Jan. 21, 1936. G. H. ROSS 2,028,249

DAMPER CONTROL SYSTEM

Filed Nov. 10, 1934

Fig. 1

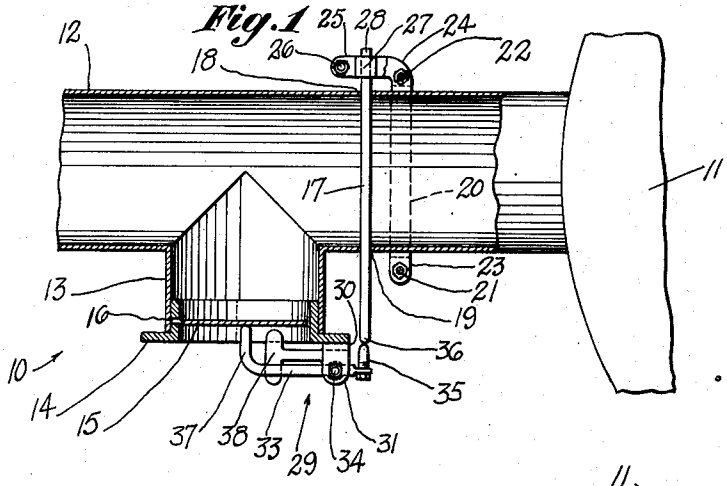


Fig. 2

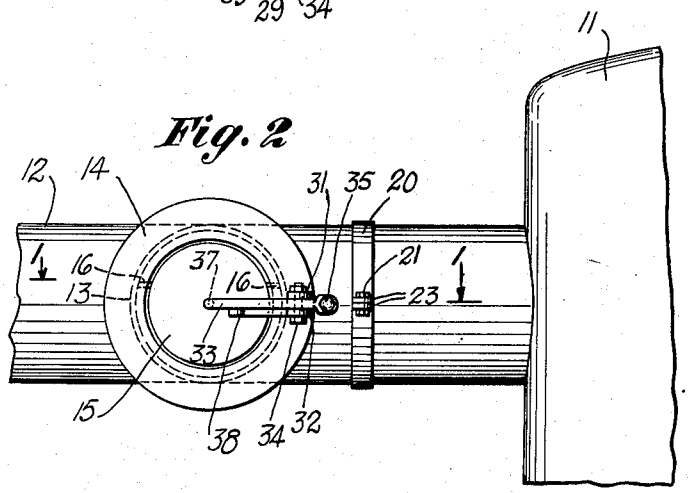


Fig. 4

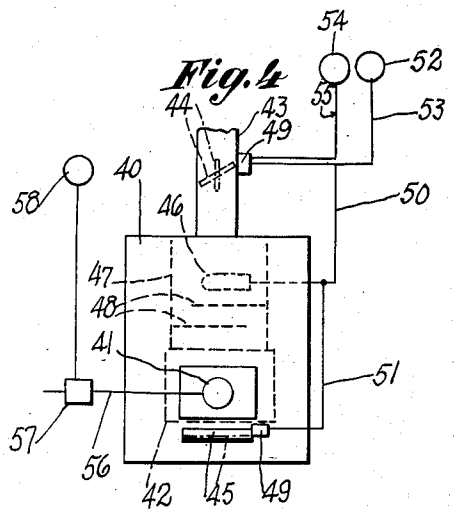
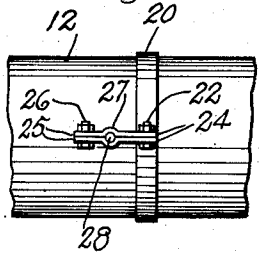


Fig. 3



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DAMPER CONTROL SYSTEM

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10 Claims. (Cl. 236—96)

This invention relates to devices such as damper control systems and methods.

One object of the invention is to provide a device of the character described having improved means to eliminate the noise and roar which occurs in the stack of a furnace, particularly of the oil fired type, and nevertheless to permit easy ignition and efficient normal operation thereof; and also to increase the conservation of fuel.

Because of the frequent difficulty in lighting up an atomizing oil burner in a house heating furnace, the damper is set so as to maintain maximum draft. This is necessary because the burner flame may puff out or blow off at any normal temperature, and especially while the furnace chamber is cool, leaving the chamber charged with products of combustion which prevent for a time the further ignition of the burner. While the flue is cool, the draft exerted thereby is low. But by maintaining the maximum draft possible, the furnace chamber is rather rapidly refilled with fresh air. Now, after the burner has been finally ignited, the flame proceeds to roar up the chimney. This is so especially while the furnace chamber is at a relatively low temperature so that the fuel cannot be consumed within the furnace chamber, and the resultant long flame extends into the stack. In the case of a steam or hot water boiler, the fire box may remain at a relatively low temperature for a considerable time; but the roaring often occurs even after the furnace has been fully heated up. I have found that if the draft is substantially reduced, this roaring is eliminated, and, of course, an important saving in fuel results. But because of the need of maximum draft in lighting the burner, it is inconvenient and troublesome to change the damper setting. The advantages of the invention become especially clear on considering that the oil burner may be automatically ignited and cut off, and hence may be intermittent in operation, according to the present practice, to maintain the temperature of the steam or water substantially constant. It is an object, therefore, of this invention to avoid these difficulties which I have perceived.

