

Nov. 11, 1952

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FURNACE DAMPER CONTROL

2,617,595

Filed Jan. 12, 1951

3 Sheets-Sheet 2

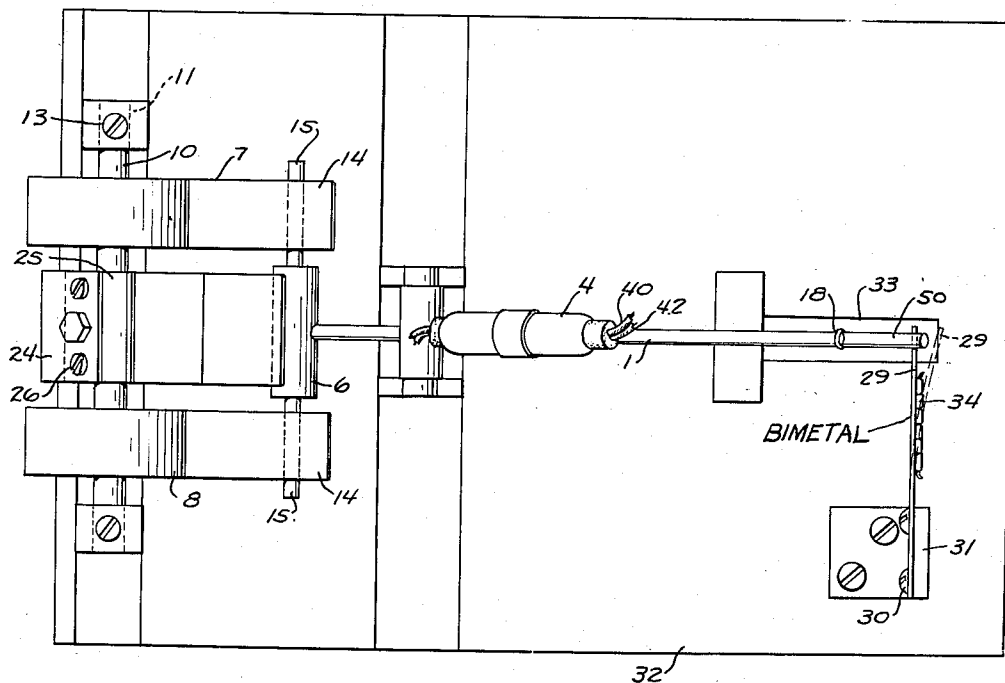
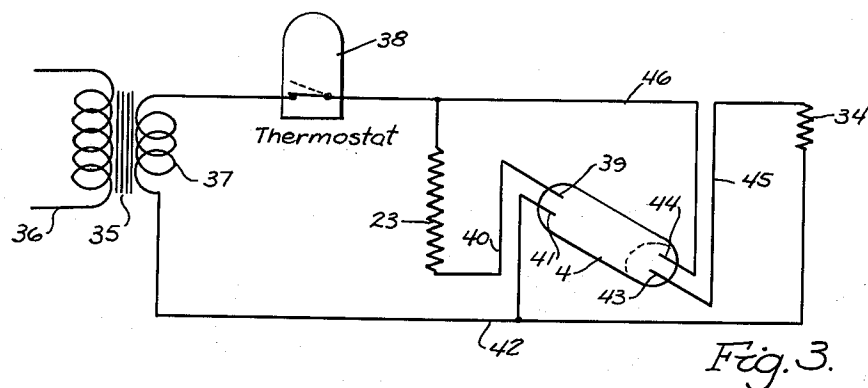


Fig. 2.

