Feb. 14, 1933. P. C. TIMM ET AL 1,897,406

FURNACE HEAT REGULATOR

Filed Dec. 17, 1931

Figure 1

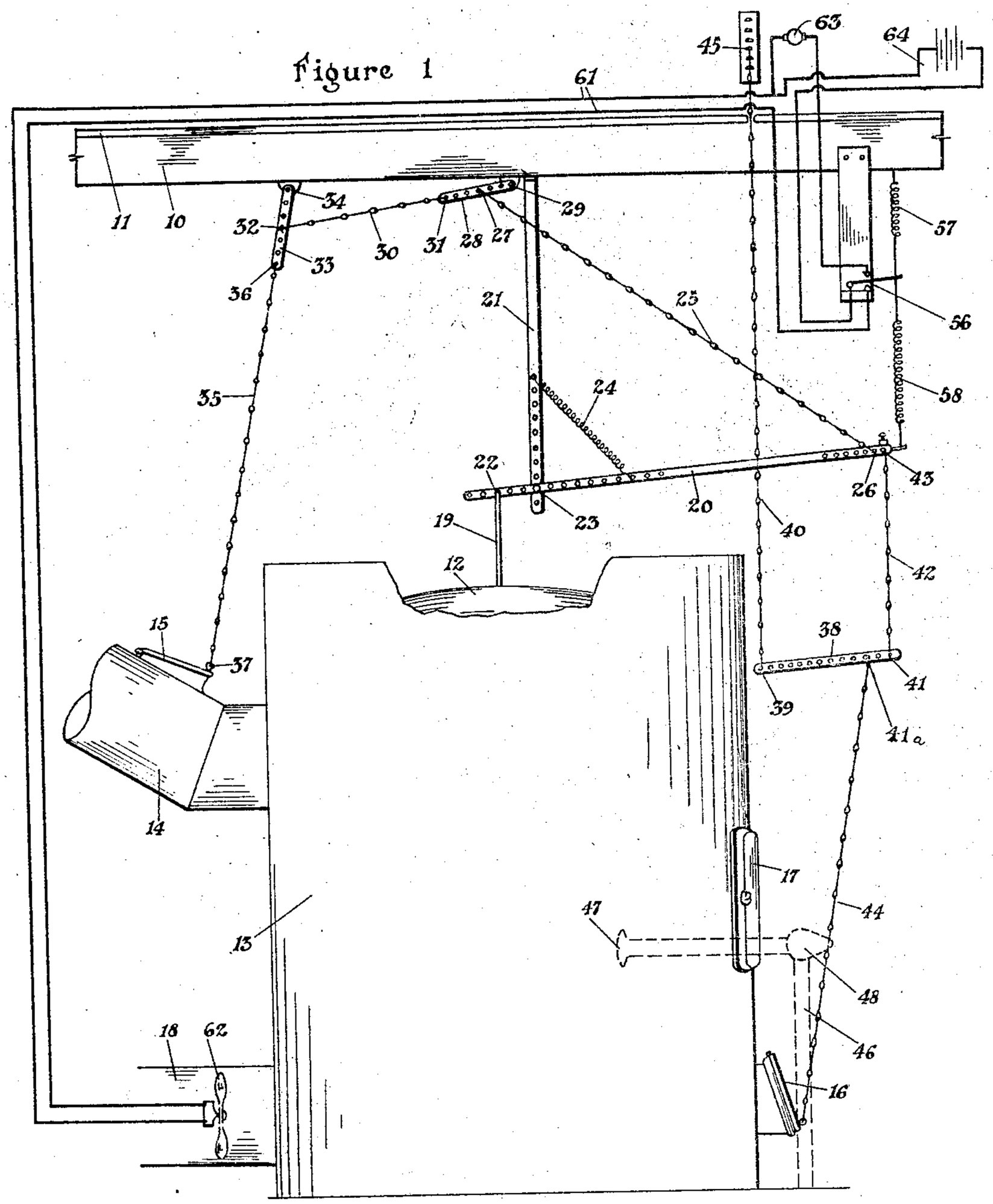


Figure 3

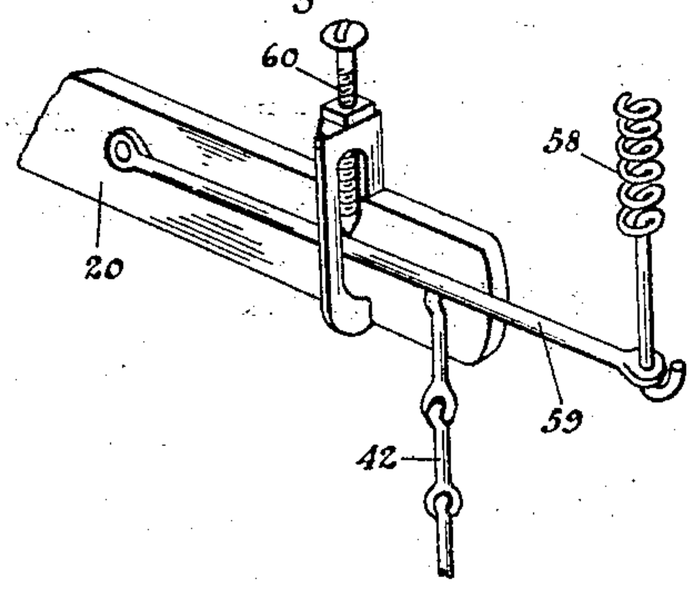
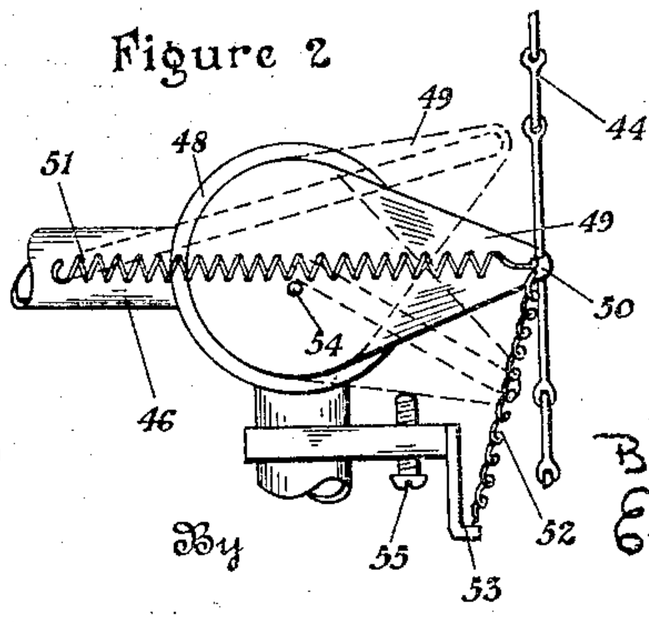


Figure 2



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UNITED STATES PATENT OFFICE

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FURNACE HEAT REGULATOR

Application filed December 17, 1931. Serial No. 581,640.

The present invention relates to furnace heat regulators which utilize the expansion and contraction of a furnace for controlling the check and the draft of the furnace and for governing the flow of air through the furnace jacket.

An object of the invention is the provision of a mechanism for translating the movements of expansion and contraction of the furnace to directly actuate the check and the draft of the furnace, the movements in the furnace wall being amplified in their effects on the check and the draft.

Another object of the invention is the provision of a mechanism of the character specified in which the amplified movements on the check are greater than those on the draft so as to insure a closing of the check before the opening of the draft.

Another object of the invention is the provision of a fuel governing mechanism for liquid or gaseous fuels whereby the opening or closing of the draft is accompanied by the opening or closing movement of the fuel conduit, all of these movements being the result of the expansion or contraction of the furnace.

Another object of the invention is the provision of a fan which may be used to produce more efficient circulation of the air through the furnace, the fan being operable electrically through the circuit which is under the control of the mechanism which is responsive to the movements of expansion and contraction of the furnace.

Still another object of the invention is the provision of an indicator operable electrically in response to the movements of expansion and contraction of the furnace to indicate a drop in temperature of the furnace below a predetermined limit.

Having in view these objects and others which will be pointed out in the following description, we will now refer to the drawing, in which

Figure 1 is a view largely in diagram showing the furnace with our invention attached thereto, parts being shown in conventional form.

Figure 2 is a view in elevation of a fragment of the fluent fuel control and showing its relation to the automatic furnace heat regulator.

Figure 3 is a view in perspective of a fragment of the electrical switch control which also responds to the movements of expansion and contraction of the furnace.

In Figure 1 the numeral 10 indicates one of the joists in the basement having thereon a floor 11. The dome 12 of the furnace is shown through a broken away portion of the furnace jacket 13. The furnace is provided with the usual furnace pipe 14 having the usual check 15, the draft 16, and the fuel door 17. The furnace also has one or more cold air pipes 18, the hot air pipes being not shown in the drawing since they are of common construction and since they are not operatively connected with any of the working parts of our mechanism.

