May 13, 1941. E. A. FIELD, JR 2,241,590

DRAFT CONTROL

Filed July 28, 1939 2 Sheets-Sheet 1

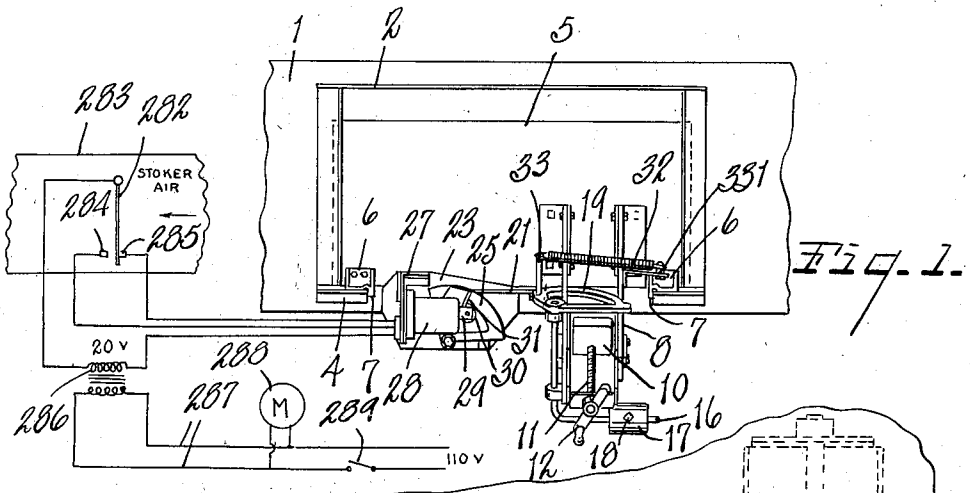


Fig. 1.

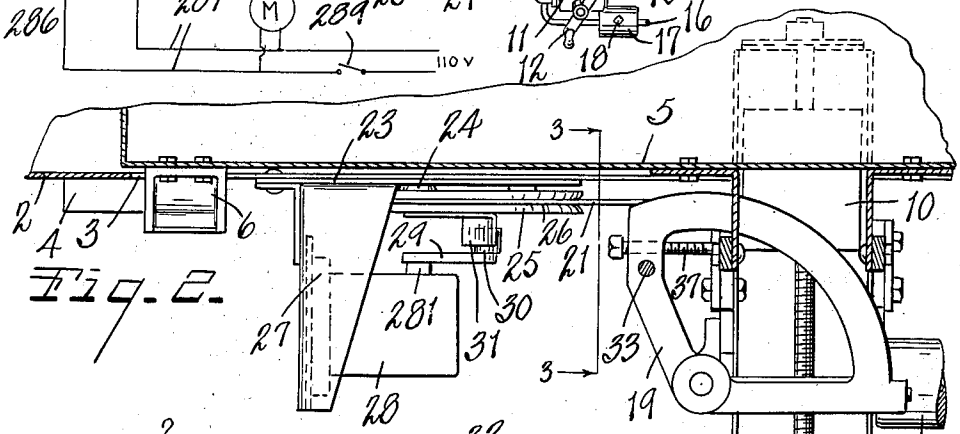


Fig. 2.

