Dec. 30, 1947. E. A. FIELD, JR 2,433,749

DRAFT REGULATOR

Filed Dec. 20, 1943 2 Sheets-Sheet 1

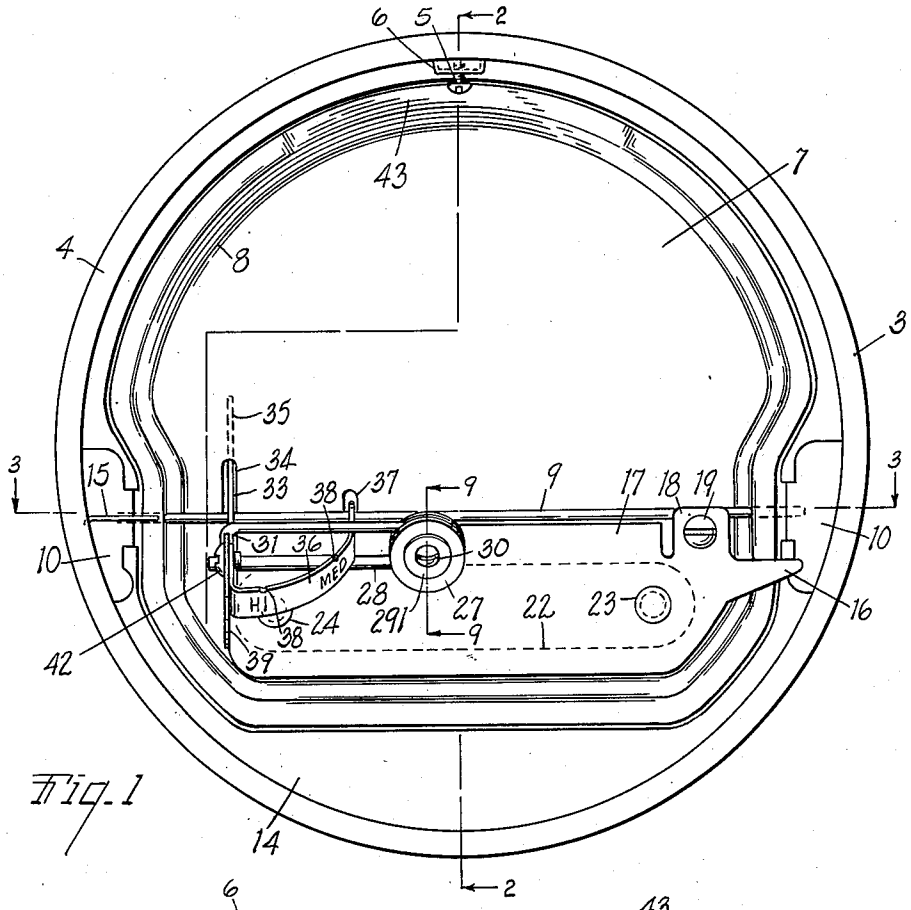


Fig. 1

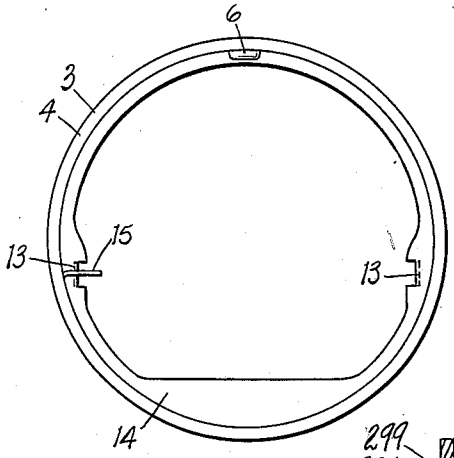


Fig. 5

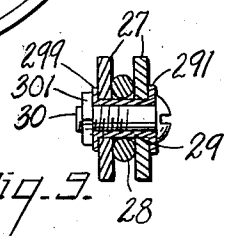


Fig. 3

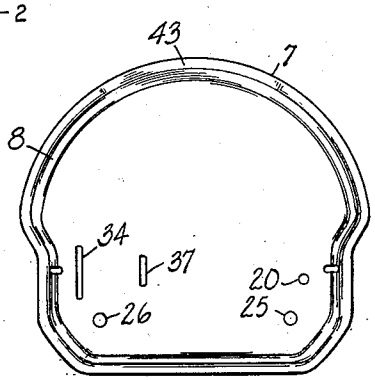


Fig. 6

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DRAFT REGULATOR

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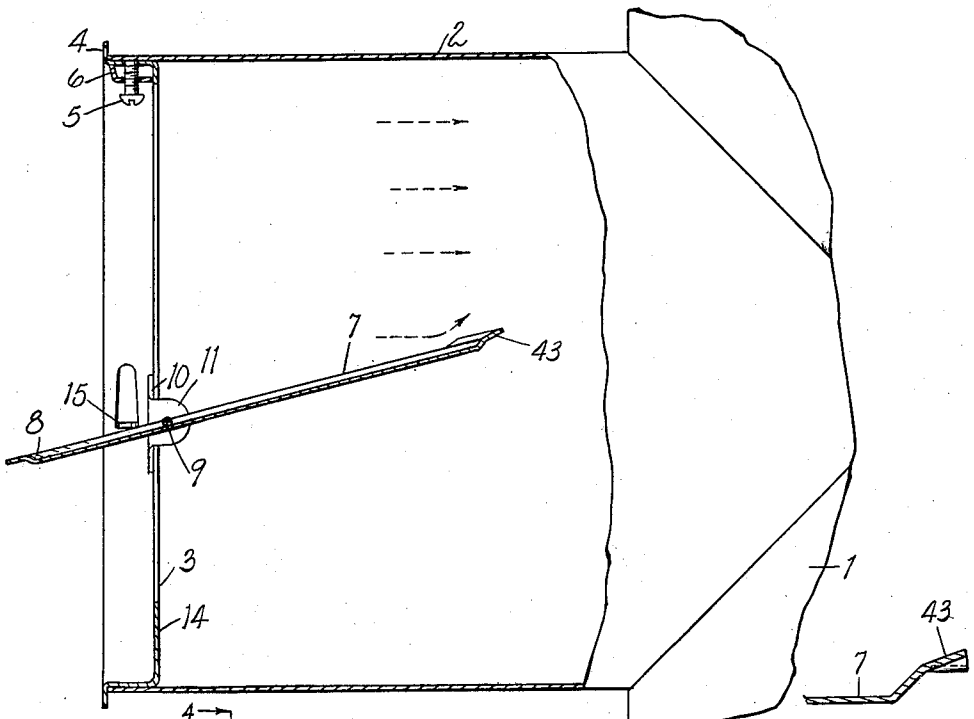


Fig. 6.

Fig. 8.

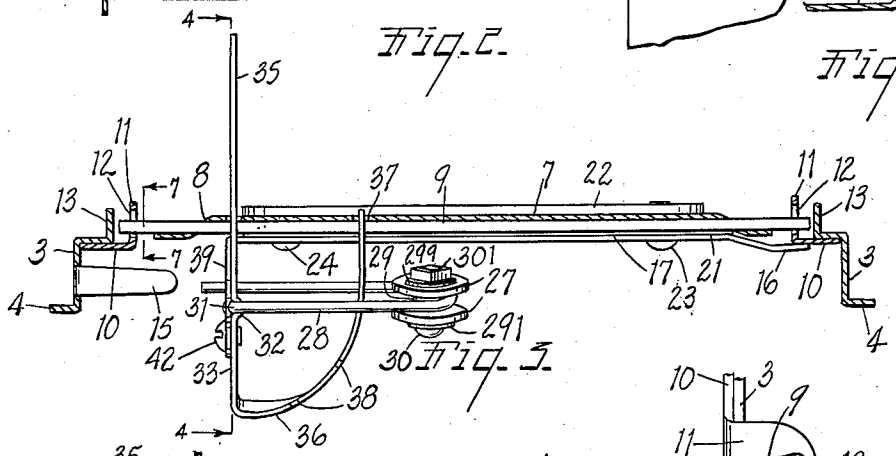


Fig. 5.

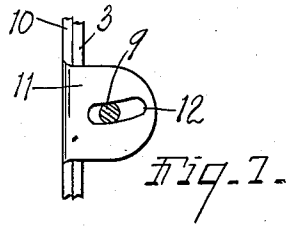


Fig. 7.

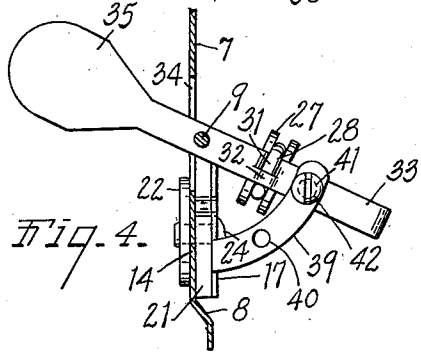


Fig. 4.

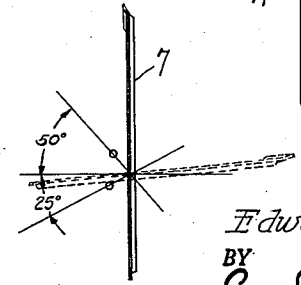


Fig. 10.

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UNITED STATES PATENT OFFICE

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DRAFT REGULATOR

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Application December 20, 1943, Serial No. 514,895

17 Claims. (Cl. 236—45)

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This invention relates to improvements in draft regulators.

The main objects of this invention are:

First, to provide an improved draft regulator for heaters and the like adapted to be attached to the smoke flue thereof to control the heater draft, said regulator having features of construction rendering the same extremely sensitive in operation as well as economical of production.

Second, to provide a regulator or draft control of the type described having means of adjustment particularly adapting the regulator for the draft conditions of a horizontal flue as well as for those of a vertical flue.

Third, to provide a draft regulator of the type described including a counterweighted gate in which the counterweight may be adjusted to and from the axis of the gate in two different planes, in one plane when the regulator is connected to a horizontal flue and in the other plane when connected to a vertical flue.

Fourth, to provide a control of the type described including a control gate of a special shape to provide extra turning thrust on the front of the gate to overcome some of the thrusts due to eddy currents at the back thereof.

