Dec. 28, 1943. J. MIRRA 2,337,676

FURNACE CONTROL

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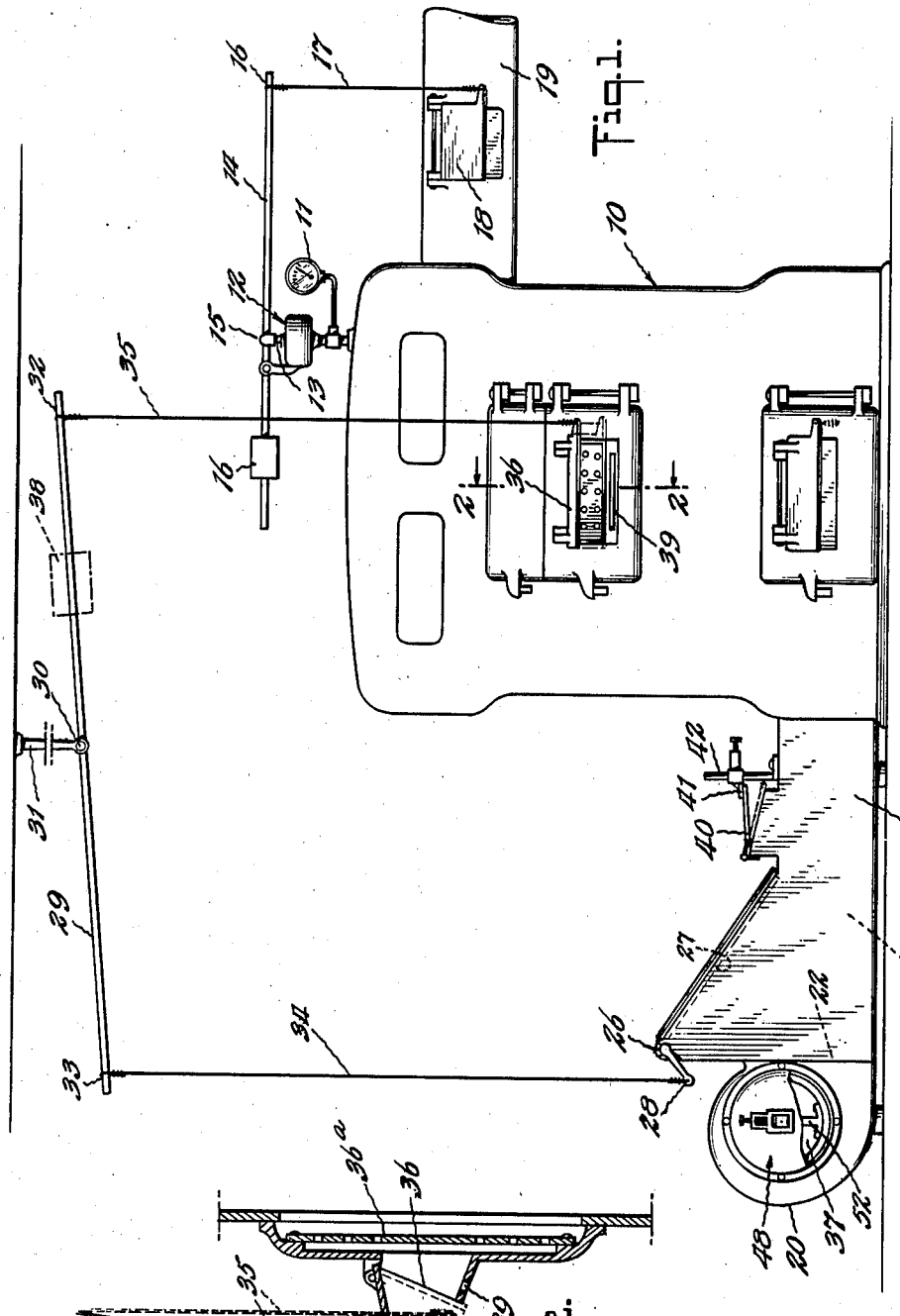


Fig. 1.

Fig. 2.

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Fig. 3.