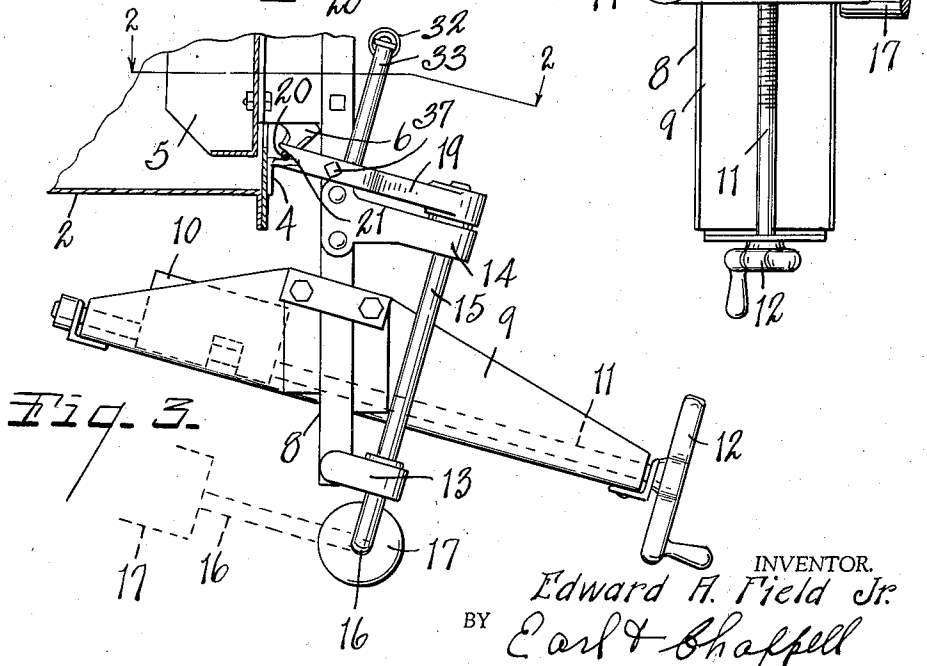


Fig. 3.

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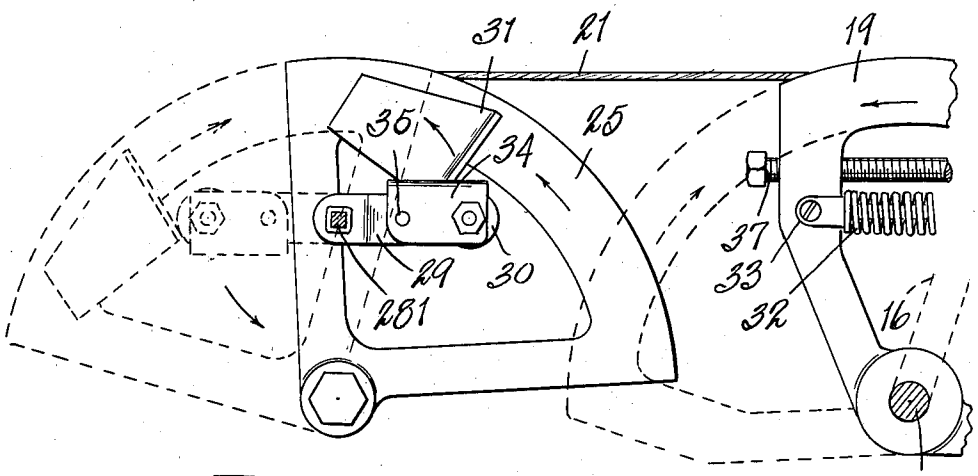


Fig. 4.

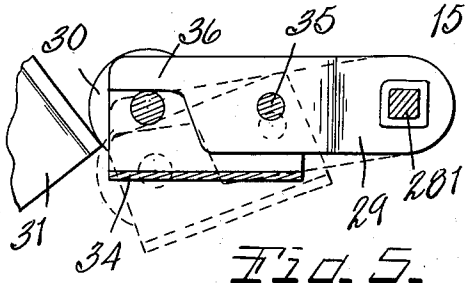


Fig. 5.

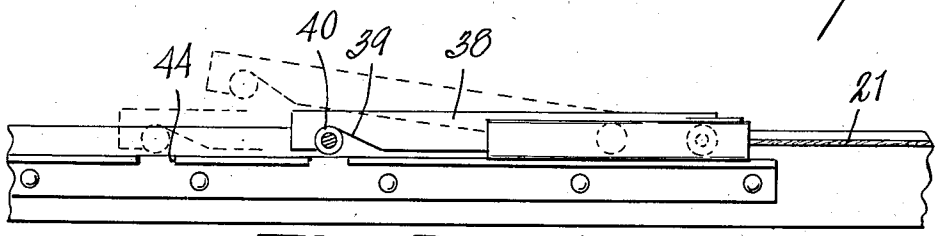


Fig. 6.

