Nov. 11, 1941. A. J. JOHNSON ET AL 2,262,460

AUTOMATIC DAMPER MECHANISM

Filed Nov. 27, 1940

Fig. 1.

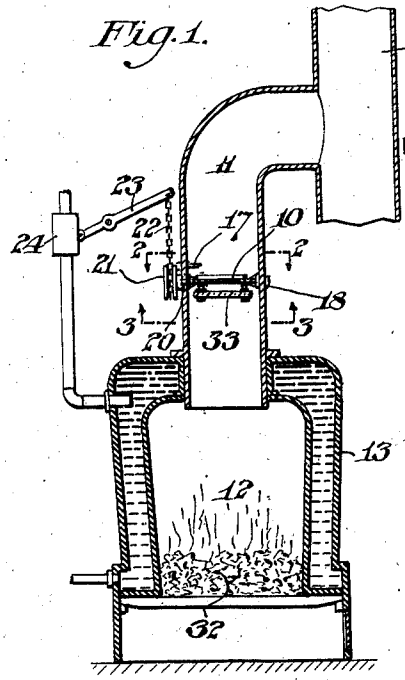


Fig. 6.

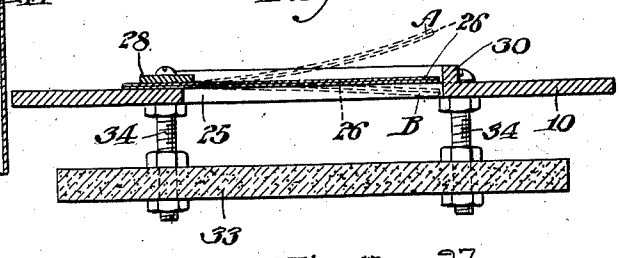


Fig. 7.

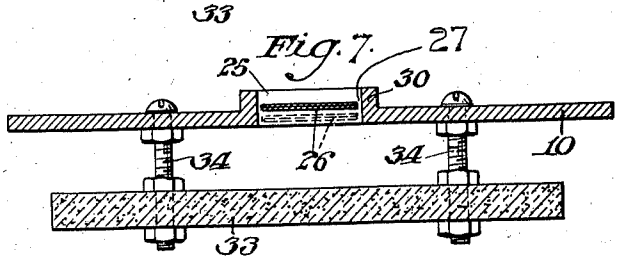


Fig. 2.

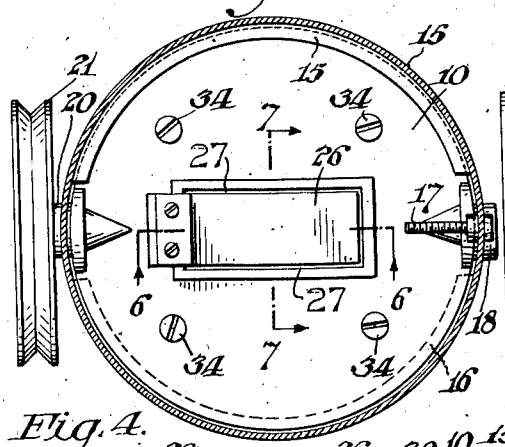


Fig. 3.

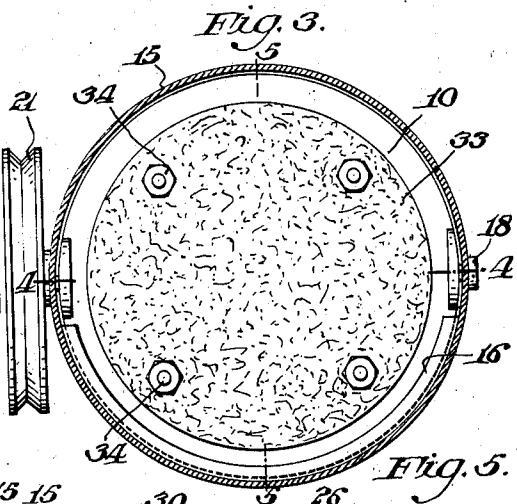


Fig. 4.