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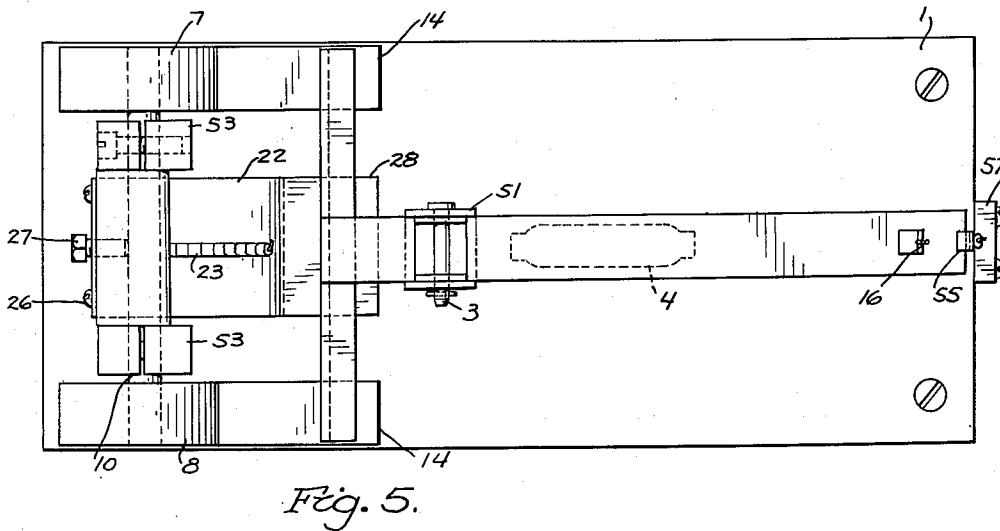
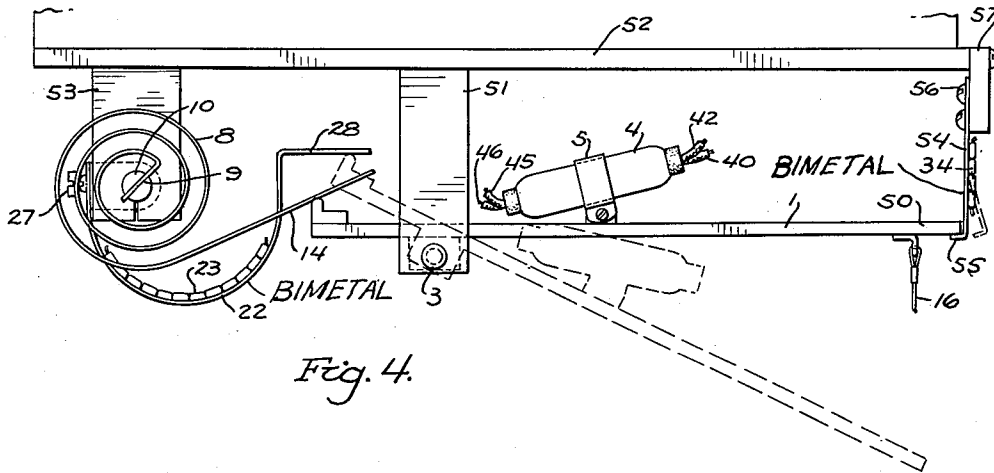
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UNITED STATES PATENT OFFICE

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FURNACE DAMPER CONTROL

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Application January 12, 1951, Serial No. 205,717

4 Claims. (Cl. 236—68)

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This invention relates to a furnace damper control.

It is an object of this invention to produce a damper control for furnaces which automatically opens the damper when the need for heat arises and automatically closes the damper when the heat requirement has been satisfied.

The invention contemplates an automatic control of this type which is of simple structure, efficient and reliable in operation, and which is economical to produce.

In the drawings:

Fig. 1 is a side elevation showing the instant furnace damper control.

Fig. 2 is a plan view of the same.

Fig. 3 is a wiring diagram of the furnace damper control.

Fig. 4 is a side elevation of a modified form of the instant furnace damper control, and

Fig. 5 is a bottom plan view of the same.

Referring more particularly to the drawings, it will be seen that the instant control comprises a lever 1 pivoted on a fixed support 2 by pin 3. A mercury switch 4 is fixed on arm 1 by bracket 5. One end of lever 1 has a cross arm 6 affixed thereto. A pair of spiral torsion springs 7 and 8 have their inner ends secured in the slotted ends 9 of rod 10 which is supported at its opposite ends in openings 11 in fixed posts 12. Set screws 13 are threaded in tapped openings in posts 12 and bear against rod 10 to hold it against rotation. The free ends 14 of springs 7 and 8 bear against the reduced ends 15 and arm 6 has bias arm 6 downwardly. In other words, springs 7 and 8 act at all times against arm 6 and tend to rotate lever 1 in a counterclockwise direction as viewed in Fig. 1. If no load were applied on arm 1 to the right of fulcrum 3, then arm 1 would be held in the position shown in Fig. 1 by springs 7 and 8. However, lever arm 1 is connected by draft link or cable 16 with the lower end of damper 17. Link 16 is connected to arm 1 as at 18 and to damper 17 as at 19.

For purposes of description and not by way of limitation, damper 17, which is the means for controlling the draft on the furnace or the combustion chamber therein, is shown as a pivoted damper pivotally supported as at 20 upon furnace 21. Damper 17 controls the flow of air into the furnace and through the grate supporting the coal, wood, or other combustible material being burned in the furnace. The torsion exerted by spring ends 14 on the lever 1, the lengths of the power arm and the resistance arm of the lever 1, and the downward thrust exerted by damper

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17 are coordinated so that the torsion exerted by springs 14 on arm 6 will be insufficient to open damper 17 or to retain damper 17 open. In other words, springs 7 and 8 counterbalance a substantial portion of the load or downward thrust exerted by damper 17.