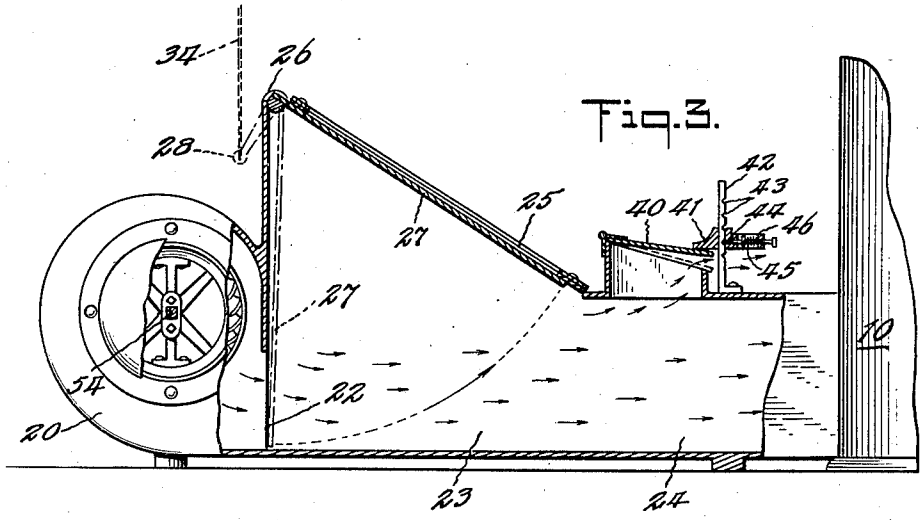


Fig. 4.

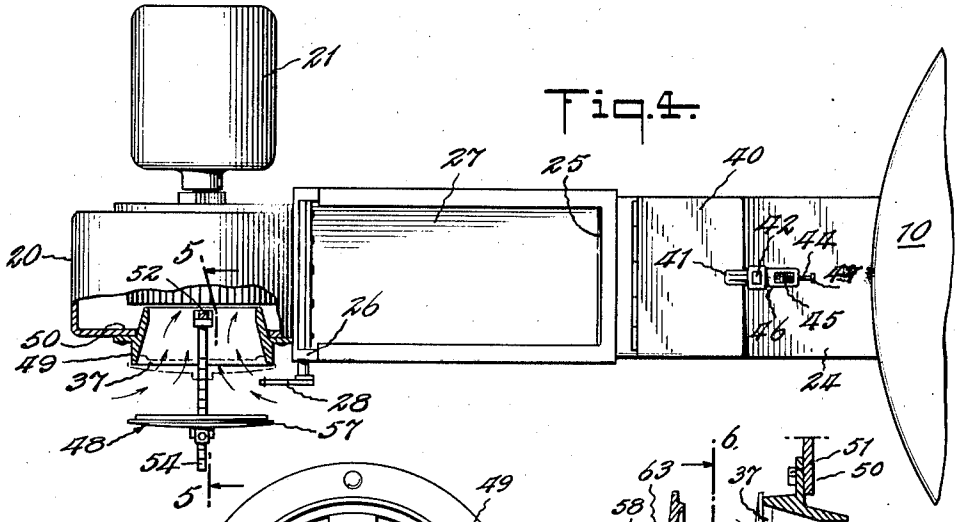


Fig. 6.

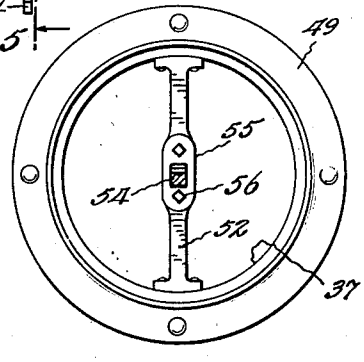
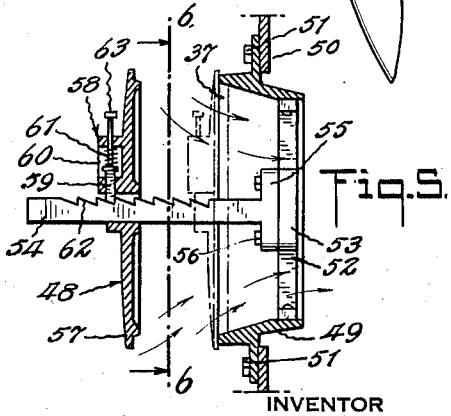


Fig. 5.



