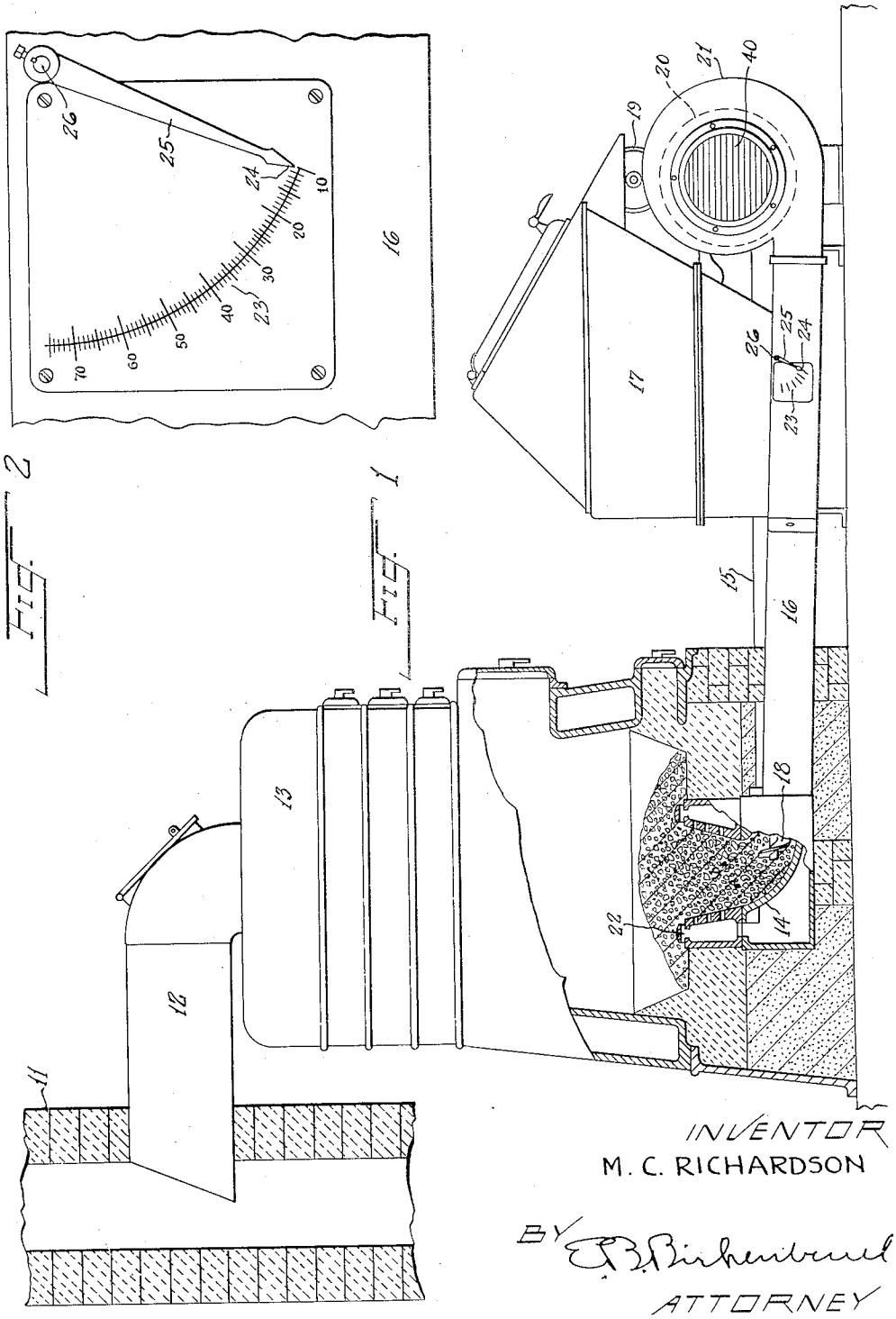
May 10, 1938. M. C. RICHARDSON 2,116,911