Fifth, to provide a draft control of the type described including a gate having an improved hinge structure to reduce friction to a minimum, and that functions in an effective and silent manner.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a front elevational view of the draft regulator.

Fig. 2 is a fragmentary view in side elevation partially broken away and in section on line 2—2 of Fig. 1, illustrating various details and structural relationships of the parts.

Fig. 3 is a section on line 3—3 of Fig. 1 illustrating the gate and the ring frame support therefor.

Fig. 4 is a fragmentary view in section on line 4—4 of Fig. 3, illustrating the gate and details of means for adjusting one of the counterweights for the gate.

Fig. 5 is a front elevation of the annular rim or frame for supporting the gate therein.

Fig. 6 is a front elevation of the gate as blanked out and pressed into form.

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Fig. 7 is an enlarged fragmentary view in section on line 7—7 of Fig. 3 illustrating the details of the hinge connection of the gate to its annular supporting frame.

Fig. 8 is an enlarged fragmentary sectional view corresponding to the section of Fig. 2, enlarged to more fully show structural detail.

Fig. 9 is a detail sectional view on line 9—9 of Fig. 1 illustrating the counterweight means for producing closing torque on the control gate.

Fig. 10 is a diagrammatic illustration of the control gate and the relative angular positions of the center of gravity of the counterweight for producing closing torque on said gate, in the open and closed positions of said gate.

The invention herein disclosed embodies in part modifications of certain of the features of construction of the draft regulator disclosed in my copending application, Serial No. 453,401, filed August 3, 1942, for Draft regulator, particularly adapting the regulator of the type therein disclosed to be readily adjusted to the draft conditions of either a horizontal or a vertical flue, as hereinafter described in detail. The above mentioned application matured April 18, 1944, into Patent No. 2,346,740.

In accordance with the present invention there is provided an improved draft control or regulator of the counterweighted gate type, said regulator being attached to a smoke flue 1 of any type of heater unit (not shown), such as a space heater, stove, furnace, or the like. The flue may be horizontally disposed or vertically disposed as shown in Fig. 2. In the illustrated embodiment the regulator comprises a cylindrical sheet metal housing 2 adapted to fit against the side of the flue 1 and secured thereto by any suitable means well known to the art.

At its outer end the housing 2 telescopically receives an annular stamped sheet metal rim or gate frame 3 provided with a radially out-turned flange 4 abutting the outer end of the housing 2. A screw 5 has threaded engagement within an opening in an integral radially inwardly offset portion 6 of the rim 3 and engages the inner surface of the housing 2 so as to secure the rim or gate frame 3 within the housing 2. In actual practice the frame 3 is desirably stamped from a single sheet metal disk to the sharply dished outline as shown in Figs. 2 and 3, following which the thus conformed member has a gate blank punched from the inner portion thereof in the desired outline of the swingable gate 7 of the control. This procedure greatly simplifies and expedites the operation of forming the gate and

effects a considerable saving of material, and simultaneously results in the formation of the gate opening in the gate frame 3. Following the blanking out of the gate blank the latter is dished inwardly at 8, as illustrated particularly in Figs. 2 and 3, to give rigidity to the gate and to allow for a slight clearance between the outer edge of the gate and the inner edge of the gate frame.

The gate 7 is provided with a pivoting hinge pin in a simple and inexpensive manner by disposing an elongated wire rod or pin element 9 on the outer or forward side thereof and passing said pin through openings formed in the inclined annular dished or flange portion 8 of the gate on opposite sides of the latter. This hinge pin is disposed eccentrically of the gate and somewhat below the center of mass of the latter.

At opposite sides of the gate frame 3, I mount hinge brackets 10, these brackets having plate-like attaching portions spot-welded or otherwise suitably secured to the gate frame 3. The brackets have rearwardly or inwardly turned arms 11 having slots 12 therein, the lower edges of which rollingly receive the ends of the hinge pin 9, to afford a silent and substantially frictionless hinge support for the gate 7. It will be noted that the bearing surfaces of the slots 12 are inclined upwardly in the arc of a circle commencing at the front of the slot and extending to the rear thereof. By thus inclining the bearing surfaces, the hinge pin 9 is prevented from skidding backwards against the rear ends of the slots, caused by pressure of the air against the front of the gate. If this skidding happens the hinge pin will no longer roll in the slots but must turn against the rear ends of the slots as in an ordinary bearing. By inclining the bearing surfaces of the slots 12 in the arc of a circle so that the angle of inclination slightly increases from the front end of the bearing surface to the rear end thereof, as shown in Fig. 7, the hinge pin will soon find a place on the bearing surface inclined at an angle of 2 or 3 degrees for ordinary drafts to 4 or 5 degrees for very strong drafts, where it will rollingly engage said bearing surface without skidding in the event that the control is not installed exactly on the level, thereby facilitating ease and rapidity in installing the controls. It will be noted by reference to Fig. 7 that the radius of curvature of the bearing surface of the slot 12 is relatively large as compared to the radius of curvature of the bearing surface of the pin 9. This permits the pin to roll rearwardly during opening of the gate from a closed vertical position to widely opened substantially horizontal position without the pin engaging a too steep an incline such as will cause the pin to slide or skid down the incline and prevent free rolling contact of the pin with the bearing surface of the slot. To prevent endwise movement of the hinge pin 9 in its bearing slots 12, lugs 13 are bent rearwardly from the gate frame 3 to engage the ends of the pin.