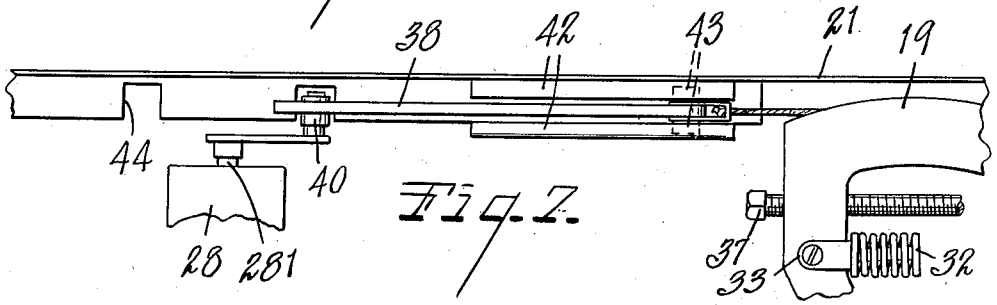


Fig. 7.

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UNITED STATES PATENT OFFICE

2,241,590

DRAFT CONTROL

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Application July 28, 1939, Serial No. 286,975

15 Claims. (Cl. 236—1)

This invention relates to improvements in draft controls.

The main objects of this invention are:

First, to provide an automatic motorized draft control well adapted for use with furnaces or boilers fed by automatic intermittently operating stokers.

Second, to provide a draft control of the type indicated having means to automatically increase the draft during periods of stoker operation.

Third, to provide a draft control having these advantages which permits a wide range of draft regulation both during the fuel feeding periods and the non-feeding periods.

Fourth, to provide a draft control having these advantages which is quickly responsive and capable of a wide range of adaptation for particular installations.

Further objects pertaining to details and economies of my invention will definitely appear from the description to follow. The invention is defined in the claims.

A structure which embodies the features of my invention is clearly illustrated in the accompanying drawings, in which:

Fig. 1 is a fragmentary view illustrating my improved draft control operatively associated with a furnace or boiler breeching which together with certain other parts is conventionally illustrated.

Fig. 2 is an enlarged fragmentary plan view in section on line 2—2 of Fig. 3 illustrating certain details of my improved draft control.

Fig. 3 is a fragmentary view in section on line 3—3 of Fig. 2.

Fig. 4 is an enlarged distorted view illustrating the counterbalance weight and motor quadrant pulleys constituting parts or elements of my invention in arbitrarily disposed relation intended to clarify the operating relation and movement of these parts during certain phases of operation of the controls.

Fig. 5 is a fragmentary sectional view illustrating certain details of construction of the motor quadrant actuating arm for enabling a quick release movement thereof.

Figs. 6 and 7 are fragmentary front elevation and top plan views, respectively, of a modified embodiment of the trip or release mechanism.

The draft control of my present invention is particularly designed for use on boilers and furnaces equipped with automatic stokers which operate intermittently. In such installations it is desirable to have a full draft or at least substantially increased draft during the periods when the stoker is in operation as this insures more satisfactory combustion during such period. However, it is desirable that such draft be checked during the periods when the stoker is not in operation, at the same time providing means for a normal draft control adjustable or adaptable for different operations and for varying operating conditions.

To this end I provide a draft control gate in operative association with the breeching of the furnace or boiler to be controlled with means for varying the operation thereof under non-stoking conditions, and with a motor driven means for increasing the draft during the stoking periods.

Referring to the drawings, Figs. 1, 2 and 3 illustrate a furnace or boiler breeching 1 having a draft control housing 2 opening thereto or communicating therewith. The draft or gate opening 3 of this housing is at the front thereof. Below and at each side of this opening is a pair of flanged or angled members 4. The gate 5 is provided at its lower edges with a pair of oppositely facing pivoting or rocker members 6 which support the gate so that it may swing or tilt inwardly. Each rocker member is provided with a depending lug 7 in end engagement with the support members 4 to limit the end play or movement of the gate and lock it in proper position relative to the opening with which it coacts.

The gate 5 is provided with a counterbalance mechanism for normal draft control of the type illustrated and claimed in my Patent No. 2,182,625, Dec. 5, 1939. The hanger or counterbalance arm 8 is secured to the gate to depend therefrom and is provided with a track 9 for the counterweight 10. This track extends a substantial distance to the front and to the rear of the arm 8. The main counterweight 10 is adjusted upon the track by means of the threaded rod 11 provided with a hand wheel 12 at its front end.