AIR FLOW INDICATING DAMPER

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FIG. 3

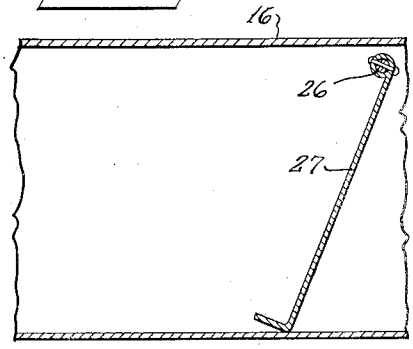


FIG. 4

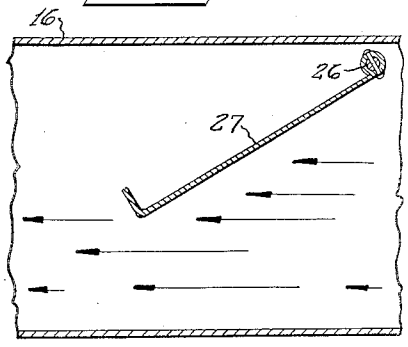


FIG. 5

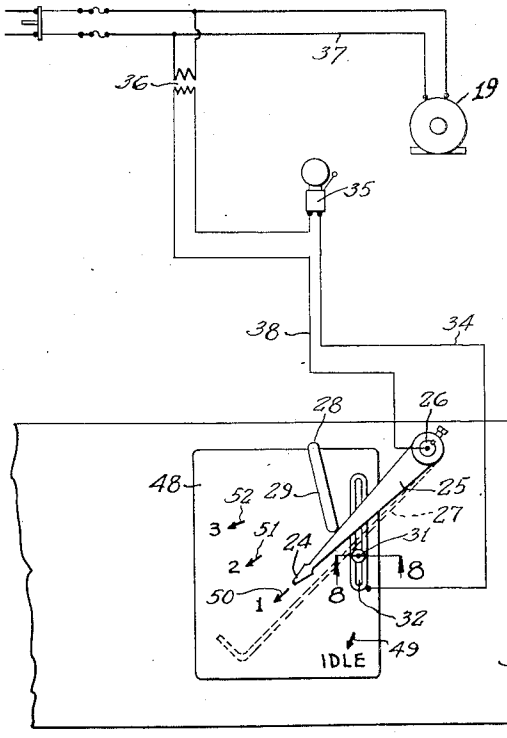


FIG. 6

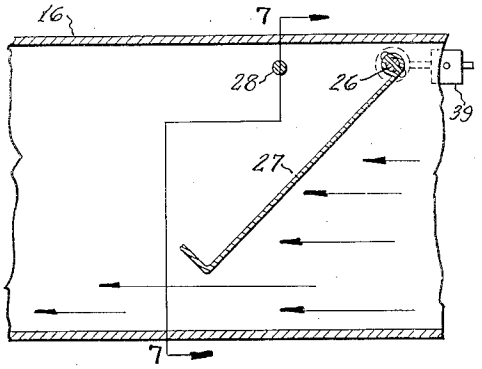


FIG. 7

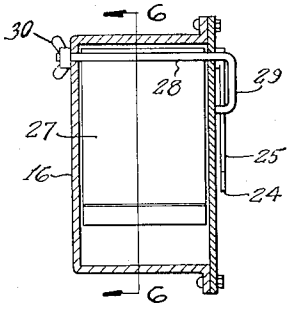
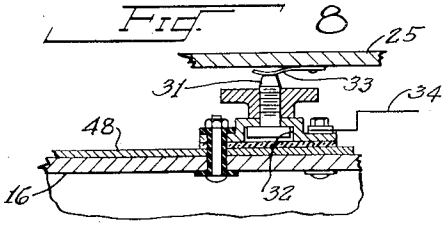


