Aug. 19, 1941. E. A. FIELD, JR 2,253,290

DRAFT CONTROL

Filed April 29, 1940

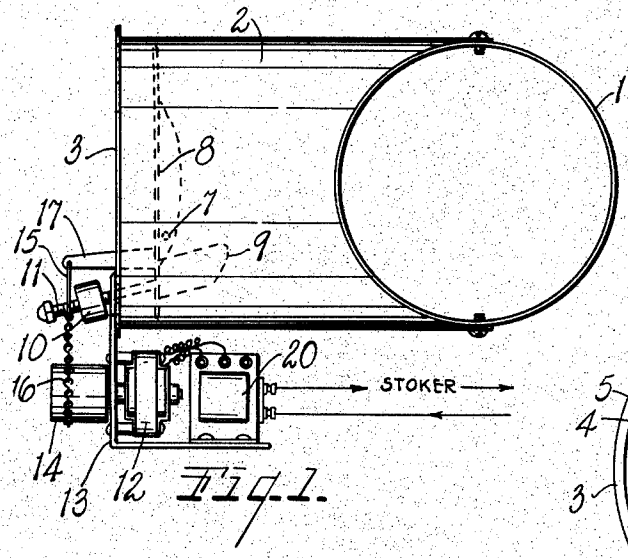


Fig. 1.

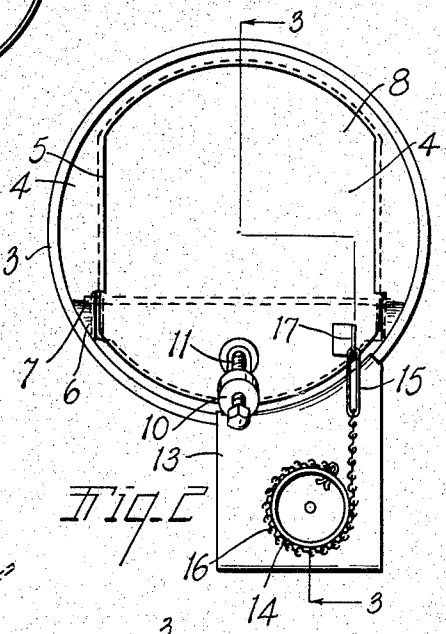


Fig. 2

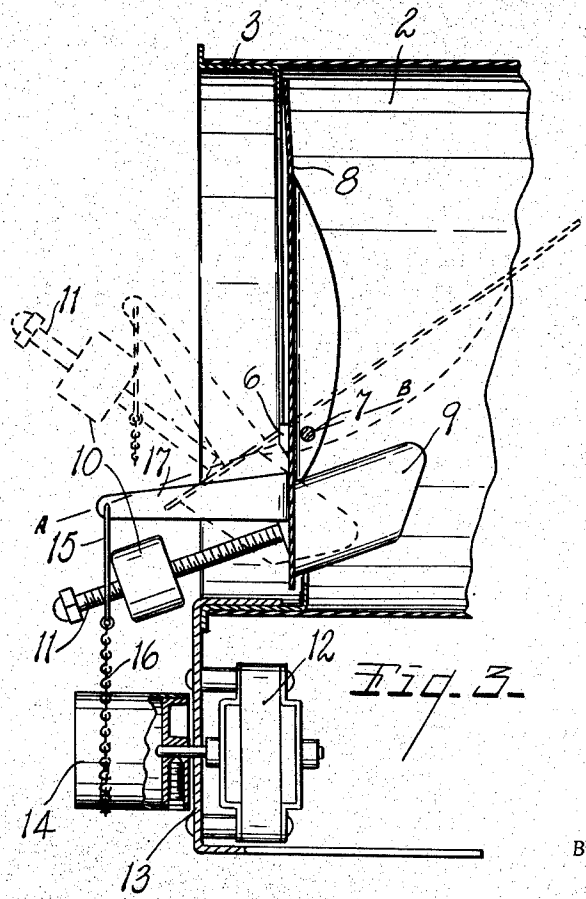


Fig. 3.