Another object of the invention is to provide a device having relatively few and simple parts and which is inexpensive to manufacture and install and which is durable, reliable and efficient in use.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a fragmentary view with parts in section taken along a horizontal broken line 1—1 of Fig. 2, showing a device embodying the invention.

Fig. 2 is a side view in elevation thereof.

Fig. 3 is a fragmentary view in elevation taken at the opposite side of the device.

Fig. 4 is a diagrammatic view in elevation showing a modified device embodying the invention.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Generally described, this invention provides means responsive to temperature in a firing chamber, or in a passage for the products of combustion, or adjacent thereto, as to be affected by a temperature thereof along a suitable point adjacent to or in the path of travel of such gases. In other words, the temperature sensitive means is responsive to such temperature as distinguished from that of the steam, hot water or the like, heated by the furnace. Hence the temperature sensitive means, while directly or indirectly affected by the temperature mentioned, is quickly responsive to operate a draft control means for the purposes stated herein. Two results follow: it is unnecessary for sufficient time to elapse to permit the water or steam to be heated, and even if the water or steam remain at a comparatively uniform temperature, the invention is independently operative to control the draft as where the burner works intermittently. The chamber may be fired by gas or oil.

Referring in detail to the drawing, 10 denotes

a device embodying the invention, of which 11 may indicate any furnace, such as a hot water or steam boiler having a firing box or chamber, with which the flue or duct 12 is in communication to discharge the gaseous products of combustion into a stack. Desirably the boiler 11 is fired by an atomizing oil burner and the burning of the fuel is controlled in part by the draft through the fire box.

The duct 12 may have a side inlet 13, in which may be set an annular frame 14 of angular cross section, for pivotally mounting a damper 15 on pins 16 lying along a horizontal line above the center of the damper, and the pins being journaled in the frame.

Extending through the duct or stack portion 12 is a thermosensitive metallic rod 17 of suitable composition. For easy mounting said rod may extend through the wall of the duct as at 18 and 19. For fixing one end of the rod or element 17, a split strap 20 may encircle the duct, said strap being secured as by bolts 21, 22 extending through corresponding pairs of ears 23, 24 of the strap. The ears 24 may have laterally extending portions 25 bolted together at 26, and having mating concaved portions 27 intermediate of the bolts 22, 26 to strongly adjustably engage around the adjacent end 28 of the element 17.

The element 17 is slidably movable through the hole 19 and is adapted to actuate means 29 engaged with the damper 15. For example, a bracket structure 30 may be secured to the frame 14, and having alined ears 31, 32 to receive therebetween a lever 33, pivoted on an upright bolt 34 passing through the ears. This pivot 34 is as close as possible to the longitudinal axis of the element 17. The adjacent end of the lever is provided with an adjustable set screw 35 having a rounded end bearing against a corresponding rounded end 36 of the element 17 alined therewith. The opposite end of the lever has an angular arm 37 extending inward into abutment relation with the damper 15 for contacting the same at a point in close proximity to the axis of the pivots 16, slightly below said axis. In this manner the lower portion of the damper is adapted to be inwardly swung under control of the element 17. To prevent undue downward strain on the lever 33 by the weight of the damper in the inward swung position thereof, the ear 32 may have a laterally extending plate or T-bar 38 to afford a support for the lever along the path of movement thereof. Since the damper 15 is in the nature of a thin plate fly valve, its weight is insufficient to cause any material friction between the lever and its support 38.