FIG. 8



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Fig. 9

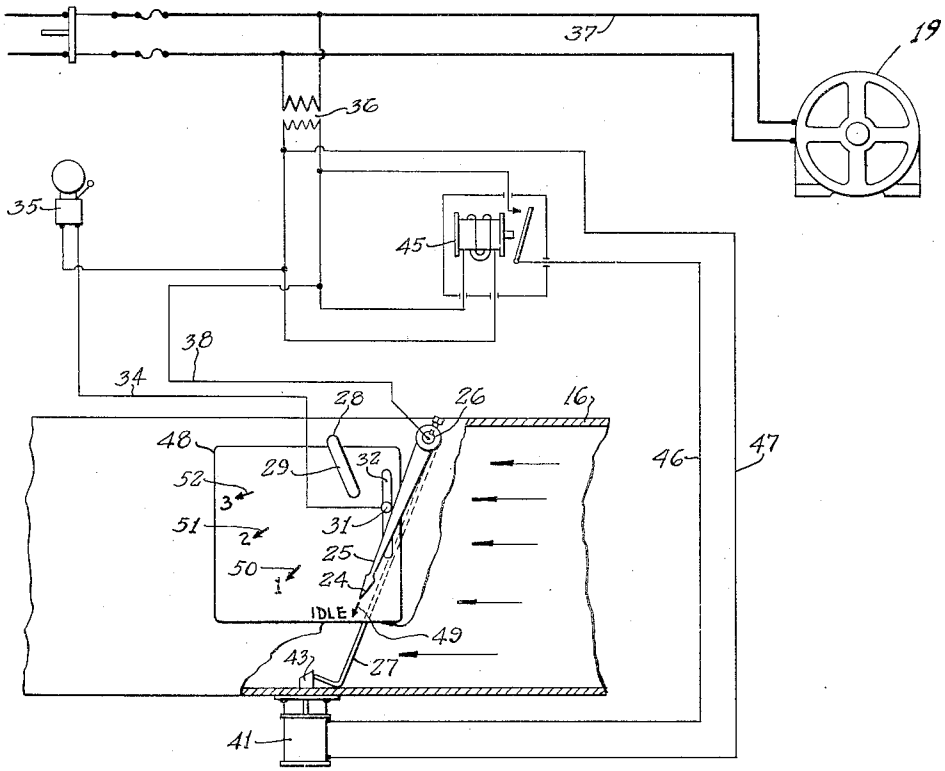


Fig. 10

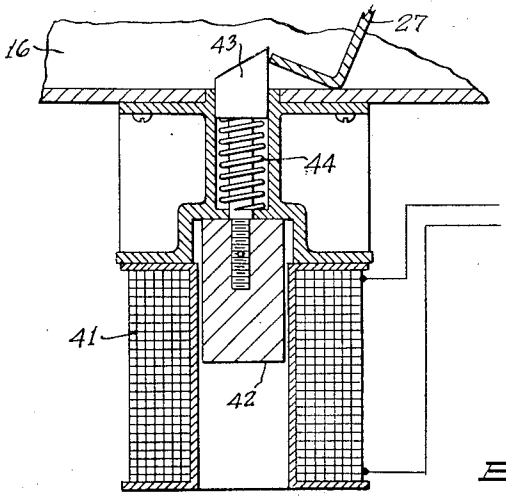
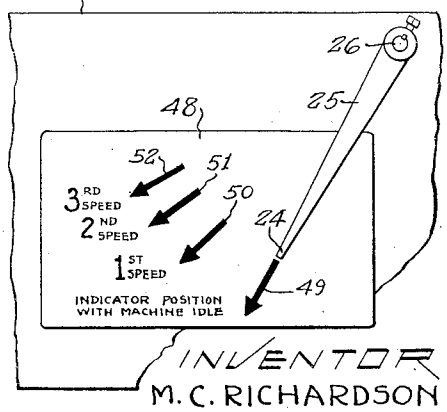


Fig. 11



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UNITED STATES PATENT OFFICE

2,116,911

AIR FLOW INDICATING DAMPER

Max C. Richardson, Portland, Oreg., assignor to Iron Fireman Manufacturing Company, Portland, Oreg.

Application August 22, 1931, Serial No. 558,726

5 Claims. (Cl. 110—69)

This invention relates generally to underfeed stokers, and particularly to a new form of air flow indicating damper.

The main object of this invention is to provide a damper for the air duct of an underfeed stoker which will make it possible to maintain a relatively correct relationship between the amount of air and fuel delivered by the stoker.

The second object is to make it possible for an inexperienced operator to correctly regulate the flow of air without opening the fire door to ascertain the conditions within the combustion chamber.

The third object is to provide an automatic banking damper in conjunction with any or all of the following features, namely an air flow limiting damper, an air indicating damper, a signaling damper and a retarding device adapted to delay the opening of the banking damper.

The functioning of the various elements herein enumerated and the objects therefor will be better understood from the specification following in which:

Fig. 1 is a general view showing the relation of the stoker, the furnace and the stack with a part of the retort cut away to disclose the fuel feed screw.

Fig. 2 is a fragmentary view showing one form of air flow indicator.

Fig. 3 is a fragmentary section through the air duct showing the banking damper closed.

Fig. 4 is a view similar to Fig. 3 but showing the banking damper held open by the air flowing through the duct.

Fig. 5 is a somewhat diagrammatic view of the indicating damper showing its connection to a signal for indicating when the flow of air drops below the proper amount.

Fig. 6 shows the banking damper being held partly open by a flow limiting device. This view is taken along the line 6—6 in Fig. 7.

Fig. 7 is a section taken along the line 7—7 in Fig. 6.

Fig. 8 is a section taken along the line 8—8 in Fig. 5.

Fig. 9 is a diagrammatic view showing means for holding the damper closed for a period of time after the stoker begins to operate.

Fig. 10 is a section through the damper latch shown in Fig. 9.

Fig. 11 illustrates a modified form of dial plate.

Similar numbers of reference refer to similar parts throughout the several views.

