of the counterweight and the arm 33 in large measure compensates for the decrease in pressure area of the plate. Thus, uniform pressure sensitivity of the damper plate 13 is assured in any operative position thereof, the adjusted resistance to air pressure being maintained automatically substantially constant by the novel counterbalancing arrangement.

From the foregoing it will be apparent that the present invention provides a novel barometric type damper construction which is simple and inexpensive to construct and operates with a high degree of efficiency throughout the pressure-fluctuation tendencies in the heating apparatus to maintain a substantially constant draft pressure predetermined to secure the most advantageous results from the particular heating apparatus. The damper plate is easily assembled in the device and can be quickly and simply removed when necessary. The means for adjusting the responsiveness of the damper plate is of a simple and highly efficient construction which is adapted not only to supplement the air pressure resistance of the damper plate at the beginning of a pressure response but also to function in diminishing the pressure resistance of the plate proportionately as the effective pressure area thereof decreases while the plate is swung open to various positions. In this connection it may be remembered that the novel arcuate adjustment of the counterweight is an important factor in attaining the improved results, and the fixed counterbalancing effect of the guiding arm and associated portion of the counterweight carrier are valuable contributions to the fine and sensitive balance attainable with the device. None of the adjustment means projects beyond the perimeter of the damper plate. The improved lightweight construction of and the doubly-assured free swinging mounting of the damper plate avoids sticking or impediment to free action of the device.

We claim as our invention:

1. A draft regulator comprising, in combination, a damper plate for substantially closing an air inlet to a flue passage and adapted to respond swingably to draft-induced suction for admitting draft-throttling atmospheric air into the flue passage, a shiftable counterweight for adjusting the responsiveness of said damper plate having a movable carrier, said plate having an aperture through which said carrier projects so that the latter can be manipulated from one side of said plate to shift the position of said counterweight relative to the opposite side of said plate, and a guiding member for said carrier mounted upon said one side of said plate, said guiding member cooperating with the portion of said carrier associated therewith to exert a fixed counterbalancing effect upon said one side of said plate.

2. A draft regulator comprising, in combination, an air inlet for a flue passage, a damper plate swingably mounted in substantially closing relation to said inlet and adapted to respond to draft-induced suction to swing open for admitting draft-throttling atmospheric air into the flue passage, said plate having a pair of spaced apertures therein, means for adjusting the responsiveness of said damper plate including a counterweight and an arcuate carrier therefor ex-

tending in slidable bearing engagement through said apertures and adapted to be moved circumferentially for shifting the position of said weight relative to said damper plate, and a guide member projecting from one face of said damper plate to hold said carrier against side play.

3. A draft regulator comprising, in combination, an air inlet for a flue passage, a damper plate swingably mounted in substantially closing relation within said inlet and adapted to respond to pressure differential to swing open for admitting draft-throttling atmospheric air into the flue passage, said plate having a pair of spaced apertures therein, means for adjusting the responsiveness of said damper plate including a counterweight and an arcuate carrier therefor extending in slidable bearing engagement through said apertures and adapted to be moved circumferentially for shifting the position of said weight relative to said damper plate, a guide member for said carrier projecting from one face of said damper plate, and means carried by said guide member for locking said carrier in adjusted position.

4. A draft regulator comprising, in combination, an air inlet for a flue passage, a damper plate swingably mounted for substantially closing said air inlet and being sensitive to draft-induced suction within said inlet to swing open for admitting draft-throttling atmospheric air through the inlet into the flue passage, means for adjusting the responsiveness of said damper plate including a counterweight and an arcuate carrier therefor projecting through said damper plate, and a guide arm for said carrier projecting from one face of said plate and having a pair of spaced portions including bearing apertures through which said carrier passes in slidable relation, and means acting between said spaced portions for locking said carrier in adjusted position.

5. An adjustable automatic draft regulator comprising, in combination, a tubular air inlet for a flue passage, an embordering ring mounted at the mouth of said inlet, a damper plate for substantially closing said inlet having means carried by said embordering ring providing a horizontal pivotal axis chordally dividing the plate into unequal segments to effect a normal draft-controlling bias of the plate within said inlet, a counterweight for selectively adjusting the bias of said plate including an arcuate carrier, apertures in said plate on opposite sides of said pivotal axis, said carrier extending through said apertures in slidable bearing engagement to support said counterweight adjacent to one face of the smaller segmental portion of the plate, a guide arm projecting from the opposite face of said smaller segmental portion and engaging said carrier in slidable bearing relation, and means carried by said arm for locking said carrier in adjusted position.

6. An automatic draft regulator comprising, in combination, an air inlet for a flue passage, a damper plate swingably mounted upon an eccentric horizontal axis in substantially closing relation to said inlet and adapted to respond to pressure differential created by draft-induced suction to swing open for admitting draft-controlling atmospheric air into the flue passage, and means for adjusting the responsiveness of said damper plate including a counterweight and a one-piece carrier therefor having bearing engagement with said damper plate on opposite sides of said axis for selective movement to shift said counterweight relative to the plate and thereby alter the pressure-opposing inertia of the plate.

7. In combination in an automatic draft regulator, a damper plate of the eccentric axis, suction responsive type; and means for adjusting the responsiveness of said damper plate comprising a counterweight and an elongated carrier therefor extending through said plate on opposite sides of said axis, said carrier being adapted to be moved in opposite directions to alter the position of one end thereof relative to said plate; said counterweight being mounted at said one end of the carrier; and stop means on the other end of the carrier for limting movement of the carrier in one direction.

8. A draft regulator of the character described comprising, in combination, a damper plate having spaced apertures therein, an arcuate member adapted for circumferential movement having its end portions projected through said apertures to extend beyond one face of the plate and leaving a substantial sector projecting from the opposite face of the plate, one end of said member having stop means for limiting lengthwise movement of the member in one direction, and a counterweight supported by the opposite end of said member and adapted to act as a stop for limiting the movement of the member in the oppostie direction.

9. A draft regulator of the character described comprising, in combination, a draft-responsive damper plate adapted to be swingably mounted on a bisecting horizontal axis in substantially closing relation within the air inlet leading to a flue passage, a counterweight for adjusting the bias of said damper plate, and a substantially ring-like carrier for said counterweight, said damper plate having a pair of spaced bearing apertures through which said carrier extends in a plane substantially perpendicular to the plate for circumferential movement to adjust the position of the counterweight relative to the plate, said apertures being located on the vertical diameter of the plate at respectively opposite sides of and in such relation to the plate axis as to bring the axis of the carrier adjacent to said plate axis, whereby the counterweight will remain at substantially the same distance from the plate axis in any position of adjustment.

10. In combination in a draft regulator of the type having a damper plate mounted in substantially closing relation to an air inlet to a flue passage but swingable to open the inlet for entry of air responsive to predetermined air pressure thereagainst, the damper plate having a bearing opening therethrough, means for adjusting the air pressure responsiveness of the damper plate comprising a counterweight and a slender carrier of substantial extent having the counterweight mounted at one of its ends and projecting through said opening, and an apertured guide arm mounted upon said plate and having said carrier extending therethrough at a point spaced from the adjacent face of the plate, said carrier being movable through said guide arm and said opening for adjusting the position of said counterweight relative to the damper plate.

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