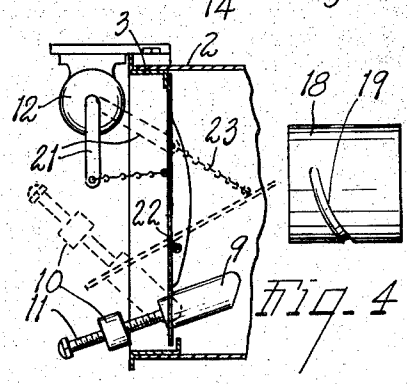


Fig. 4

Fig. 5

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DRAFT CONTROL

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6 Claims. (Cl. 236—45)

This invention relates to improvements in draft controls.

The main objects of my invention are:

First, to provide a novel draft control for stoker-fired or other automatically fired or controlled heating plants, which is very sensitive in its operation.

Second, to provide a control of the type described which is simple in its parts and readily embodied on existing furnace installations.

Third, to provide a control for checking the draft of an automatically fired or controlled furnace during the "off" period of the same, wherein the draft may be readily increased when the furnace is operating.

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

A structure embodying the features of my invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a view in side elevation illustrating a draft control in accordance with my invention operatively installed on the furnace breeching.

Fig. 2 is a view in front elevation of the installation illustrated in Fig. 1.

Fig. 3 is an enlarged fragmentary view in section on line 3—3 of Fig. 2, more clearly illustrating the construction and arrangement of the parts, two different positions of the draft control gate or damper constituting an element of the device being illustrated in solid and dotted lines respectively.

Fig. 4 is a detail view illustrating a modified form of pulley which may be employed in lieu of that illustrated in Fig. 3.

Fig. 5 is a side view in vertical longitudinal section illustrating a modified embodiment of the invention.

The present invention relates to a motorized draft control for the breeching of automatically fired furnaces. Though particularly devised for installation in a stoker-fired furnace, it will be apparent from the description to follow that the device of my invention is not unduly limited in this respect and can be applied to any automatically operating or controlled heating plant. Generally speaking, the invention has for its purpose the obtaining of a very sensitive and flexible control of the draft by the regulation of the current supply to the motor of the device, thereby regulating the torque developed by the motor in such manner that the desired amount of draft can be selected and maintained, whether during the "off" period of the burner or when the burner is on. The ability to control the closing force applied to a draft regulating gate or damper makes this flexibility possible and so far as I am aware is not possessed by any hitherto proposed draft control devices.

Referring to the drawing, the reference numeral 1 indicates a duct or breeching leading from a furnace to the stack through which the products of combustion pass. This duct has a suitable lateral opening formed therein and a cylindrical collar or housing member 2 is suitably attached to the duct to enclose this opening and thereby constitute a housing member communicating with the duct, the general outline of the duct and housing member being T shaped.

At the outer end of the housing member 2, a circular frame or stamping 3 is inserted in the open end of the housing member 2, this frame having the inwardly extending side wings 4 defining a generally rectangular gateway or opening 5. Suitable provisions generally indicated by the reference numeral 6 are incorporated in the frame for journaling a transverse trunnion or pivot rod 7 upon which the gate 8 is secured at a point substantially beneath its center to thereby eccentrically pivot the gate in the housing opening.

Gate 8 is provided with a standard counterweight or balance mechanism consisting of the back or rear weight 9 attached to the gate and a further front weight 10 longitudinally adjustably carried on the threaded screw 11 which is secured to and extends forwardly of the gate.

The foregoing balancing mechanism exerts a predetermined counterbalancing action on the gate which is regulable within certain limits by the adjustment of weight 10. In addition thereto, the present invention contemplates the provision of auxiliary motorized control means whose effect on the gate closely simulates the action of the counterbalancing mechanism, which effect may be accurately varied as desired depending upon the conditions of operation, the atmospheric draft existing and the like. This auxiliary mechanism consists of a suitable small, low-voltage motor 12 obtainable on the market from a number of manufacturers and designed to develop a predetermined torque which is variable by regulation of the current energizing the motor. The motor is mounted on a sheet metal bracket 13 attached to the frame or stamping 3 in housing member 2 and the shaft of the motor extends forwardly of this bracket and has secured thereto a wide pulley 14. This pulley is con-

nected by means of a link 15 and a light chain 16 to an arm 17 attached to and extending forwardly of gate 8.