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FURNACE CONTROL

James Mirra, Brooklyn, N. Y.

Application November 12, 1942, Serial No. 465,335

3 Claims. (Cl. 110—53)

This invention relates to furnace apparatus, and particularly to a device for controlling the draft of a steam furnace, the present invention being an improvement over the apparatus disclosed in my previous patents numbered 2,149,706 and 2,209,533.

It is an important object of my invention to conveniently regulate the quantity of air introduced into a furnace by a forced draft system without the use of any rheostatic or other electrical control devices commonly employed to vary the speed of the blower motor. And in this aspect of my invention it is another object to enable a conventional blower conduit leading from the atmosphere to the furnace to be readily equipped with means for adjustably regulating the amount of air forced into the furnace.

It is a matter of common knowledge that it is generally desirable to introduce more than the theoretically correct amount of air into a furnace, in order to assure complete combustion. However, forcing excessive quantities of air into a furnace often results in undesirable back pressures, with a consequent leakage of air through furnace doors or other crevices. It is within the further contemplation of my invention to eliminate the undesirable results of such back pressures, particularly where they are conducive to leakage, an objective which I attain in a simple and automatically controlled manner.

It is a further object of my invention to provide a combined natural and forced draft unit of simple construction and adapted for operative use with a conventional furnace. And in this aspect of my invention it is a further object to enable a single valve member to be operatively associated with both the natural and forced draft inlets, whereby it will be effective in opening one of the said inlets while closing the other; and it is my further object to accomplish this result merely by the use of air pressure working against gravity, and without the use of any mechanical actuating means.

It is still another object of my invention, in one form thereof, to cause an operative opening of an excess air door by air pressure alone, working against gravity—thereby effecting a simple and silently operating device. And it is within the contemplation of my invention to enable the excess air valve to be operatively opened by air pressure a predetermined amount, in accordance with a manual setting.

It is also within the contemplation of my invention to regulate the introduction of secondary air into the furnace for the purpose of consuming unburnt gases generated by coal, whereby the amount of secondary air admitted will have a predetermined relation to the amount of primary air introduced into the furnace. And in this aspect of my invention, it is an object to employ a single control lever coacting both with the main air valve and the secondary air control.

Other objects, features and advantages of this invention will appear from the drawings and the description hereinafter given.

Referring to the drawings,

Figure 1 is a front elevation of a furnace provided with the apparatus of my invention.

Figure 2 is a fragmentary section of Figure 1 taken along line 2—2.

Figure 3 is a fragmentary vertical sectional elevation of the blower and air control portion of my invention, the main valve and excess air members being shown in two operable positions.

Figure 4 is a plan view of the structure of Figure 3, a portion of the blower being broken away to show the inlet air control mechanism.

Figure 5 is an enlarged section of Figure 4 taken along line 5—5, and

Figure 6 is a section of Figure 5 taken along line 6—6.

In the drawings, the furnace 10 is provided with a conventional steam pressure gauge 11 and a natural draft regulator 12, the regulator being mechanical in action and containing a conventional steam-actuated diaphragm having associated therewith a plunger 13 in operative engagement with the lever 14, said lever being pivotally supported at the fulcrum 15 and having mounted thereon a movable weight 16. The outer end 16 of said lever is connected by chain 17 with the conventional pivotally mounted check door 18 in the flue 19 associated with the furnace. The furnace also includes other conventional appurtenances which need not here be described inasmuch as they are well known in the art. The apparatus thus far described is of more or less conventional structure.

In the form of my invention disclosed in the drawings, a blower 20 is disposed externally with respect to the furnace, the blower being driven by the motor 21. The outlet aperture 22 of the blower is shown to be in a vertical plane and communicates with the valve chamber 23 which is suitably connected to the pipe 24 communicating with the furnace underneath the grate thereof. The upper portion of said valve chamber contains the natural draft inlet opening 25, shown disposed in an inclined plane, and also communicating with said chamber 23. Swing-

ably mounted upon the pivotal support 26 of the said valve chamber is the main valve member 27 which, in its vertical inoperative position obstructs the said outlet 22 of the blower, and in its upper or operative position opens said outlet 22 and obstructs the said natural air inlet 25, as indicated by the dot-dash lines of Figure 3. Suitably connected to the said valve member 27, preferably at the said pivotal mounting thereof, is the arm 28 shown positioned outside said chamber 25.