As stated in the aforesaid Patent No. 2,182,625, the adjustment of the weight 10 controls the gate 5, thereby regulating the draft for the furnace or boiler in normal operation thereof. This gate counterbalancing means is capable of a very wide range of adjustment, thereby adapting the control apparatus to a wide range in installations and operating conditions to be met or which may be desired.

The hanger or counterbalance arm 8 is provided with a pair of brackets 13 and 14 extending forwardly therefrom, these brackets being provided with bearings for the counterweight shaft 15 which terminates at its lower end in an

angularly disposed arm 16 on which the auxiliary counterweight 17 is adjustably mounted. A set screw 18 or other suitable means is provided for securing the weight in its adjusted positions on the arm 16. This rock shaft 15 may be rotated to swing the arm to a position substantially at right angles to the track 9, or, in effect, to swing the weight forwardly and thus materially increase the counterbalancing bias on the gate.

This auxiliary weight is preferably such that when in its actuated position the counterbalancing load on the gate is such as to partly or entirely close the gate and retain it in such a position under normal draft conditions, thereby very materially increasing the draft. I provide means for accomplishing this adjustment during the stoking period or period of operation of the stoker.

I will now describe the mechanism by which this automatic control or adjustment is effected in the preferred embodiment of my invention. On the upper end of the shaft or spindle 15 is a segment or quadrant pulley 19 peripherally grooved at 20 to receive the tension or actuating cable 21. This cable 21 is secured to the pulley 19 at one end of the arc thereof. Since this pulley controls the position of the auxiliary weight it is carried by and movable with the hanger for the main track or way 9 and for convenience I designate it as the "actuated quadrant." The control housing has mounted thereon at 24 a supporting plate 23 upon which is pivotally mounted a second segmental pulley or quadrant 25 grooved at 26 to receive the cable 21. The pulley is attached to the quadrant 25 at the end thereof remote from the actuated quadrant 19. For convenience I designate the quadrant 25 as the "actuating quadrant," it being motor driven.

Accordingly it will be observed that a predetermined angular movement of the actuating quadrant 25 effects or produces equal angular movement as the actuated quadrant, since the two are of the same radius. It should be noted that the peripheral grooves of each of these quadrants 19 and 25 are in alinement with the pivot axis of the gate, see Figs. 1, 2 and 3, and that accordingly the cable 21 is in alinement therewith, with the result that there is no distortion force developed when the cable is tensioned tending directly to cause the guide to swing in either direction, and, conversely, movement of the guide does not apply stresses to the cable.

The supporting plate 23 has a forwardly extending bracket 27 thereon to which is secured a motor 28 of the conventional damper type, so-called, that is, a motor adapted to rotate a predetermined number of degrees, in this case 180 degrees, on successive energizations. The shaft 281 of this motor actuates a driving arm 29 which is provided with a roller 30 arranged to coact with an angled trip or tappet element 31 extending from the side of the actuating quadrant 25 whereby, when the motor is actuated through a cycle, the roller of the arm engages the tappet element through a predetermined number of degrees of the 180 degrees motor travel, thereby actuating the quadrants through the same predetermined angular travel. In the instant case this amounts to 60 degrees, which is sufficient to shift the auxiliary weight 17 from one position to the other.

The energization of motor 28 can be effected in any suitable manner and from any suitable source of current, as for example from an external transformer. In practice I utilize an electrical switch (not shown) which is suitably controlled by the stoker motor so that each time the stoker starts a contact is made, causing motor 28 to turn 180 degrees, then stop, and to turn a further 180 degrees and stop when the stoker shuts down, thereby completing the cycle. These operating connections are illustrated diagrammatically in Fig. 1 wherein the reference numeral 282 indicates a draft controlled conducting switch element pivotally mounted in a conduit 283 traversed by the force-fed combustion air for the stoker. This element is adapted to engage a stationary contact 284 when the stoker is operating and the stoker blower is forcing air through the conduit and to engage the fixed contact 285 when the stoker comes to rest and the blower shuts off, thus completing two distinct energizing circuits for motor 28. These circuits are fed from the secondary of a transformer 286 whose primary is connected to a suitable source of voltage supply through leads 287 and with which the stoker motor 288 may be connected in parallel if desired. The primary circuit may be controlled by a thermally responsive or other switch 289.