It should be particularly noted that the theoretical line A—B drawn through the point of attachment of the chain and link to arm 17 and through the pivot point or rod 7 for the gate is parallel to the plane of adjustment of weight 10, i. e., parallel to the threaded screw 11. In this manner, motor 12, when actuated to pull chain 16, acts on the gate in precisely the same manner as the fixed counterbalancing mechanism; that is, as the gate swings from the position indicated in solid lines in Fig. 3 to that indicated in dotted lines, the horizontal lever arm or moment arm varies in length as the point of attachment of the link to the arm approaches the gate. Although the chain does not pull in an exactly vertical direction for every position of the gate, the discrepancy is very slight and even this can be minimized by lowering the motor and increasing the length of the chain, or alternatively, the pulley can be provided with a suitable helical groove upon which the chain winds to maintain a vertical relation thereof. A pulley for such a modified installation is illustrated in Fig. 4 and designated 18, the helical groove being indicated by the reference numeral 19. The essential feature is that the motor gives approximately the same effect of resistance to opening under fluid pressure on the gate as that produced by a standard adjustment or balancing means.

Referring to Fig. 1, the motor 12 is wired to a transformer 20 which is in turn parallel with the stoker (not shown) or other automatic fueling or combustion device or instrumentality controlling actuation of the furnace. I desire it to be understood that in referring in the appended claims to a combustion device or instrumentality I use these terms broadly intending to cover thereby any control or actuating means for a furnace such as a stoker, oil or gas burner or control, thermostat, etc. When wired in this way, the motor is energized as long as the burner operates, but develops no torque as soon as the burner shuts down. It will be understood that the motor operates in a stalled position most of the time, hence must be designed to withstand this type of service. As stated, such motors can be obtained from a number of manufacturers.

Inasmuch as the current applied to the motor can be increased or decreased as desired, the amount that the draft is increased when the burner starts and the chain is pulled downwardly by the motor can be adjusted to a fine degree. For instance, if a draft of .02 inch were maintained during the "off" period, a draft of .04 inch can be carried when the burner or firing device is on, or the draft can be .05 inch or .06 inch while the burner is on. Being free to open or close, the gate 8 can be adjusted to give a very low draft, for example, .01 or .02 inch, if desired. Obviously, these drafts have to be substantially increased whenever the burner operates and this the motor accomplishes very satisfactorily. Furthermore, the gate is not held in positive or fixed position during the "off" period of the combustion device, but can shift freely. So far as I am aware, these features have not been incorporated in any draft control equipment heretofore placed on the market. I am aware that solenoids have been employed in connection with the operation of draft control gates, but these have a snap action and it would be very difficult to arrange them to give the varying closing force which I am able to obtain with the above described structure.

Attention has been directed to the fact that as the gate opens, for example, to the dotted line position of Fig. 3, the point of attachment of link 16 to the arm 17 swings up and over toward the vertical plane, passing through the gate axis 7. This results in a shortened lever arm and diminished closing torque or moment, as has been described. Such result is wholly consistent with the fact that as the effective area of the gate becomes less and less upon opening of the latter, the force tending to close the gate or resist opening thereof should be reduced in proportion.

Another construction for proportioning the closing action to the effective area of the gate is illustrated in Fig. 5, wherein the motor 12 is mounted on the top of the housing member 2 and is provided with an arm 21 fixedly secured to the shaft thereof and connected at its free end to the gate above the pivot 22 of the latter by means of a chain 23. Closed and open positions of the gate and actuating instrumentalities therefor are illustrated in solid and dotted lines respectively and it will be observed that as arm 21 swings clockwise from the dotted line to the solid line position, the component of horizontal force increases as the effective area of the gate increases. This component is a function of the angular disposition of the arm 21 just as the effective area of gate 8 is a function of the angle of its inclination. In other respects, the embodiment of Fig. 5 is similar to that of Figs. 1, 2, and 3, the motor being wired with the stoker or other automatic combustion device and energized simultaneously therewith for the purposes mentioned in the preceding description.

I am unaware that it has ever been proposed to provide a draft control for an automatically operated heating plant which enables very low draft during the "off" period and a much higher draft during the "on" period by means of a motorized control dependent on variation of the motor energizing current for its action. Nor am I aware that anyone has devised a control which is at once very flexible and extremely accurate by reason of provisions for eliminating any gate actuating effects dissimilar to the effect of a counterweight mechanism. The sensitivity and selectivity of control of gate structures is greatly enhanced by the present device, with the result that increased efficiency and economy of combustion are made possible.