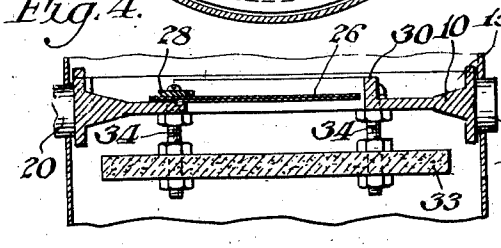
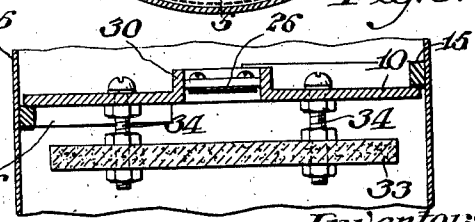


Fig. 5.



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AUTOMATIC DAMPER MECHANISM

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6 Claims. (Cl. 236—93)

The present invention relates to damper controls for heaters and more particularly to an automatic damper mechanism which is responsive to flue temperatures for control purposes.

In the operation of thermostatic dampers in heaters it is generally essential that the thermostatic elements be so designed and balanced with respect to the controlling temperature as to ensure certain and accurate firm control for any given temperature. Particularly is this important where a banked fire condition enters into the problem and its preservation made possible during falling flue or stack temperatures. In some types of heaters the controlling elements must be located, for efficient response, in a heat zone so closely adjacent to the fire bed as to be seriously affected by radiant heat emanating therefrom. Such radiant heat destroys the initial balance of the control system and introduces a disturbing factor of error.

Some of the objects of the present invention are to provide an automatic control for heaters; to provide an automatic control responsive to flue gas temperature for maintaining a substantially uniform banked fire condition in a heater when such condition is required; to provide a thermostatic damper responsive to flue gas temperature in such a manner as to close during a drop in flue gas temperature corresponding to a banked fire condition and to remain closed under a temperature lower than such temperature; to provide a damper control wherein radiant heat from a controlled fire or any source other than the flue gas is eliminated as a factor to unbalance a set damper-temperature relation; and to provide other improvements as will hereinafter appear.

In the accompanying drawing Fig. 1 represents a sectional elevation somewhat diagrammatic, of a water heater, chimney and interconnecting flue, the latter showing an automatic damper control embodying one form of the present invention; Fig. 2 represents, on an enlarged scale, a section on line 2—2 of Fig. 1; Fig. 3 represents, on an enlarged scale, a section on line 3—3 of Fig. 1; Fig. 4 represents a section on line 4—4 of Fig. 3; Fig. 5 represents a section on line 5—5 of Fig. 3; Fig. 6 represents an enlarged detail on section line 6—6 of Fig. 2; and Fig. 7 represents an enlarged detail on section line 7—7 of Fig. 2.

Referring to the drawing one form of the present invention is shown in association with a main damper 10 which is located in a pipe 11 leading from the combustion chamber 12, of a heater 13, to a chimney stack 14, this latter as usual communicating with the atmosphere at its discharge end. For purposes of example, the invention is shown as applied to a water heater supplying hot water for domestic purposes, such heater being more generally known as "bucket a day" heaters. However, the invention is not limited to this specific type heater but is equally well adapted to any type of heater wherein a damper is so located as to be exposed to the radiant heat of the heater fire or any source of radiant heat other than the flue gas, and wherein it is undesirable for the fire control to be responsive to stack draft fluctuations. This latter can be explained as follows: in heaters used for house heating, fluctuations of stack draft due to weather changes, atmospheric conditions, high winds and lowered temperature normally coact with heater regulators to establish a heating condition corresponding to what ever atmospheric change takes place. Thus if a heater is operating at a relatively low rate by reason of a warm atmosphere, and there comes a change to a cold atmosphere it is essential and expected that the heater will begin to function at a higher rate to maintain the required livable temperature in the house. Hence for house heating the heater is supposed, through suitable controls, to respond to atmospheric changes. In heaters to which the present invention is applied it is extremely undesirable for the fire to be responsive to stack draft fluctuations. For example, a water heater has stored its reservoir with water at a predetermined high temperature and the heater then operates under a banked fire condition so long as flue draft remains substantially constant. If, however, an atmospheric change causes an increase in the pull of the stack then the fire is restored to activity, when it should remain banked, and overheating of the water will result. It is an object of this invention to prevent such improper overheating of the water by stack draft fluctuations.