The foregoing circuit connects the motor 28 for energization in response to the stoker operation. This arrangement is merely illustrative of a single possible method of effecting operation of motor 28 at the initiation and termination of the stoker operation and other hookups or combinations will occur to those skilled in the art.

In the present device the motor 28 actuates the actuating quadrant and pulls cable 21 each time the stoker shuts down, thereby moving arm 17 approximately 60 degrees to the rear and reducing the draft in the breeching accordingly. It will be appreciated, however, that as soon as the stoker again starts it is necessary that the draft control gate counterbalance be restored immediately to the original or predetermined amount. Accordingly, in order to accomplish this quick return, I utilize a tripping action wherein the driving roller 30 passes out of contact with tappet or trip wing 31, freeing the actuating quadrant from the motor, at which time the quadrants are quickly returned to initial position by means of a tension spring 32 connected at one end to a pin 33 on the actuated quadrant 19.

To further hasten the aforesaid return action I provide a jointed connection between the tappet actuating roller 30 and the motor arm 29 as illustrated in Figs. 4 and 5; i. e., the roller 30 is rotatably mounted in a stamping 34 pivoted to arm 29 at 35. During the larger portion of the period of engagement of the roller with the wing tappet 31 the roller pivot is engaged by an extension or finger 36 on arm 29, but when the mid point of the roller passes the bottom edge of the wing plate the roller snaps past the latter from the position illustrated in solid lines in Fig. 5 to that illustrated in dotted lines. The roller snaps ahead of the center line of arm 29, freeing the quadrant and allowing it to return under the influence of spring 32. When arm 29 rotates to the position at which it will come to rest during the period of stoker operation, i. e., as illustrated in solid lines in Fig. 4, the roller drops back into place again. Attention is directed to the fact that in Fig. 4 the quadrants 19 and 25 are shown in an arbitrarily arranged relation for the sole purpose of illustrating the coaction thereof to rotate arm 15. This relation of the quadrants would never actually occur in operation, as Figs. 1 and 2 make clear.

An adjustable stop screw 37 is carried by the actuated quadrant 19, see Figs. 2 and 4, and abuts hanger 8 to hold the weight support 16 in proper

position parallel to the pivot line of the gate during the "on" period of operation of the stoker.

In installing the control the main weight 10 is manually adjusted while the stoker is in operation (with the weight support arm 16 parallel to the axis of the gate) sufficiently to maintain the gate closed. As soon as the stoker shuts down, the weight supporting arm 16 will move to the dotted line position of Fig. 3, at which time the auxiliary weight 17 can be adjustably shifted thereon to give the gate the desired stabilizing opening and resultant reduction in draft. Thereafter, the control is entirely automatic in operation and functions quickly and efficiently to effect a considerable economy in fuel by eliminating unnecessarily rapid burning of fuel when there is no special call for heat.

In place of the tripping action and motor quadrant illustrated in Figs. 1 to 5, inclusive, it may be desirable to incorporate the modified mechanism illustrated in Figs. 6 and 7 for accomplishing the same purpose. This mechanism consists of a connecting rod or link 38 attached at one end to the cable 21 and provided adjacent its opposite end with a downwardly facing notch-like catch 39 adapted to coact with a roller 40 on a rotating arm 41 secured to the shaft of draft motor 23. The link 38 is laterally and vertically restrained at the end adjacent cable 21 by fixed channel-like ways 42 receiving laterally extending anti-friction rollers 43 on the said end of the link. During its rotary travel the roller 40 passes through spaced slots 44 in the projecting leg of an angle iron mounted to extend across the lower front part of the draft control housing, the arm 41 traveling in counterclockwise direction as illustrated in Fig. 6 and moving the link 38 through the successive positions shown in solid and dotted lines in that figure; i. e., the roller 40 first passes upwardly through the right hand slot 44, engaging in notch 39 and pulling link 38 upwardly and to the left, thence downwardly through the other slot 44, at the same time stripping itself from the link which is then returned by the cushioned spring 32 in the manner described above. This construction is in general functionally the equivalent of that illustrated in Figs. 1 to 5, inclusive.