For opening damper 17 there is provided a heat motor which preferably takes the form of a curved or arcuate strip 22 of thermostatic laminated metal such as thermostatic bimetal or trimetal. The low expansion side of the thermostatic bimetal is positioned on the outer side of the curve so that upon a rise in temperature the arcuate strip 22 will expand and upon a fall in temperature the arcuate strip 22 will contract. Heat is supplied to the bimetal strip 22 by an electrical resistance element 23. The one end 24 of element 22 is fixed to block 25 by means of screws 26. Block 25 is fixed on rod 10 by a set screw 27. Since the end 24 of element 22 is fixed or anchored, therefore upon a rise in temperature the other end 28 of the arm will move downwardly. The position of the bimetal element 22 when the heater 23 is deenergized is shown in Fig. 1.

A heat responsive latch or holding mechanism is provided for holding the lever 1 in its damper open position, illustrated in Fig. 1, full lines. This latch takes the form of a thermostatic laminated metal member or strip 29 anchored by screws 30 to post 31 which is fixed on support member 32. Support member 32 is provided with an opening 33 through which link 16 passes. Strip 29, like strip 22, can be made from any known laminated thermostatic metal such as bi- or trimetal. Latch 29 is energized by an electrical resistance heating element 34 which is mounted thereon and in heat exchange relation therewith.

The wiring diagram for the instant furnace damper control is shown in Fig. 3. The transformer 35 is connected into the usual 110 volt circuit 36. The secondary winding 37 of the transformer which lowers the voltage to any desirable low voltage, e. g., approximately 24 volts, is connected through thermostat 38 and mercury switch 4 with heating elements 23 and 34. Heating element 23 for bimetal strip 22 will preferably have a substantially greater heating capacity or wattage than heater 34. Mercury switch 4 is a single pole, double throw switch. Heater 23 is connected with contact 39 by line 40 and contact 41 is connected by line 42 with the secondary winding 37. The other set of contacts 43 and 44 of mercury switch 4 are connected respectively by

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line 45 with heater element 34 and by line 46 with the secondary winding 37 of the transformer through thermostat 38.

The operation of the instant furnace damper control is as follows: As shown in the dotted lines in Fig. 1, the damper 19 is closed, heating elements 23 and 34 are deenergized so that latch 39 is in released position, dotted line showing Fig. 2, and heat motor 22 is deenergized and in contracted position, shown in Fig. 1. Lever arm 1 is also in the dotted line position shown in Fig. 1 so that the mercury in switch 4 is bridging contacts 39 and 41 and contacts 43 and 44 are open. When thermostat 38 closes and calls for heat, then heater element 23 is immediately energized and heats bimetal element 22 causing the same to open, that is, end 28 moves downwardly and acts upon lever arm 6 to swing lever 1 counterclockwise thereby acting through link 16 to open damper 17. The counterclockwise movement of lever 1 is assisted by counterbalancing springs 7 and 8. As lever arm 1 swings counterclockwise, mercury switch 4 swings with the lever 1 and the mercury in the switch now shifts to the other end of the bulb thereby breaking contacts 39 and 41 and closing contacts 43 and 44. This deenergizes heating element 23 and energizes heating element 34 so that latch or bimetal element 29 now deflects toward the left, Fig. 2, and beneath the outer end 50 of lever 1. Heater element 34 remains energized as long as thermostat 38 calls for heat. Although heating element 23 is deenergized when arm 1 is swung counterclockwise to open damper 17, it will be appreciated that heat motor 22 does not cool immediately so that heat motor 22 acts to hold lever 1 in the full line position for a sufficient length of time to permit latch 29 to swing inwardly beneath end 50 of lever 1 to hold the same in raised position. This condition of the electrical circuit is illustrated in Fig. 3.

Even though thermostatic switch 38 is closed, contacts 39 and 41 are open, heating element 23 is deenergized and bimetal strip 22 begins to contract and finally reaches its fully contracted position, as shown in Fig. 1. The increased draft through the furnace causes it to supply additional heat and as soon as the space being heated reaches the temperature setting of the thermostat, thermostatic switch 38 opens thereby stopping the current flow through heating element 34. Bimetal element 29 now begins to cool and flex outwardly toward the dotted line position Fig. 2, where it releases the outer end 50 of lever 1 so that the damper 17 closes and swings arm 1 clockwise to the dotted line position shown in Fig. 1. This again tilts mercury switch 4 so that contacts 39 and 41 are again bridged by the mercury in bulb 4 and contacts 43 and 44 are open.

The form of control shown in Figs. 4 and 5 differs from the principal form of the invention primarily in that the lever arm 1 is pivotally mounted on supports 51 which depend from support 52 and springs 7 and 8 and heat motor 22 and 23 are mounted upon supports 53 which depend from support 52. In this form of the invention the holding latch for engaging end 50 of lever 1 comprises a bimetal strip 54 having its end 55 turned at a right angle to provide a hook for engaging beneath the end 50 of lever 1. Strip 54 is heated by the heating element 34 the same as bimetal strip 29. The latch 54 is anchored by screws 56 to fixed support 57.