The dome 12 of the furnace is subject to considerable expansion and contraction as the temperature of the furnace goes up or down. This movement of the dome 12 is utilized in our invention for actuating the check 15 and the draft 16 and also for actuating several other parts to be described later. The rod 19 of suitable length is so positioned that its lower extremity bears against the dome 12, the rod being vertically positioned so as to utilize to the full extent the movements of the dome 12. This rod 19 is pivotally connected to a bar 20 which is more or less horizontal. The bar 20 is pivotally and adjustably secured to the support 21 which in turn is rigidly secured, preferably in a vertical position, to the joist 10. The point 22 is the pivotal point where the rod 19 is adjustably secured to the bar 20 and the point 23 is the pivotal point between

the bar 20 and its support 21. The length of the bar 20 beyond the pivotal point 23 is considerably greater than the distance between the pivotal points 22 and 23. This would naturally tend to depress the outer end portion of the bar 20 due to the weight of the bar. A compensating spring 24 is thus connected at its ends to the bar 20 and the support 21 and this spring has sufficient tension to maintain the lower end of the rod 19 always in contact with the dome 12.

The cable or chain 25 is secured at 26 to the bar 20 and at 27 to the lever 28 which is pivotally secured at 29 to the joist 10. A second cable or chain 30 is secured at 31 to the lever 28 and at 32 to the lever 33. The lever 33 is pivotally secured at 34 to the joist 10. The third cable or chain 35 is secured at 36 to the lever 33 and at 37 to the check 15.

It will thus be seen that the movement in an upward direction of the rod 19 will be communicated to the arm 20 which pivots as a lever about the pivotal point 23. The movement of the rod 19 will be very slight but this movement is considerably amplified in the lever 20 so that the point 26 will move downwardly through a much greater distance than that of the upward movement of the rod 19. The downward movement of the point 26 is communicated through the cable 25 to the point 27 which thus moves in an arc about the pivot 29. This causes a tension on the cable 30 which swings the point 32 through an arc about the pivotal point 34. The resulting tension on the cable 35 is communicated to the check 15 for lifting the check. The reverse movement will of course take place when the dome 12 contracts and permits the rod 19 to be depressed.

While the above described structure in its broadest aspects has been known to the public for many years, there are features about it which so far as we are aware are entirely new and it is upon these new features that the success of the present invention depends. As pointed out above, the amplification of the movement of the point 22 as translated into the movement of the point 26 is very great, this amplification depending to some extent on the adjustment of the points 23 and 26. In our present arrangement this arrangement is in approximately a twenty-two to one ratio although other ratios may under certain circumstances be found to be more advantageous. In the lever 28 the distance between the points 31 and 29 is substantially twice the distance between the points 27 and 29. This results in a further amplification in substantially a two to one ratio. A still further amplification in a two to one ratio is brought about in the lever 33. With these ratios the point 37 moves in a vertical direction through substantially eighty-eight times the movement of the lower extremity of the rod 19. These ratios are, however, merely illustrative since other ratios may be obtained by means of adjustments of the various levers.

One other feature should be emphasized. It will be noticed that when the check is closed, as shown in Figure 1, the cable 35 is in alignment with the lever 33 and the cable 30 is in alignment with the lever 28. At the beginning of movement of the lever 33, the vertical component of the arcuate movement of the point 36 is exceedingly small but this portion of the movement is rapidly accelerated as the arc of the movement of the point 36 increases. A similar action takes place in the lever 28. The combined result is that the initial lifting-movement of the check 15 is exceedingly small but this movement increases very rapidly as the check is being lifted. Likewise the lowering of the check is exceedingly rapid at the start and very slow at the end of the lowering movement of the check. Further reference to this action will be made in connection with the action on the draft 16.

The bar 38 is pivotally secured at 39 to the support 40. The support 40 may be a flexible cable or chain or it may be a rigid rod. At its opposite extremity at 41 the bar 38 is supported by the cable 42 which is secured at 43 to the lever 20. It will be apparent that upward movement of the point 43 will be communicated to the point 41 which moves in an upward direction in response to the pivotal movement of the bar 38 about its pivotal connection 39. The bar 38 and the lever 20 will not maintain a parallel relation since their movements are about the pivots 39 and 23 respectively. The movement of the point 43 will thus be decreased in its translation into the movement of the point 41*a*. A cable 44 is connected to the bar 38 and to the draft 16 so that upward movement of the point 41 will open the draft 16 and downward movement of the point 41 will close the draft 16. It is to be understood, however, that the points 26 and 43 may be made to coincide.