I have illustrated and described my improvements in embodiments which are 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 improvements as may be desired.

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

1. A draft control for an automatically fired furnace or boiler wherein the combustion device operates intermittently, comprising a housing communicating with an opening in the furnace breeching and having a further opening communicating with the atmosphere, a counterbalanced gate pivotally mounted in said last named opening, means for decreasing the resistance to opening of said gate during the periods of inaction of the device comprising a bracket connected to the gate, a shaft pivotally mounted in the bracket and having an offset arm, an auxiliary counterweight adjustably mounted on said arm, said shaft being swingable on the gate to shift the arm from a position parallel to the axis of the gate to a position at an angle thereto to decrease the auxiliary counterweight closing moment on the gate, means for rotating said shaft at the commencement of said periods of operation and inaction of the device comprising a motor controlled by the device and adapted to be energized for a predetermined period and then come to rest, means for mounting said motor on the control housing, a quadrant member pivotally mounted on said housing, an arm on the motor releasably engaging said quadrant member to rotate the same a predetermined number of degrees when the motor is energized, a further quadrant member on said shaft, a tension member connecting said quadrant members for simultaneous movement upon actuation of the first named quadrant member, said motor being energized at the initiation of operation of the device to disengage said motor arm from said first named quadrant member and complete a motor cycle to return the motor arm to initial position, and spring means for quickly rotating the quadrant members in the opposite direction when disengaged from said motor arm.

2. A draft control for an automatically fired furnace or boiler wherein the combustion device operates intermittently, comprising a housing communicating with an opening in the furnace breeching and having a further opening communicating with the atmosphere, a gate pivotally mounted in said last named opening, means for decreasing the resistance to opening of said gate during the periods of inaction of the device comprising a shaft pivotally mounted on the gate and having an offset arm, a counterweight adjustably mounted on said arm, said shaft being swingable on the gate to shift the arm from a position parallel to the axis of the gate to a position at an angle thereto so that said weight in said last named position decreases the closing moment on the gate, means for rotating said shaft at the commencement of said periods of operation and inaction of the device comprising a motor controlled by the device and adapted to be energized for a predetermined period and then come to rest, means for mounting said motor on the control housing, a rotatable member pivotally mounted on said housing, an arm on the motor releasably engaging said last named member to rotate the same a predetermined number of degrees when the motor is energized, a crank member on said shaft, a tension member connecting said rotatable and crank members for simultaneous movement upon actuation of the rotatable member by said motor, said motor being energized at the initiation of operation of the device to disengage said motor arm from said rotatable member and complete a motor cycle to return the motor arm to initial position, and spring means for quickly rotating the rotatable and crank members in the opposite direction where disengaged from said motor arm.

3. A draft control for an automatically fired furnace or boiler wherein the combustion device operates intermittently, comprising a housing communicating with an opening in the furnace breeching and having a further opening communicating with the atmosphere, a gate pivotally mounted in said last named opening, means for decreasing the resistance to opening of said gate during the periods of inaction of the device comprising a shaft pivotally mounted on the gate and having an offset arm, a counterweight mounted on said arm, said shaft being swingable on the gate to shift the arm from a position parallel to the axis of the gate to a position at an angle thereto so that said weight in said last

named position decreases the closing moment on the gate, means for rotating said shaft at the commencement of said periods of operation and inaction of the device comprising a motor controlled by the device and adapted to be energized for a predetermined period and then come to rest at the initiation and conclusion of operation of the device, means for mounting said motor on the control housing, a rotatable member pivotally mounted on said housing, an arm on the motor engaging said last named member to rotate the same a predetermined number of degrees when the motor is energized upon conclusion of the operation of the device, a crank member on said shaft, a tension member connecting said rotatable and crank members for simultaneous movement upon actuation of the rotatable member by said motor, said motor being energized at the initiation of operation of the device to disengage said motor arm from said rotatable member and complete a motor cycle to return the motor arm to initial position, and means for actuating the said members in the opposite direction when disengaged from said motor arm.