Referring in detail to the drawings, there is shown a stack 11 into which extends the smoke pipe 12 of a furnace 13 in which is disposed the retort 14 of an underfeed stoker provided with the usual fuel feed duct 15 and air duct 16. Fuel is moved from the hopper 17 through the fuel feed duct 15 by a fuel feed screw 18 which is rotated by the motor 19. A fan 20 concealed within the casing 21 delivers air through the air duct 16 to the tuyères 22.

It will be understood that in this instance the motor 19 drives the screw 18 and the fan 20 simultaneously.

On the side of the duct 16 is disposed an arcuate scale 23 which lies in the path of the point 24 of an air flow indicator arm 25 which is secured to the shaft 26 of the damper 27. This damper may be of any desired shape, but is illustrated in this case as being hinged at its upper end so that its own weight shall normally hold same in a closed position and that its inclination and weight will be such as to prevent the natural draft of the stack 11 from opening same, but at the same time to permit it to open under the pressure of the air from the fan 20, unless otherwise prevented.

Regarded solely in the form shown in Figs. 3 and 4 the damper 27 would function merely as a banking damper, which is unidirectional, and installed so that air can go only in the direction from the fan to the furnace, its function being to prevent an undesirable amount of air from gaining an access to the fuel when the stoker is not operating.

As a banking damper the arm 25 is not required, but in order to indicate the amount of air which is flowing through the duct 16 the scale 23 and the arm 25 are utilized.

The values and groupings, as well as the form of the indicator marks, may assume numberless variations and may be arbitrary in nature, or may represent actual values in air flow measurements.

Turning now to the air flow limiting device, the same will be seen to consist of a shaft 28 which is mounted across the duct 16 and is provided on one end with a stop arm 29 which can be frictionally held in the path of the arm 25 by means of a wing nut 30. The function of the stop arm 29 is to limit the amount of air which can be delivered through the duct by a given fan speed by the simple expedient of restricting the opening. In other words, by providing a stop for the opening movement of the vane or damper 27.

In order that the attendant may be notified in case the air flow should fall below the amount

deemed correct for a given kind of coal there is provided a minimum flow signal consisting of a contact post 31 which is adjustably mounted in the slot 32. The arm 25 is provided with a spring contact 33 adapted to freely wipe across the post 31. The post 31 is connected by a wire 34 to one side of a bell 35 which is connected to one side of a transformer 36 which, in turn, is placed across the power line 37 of the motor 19. The arm 25, which is insulated from the post 31, is connected by a wire 38 to the transformer 36.

With the signal feature included in the device if the banking damper closes an undesirable amount while the stoker is being operated—that is, if an insufficient amount of air is being delivered to the furnace—then a signal is sounded for the attendant who will make the necessary correction.

In some cases it will be found desirable to provide an adjustable weight 39 on the shaft 26 in order that the desired relationship between the air and fuel delivery may be maintained (see Fig. 6). In other instances, and sometimes in conjunction with the adjustment of the weight 39, the attendant merely controls the air delivered to the fan 20 by restricting the fan opening at the louvers 40, or by a manually set auxiliary damper (not shown).

It will be noted that in the form of the device shown in Fig. 5 the signal 35 is sounded only when the motor 19 is being operated, since of course it is not desirable to sound this signal each time the motor stops under the action of its usual controls.

In the form of the device shown in Fig. 9 there is included a damper retarder whose function it is to delay the opening of the banking damper 27 after the motor 19 commences to operate. This may be accomplished in many different ways, and in the representative form shown there is employed a solenoid 41 whose core 42 is provided with a spring-urged latch 43 which is normally in a projected position so that when the motor 19 stops and the damper 27 falls by reason of the fact that it is not held up by the force of the passing air it will strike against the latch 43, momentarily depressing same until the damper 27 reaches the position shown in Fig. 10, after which the latch 43 rises, under the influence of the spring 44, latching the damper 27 in a closed position.

There is also provided a retarding relay 45 which operates from the transformer 36. From the relay 45 extends the lead wire 46 which connects with the solenoid 41 whose opposite side is connected by a wire 47 to the transformer 36. The retarding relay 45 is of the well known delayed action type and provides that a predetermined space of time shall elapse between the flow of current to the relay and the movement of its armature to close the circuit thru coil 41, the effect in the present case being that when the motor starts current will flow thru the coil of the magnet 45 but the armature will not be attracted for a definite period of time and consequently the banking damper will be held closed for a chosen time while the motor is delivering new fuel to the furnace.