Referring to Figs. 1 and 2, it will be noted that the gate frame 3 has a considerable segment of the material of which it is fabricated, designated 14, left therein at the lower portion thereof, instead of blanking this material out as a part of the gate. The purpose of this is to provide a large area of the gate above the hinge pin 9 thereof, as compared to the gate area below the hinge pin. The force tending to open the gate is only equal to the pressure of the air acting upon the differential in the area between said upper and lower areas. I have accordingly provided a relatively large differential, as compared to the size of the gate itself, so that a given air pressure acting on the gate swings the same with sufficient force to overcome any factor tending to cause sticking of the gate, for example, accumulation of dirt or soot at the hinge thereof. With the upper half of the gate of a generally circular outline as shown so as to closely fit the circular housing and provide for a gate of maximum area, it is essential that the hinge pin 9 extend through the housing closely adjacent the axis of the circular housing in order to prevent the circular edges of the gate striking the housing when the gate opens.

In order to limit the movement of the gate between its open and closed positions, I provide a stop member for the open position consisting of a relatively elongated spring stop lug or member 15 struck radially inwardly from one side of the gate frame 3. This stop coacts with the gate 7 in the manner clearly illustrated in Fig. 2, in the fully opened position of the gate. In order to limit the movement of the gate in the opposite direction or closed position I provide a closing stop 16 in the form of a relatively long finger formed on the plate 17 as hereafter described. This finger engages the gate frame 3 as shown in Figs. 1 and 3 to limit the closing movement of the gate. To lock the hinge pin 9 to the gate, the plate 17 is provided with a projecting portion 18 engaging over the hinge pin. A bolt 19 passes through an opening in the projection 18 and an opening 20 in the gate 7 and is provided with a nut (not shown) at the back of the gate for drawing the parts into tight engagement.

As the hinge pin 9 of the gate is set off center it is necessary that the gate have a balancing means to adjust the differences in weight above and below the hinge pin, so counterweights or balance weights 21 and 22 are provided. The balance weights 21 consists of a heavy piece of material shaped more or less like the plate 17 which covers the same when the parts are fully assembled. The cover plate 17 and the balance weights 21 are secured to the front of the gate by the attaching rivets 23 and 24 extending through openings 25 and 26 respectively in the gate. The balance weight 22 is mounted on the inner side of the gate and is secured thereto by the single attaching rivet 23 extending through said weight eccentric thereof. The sole purpose of the weight 22 is to enable the gate to be properly balanced prior to leaving the factory. Thereafter it is not designed to be manipulated in any manner.

Another counterweight means is also provided which provides for the sole closing torque of the gate. This counterweight means has two separate adjustments, one being for controlling the draft and the other adapting the draft control for the draft conditions of either a vertical or a horizontal flue. The counterweight for this means comprises the washer-like weights 27 and the weight adjustment arm or lever 28. The weights 27 are mounted upon the arm or lever 28 by means of a tubular rivet or eyelet 29 which is inserted through the weights, one being disposd on either side of the arm and between the arms of the lever at the bight thereof. This eyelet or rivet is headed at one end and offset at the other as shown in Fig. 9 for retaining the washer-like weights. The bolt 30 with its nut 30' inserted through the eyelet supplies additional weight and is used when the mechanism is set for operation in a horizontal flue. For

horizontal pipe installation the weight washers 27 and securing bolt 30 are installed on the eyelet 29 on weight arm 28, but for vertical pipe installation the bolt is omitted, the weight arm 28 alone then providing closing torque for such vertical flue installation. The weight arm 28 has at the end of one arm thereof an inwardly bent portion 31 pivotally mounted between the opposite offset portions 32 in the supporting lever 33 pivotally mounted on the hinge pin 9 and projecting through a vertically elongated opening 34 in the gate 7 and to the rear of the gate so that the enlarged portion 35 of the supporting arm at the rear of the hinge pin counterbalances the portion of the arm forward of the hinge pin. The weight arm 33 at its forward end is provided with a rearwardly bent extension 36 with its forward portion of quadrant shape and with its rearward end pivoted on the hinge pin 9 and projecting therebeyond through an opening 37 in the gate 7. The weight arm 28 clampingly embraces the quadrant of the arm extension 36, so that the weight arm 28 may be retained in any adjusted position to provide for the draft control desired. To further insure the weight arm 28 being retained in adjusted position the quadrant 26 is provided with notches 38 appropriately designated as high, medium and low, as shown in Fig. 1. The pivot 31 of the weight arm 28 is so disposed relative to the supporting lever or arm 33 that the arm 28 with the weights 27 thereon is adjusted towards and from the hinge pin 9 and in a plane having lying therein the pivotal axis of the gate.