The electrical circuit or wiring diagram and the mode of operation of this furnace damper

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control is the same as that of the principal form of the invention. When thermostat 38 calls for heat and heat motor 22, 23 has opened the damper by rotating lever 1 to the full line position Fig. 4, then the circuit through heater 34 is completed and latch 54 flexes inwardly so that hook 55 engages beneath end 50 of lever 1 to hold lever 1 in damper opening position until the thermostat 38 is satisfied whereupon resistance element 34 is deenergized and latch 54 flexes outwardly, dotted line showing Fig. 5, to release lever 1 and permit damper 17 to close.

The electrical circuit diagram, Fig. 3, corresponds with the full line showing of the damper control Fig. 1 wherein the damper is opened, end 50 of lever 1 is supported upon latch 29 and the circuit through heating element 23 and contacts 39 and 41 has been broken long enough for bimetal element 22 to cool to its normal deenergized position. When heat motor 22, 23 is energized to open damper 17, the circuit through contacts 39, 41 will break as the damper 17 approaches fully open position. However, since the resistance element 23 will be covered with insulation in a manner well known, the residual heat in the heat motor will cause element 22 to expand somewhat further to raise the end 50 of lever 1 above latch 29 and hold the lever 51 in this position until element 29 is deflected beneath lever 1 due to the heating of element 34. After latch 29 engages beneath end 50 of lever 1, element 22 will contract as its temperature falls but the damper 17 will be retained open by latch 29 until the thermostat 38 is satisfied and opens to break the circuit.

It is evident from the above that in case of power failure damper 17 will always close and shut off the draft to the furnace.

We claim:

1. A furnace damper control mechanism comprising a member adapted to be moved in one direction to open the damper and in the opposite direction to close the damper, power means acting on said member and tending to move said member in a damper opening direction, said power means of itself being insufficient to move said member in a damper opening direction, a first heat responsive motor energizable to assist said power means to move the member in a damper opening direction, a latch for holding the member in open damper position, a second heat motor energizable for actuating said latch into latching relation with said member, an electrical circuit including a thermal responsive switch and electrical switch means in series therewith, said electrical switch means being actuated as the member approaches damper open position to complete the circuit through the second heat motor and break the circuit through the first heat motor whereby, when the thermal responsive switch is closed, the latch is moved into engagement with said member to hold the member in open damper position, said electrical switch means being actuated as the member moves in a damper closing direction to complete the circuit through the first heat motor and break the circuit through the second heat motor, said thermal responsive switch responding to a rise in temperature to break the circuit to said second heat motor whereby the latch is released and the member moves in a damper closing direction, said thermal switch responding to a fall in temperature to close the circuit to said electrical switch means and, when the member is in damper closing position, to close the circuit to said first

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heat motor whereby said first heat motor is energized and supplements the power of said power means to move said member in a damper opening direction.

2. The furnace damper control mechanism defined in claim 1 wherein said member comprises a lever pivotally supported between its ends and one end of which has an operative connection with said first heat motor and the other end of which is adapted for engagement with said latch for holding the lever in damper open position.

3. A furnace damper control mechanism comprising a lever supported between its ends and adapted to swing in one direction to open the damper and in the opposite direction to close the damper, force applying means acting on one end of said lever and tending to swing the lever in the damper opening direction, said force applying means being incapable of itself to swing said lever in the damper opening direction, a first heat responsive motor operatively connected with one end of said lever and energizable to assist said force applying means to swing the lever in a damper opening direction, a latch for holding the lever in open damper position, a second heat motor energizable for actuating said latch into latching relation with said lever, an electrical circuit including a thermal responsive switch and electrical switch means in series circuit therewith, said electrical switch means being actuated as the lever swings in damper opening direction to complete the circuit through the second heat motor and break the circuit through the first heat motor whereby, when the thermal responsive switch is closed, the latch is moved into engagement with said lever to hold said lever in open damper position, said electrical switch means being actuated as the lever swings in a damper closing direction to complete the circuit through the first heat motor and break the circuit through the second heat motor, said thermal

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responsive switch responding to a rise in temperature to break the circuit to said second heat motor whereby the latch is released and the lever moves in a damper closing direction, said thermal responsive switch responding to a fall in temperature to close the circuit to said electrical switch means and, when the lever is in damper closing position, to close the circuit to said first heat motor whereby said first heat motor supplements the force applied by said force applying means to move said lever in damper opening direction.

4. The furnace damper control mechanism defined in claim 1 wherein said member comprises a lever pivotally supported between its ends, said power means comprising a spring acting on said lever and tending to swing the lever in one direction about its pivotal support, said lever having one end thereof connectable with the damper to be controlled, said first heat motor having an operative connection with one end of said lever.

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