To all whom it may concern:

Be it known that I, FRANK W. HARRINGTON, a citizen of the United States, residing at Harris, town of Coventry, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Automatic Draft-Regulators for Steam-Boiler Furnaces, of which the following is a specification.

My invention relates to draft-regulators for boiler furnaces, and it consists in the novel construction and arrangement of the devices employed, all as more fully herein-after set forth and claimed.

The object I have in view is to provide steam boiler furnaces with improved automatic means for increasing the efficiency of the boiler in a comparatively simple and inexpensive manner and without materially changing or altering the plant.

The present invention is more especially adapted to furnaces having a forced-draft, as for example, a steam-actuated blower for drawing and forcing air under the fire-grates to aid or facilitate combustion of the waste gases before they escape into the uptake or smoke flue.

The invention herein resides in the employment of an electrically controlled, normally open steam valve for actuating the blower, the controlling means also capable of automatically shutting off the steam to the latter when the fire-door of the furnace is opened. Or, in other words, upon temporarily opening the fire-door, as in firing, its movement actuates a member of a quick-acting switch disposed in an electric circuit of high voltage, whereby the circuit is adapted to be quickly closed, the result being to automatically close the valve, thereby preventing the entrance of steam and air to the blower and furnace while the door remains open. The act of closing the door causes the switch to break the electric circuit and reopen the steam valve, the latter, together with the blower, then being normally operable again. The counterweighted main or flue damper may be connected by suitable means to move in unison with the steam-valve, thereby, when the fire-door is opened, not only shutting off the supply of steam and air to the blower, as stated, but automatically closing the damper too, thus for the time being rendering the draft inert.

In the accompanying sheet of drawings illustrating my invention, Figure 1 represents a side elevation of a steam boiler and its setting, including a steam blower for increasing the draft and means for automatically controlling the blower. Fig. 2 is a front elevation, in enlarged scale, showing the fire-door normally closed and connected to a quick-acting electric switch, the latter being normally open and having its poles adapted to connect with a suitable solenoid or other analogous electric device. Fig. 3 is a view similar to Fig. 2, showing the fire-door open, the switch and its electric circuit thereby being correspondingly closed. Fig. 4 is a partial plan view, in reduced scale, corresponding with Fig. 3. Fig. 5 is a side elevation, in enlarged scale, showing the steam inlet valve in the normally open position and adapted to connect with and operate any suitable forced-draft steam blower device. Said figure also shows an electric element or solenoid connected with the valve for automatically closing it. Fig. 6 is a similar view of the valve, &c., in the closed position; and Fig. 7 is a partial side view showing the flue damper practically closed, corresponding with Fig. 6.

In Fig. 1 of the drawings is represented a steam-boiler and its setting, the same being of the safety or water-tube type, arranged substantially as usual. Said figure also indicates a forced draft appliance or steamblower B mounted in or on the boiler setting, and an electrically operated steam-valve d adapted to control the latter's movements whenever the fire-door a is opened and closed. The several parts in this figure are represented in the normal position, corresponding with a closed fire-door, an open steam-valve d and a normally working blower, the electric circuit also being normally open; the general arrangement of the whole being indicated by A. The setting is also provided with a furnace or combustion chamber a', grates t, ash-pit door a', up-take or smoke-flue f and its damper e, substantially as usual.

The solenoid or electric device C mounted on a suitable base o is adapted to be ener-
gized by means of a battery D or other generator of a suitable electric current, the latter being conducted to and from the element C by means of current-conducting wires c, c'. The operating lever d', fulcrumed at d' of the steam-valve d, is connected at the free end portion to a vertically movable weighted core r, or analogous means, whereby the lever is moved upward to close the valve d through the medium of the current passing through the element C whenever the circuit is closed—see Fig. 6 position. Upon again opening the circuit, as for example, by closing the fire-door, the element C is deener-gized, the weight or gravity of core r, &c., automatically causing the lever to move downward back to its normal open position; the piston or dasher m at the same time, swinging to equalize or steady the lever in its down-ward movement—see Fig. 5. It may be stated that the cylinder in which the piston or dasher m is mounted is partly filled with a fluid, as oil, substantially of the same weight and characteristics as that, is the fluid used, and is the same as mentioned in the first paragraph of this specification. The movement of the fluid, or more or less restricted openings through it for the passage of the oil, thereby preventing the piston and its connected parts from moving too quickly, thus forming a cushion; for example, in moving downward the movement is retarded thereby correspondingly controlling the opening of the valve and the starting of the forced-draft blower. The arrangement represented is also adapted to actuate the flue-damper e coincidently with the movements of the said valve's lever d'. This may be effected by a suitably mounted cord or flexible connection r, attached to the outer end of the lever and to the free end of the damper lever l, as indicated in Fig. 1. The damper lever and cord may be provided with a suitable counter-weight w. When the electric circuit is closed, as before stated, the lever d' causes the damper to automatically close the flue—see corresponding position of damper in Fig. 7.