The weight arm 28 with the weights 27 thereon may be adjusted to swing in either of two planes, both of which have lying therein the pivotal axis of the gate, these planes of adjustment being disposed at different angular distances from the plane of the gate to provide for different closing torques on the gate. When the draft control is installed on a vertical flue, to provide a greater closing torque on the gate in the closed position thereof and a smaller closing torque in the widely opened position thereof, as compared to the closing torques on the gate for the corresponding positions respectively of the gate for horizontal pipe installation, the plane of adjustment of the weight arm 28 is at a greater angular distance from the plane of the gate than when the draft control is connected to a horizontal flue, for the reason that when connected to a vertical flue the smoke eddying into the collar of the draft control strikes the back of the gate with greater force and offers greater resistance to the opening of the gate than when the draft control is connected to a horizontal flue.

The means for effecting this adjustment comprises an outwardly and upwardly projecting curved arm 39 integral with the plate 17 and provided with an inner lower opening 40 and an outer upper opening 41, both of which are adapted to receive a screw 42 having threaded engagement in an opening in the supporting lever 33 to which the weight arm 28 is pivoted. When installing the draft control to a vertical flue the screw 42 is inserted through the upper opening 41 and threaded into the lever 33, as shown in Fig. 4, this without the use of the bolt 30, providing for the necessary closing torque on the gate 7 when the control is connected on the vertical flue. When installing the draft control on a horizontal flue, the screw 42 is inserted in the lower opening 40 and this, together with the bolt 30 provides for the additional closing torque necessary when the control is installed on a horizontal flue. It will be noted that whether the supporting lever 33 is connected at the upper opening 41 for the torque necessary when the draft regulator is connected to a vertical flue or is connected to lower opening 40 for the torque necessary when the draft regulator is connected to a horizontal flue, in both instances the adjustment of weight arm 28 relative to the quadrant position of the arm 36 for low, medium draft control remains the same.

During the assembly operation at the factory all the parts are mounted on the gate, with the exception of the weights 27 and their supporting arm 28. Without this arm and these weights, but with all the other parts, the gate is designed to be nearly in balance—that is, the center of gravity is located on the center line of the hinge pin 9, the final balancing having been effected by adjustment of the eccentrically mounted balance weight 22 about the rivet 23. The weight arm 28 provides the closing torque, this torque being slight if the arm is set in a notch 38 designated as low draft, and greater if the lever is adjusted outwardly to a notch 38 designated as high draft. As the weight arm 28 is adjusted outwardly the center of gravity of said parts also moves outwardly which increases the moment of force tending to close the gate. If the supporting lever 33 is attached at the outer hole 41, for vertical pipe installation, as the gate opens, the center of gravity of the torque arm moves outward and upward for the first 25 degrees, and then inward and upward for the next 50 degrees, as shown in the diagrammatic illustration of Fig. 10. If the supporting lever 33 is connected at the inner hole 40, for horizontal pipe installation, said center of gravity moves outward and upward for the first 57 degrees and then inward and upward for the next 18 degrees. Because of the above mentioned inward and upward movement of 50 degrees when adjustment is made for a vertical flue installation, as compared to inward and upward movement of only 18 degrees when adjustment is made for a horizontal flue installation, resulting in the closing torque on the gate during the latter part of its opening movement decreasing a considerably and relatively rapidly in vertical flue installation, as compared to that of a horizontal flue installation, it is desirable that the opening thrust on the gate be increased in substantial opened positions thereof to offset the above mentioned varying conditions. This increased thrust is effected by bending a substantial segment of the upper portion of the gate 7 outwardly at an angle of approximately 20 degrees to the plane of the gate as shown at 43 in Fig. 2. This, in addition to the flange or angle resulting from the dishing of the gate, provides a substantial flange against which the air flowing over the gate impinges, even when the gate is in its fully open position as shown in Fig. 2. This not only increases the opening thrust against the gate, particularly during the latter part of the opening movement, but it minimizes the teetering or fluctuation of the gate during a wide range of its movement. This also counteracts in a large measure the variations resulting from eddying currents in the flue or in the regulator housing at the rear of the gate, and gives desirable results for both vertical and horizontal installations of the draft regulator.

The above described control may be quickly and accurately adjusted for either vertical or

horizontal flue installations. It is very easily, quickly and economically manufactured. There are no parts requiring considerable attention and care in use, and it is exceedingly sensitive and accurate in operation.

I have illustrated and described my invention in an embodiment which I have found very practical. I have not attempted to illustrate or describe other embodiments or adaptations as it is believed this disclosure will enable those skilled in the art to embody or adapt my invention as may be desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a draft regulator, a cylindrical open ended control housing, a circular gate frame disposed concentrically adjacent the open end of the housing, a control gate of generally circular outline pivoted on said gate frame, the pivotal axis of said gate being horizontal and extending relatively close to the axis of the circular housing, the periphery of said gate being disposed closely adjacent said gate frame and the gate being truncated on a chord parallel to the gate axis to thereby afford a large pressure area differential on opposite vertical sides of said axis, said gate having an outwardly inclined portion along the upper edge thereof to increase the opening thrust on the upper portion of said gate in relatively wide open positions thereof, a weight arm and a weight thereon together constituting a counterweight to produce closing torque on said gate, a pivotally adjustable lever, the pivotal axis of said lever and the pivotal axis of the gate coinciding, said lever extending outwardly and downwardly from said gate to swing to and from the gate, said weight arm being pivoted to said lever to swing to and from the pivotal axis of the gate and to swing in a plane having the pivotal axis of the gate lying therein, means for retaining the weight arm with the weight thereon in different adjusted angular positions relative to the said lever to adjust the draft control, and means for retaining said lever in different adjusted angular positions relative to said gate to adapt the regulator for the draft conditions of either a horizontal or a vertical flue.