4. A draft control for a furnace or boiler operated by an intermittently operating combustion device, comprising a control housing communicating with the breeching of the furnace and having an opening communicating with the atmosphere, a gate pivotally mounted in said opening, a manually adjustable counterbalance weight mounted on said gate, an auxiliary counterbalance weight pivotally mounted on said gate, and means for pivotally shifting said auxiliary weight during the periods of inaction of the device to a position relative to the axis of the gate so that the auxiliary weight decreases the resistance of said gate to opening comprising a motor controlled by the device and adapted to operate for predetermined periods at the initiation and termination of operation of the device, and means controlled by said motor for shifting said auxiliary weight.

5. A draft control for a furnace or boiler operated by an intermittently operating combustion device, comprising a control housing communicating with the breeching of the furnace and having an opening communicating with the atmosphere, a gate pivotally mounted in said opening, a counterbalance weight mounted on said gate, an auxiliary counterbalance weight pivotally mounted on said gate, and means for pivotally shifting said auxiliary weight during the periods of inaction of the device to a position relative to the axis of the gate so that the auxiliary weight decreases the resistance of said gate to opening comprising a motor controlled by the device and means controlled by said motor for shifting said auxiliary weight.

6. A motorized draft control for a furnace provided with a combustion device operating intermittently, said control being adapted to reduce the furnace draft during periods of inoperation of the device, comprising a draft control housing communicating with the furnace breeching, a gate controlling the flow of air through said housing, and means to control the movement of said gate to reduce its resistance to opening during periods of inoperation of the device, comprising an arm pivoted on said gate having a counterweight thereon and normally lying substantially parallel to the axis of the gate in a position wherein the counterweight exerts a minimum opening bias on the gate, and means to swing the arm when the device comes to rest to shift the counterweight to a position to exert a reduced closing bias or greater opening bias on the gate comprising a motor on the housing under the control of the device and adapted to operate for predetermined periods at the initiation and termination of operation of the device, means connecting said motor and arm for pivotal movement of the latter to said last named position when the operation of the device terminates, and means for returning the arm to said first named position when the operation of the device resumes.

7. A motorized draft control for a furnace provided with a combustion device operating intermittently, said control being adapted to reduce the furnace draft during periods of inoperation of the device, comprising a draft control housing communicating with the furnace breeching, a gate controlling the flow of air through said housing, means to control the movement of said gate to reduce its resistance to opening during periods of inoperation of the device comprising an arm pivoted on said gate having a counterweight thereon and normally lying substantially parallel to the axis of the gate in a position wherein the counterweight exerts a minimum opening bias on the gate, and means controlled by said device for moving the arm to a position to exert a reduced closing bias or greater opening bias on the gate when the operation of the device terminates and for returning the arm to said first named position when the operation of the device resumes.

8. A motorized draft control for a furnace or boiler fired by an intermittently operating combustion device adapted to reduce the furnace draft during periods of inoperation of the device, comprising a draft control housing communicating with the furnace breeching, a gate controlling the flow of air through said housing, and means to control said gate to reduce its resistance to opening during periods of inoperation of the device, comprising a counterweight on said gate normally lying adjacent the axis of the gate in position to exert a minimum opening bias on the gate, means to shift the counterweight to a position relative to the gate axis to exert a reduced closing bias or greater opening bias on the gate, comprising a motor under the control of the device and adapted to operate for a predetermined period at the termination of operation of the device, and means for operatively connecting said motor to said counterweight to effect movement thereof upon actuation of the motor, and means for returning said counterweight to said first named position upon initiation of operation of the device.

9. In a draft control for an automatically fired furnace or boiler, wherein the fuel supply device operates intermittently, the combination of a pivotally mounted draft control gate operatively associated with the furnace or boiler breeching, a hanger arm connected to the gate, a main counterbalance weight adjustably mounted on said hanger arm, an auxiliary counterbalance weight adjustably mounted on said hanger arm for adjustment independently of said counterbalance, a motor on said housing controlled by the device and adapted to be energized for a predetermined period and then come to rest at the initiation and conclusion of operation of the device, a quadrant member pivotally mounted on said housing, an arm on the motor releasably engaging said quadrant member to rotate the same a predetermined number of degrees when

the motor is energized, a further quadrant member operatively connected to said auxiliary counterbalance, a tension member connecting said quadrant members for simultaneous movement upon actuation of the first-named quadrant member, said motor being energized at another period to disengage said motor arm from said first-named quadrant member and complete a motor cycle to return the motor arm to initial position, and spring means for quickly rotating the quadrant members in the opposite direction when disengaged from said motor arm.