In the form of my invention illustrated, a main control lever 29 is disposed over the furnace and extends substantially transversely thereof, the lever being pivotally supported at 30 by the bracket 31. The furnace or inner end 32 of the lever is preferably in overhanging relation with respect to the front edge of the furnace, the opposite or outer end 33 of said lever extending sufficiently laterally beyond the furnace to enable it to be connected by the chain 34 with the said arm 28 of the main valve member 27. The said end 32 of the lever is connected by the chain 35 to the pivotally mounted secondary air door 36 disposed at the level of the fire box and above the grate of the furnace.

The said lever 29, secondary air door 36 and main valve member 27, together with their associated parts, are so proportioned and arranged that under normal conditions (with the blower inoperative and the furnace operating under natural draft conditions) the secondary air door 36 and the main valve member 27 will gravitationally be maintained in their lowered substantially vertical closed positions.

Under the natural draft conditions above-referred-to, air will enter the inlet 25 in the valve chamber and be drawn through the furnace up into the stack. The check door 13 is gravitationally maintained in its lowermost or closed position; but upon a rise in steam pressure above a predetermined magnitude, the plunger 13 will elevate the arm of the lever 14 with which it is in engagement, to cause a consequent opening of the said check door 13, thereby producing a reduction in the draft and a consequent diminution of steam pressure,—all in a conventional manner.

Should it be desired to increase the draft, the blower 20 can be set into operation, either manually or by an automatic switch mechanism substantially like that referred to in my said Patent No. 2,209,533. When the blower is thus actuated, air will be drawn in from inlet 37 through outlet 22, the pressure causing the valve member 27 to be pivotally elevated from its vertical inoperative position to its horizontal operative position. The movement of the valve under the influence of the air pressure will thus result in an opening of the forced draft aperture 22 and a closing of the natural draft aperture 25. It will also be observed that the upward movement of the main valve member 27 also causes a lowering of arm 28 thereby causing the chain 34 to pull down the outer end 33 of the control lever 29 and causing an upward movement of the inner end 32 of said control lever. This will cause an opening of the secondary air door 36 to the dot-dash position indicated in Figure 2. The valve member 27, lever 29 and secondary air door 36 are so weighted and proportioned as to permit the air pressure resulting from the operation of the blower to cause an upward movement of the valve member 27 against the resisting action of the said lever 29 and secondary air door 36. It is obvious that by suitably proportioning and arranging the parts, such a balanced effect can be obtained as to cause a retarded movement of the valve member 27 from its vertical to its horizontal position whereby a silent operation can be assured. It is also apparent that by suitably positioning a weight 38 on lever 29, or by entirely eliminating such weight if need be, the desired speed of movement of the valve member 27 can be obtained.

The opening of the said secondary air door 36 permits the admission of air above the grate to consume any unburnt gases that may be generated by the coal. Under normal natural draft conditions, there are obviously lesser quantities of such unburnt gases than under forced air conditions, and hence the introduction of secondary air is not quite as urgent. However, it is known that some unburnt gases, such as carbon monoxide, are generally present, and that some secondary air should at all times be introduced to permit the burning of such gases. For this purpose, a secondary air aperture 39 is provided to permit air to be drawn into the furnace even when the door 36 is in its lowermost position. When, however, the blower 20 is employed, the greater quantities of air introduced generally results in relatively large quantities of unburnt gases, and for this reason more secondary air is required under these conditions. Hence the simultaneous opening of both the main valve member 27 and the secondary air door 36 permits the maximum amount of secondary air to enter when the furnace is operating under forced draft conditions.