2. In a draft regulator, a cylindrical open ended control housing, a circular gate frame disposed concentrically adjacent the open end of said housing, a control gate of generally circular outline disposed in said gate frame, a hinge pin horizontally disposed on said gate and fixedly secured thereo, bearing members having bearing surfaces upwardly curved in a rearward direction for rollingly supporting the opposite ends of said hinge pin, the lower portion of said gate being truncated on a chord parallel to said axis to provide a large pressure area differential on opposite vertical sides to the axis of the gate, the upper edge portion of the gate being inclined outwardly at an angle of approximately 20 degrees to the plane of the gate to increase the opening thrust on the gate in relatively wide open positions thereof, a gate closing torque weight arm, a lever pivotally adjustable on said hinge pin and extending outwardly and downwardly from said gate, said weight arm being pivotally mounted on said lever to swing in a plane having lying therein the pivotal axis of the gate and to also swing to and from said pivotal axis, means for retaining said torque arm in different adjusted angular positions relative to said lever for varying the draft, and means for retaining said lever in different adjusted angular positions relative to the plane of the gate to adapt the regulator for the draft conditions of either a horizontal or a vertical flue.

3. In a draft regulator, a circular open ended control housing for passage of air therethrough to a smoke flue, a gate of generally circular outline in said housing for controlling the passage of air therethrough, said gate being mounted on a horizontal axis disposed closely adjacent the center of said housing, said gate having differential pressure areas above and below said axis to open said gate by excess of pressure on the outer surface thereof, a counterweight for producing closing torque on said gate, a lever pivotally mounted to swing about an axis substantially coincident with the horizontal axis of the gate to and from the plane of the gate, said counterweight being pivotally mounted on said lever to swing to and from the horizontal axis of the gate and to swing in a plane coinciding substantially with said axis, means for retaining said counterweight in pivotally adjusted positions on said lever for adjusting the draft control, and means for retaining the lever in adjusted angular positions relative to the plane of the gate to adapt the regulator for the draft conditions of either a horizontal or a vertical flue.

4. In a draft regulator, an open ended control housing for passage of air therethrough to a smoke flue, a control gate for the housing, said gate being pivotally mounted on a horizontal axis and having differential pressure areas above and below said axis, the area above being substantially greater than that below, counterweight means including an arm for producing a closing torque on said gate, a lever pivotally mounted on said gate to swing to and from the plane of the gate, said arm being pivotally mounted on said lever to swing to and from the axis of the gate and to swing in a plane coinciding substantially with said axis, means for retaining the arm in pivotally adjusted positions relative to the lever, and means for retaining the lever in pivotally adjusted positions relative to the gate.

5. A draft regulator device comprising an open ended control housing for passage of air therethrough into a flue, a control gate horizontally pivotally mounted in said housing, counterweight means including an arm to produce a closing torque on said gate, a lever pivotally mounted on the gate to swing to and from the plane of the gate, the pivotal axis of said lever substantially coinciding with the pivotal axis of said gate, means for retaining said lever in different angular positions relative to the plane of the gate, said arm being pivotally mounted on said lever to swing to and from the pivotal axis of the gate and in a plane having substantially lying therein the pivotal axis of the gate, and means for retaining said arm in different angular positions relative to said lever.

6. A draft regulator device comprising an open ended control housing, a control gate disposed adjacent the outer end of said housing and pivotally mounted on a horizontal axis, a counterweight for producing closing torque on said gate, a lever pivotally mounted on said gate for adjustment to and from the plane of the gate, said counterweight being pivotally mounted on said lever for angular adjustment to and from

the pivotal axis of the gate and in a plane having lying substantially therein the pivotal axis of the gate.

7. A draft regulator device comprising an open ended control housing, a control gate disposed adjacent the outer end of said housing and mounted on a horizontal axis, a counterweight for producing closing torque on said gate, a first means on said gate for adjusting the counterweight to and from the plane of the gate to adapt the draft regulator for the draft conditions of either a vertical or a horizontal flue, a second means adjustable on said first means for moving the counterweight to and from said horizontal axis for adjusting the draft when the draft regulator is connected to either a vertical or a horizontal flue, said second means including a lever pivoted to said first means, the pivotal axis of said lever extending in a direction substantially at right angles to the direction of said horizontal axis of said gate.