I have illustrated and described my improvements in embodiments which are very practical. I have not attempted to illustrate and describe other embodiments or adaptations as it is believed this disclosure will enable those skilled in the art to adapt or embody 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 a heating plant having an automatically operated combustion instrumentality, said control comprising a housing adapted to be communicated with a discharge duct for the products of combustion of the plant, a gate pivoted eccentrically on a pivot on said housing to control an opening therein, counterbalancing means on the gate including a weight having a predetermined torque arm and adapted to regulate the resistance of the gate to opening

under the influence of the draft to be controlled, a fixed motor, and means operatively connected to said gate and motor and actuated by the latter for exerting torque on the gate, said last named means being connected to the gate at a point on a theoretical line extending through the gate pivot parallel to the torque arm of said weight, whereby the moment arm of the torque applied to the gate by the motor varies in the manner of the torque arm of said counterbalancing weight as the gate pivots, said motor being adapted to be connected to said instrumentality for energization simultaneously with the energization of said instrumentality whereby torque is applied by said motor when the instrumentality is operating and not otherwise, the torque developed by said motor being controllable by regulation of the current energizing the same.

2. A draft control for a heating plant having an automatically operated combustion instrumentality, said control comprising a housing adapted to be communicated with a discharge duct for the products of combustion of the plant, a gate pivoted on a pivot on said housing to control an opening therein, counterbalancing means exerting torque on the gate to control the resistance of the gate to opening under the influence of the draft to be controlled, an automatic actuating device, and means operatively connected to said gate and actuating device and actuated by the latter for exerting torque on the gate, said last named means being connected to the gate at a point on a theoretical line extending through the gate pivot parallel to the torque arm of said counterbalancing means, whereby the moment arm of the torque applied to the gate by the actuating device varies in the manner of the torque arm of said counterbalancing means as the gate pivots, said device being adapted to be connected to said instrumentality for energization simultaneously with the energization of said instrumentality whereby torque is applied by said device when the instrumentality is operating and not otherwise.

3. A draft control for a heating plant having an automatically operated combustion device, said control comprising a housing adapted to be communicated with a discharge duct for the products of combustion of the plant, a gate pivoted on a pivot on said housing to control an opening therein, balance means exerting variable torque on said gate as the latter pivots, a fixed motor, and means operatively connected to said motor and gate for exerting torque on the gate, said last named means being connected to the gate whereby the moment arm of the torque applied to the gate by said motor varies proportionately to the torque of said balance means as the gate pivots, said motor being adapted to be connected to said instrumentality for energization simultaneously with the energization of said first named device, the torque developed by said motor being controllable by regulation of the current energizing the same.

4. In an apparatus of the class described, the combination of a pivotally mounted stabilizer gate, an adjustable counterweight for said gate effective to exert variable closing torque thereon during swinging of the gate, an arm on said gate, a driven pulley, a flexible connection from said arm to said pulley, said arm being mounted and arranged on said gate so that a line of the point of connection through the flexible means thereto and through the pivot point of the gate is in parallelism with the direction of adjustment of said weight and a motor connected to said pulley to actuate the same and tension the connection to thereby exert varying closing effort on said gate.

5. A draft control of the type described comprising a support having an opening and a stabilizer gate pivotally mounted thereon to control said opening, adjustable counterweight means on said gate normally exerting torque thereon tending to pivotally swing the same in one direction, and means for exerting variable torque on the gate to modify the action of said counterweight means, comprising a stalling motor, a rotatable drum actuated by the shaft of said motor, and a flexible connection from said drum to said gate, said flexible connection being secured to the gate at a point on a theoretical line through the pivot of the gate parallel to the torque arm of said counterweight means to exert torque thereon varying in the manner of the counterweight torque when the motor and drum are actuated.

6. A draft control of the type described comprising a support having an opening and a stabilizer gate pivotally mounted thereon to control said opening, counterweight means on said gate normally exerting torque thereon tending to pivotally swing the same in one direction, and means for exerting variable torque on the gate to modify the action of said counterweight means, comprising a stalling motor and a connection to said gate actuated by said motor, said connection being associated with the gate at a point on a theoretical line through the gate pivot parallel to the torque arm of said counterweight means.

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