As hereinabove stated, the blower 20 is generally so operated that the quantity of air forced thereby into the furnace is greater than the theoretically correct amount, so as to assure complete combustion. This, however, has its drawbacks inasmuch as the resistance afforded by the furnace to the flow of air results in a back pressure, with a consequent leakage of air through furnace doors or other crevices. To introduce just the correct amount of excess air would require the most careful regulation and constant attention,—and the difficulty of effectuating such regulation almost always results in the forcing of more air than needed into the furnace, with the aforesaid undesirable results. I eliminate the shortcomings inherent in the employment of excess quantities of air by providing an automatically operated excess air outlet valve, capable of adjustable regulation.

In one form of my invention, this excess air valve consists of a pivotally mounted door or valve member 40, preferably disposed at the upper portion of pipe 24. The said door can be opened upwardly by the air pressure therebelow, the amount of opening being governed by the position of stop 41. The said stop, in the preferred form illustrated, is engageable with the upper surface of the door 40, and is slidably mounted over the vertical post 42 supported on said pipe 24. The said post contains a plurality of notches 43 each being adapted to be engaged by the locking member 44 yieldably urged in the direction of the notches by spring 45. Said locking member is slidably movable within the hollow member 46, and can be retracted, against the action of said spring, by manipulating the knob 47 thereof.

It is thus apparent that by retracting the said locking member and thereby releasing the stop member 41 from immovable engagement with the

post 42, the said stop member can be slidably moved up or down on the post to any desired position; and when the desired position is attained, the locking member is released to permit the spring 45 to yieldably urge it against a coacting notch, as in Figure 3. With the stop 41 thus set for any position, the excess air door 40 will be limited in its upward movement by the stop.

In the event there is a back pressure induced by excess air generated by the blower, said air will cause a lifting of the door 40, whereupon the excess air will be forced out through the door into the atmosphere—the furnace taking as much air as can be forced therethrough. Should it be desired to decrease the amount of air entering the furnace proper, the stop 41 is elevated to a predetermined position upwardly, whereupon the excess air door will be capable of elevation to a higher level and more air will accordingly be blown therethrough and correspondingly less air introduced into the furnace. This is particularly true by virtue of the fact that said door is disposed between the blower 20 and the furnace 10. And should it be desired to obtain the maximum air generated by the blower, all that need be done is to lower the stop 41 to its lowermost position, whereupon the excess air door 40 will be sealed, and all the air from the blower will be introduced directly itno the furnace.

It is thus apparent that the amount of air that can be introduced into the furnace can be governed, within predetermined limits, by the excess air door 40, without the necessity of regulating the speed of the motor 21 by rheostatic or other control means. And if, during the normal operation of the furnace, there should be changes in the resistance to the flow of air through the furnace, such as by clinkers, etc., the variable quantities of excess air will flow out through the said excess air door 40.

As another or further means of regulating the amount of air that can be introduced into the furnace, either to supplement said excess air door 40 or as a substitute therefor, the valve control means 43 at the inlet portion of the blower 20 can be employed. In the form of my invention illustrated, a circular fitting 49 is applied over the inlet wall 50 of the blower. In the form shown, said fitting is detachably secured to the wall 50 of the blower by fastening means 51, although it can be an integral part thereof.

The said fitting 49 contains a diametral supporting bar 52, the central portion of which is of expanded proportions to constitute a base 53 for the horizontal post 54. The base 55 of said post may be attached to the base 53 of the bar by means of fasteners 56.

Slidably mounted over said horizontal post 54 is the circular valve plate or disc 57 which can be releasably secured to predetermined portions of the post 54 by a locking mechanism 58 substantially similar to that described in connection with the excess door 40. Specifically, this locking mechanism contains a locking member 59 disposed within casing 60 and yieldably urged by the spring 61 against any selected one of the teeth 62 on the post 54. By manipulating knob 63 of the locking member, it can be released from engagement with the teeth or brought into operative engagement therewith as in the manner of the excess door locking device. Thus, the valve disc 57 can be releasably secured to any desired portion of the post 54 for varying its distance with respect to the inlet opening 37 of the blower.

It is thus apparent that if said valve disc 57 is brought into close proximity with the inlet opening 37, less air will be admitted into the blower than would be the case if said disc were more remote therefrom. It is preferred that the proportions of the disc be made to conform substantially with those of the inlet opening 37 of the blower.