8. A draft regulator device comprising an open ended control housing, a control gate disposed adjacent the outer end of said housing and mounted on a horizontal axis, counterweight means for producing closing torque on said gate, a lever pivotally adjustably mounted on said gate, the pivotal axes of the lever and gate substantially coinciding, the lever projecting on opposite sides of its pivotal axis and through the gate to the opposite sides thereof and having its opposite ends on opposite sides of its pivotal axis substantially balanced, said counterweight means mounted on the lever for adjustment towards and from the pivotal axis of the gate, and for adjustment in a plane coinciding substantially with the pivotal axis of the gate.

9. In a draft regulator, an open ended control housing for passage of air therethrough into a flue, a pivoted control gate disposed adjacent the outer open end of said housing and adapted to be opened by excess pressure on the outer surface thereof, a first means for producing a closing torque on said gate, a second means for adjusting said first means to adjust the closing torque to adapt the draft regulator to the draft conditions of either a vertical or a horizontal flue, and a third means for adjusting said first means to adjust the closing torque to vary the draft when the regulator is connected to either a vertical or a horizontal flue, said second and third means including two levers pivotally adjustably connected to each other, one of said levers being pivotally adjustably connected to said gate, and the other lever supporting said first means, the pivotal axes of the two levers extending in directions substantially at right angles to each other, the last named lever swinging on its pivotal connection with the first-named lever in a plane substantially parallel and substantially coinciding with the axis of the pivotal connection of the first-named lever to the gate.

10. In a draft regulator device, an open ended control housing for passage of air therethrough into a flue, a pivoted control gate in the outer open end of said housing to be opened by excess of pressure on the outer surface of the gate, counterweight means on said gate for producing a closing torque on said gate, a horizontally disposed hinge pin to which said gate is fixedly secured, bearing members at the opposite ends of said pivot pin, said bearing members having bearing surfaces upwardly curved in a rearward direction for rollingly supporting said pivot pin,

the bearing surfaces of said pin being curved and providing a continuously and uninterruptedly curved rolling contact with the upwardly curved bearing surfaces of said bearing members during movement of the gate from a closed substantially vertical position to a widely opened substantially horizontal position, the radius of curvature of the bearing surfaces of the bearing members being relatively large as compared to the radius of curvature of the bearing surfaces of said pin, the rearwardly and upwardly curved bearing surfaces of the bearing members being adapted progressively to increase gravitational resistance to the opening of said gate as said pin rolls rearwardly and upwardly along the progressively increasing steepness of said curved bearing surfaces, the gravitational resistance being at a minimum when the pin is in a forward position.

11. A draft regulator device comprising an open ended control housing for passage of air therethrough into a flue, a control gate horizontally pivotally mounted in said housing to be opened by excess of pressure on the outer surface thereof, means for producing a closing torque on said gate, hinge means on said gate, and bearing members having bearing surfaces upwardly curved in a rearward direction for rollingly supporting said hinge means, the bearing surfaces of said hinge means being curved and providing a continuously uninterruptedly curved rolling contact with the upwardly curved bearing surfaces of said bearing members during movement of the gate from a closed substantially vertical position to a widely open substantially horizontal position, the radius of curvature of the bearing surfaces of the bearing members being relatively large as compared to the radius of curvature of the bearing surfaces of the hinge means, the rearwardly and upwardly curved bearing surfaces of the bearing members being adapted progressively to increase gravitational resistance to the opening of said gate as said hinge means roll rearwardly and upwardly along the progressively increasing steepness of said curved bearing surfaces, the gravitational resistance being at a minimum when the hinge means is in a forward position.

12. A draft regulator device comprising an open ended control housing for passage of air therethrough to a flue, a control gate horizontally pivotally mounted in the outer open end of said housing to be opened by excess of pressure on the outer surface thereof, a first lever constituting a counterweight to produce a closing torque on said gate, a second lever mounted for angular adjustment about the pivotal axis of said gate to and from the plane of the gate, said first lever being pivotally mounted on said second lever for adjustment to and from the pivotal axis of the gate and in a plane having lying therein said pivotal axis, said gate having the upper edge thereof inclined outwardly from the plane of the gate to increase the opening thrust on the gate in substantial opened positions thereof.

13. In a draft regulator, an open ended control housing for passage of air therethrough to a flue, a control gate in said housing, said gate being mounted on a horizontal pivot to be opened by excess pressure on the outer surface thereof, counterweight means including a first lever to produce a closing torque on said gate, a second lever pivotally mounted on said gate for angular adjustment to and from the plane of the gate, said first lever being pivotally mounted on said

second lever, the direction of the pivotal axis of the first lever being substantially at right angles to the direction of the pivotal axis of the second lever, said first lever swinging on its pivotal connection with said second lever in a plane substantially parallel and substantially coinciding with the axis of the pivotal connection of said second lever with the gate, said gate having the upper edge portion thereof inclined outwardly from the plane of the gate to increase the opening thrust thereon in substantial opened positions thereof.