The check 15 and the draft 16 may both be in closed position or the draft 16 may be open while the check 15 is closed. The check 15, however, should never be open when the draft 16 is open. The arrangement of the linkage and cables is such that in the movement from the open position of the check 15, the check must be fully closed before the opening movement of the draft 16 begins. In this way any gases which may be accumulated in the furnace will be prevented from escaping.

It will be noticed that the bar 38 is suspended by means of a support 40. The upper end of this support is in one of the rooms above the basement so that it is easy of access. If left in one position, the temperature of the living rooms remains substantially con-

stant as long as the fuel supply is kept up. If this temperature is too high or too low due possibly to outside changes in temperature, it is possible to adjust the support 40 so as to increase or decrease that temperature. The support 40 is anchored in a plate 45 or other suitable device which is so arranged that the point 39 may be adjusted in elevation. This of course alters the pivotal point of the bar 38 so as to alter the movement of the cable 44 to thereby increase or decrease the draft through 16 by altering the distance between the point 43 and the draft. This adjustment may also be employed mornings and evenings to give the rooms different day and night temperatures.

As thus far described, the mechanism is designed for use when a solid fuel is employed in the furnace. In Figures 2 and 3 and in dotted lines in Figure 1, we show additional mechanism for adapting the invention to use with a liquid or gaseous fuel. Every part of the above described structure remains in place but it is merely connected so as to operate the valve which admits the fluent fuel. This fuel whether liquid or gaseous is admitted through a conduit 46 to a burner 47 of any suitable type. The conduit 46 is provided with a cut-off valve 48. The valve 48 may be of any suitable type which is open in one position but which may be closed by turning in either of two directions. This valve is provided with an arm 49 as best shown in Figure 2, the open position of the valve showing the arm in full line position with the two closed positions shown in dotted lines. The arm 49 is connected at 50 to the cable or chain 44. It will be apparent that the up and down movement of the chain or cable 44 will be communicated not only to the draft 16 but also to the valve 48 through the arm 49. The arrangement of the valve is, however, such that the normal movements of the arm 49 are in the arc below the horizontal in Figure 2. A spring 51 connects the arm 49 with a fixed part so that the spring is in dead center relation when the valve 48 is in its fully opened position. Another spring 52 connects the arm 49 with a fixed abutment 53 in a manner such that it tends to exert a downward pull on the arm 49. There is also provided a pin 54 which acts as an abutment against an intermediate point of the spring 51 during the downward movements of the arm 49. The action of the spring 51 tends to hold the valve in its fully opened position but the spring 52 tends to pull the arm 49 downwardly. In the downward movement of the arm 49 the spring 52 encounters the tension of only a portion of the spring 51 since the other portion is rendered inoperative by the pin 54. The downward movement of the arm 49 tends to close the valve gradually. In this movement it is highly desirable that the valve be not closed entirely as otherwise the flame would be extinguished and the valve would then later be opened as the furnace cools off. To avoid this difficulty we provide an adjustable stop 55 which may be so adjusted as to leave a small pilot light in the burner 47 when the arm 49 is pulled down to its lowermost position. Should the furnace fire accidentally go out the contraction of the dome 12 would pull the arm 49 upwardly, the full action of the spring 51 would be exerted to close the valve 48 with the arm 49 in the dotted line position as shown above the horizontal in Figure 2. This would provide for a full closing of the valve 48 so that no fuel could flow into the furnace. This would not be objectionable since there would be no danger of the valve opening since the furnace when cooled will not impart movement to the arm 19 until steps are taken to again heat the furnace.

It is desirable also that a fan may be employed for developing more efficient circulation of air through the furnace and that it be operable automatically in response to the heat of the furnace. It is also desirable that an indicator be placed in one of the living rooms to indicate that the flame in the furnace has become extinguished or decreased to the extent that immediate attention can be given to the fire before the temperature of the rooms falls to too low a degree. For this purpose we have provided a system of electrical circuits which are governed by the above described linkage. This system of electrical circuits may include any composite switch arrangement such as a three-way switch 56 which is actuated by a connection including two counterbalancing springs 57 and 58. This connection is anchored to a fixed point as shown in Figure 1 where the anchor is on the joist 10 and its lower end is connected with an arm 59 which in turn is pivotally connected to the bar 20 as best shown in Figure 3. This arrangement is provided with an adjustment 60 for adjusting the three-way switch 56 into neutral position. As the temperature increases the arm of the switch 56 will be drawn downwardly against the lower contact point of the switch. This closes the fan circuit 61 and automatically sets in operation the fan 62 to force cold air over the furnace and to set up a brisk circulation through the furnace jacket and into the rooms above. If, however, the temperature of the furnace is lowered to the point where the flame is extinguished or reduced to a subnormal degree, the arm 59 will be elevated so that the arm of the three-way switch 56 touches the upper contact point of the switch to close the circuit through the indicator 63. This indicator may be a bell or a buzzer or a pilot light or any other suitable alarm in a convenient place in the living or other room and it will warn the occupants that it is time to attend to the furnace. Both of these cir-

cuits are connected to any suitable source of electrical energy such as the lighting system of the house or a battery 64.