The operation of the device 10 and the method contemplated by the invention will now be described. The furnace 11 and flue 12 being cold, the element 17 is in contracted condition, and the damper 15 is closed. As this damper is of the atmospheric type, the result is that no air can now enter the flue except through the furnace chamber so that the maximum draft available is obtained. Now the oil burner is ignited, and the draft helps the ignition to occur by preventing choking of the flame. Should the flame accidentally blow out, the products of combustion are rapidly withdrawn by the draft from the firing chamber, so that the burner can again be ignited. During all this time, the element 17 being remote from the fire box has not been affected by any puff of flame, so that the damper remains set, and the burner can be again ignited. As soon as ignition has been fairly completed, and the burner is in operation, the hot products of combustion passing up the stack rapidly heat up the element 17. Sufficient heating of the element may be effected within one minute or even less, and it may be sufficient for the element to attain a temperature of as little as several hundred degrees in order to operate. Then when the element 17 expands, it moves the set screw 35 to cause the lever 33 to swing clockwise to move the damper 15 inward about its pivots 16. Air now enters the flue through the inlet 13 and reduces the draft in the furnace chamber. The noise and roar of the flames in the flue are thus almost immediately ended. As the flue heats up, the damper 15 opens a little further, but not much more, and the pull of the stack becomes greater so that combustion can proceed at the desired rate. But for the same reason the flow through the inlet 13 becomes greater so that an equilibrium is reached at which combustion is effected with a minimum supply of air, resulting in conservation of fuel.

Thus the method requires that after the fuel is ignited, the temperature at the stack is observed, since the element 17 may be regarded as a temperature indicator, and the damper set to reduce the draft accordingly. The stack temperature will show that the combustion of the fuel has been regularly begun.

If the burner is intermittently operated to keep a uniform house temperature, the air passing through the furnace and flue will cool off the element 17, and even the sheet metal duct 12, and as the damper closes the cooling increases, so that the burner is ready to be again ignited, the device is back again substantially in the initial position hereinbefore described. Nevertheless because the damper closes slowly, the furnace walls will not cool off as rapidly as where the damper was fully closed, according to the previous practice. Hence damage to the furnace may be avoided.

If in igniting the burner, a puff or explosive ignition occurs, the damper 15 may be held closed by the support 38 acting as a stop to prevent flame from blowing out from the flue.

The projecting parts of the element 17 and its associated parts may be regarded as air-cooled means facilitating the cooling of the element by air outside of the flue. The element may be made to operate the damper at a higher temperature than hereinbefore mentioned, as may be desired.

In Fig. 4 is shown a modification of the invention including a steam boiler having an atomizing oil burner 41 firing into the chamber 42 of the boiler, and the spent gases passing out through the flue 43. A damper 44 may be located in the latter, and a damper 45 may be disposed to supply air to the base of the firing chamber 42. A temperature sensitive element 46 may be disposed in or adjoining passages controlled by one or both of the dampers, or in a passage 47 that contains baffles 48. The dampers may be moved from the dot-dash line positions to the dotted line positions to reduce the draft, by any suitable operating means 49 connected at 50, 51 with the means 46 for actuation by the latter. A remote temperature indicator 52 may be connected at 53 to the means 46, independently of 49, and a remote control 54 may be connected at 55 to the operating de-

vice such as 49 so that the operator may set the damper after observing the temperature, according to my improved method, in the event that it be desired to operate the device manually instead of automatically.

Where the burner 41 is intermittently operated, the fuel line 56 therefor may be controlled by a suitable means 57 that is actuated by any device 58 responsive to steam pressure or to room tempefature as may be preferred.

It will be appreciated that various changes and modifications may be made in the device as shown in the drawing, and that the same is submitted in an illustrative and not in a limiting sense, the scope of the invention being defined in the following claims.

I claim:

1. In a device having a furnace, a stack therefor having an opening in communication with the atmosphere, and a damper for said opening movable between open and closed positions and adapted, in the closed position, to cause the stack to exert a maximum draft in the furnace for the rapid starting of a fire therein, the combination with said stack and damper, of metallic means expansibly responsive to the temperature in the stack, and actuator means controlled by the temperature responsive means to move the damper from the closed position to an open position thereof, and the actuator means having means to cause a rapid initial opening movement of the damper for an initial relatively low rise in temperature from cold in the stack, and a subsequent opening movement of the damper at a decreased rate for a further rise in temperature in the stack, whereby the maximum draft is rapidly reduced as combustion is initiated, and the draft regulated as the temperature in the stack continues to rise.

2. In an oil furnace, the combination with a stack and an atmospheric damper therefor movable from closed to open position to reduce the draft in the furnace, with the stack having sufficient capacity to exert an excessive draft in the furnace in the closed position of the damper to facilitate ignition of the oil, of means responsive to temperature in the stack, and actuator means for the damper controlled by the temperature responsive means, said damper being moved from closed position to an open position upon a relatively low rise in temperature in the stack to cause a substantial reduction in draft substantially as soon as combustion in the furnace is begun, to obtain a normal draft, and the actuator means causing said damper to gradually regulate the draft as the stack temperature increases to maintain normal conditions of combustion in the furnace.