The means shown for actuating the quick-moving switch E (Figs. 2, 3 and 4) consists, as shown, of a lever or arm s' (pivoted at its upper end s' to a fixed base board E) suitably jointed or connected to a guided lower rod q, which in turn is hinged to the horizontal link g', the latter being jointed to the single knife k (Fig. 4) pivoted to the single pole switch E. The means for moving the said lever s' comprises a relatively stiff helical spring s having one end fastened to the lever and the other end to a guided, endwise movable, horizontal rod b (of said base E') having its inner end jointed to a link b' suitably positioned and attached to the fire-door a. It may be stated that as thus arranged the act of widening the door moves the rod b so that when the latter carries the spring s' sufficiently past the pivot s'' of lever s', the yielding force of the spring quickly moves the lever, &c., from the normal position shown in Fig. 2 to that shown in Fig. 3, thereby causing the bar g'' to swing the knife k into engagement with the pole to energize the switch E. See also Fig. 4. Obviously, some or all of the said parts are or may be suitably insulated.

Assuming the boiler, &c., to be in normal operation, wherein the steam-blower B is actuated by steam passing to it from the steam-drums z, pipes p and p', and open valve d, the corresponding normal positions of the fire-door a, damper e and electrically controlled lever d' of the valve d, switch, &c., are substantially as represented in Figs. 1, 2 and 5. Now, upon opening the fire-door, the several members connected therewith are simultaneously actuated; thus swinging the contact member or knife k of the switch E into electrical engagement with its pole and closing the circuit, the result being to move the core or member n of the solenoid upward to its limit, which action at the same time elevates the lever d' and automatically closes the steam valve, thus temporarily cutting off the supply of steam to the forced draft blower B while the door is open. See corresponding positions Figs. 3, 4 and 6. At the same time, too, the upward movement of the valve-lever operates to close the flue-damper e (see Fig. 7). Upon closing the fire-door the several parts are caused to automatically move back to the normal or open position. It may be added that the admission of steam from the blower B, operates to prevent the entrance of cold air into the furnace while the fire-door remains open, thereby at the same time preventing the escape of more or less of the heated waste gases, and increasing the boiler's efficiency, with the resultant saving in fuel. Since the action of the appliances and connections are practically automatic, it is apparent therefrom that no additional work is imposed upon the fireman or person in charge. It may be further stated that the automatic controlling device is electrically connected with the fire-door and forced-draft blower of a furnace solely for reducing or practically shutting off the influx of atmospheric air into the furnace when the fire-door is temporarily opened. The device also serves to automatically restore the blower to its normal working condition simultaneously with the act of closing the fire-door. As thus constructed and connected it is obvious that the controlling device is wholly independent of and is not dependent upon the pressure of steam in the boiler, or temperature even, for its action in reducing the volume of air from the blower while the fire-door is temporarily open.
While I have represented in the drawings a boiler and setting of the water-tube type, it is obvious that the invention is equally applicable and as efficient when applied to other classes of steam-generating boilers.

I claim as my invention and desire to secure by U. S. Letters Patent:

1. In an automatic forced-draft controller for steam-boiler furnaces, the combination with a boiler, its setting, a furnace having a firing-opening, a fire-door normally closing said opening, and a force-draft blower adapted and arranged to discharge air into said furnace to accelerate the draft, of a circuit-closer disposed in a normally open electric circuit, means located between said fire-door and circuit-closer engageable by the fire-door, when open, to actuate the circuit-closer to close the circuit, and electrically actuated means for reducing the volume of air discharged from the blower into the furnace while the fire-door is thus open, said action of the parts being simultaneously effected irrespective of steam pressure and temperature.

2. In draft-controlling means for steam-boiler furnaces, the combination of a furnace provided with an opening adapted to receive fuel therethrough, a fire-door normally closing said opening, a force-draft blower in normal open communication with the furnace, means for actuating the blower, an electric circuit having means disposed therein for controlling the movements of said blower, and a circuit-closer operable upon opening said fire-door, thereby while the door is open automatically reducing the volume of air discharged from the blower.

3. The combination with a steam-boiler and the usual accessories, including a furnace provided with a firing-opening and a fire-door normally closing said opening, of a force-draft blower communicating with the furnace, means for actuating the blower, an electrical circuit having a switch element disposed therein, and means engageable with the fire-door and with said switch for energizing the circuit to temporarily render inoperative the blower-actuating means upon opening the fire-door, for the purpose set forth.

4. The combination with a steam-boiler and its setting, including a furnace having a firing-opening and movably mounted fire-door normally closing said opening, of a force-draft blower arranged to discharge air under pressure into said furnace, means for actuating the blower, a normally open electric circuit, a switch located in said circuit, means disposed with respect to the switch and fire-door for simultaneously actuating the switch and energizing said circuit upon opening the fire-door, and normally stationary means connected with the blower operable automatically by the current flowing through said energized circuit to reduce the volume of air discharged from the blower into the furnace when the fire-door is open.

In testimony whereof I have affixed my signature in presence of two witnesses.

FRANK W. HARRINGTON.

Witnesses:

Geo. H. Remington,
Earl R. Mulcahey.