It is obvious that numerous variations and modifications are possible in the above described structures. For example, the fan 62 is shown as being located in a cold air pipe of the furnace. The fan may, however, be positioned in any place in the furnace where the circulation through the furnace jacket may be speeded up. The switch 56 may be a switch of any convenient type which will both close the circuit through a fan and close another circuit through an indicator. The valve 48 may also be any valve having an arm 49 which has two shut-off positions and an intermediate full-opening position. We therefore wish it to be understood that we reserve to ourselves the rights to all mechanical equivalents of the features claimed in the appended claims.

Having thus described our invention in such full, clear, and exact terms that its construction and operation will be readily understood by others skilled in the art to which it pertains, what we claim as new and desire to secure by Letters Patent of the United States is:

1. An attachment for a furnace having a check valve, a lever and a connection between said lever and the check valve, said connection being in alignment with said lever when the check valve is in closed position, means responsive to the movements of expansion and contraction of the furnace, and a connection between said means and said lever at a point intermediate said first named connection and the pivot of said lever whereby the opening movement of the check valve will be accelerated and whereby the speed of the closing movement of the check valve will decrease gradually from its open position to its closed position.

2. An attachment for a furnace having a draft valve and a fluent fuel conduit with a shut-off valve in the conduit, said attachment including means for transmitting in amplified form the movements of expansion and contraction of the furnace, connecting means between said transmitting means and the draft valve of the furnace and the shut-off valve of the fuel conduit for gradually closing the draft valve and the shut-off valve when the furnace reaches a predetermined limit of expansion and for gradually moving the shut-off valve toward opening position when the furnace reaches a predetermined limit of contraction.

3. A furnace attachment including means for transmitting in amplified form the movements of expansion and contraction of the furnace, a conduit for admitting fluent fuel into the furnace, a shut-off valve having two closing positions and an intermediate full-opening position, and a connection between said transmitting means and said shut-off valve for gradually moving said shut-off valve toward or away from the full-opening position in response to the movements of expansion and contraction of the furnace.

4. A furnace attachment including a fan for producing a forced circulation of air through the furnace jacket, means for transmitting the movements of expansion and contraction of the furnace, and means connecting said transmitting means for starting the action of said fan when the furnace reaches a predetermined limit of expansion and for stopping the action of the fan when the furnace contracts below the afore mentioned limit of expansion.

5. A furnace attachment including a fan for producing a forced circulation of air through the furnace jacket, means for transmitting the movements of expansion and contraction of the furnace, means connecting said transmitting means for starting the action of said fan when the furnace reaches a predetermined limit of expansion and for stopping the action of the fan when the furnace contracts below the afore mentioned limit of expansion, and an indicator connected to said transmitting means for indicating the contraction of the furnace to a predetermined limit.

6. In combination with a furnace having a check valve and a draft valve and a conduit for fluent fuel with a shut-off valve in the conduit, a rod bearing against the dome of the furnace, a lever pivotally connected with said rod, said lever being fulcrumed at a greater distance from its outer extremity than from its connection with said rod whereby the expansive movements of the dome are transmitted through said rod and transmitted in greatly amplified form through said lever to the outer extremity thereof, and flexible connections between the outer extremity of said lever and the check valve and the draft valve of the fuel conduit for opening the check valve at a predetermined limit of expansion of the dome and for closing the check valve and then opening the draft valve of the furnace and the shut-off valve of the fuel conduit at a predetermined limit of contraction of the dome of the furnace.

7. An attachment for a furnace having a check valve and a draft valve, said attachment including a vertical support adapted to be rigidly secured to a fixed structure above the furnace, a lever pivotally secured to said support, a rod depending from said lever with the lower extremity thereof bearing against the dome of the furnace, a compensating spring between said support and said lever for urging said rod into pressing engagement with the dome of the furnace, connections between the outer extremity of said lever and the check valve, and other connec-

tions between the outer extremity of said lever and the draft valve, said two connections cooperating automatically in response to the movements of contraction and expansion of the dome of the furnace to close the check valve and then to open the draft valve or to close the draft valve and then open the check valve.

In testimony whereof we affix our signatures.

PAUL C. TIMM.
WILLIAM P. TIMM.