In the present instance, the control of the invention consists of the main damper 10 having a shape to conform to the contour of the inner wall of the pipe 11 and of a size to prevent products of combustion passing between this inner wall and said damper when the latter is disposed transversely of the pipe 11. Such exact closing of the damper 10 is assured by the provision of two arcuate stop ribs 15 and 16 at opposite sides of the inner wall of the pipe 11, and which are permanently fixed in position by any suitable means. These ribs 15 and 16 lie in parallel

planes at right angles to the axis of the pipe 11 and spaced apart axially of the pipe 11 such a distance as will receive the thickness of the damper therebetween to thus cause the damper in closed position to abut the rib 15 along one edge and to abut the rib 16 along the opposite edge. In addition to acting as limit stops for the damper, these ribs also close the clearance between the damper and the smoke pipe so that all draft around the damper 10 is cut off when the damper is closed to approximate a banked fire condition.

In order to limit the swing of the damper 10 so that it will not travel beyond its full open position, a stop lug 17 is fixed to the pipe 10 in the path of the damper and in the proper location to so limit its movement.

The damper 10 is pivotally mounted within the pipe 11 by means of trunnions 18 and 20, the former being a threaded part for assembly purposes, and the latter projecting exteriorly of the pipe to mount an operating pulley 21 or other manipulatable means. Preferably also the damper 10 is so counterbalanced that when released from control it will swing by gravity to its closed position. One form of automatic control is diagrammatically illustrated wherein the pulley 21 can be open by the pull of a chain 22 by a lever 23 under the action of a thermostat member 24, of well known form, located in the hot water supply line or elsewhere to be subject to the temperature of the water.

For permitting some flow of the gases of combustion when the damper 10 is closed and providing for the regulation of such flow in accordance with variations in stack temperatures, the damper 10 is provided with a vent hole 25 which is shown as rectangular in shape and preferably lies coaxial with the pivotal axis of the damper. This hole 25 is arranged to be controlled by an automatic damper 26 formed as a bimetallic strip having a shape conforming generally to the contour of such hole. The dimensions of this damper 26 are somewhat less than the hole so that when the strip is entirely within the hole there will be a clearance 27 of sufficient area to pass enough combustion gases to relieve back pressure and keep the fire alive during this banked fire period. One short marginal edge of the damper 26 is fixed to the damper 10 by a screw held clamp 28 and this arrangement allows the strip to flex freely under temperature changes. When the stack temperature is above a predetermined value the strip damper 26 will be open and as the temperature in the stack falls below such value the damper 26 swings to its closed position following the temperature decline, such closed position corresponding to a banked fire condition. Obviously if this temperature should continue to decline it might reach a value whereby the damper 26 would pass through the hole 25 and open it from the side opposite to which the movement started. Such a condition arises when some exterior atmospheric change takes place, which in an ordinary house heater would call for more heat but which in the heater to which this control is applied is detrimental to its proper functioning. This disadvantage has been overcome, in the present instance, by ingeniously proportioning the depth of the hole 25 with respect to the length of possible travel of the damper 26 so that under temperatures below banked fire flue temperature the damper 26 cannot swing to an open position. As shown this additional depth is greater than the thickness of the damper 10 and is obtained by forming a hole framing wall 30 about the three free edges of the strip damper 26. By this arrangement the damper 26 under a normal lowering of flue temperature will move from the dotted line position A of Fig. 6 to the full line position, which latter is the closed position under banked fire flue temperature. Further drop in flue temperature may move the damper 26 to the dotted line position B, where it is still substantially closed and represents its maximum movement in that direction. Thus no renewed activity of the banked fire can take place by reason of this exterior atmospheric condition.

By reason of the sensitivity of the bimetallic material of the damper 26 and to the fact that in this type of heater the damper 10 is in relatively close juxtaposed relation to the fire bed 32, the effect of radiant heat from the live coal has been found to so alter the expected action of the damper 26 as to quite upset the calculated balance between the flue temperature and the action of the thermostatic element. This disturbing problem has been solved by providing a shield 33 formed by a sheet of asbestos composition or other material of relatively low thermal conductivity or one of high reflectivity or possibly a combination of both characteristics. As shown the shield 33 is fixed to the fire side of the damper 10 by spacer fastening devices 34 which hold it sufficiently spaced therefrom to permit the combustion gases to flow with little restriction between these parts and impinge upon the damper 26 and pass through the hole 25. This action is facilitated by making the diameter of the shield 33 as much less than that of the damper 10 as will permit this desirable flow without exposing the damper 26 to radiant heat from the fire bed 12. Thus since the shield 33 is spaced from the damper 10 and is between the hole 25 and the fire bed, all of the products of combustion are caused to follow a tortuous path around the shield to directly contact the thermostatic damper 26.