10. In a draft control for an automatically-fired furnace or boiler, wherein the fuel supply device operates intermittently, the combination of a pivotally mounted draft control gate operatively associated with the furnace or boiler breeching, a hanger arm connected to the gate, a main counterweight adjustably mounted on said hanger arm, an auxiliary counterweight adjustably mounted on said hanger arm for adjustment independently of said main counterweight, a motor controlled by the device and adapted to be energized for a predetermined period and then come to rest at the initiation and conclusion of operation of the device, means actuated by the motor for shifting said auxiliary counterweight in one direction, and spring means for shifting said auxiliary counterweight in the opposite direction.

11. In a draft stabilizer, the combination of a pivotally mounted draft control gate, a hanger arm mounted on said gate and depending below the pivot thereof, a counterweight support mounted on said arm in transverse relation to the axis of said gate, a main counterweight mounted on said support for manual adjustment, a rockshaft mounted on said hanger arm with the plane of its axis substantially at right angles to the line of adjustment of said main counterweight on said support, said rockshaft being provided with a laterally projecting arm adapted to swing upon the actuation of the rockshaft from a position of substantial parallelism with the line of adjustment of said main counterweight to a position at an angle thereto, an auxiliary counterweight mounted on said arm of said rockshaft, an actuated quadrant on said rockshaft and an actuating quadrant, said quadrants being substantially tangent to the axis of the gate and connected by a tension member disposed with its connecting reach coaxial with the axis of said gate so that it is not affected by the swinging of the gate, a predetermined-period operating motor, and an arm actuated thereby, said actuating quadrant being engageable by said motor actuated arm to angularly shift the actuating quadrant.

12. In a draft stabilizer, the combination of a pivotally mounted draft control gate, a hanger arm mounted on said gate and depending below the pivot thereof, a counterweight support mounted on said arm in transverse relation to the axis of said gate, a main counterweight mounted on said support for manual adjustment, a rockshaft mounted on said hanger arm, said rockshaft being provided with a laterally-projecting arm, an auxiliary counterweight mounted on said arm of said rockshaft, and a predetermined-period operating motor operatively connected to said rock shaft.

13. In a draft stabilizer, the combination of a pivotally mounted draft control gate, a hanger arm mounted on said gate, a main counterweight adjustably mounted on said hanger arm, a rockshaft on said hanger arm provided with a laterally-projecting counterweight arm, an auxiliary counterweight mounted on said arm whereby the actuation of said rockshaft shifts said auxiliary counterweight to vary the closing moment exerted by said counterweights upon said gate, and a predetermined-period operating motor operatively connected to said rockshaft, the period of operation of said motor being such as to swing said auxiliary counterweight from one position to another.

14. In a draft stabilizer, the combination of a pivotally mounted draft control gate, a hanger arm mounted on said gate, a main counterweight adjustably mounted on said hanger arm, an auxiliary counterweight mounted on said hanger arm for adjustment independently of said main counterweight to vary the closing moment exerted by said counterweights upon said gate, and a predetermined-period operating motor operatively connected to said auxiliary counterweight.

15. In combination, a furnace or boiler equipped with an intermittently operating fuel supply means, a pivotally mounted draft control gate, a counterbalance for said gate, and means for controlling the resistance of said gate to the flow of air through said opening to thereby regulate the draft, comprising a motor mounted adjacent the housing and adapted when energized to operate for a predetermined period and then come to rest, connections between said motor and supply means for energizing the motor at the initiation and termination of the operation of the supply means, and means controlled by said motor for increasing and decreasing the resistance of the gate to flow of air through the opening at the initiation and termination, respectively, of the operation of the supply means, comprising an auxiliary counterweight pivoted eccentrically on the gate, and means controlled by the motor to pivotally shift said auxiliary counterweight and vary the moment exerted thereby on the gate.

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