The arrangement is such that the amount of air introduced itno the furnace can be regulated by a simple manual operation without the necessity of controlling the operation of the motor. And inasmuch as the assembly can be detachably secured to the blower, in the manner above set forth, it may have a wide field of application to the presently existing blowers.

It thus appears from the description hereinabove given that I have devised a compact arrangement for readily effecting a control of the amount of air introduced into a furnace, and for providing against the dangers of excess air. The apparatus also contains a unitary valve chamber housing a single valve adapted to control both natural and forced draft operation, as well as the operation of a secondary air door.

It is of course understood that other additional forms and modifications of the apparatus constituting this invention can be employed beyond and in addition to those hereinbefore described, all within the scope of the appended claims.

What I claim is:

1. In combination with a furnace, a draft regulating device containing a valve chamber communicating with the furnace, a forced draft inlet and a natural draft inlet associated with the chamber and in adjacent angular relation, a pivotally supported valve member disposed within the chamber and between said inlets, said valve member being swingably movable between two extreme positions at said forced and natural draft inlets, respectively, the valve member being adapted when operatively moved from one extreme position to the other to open one inlet and close the other, a blower associated with said forced draft inlet and adapted to exert an operative effort upon the valve member, whereby the member will be maintained, by the pressure of the air from the blower, in closed relation to the natural draft inlet and in open relation to the forced draft inlet, an arm connected with said valve member and operatively movable therewith, a lever, a secondary air door associated with the furnace, means connecting one end of the lever to the secondary air door, the other end of the lever being connected to the said arm, the secondary air door being in a closed position when said valve member is in closing relation with respect to the forced draft inlet, the arm, lever and connecting means being so proportioned that upon an operative movement of the valve member from the forced draft inlet to the natural draft inlet the secondary air door will be correspondingly opened.

2. In combination with a furnace, a draft regulating device containing a valve chamber communicating with the furnace, a forced draft inlet and a natural draft inlet associated with the chamber and in adjacent angular relation, a pivotally supported valve member disposed within the chamber and between said inlets, said valve member being swingably movable between two extreme positions at said forced and natural draft inlets, respectively, the valve member being adapted when operatively moved from one extreme position to the other to open one inlet and

close the other, a blower associated with said forced draft inlet and adapted to exert an operative effort upon the valve member, whereby the member will be maintained, by the pressure of the air from the blower, in closed relation to the natural draft inlet and in open relation to the forced draft inlet, a secondary air door associated with the furnace and normally in its closed position when the valve member is in closing relation with respect to the forced draft inlet, connecting means between said valve member and said secondary air door whereby upon an operative movement of the valve member from the forced draft inlet to the natural draft inlet the secondary air door will be correspondingly opened, said blower having an inlet aperture, and valve control means at the inlet aperture of the blower containing a valve plate adjustably movable with respect to said aperture and adapted for obstructing relation with respect to said aperture, and a mounting for adjustably supporting said plate.

3. In combination with a furnace, a draft regulating device containing a valve chamber communicating with the furnace, a forced draft inlet and a natural draft inlet associated with the chamber and in adjacent angular relation, a pivotally supported valve member disposed within the chamber and between said inlets, said valve member being swingably movable between two extreme positions at said forced and natural draft inlets, respectively, the valve member being adapted when operatively moved from one extreme position to the other to open one inlet and close the other, a blower associated with said forced draft inlet and adapted to exert an operative effort upon the valve member, whereby the member will be maintained, by the pressure of the air from the blower, in closed relation to the natural draft inlet and in open relation to the forced draft inlet, a secondary air door associated with the furnace and normally in its closed position when the valve member is in closing relation with respect to the forced draft inlet, connecting means between said valve member and said secondary air door whereby upon an operative movement of the valve member from the forced draft inlet to the natural draft inlet the secondary air door will be correspondingly opened, and a pivotally supported upwardly swingable excess air valve communicating between the atmosphere and the said chamber, said valve being operatively responsive to air pressure within the chamber, whereby it will swing upwardly to release air from the chamber into the atmosphere.

JAMES MIRRA.