From the foregoing it will now be apparent that a complete unitary control has been devised for a heater when under banked fire conditions. Thus the dimensions of the thermostatic damper with respect to the hole in the main damper are such as to permit the thermostatic damper to close the hole under falling temperature except for a restricted passage or clearance through which sufficient draft is maintained to hold the fire properly banked. Also the depth of the hole with respect to the travel of the thermostatic damper in a closing direction is such as to prevent this damper from opening in response to a falling flue gas temperature. This is in direct opposition to the effect of a falling temperature upon a thermostatic damper in a house heating heater since there it required that the damper open to restore the fire immediately, while in a heater for heating water such restoring should not follow a lowering of the stack temperature, in fact it might well be a source of danger since if the water were at its maximum usable temperature and then improperly raised in temperature (because the stack temperature dropped) a dangerous pressure could easily develop. By the present novel construction the auxiliary damper is open only when the fire is active and remains closed when the fire is banked, except for the necessary restricted draft clearance.

Furthermore, in order to maintain the proper set balance between the thermostatic element

and the stack temperature, the novel shield construction has been provided so that radiant heat can not reach the thermostatic damper and unbalance the necessary set relation.

Having thus described our invention, we claim:

1. A banked fire control for heaters, comprising a damper for opening and closing a flue to passage of products of combustion, means including a thermostatic element for permitting and controlling the passage of said products from one side of said damper to the other when said damper is closed for banked fire control, said means being directly exposed to the temperature of said products in said flue, and heat insulating means between said thermostatic element and the fire bed to prevent radiant heat of said fire bed from affecting said thermostatic element said insulating means being carried by said damper and spaced therefrom to form a circuitous path for products travelling to said passage.

2. A banked fire control for heaters, comprising a damper for opening and closing a flue to passage of products of combustion, means including a thermostatic element for permitting and controlling the passage of said products from one side of said damper to the other when said damper is closed for banked fire control, said means being responsive to the temperature of said products in said flue, a shield of heat insulating material, interposed between said thermostatic element and the heater fire when said damper is in banked fire position means to mount said shield to form a path for products of combustion between said shield and damper, said means maintaining said shield substantially parallel to said damper in the closed position of said damper, and means for moving the shield to permit substantial free flow of gases about the damper in the open position of the damper.

3. In a control for heaters, a damper for opening and closing a flue to passage of products of combustion, said damper having a hole for passage of said products when said damper is closed for banked fire conditions, and an auxiliary damper of thermostatic material mounted to open said hole under active fire conditions, the relative dimensions of said auxiliary damper and hole forming a restricted passage about said auxiliary damper when closed, and the depth of said hole being such that the maximum travel of said auxiliary damper towards the hot side of said damper ends within said hole, whereby said auxiliary damper once closed by a predetermined low banked fire flue temperature remains closed for temperatures below such value during banked fire conditions.

4. In a control for heaters, a damper for opening and closing a flue to passage of products of combustion, said damper having a passage therethrough for said products when said damper is closed for banked fire conditions, an auxiliary damper of thermostatic material arranged to control said passage, said thermostatic damper being set to open said passage in response to active fire temperature and substantially close said passage under banked fire temperature, and means increasing the length of said passage so that said thermostatic damper moving in response to a temperature lower than banked fire temperature remains closed and is prevented from opening on the hot side of said damper.

5. A banked fire control for heaters, comprising a main damper for controlling a flue passage for products of combustion, said damper having a hole therethrough for said products to traverse, a thermostatically operated damper for controlling said hole, a shield of heat insulating material and means to interpose said shield between said hole and the bed of a fire as said main damper is moved to banked fire position, whereby products of combustion pass around said shield into said hole while radiant heat from said fire is shut off from said thermostatic damper.

6. As a new article of manufacture, a main damper having a passage therethrough, an auxiliary damper for said passage, a thermostatic element controlling said auxiliary damper, and a shield of heat insulating material mounted on said main damper in spaced substantially parallel relation thereto, said shield being larger than said passage.

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