3. In a furnace, the combination with a stack therefor, having a flow controlling open tube directly communicable with the atmosphere, and a damper within said tube movable from closed to open positions to regulate inflow of air into the stack for reducing the draft, said damper being swingable about an axis in relative proximity to the center of the damper, of means responsive to the temperature in the stack, and actuator means controlled by the temperature responsive means, said actuator means having substantially continuous engagement with the damper in close proximity to the axis thereof so as to swing said damper at a decreasing angular rate to cause a marked initial reduction in draft upon initiation of combustion and then a gradual regulatory decrease in draft as the stack temperature increases upon attaining normal combustion conditions.

4. In a furnace, the combination with a stack therefor having an opening, and a damper for said opening mounted for swinging movement about an axis in proximity to the center of the damper, the damper being movable from closed to open position to decrease the draft in the furnace, of means responsive to the stack temperature, and actuator means controlled thereby to operate the damper, said temperature responsive means and said actuator means being movable substantially along a plane, said actuator means engaging the damper in close proximity to the axis thereof to swing the damper from full closed to open positions at increasing rates of speed with respect to the temperature increases in the stack, as and for the purpose set forth.

5. In a furnace, the combination with a stack therefor having a flow controlling open tube directly communicable with the atmosphere, and a damper within said tube movable from closed to open positions to regulate inflow of air into the stack for reducing the draft, said damper being swingable about an axis in relative proximity to the center of the damper, of means responsive to the temperature in the stack, and including a metallic element extending through the stack, separate means encircling the stack and engaging one end portion of the element to fix said end portion thereof, the stack having a hole for guiding the other end portion of the element, a lever actuable by said element, means for mounting said lever on said tube, and said lever having engagement with the damper in close proximity to the said axis thereof, as and for the purpose set forth.

6. In a furnace, the combination with a stack for the furnace having an opening communicable with the atmosphere, and a damper in said opening swingable about a horizontal axis in proximity to the center of the damper so that the damper is movable from closed to open positions to reduce the draft in the furnace of a transverse substantially horizontal rod extending substantially through the stack so as to expand and contract subject to the temperature in the stack, said rod being fixed at one end and being movable at its other end through a hole in the wall of the stack, a lever mounted on the stack and having a substantially vertical axis, said lever being actuable by the movable end of said rod, the damper having its axis of swinging movement above the center of gravity of the damper so that the latter normally depends in upright closed position, said lever having abutment with the damper substantially at a diameter thereof, below the axis of swinging motion, to swing the damper from closed to an open position to substantially reduce the draft in the furnace upon expansion of the rod in response to a relatively small rise in stack temperature when combustion in the furnace is begun and then to slowly reduce the draft in the furnace as combustion progresses and the stack temperature diminishes.

7. In a furnace, the combination with a stack therefor having an opening directly communicable with the atmosphere, and a damper for initially closing said opening, of means for controlling said damper, said means including an element responsive to stack temperature, said damper being mounted for swinging movement about an axis spaced from the center of the damper, said means including an inwardly mov-

able portion controlled by said element and engaging the damper on the outside of the stack substantially at a central region of the damper spaced from the swinging axis thereof so that a backfire in the furnace is unable to swing the damper open.

8. In a furnace, the combination with a stack therefor having an opening communicable with the atmosphere, and a damper for said opening, of means for controlling said damper, said means including a temperature sensitive element responsive to a rise in temperature upon initiation of combustion in the furnace, said damper being swingable about a substantially horizontal axis above the center of gravity of the damper so that the damper lies in normally upright closed position, and said means having a portion movable substantially horizontally under control of said element, said portion having external lost motion abutment against the damper below the said axis and in relatively close proximity thereto to open the damper at a rapidly decreasing rate, and for the purpose set forth.

9. In a furnace, the combination with a stack therefor having an opening directly communicable with the atmosphere for controlling draft in the furnace, and a damper for said opening movable from closed to open positions to reduce the draft, of a substantially straight rod extending through the stack and exposed for direct contact with the gases therein so as to expand and contract according to temperature changes in the stack, and actuator means controlled by said rod, said damper being swingably mounted, and said acutator means having lost motion cam engagement with the damper in close proximity to but in spaced relation from the axis of swinging motion of the damper to open the damper at a decreasing rate of speed for equal temperature increments in the stack.

10. In a furnace, the combination with a stack therefor having an opening communicable with the atmosphere to vary the draft in the furnace, and a swingable damper for said opening movable from closed to open position, to reduce said draft, of means responsive to the temperature in the stack, and actuator means controlled thereby, said actuator means having a portion movable substantially along a plane and abutting said damper in relatively close proximity to the axis of swinging motion thereof for a lost motion camming engagement, as set forth.

GEORGE H. ROSS.