14. In a draft regulator device, comprising a cylindrical open-ended control housing and a control gate of generally circular outline pivoted therein on a horizontal axis located adjacent the longitudinal center of the housing, the lateral and upper portion of the periphery of said gate being disposed closely adjacent said housing and the gate being truncated on a chord parallel to the gate axis to thereby afford a large pressure area differential on opposite vertical sides of said axis while enabling the latter to be disposed adjacent the center of the frame and the gate periphery closely adjacent the housing, a counterweight on said gate to produce a closing torque on the same, and a stop to limit the opening movement of the gate when the plane of the gate is inclined slightly upwardly toward the rear, a first means for adjustably retaining said counterweight means in a first position at a substantial distance from the plane of the gate to adapt the draft regulator for connection to a horizontal flue and in a second position at a greater distance from the plane of the gate to adapt the draft regulator for connection to a vertical flue, said positions being disposed in the arc of a circle, the plane of the circle being substantially at right angles to the plane of the gate and the center of the circle coinciding substantially with the pivotal axis of the gate, a second means supported by said first means for adjustably retaining said counterweight means in positions at different distances from the pivotal axis of the gate, said positions last mentioned being disposed in a plane substantially coinciding with the pivotal axis of the gate, said gate having an upper portion thereof inclined outwardly from the plane of the gate to increase the opening thrust on the gate in relatively widely opened positions thereof to supplement the decreasing closing torque on said gate due to inward movement of the center of gravity of said counterweight so as to cause the gate to open more widely and thus acting to maintain the draft at a more uniform value.

15. In a draft regulator, a cylindrical open-ended control housing for passage of air therethrough to a flue, a control gate of a generally circular outline in said housing, said gate being mounted on a horizontal pivot closely adjacent the center of the housing for the upper portion of the gate to open inwardly by excess pressure on the outer surface thereof, counterweight means on said gate for producing closing torque on said gate, the center of gravity of said counterweight means being disposed forwardly of the plane of the gate and below the horizontal plane of the pivotal axis of the gate when the gate is in a vertically closed position, said center of gravity being disposed to move upwardly during the entire opening movement of said gate, and to move a substantial distance inwardly during the latter portion of the relatively widely opened positions of the gate, said gate having a portion thereof adjacent the upper edge thereof inclined outwardly from the plane of the gate to increase the opening thrust on the gate during said widely opened positions thereof to supplement the decreasing closing torque on said gate caused by said inward movement of the center of gravity of the counterweight during said relatively wide opened positions of the gate so as to cause the gate to open more widely and thus acting to maintain the draft at a more uniform value.

16. In a draft regulator, a cylindrical open-ended control housing, a control gate of generally circular outline adjacent the outer end of said housing, said gate being vertically disposed in the closed position thereof, said gate being horizontally pivotally mounted adjacent the center of said housing for inward movement of the upper portion of the gate by excess pressure on the outer surface thereof, a stop for limiting the inward movement of said upper portion of the gate when the plane of the gate is inclined slightly upwardly toward the rear, and a counterweight on said gate for producing closing torque on the same, the center of gravity of the counterweight being substantially spaced from the plane of the gate and beneath the horizontal plane of the pivotal axis when the gate is in a vertical closed position, said center of gravity being disposed substantially above said horizontal plane in the widely opened position of the gate against said stop, a first means for adjustably retaining said counterweight means in a first position at a substantial distance from the plane of the gate to adapt the draft regulator for connection to a horizontal flue and in a second position at a greater distance from the plane of the gate to adapt the draft regulator for connection to a vertical flue, said positions being disposed in the arc of a circle, the plane of the circle being substantially at right angles to the plane of the gate and the center of the circle coinciding substantially with the pivotal axis of the gate, a second means supported by said first means for adjustably retaining said counterweight means in positions at different distances from the pivotal axis of the gate, said positions last mentioned being disposed in a plane substantially coinciding with the pivotal axis of the gate, an upper portion of the gate being inclined outwardly relative to the plane of the gate to increase the opening thrust on the gate in widely opened positions of the gate to supplement decreasing torque on said gate so as to cause the gate to open more widely and thus acting to maintain the draft at a more uniform value.

17. In a draft regulator, an open-ended control housing, a control gate in the outer end of the housing, said gate being vertically disposed in the closed position thereof, said gate being horizontally pivotally mounted for inward movement of the upper portion thereof by excess of pressure on the outer surface thereof, a stop for limiting inward movement of the upper portion of the gate when the plane of the gate is inclined slightly upwardly toward the rear, and a counterweight on said gate to produce a closing torque on the same, said counterweight being disposed to move upwardly and inwardly during the relatively widely opened positions of the gate, a first means for adjustably retaining said counterweight means in a first position at a substantial distance from the plane of the gate to adapt the draft regulator for connection to a horizontal flue and in a second position at a

greater distance from the plane of the gate to adapt the draft regulator for connection to a vertical flue, said positions being disposed in the arc of a circle, the plane of the circle being substantially at right angles to the plane of the gate and the center of the circle coinciding substantially with the pivotal axis of the gate, a second means supported by said first means for adjustably retaining said counterweight means in positions at different distances from the pivotal axis of the gate, said positions last mentioned being disposed in a plane substantially coinciding with the pivotal axis of the gate, an upper portion of the gate being inclined outwardly from the plane of the gate to increase the opening thust on the same during the relaitvely widely opened positions to supplement the decreasing closing torque on the gate so as to cause the gate to open more widely and thus acting to maintain the draft at a more uniform value.

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