While the elements of the device are separately usable and may be combined with each other in some instances to a good advantage, they assume their best relationship for the purpose intended when combined as shown in Fig. 9, in which the automatic banking damper 27 is provided with an opening limit and its exact position is automatically indicated and in which a deficiency of air is automatically and audibly sounded, and at the same time provision is made whereby the full blast of air will not be permitted to reach the fuel bed until the fuel delivery mechanism has had an opportunity to deliver a sufficient amount of fuel to prevent the light and possibly easily blown particles from being blown out of the retort into the various passages of the furnace and stack. Obviously some air may leak past the damper 27 when in the position shown in Fig. 9, but this leakage is not objectionable.

As previously stated, the various elements herein may assume many different forms and I have therefore attempted to show only representative forms of each element and have illustrated the operation of the separate elements in somewhat detached forms in order to give a clearer understanding of their functioning.

While reference has been made to the element 27 as a banking damper or a damper or a vane, it must be understood that this refers to any element which can be actuated by a flow of air through the air duct which supplies the combustion air to a stoker and which in turn will operate an indicator or other element specifically referred to in the specification and claims.

In the form of the indicator illustrated in Fig. 11 there is shown a dial plate 48 on which are indicated, for example, four arrows 49, 50, 51 and 52. The arrow 49 indicates the position which should be assumed by the indicator 25 with the machine idle. The arrow 50 indicates the position which the indicator should assume when the machine is operating at first speed, it being understood that the stoker includes a change gear mechanism which, in this instance, provides three different speeds for the feed worm and therefore three different rates of fuel feeding. The arrow 51 likewise indicates the indicator position for the second speed and the arrow 52 indicates the position for the third speed. In other words, the arrows 49 are disposed with relation to the position of the indicator arm which indicates the volume of air being delivered to the stoker and this bears a definite relation to the amount of fuel delivered by the stoker as indicated by the particular gear ratio employed. In other words, advantage is taken of the fact that the velocity of the air passing through the duct and its impact with the damper or other element indicates the amount of air passing through the duct as distinguished from the pressure of the air which may be within the duct, which might of course be very high even though little air actually flows through the duct; for example, in the presence of a high fuel bed which would bring about such a condition.

Now if the stoker is being operated at first speed—that is, with a minimum amount of fuel feeding—the indicator arm 25 should coincide with the arrow 50, and if it is desired to increase the rate of burning to the third speed it will be necessary for the operator to adjust his gear ratio in whatever manner is necessary in the particular stoker involved to give him this third speed. His air flow is then adjusted until the indicator arm 25 will register with the arrow 52, and so on through any other change of ratio which may be desired.

In the form of the device shown in Figs. 1 and 9 the operation is as follows: Assuming that the motor 19 is being operated and that fuel and air

are being delivered to the zone of combustion, and that the fire is burning normally and that the motor 19 is then stopped thermostatically or manually for any reason whatsoever, it follows that the damper 27 can then no longer float in the air stream, but will fall to the position shown in Fig. 9, and be latched there, as previously described.

Then assuming that the motor 19 is again operated, it can be seen that the fuel delivery will immediately begin, but the air delivery will not begin until the retarding relay 45 functions, thus providing a lapse in time between the commencement of the fuel feed and the start of the air delivery.

I claim:

1. The combination with a multi-speed, motor driven stoker for feeding fuel at any one of a number of different rates and simultaneously feeding air thru an air duct at corresponding rates; of a one-way, banking damper in said air-duct of such weight as to close under the effect of gravity when the stoker motor is not delivering air and to assume intermediate positions when the stoker is delivering air thru the air duct, such intermediate positions varying with the velocity of the air in the duct, and means for indicating the position of said damper, whereby the stoker tender may be apprised of any variation from the proper rate of air flow for the chosen rate of fuel feed plus a member to limit the opening of said banking damper, said member being manually adjustable so as to be set at different positions for the different speeds of the stoker motor.

2. The combination with a multi-speed, motor driven stoker for feeding fuel at any one of a number of different rates and simultaneously feeding air thru an air duct at corresponding rates; of a one-way, banking damper in said air-duct of such weight as to close under the effect of gravity when the stoker motor is not delivering air and to assume intermediate positions when the stoker is delivering air thru the air duct, such intermediate positions varying with the velocity of the air in the duct, and means for indicating the position of said damper, whereby the stoker tender may be apprised of any variation from the proper rate of air flow for the chosen rate of fuel feed plus latching means for holding the damper closed and delayed-action latch-releasing means electrically connected to the motor circuit to release the latch a predetermined time after the motor has been energized and delivered a quantity of fuel.

3. The combination with a multi-speed, motor driven stoker for feeding fuel at any one of a number of different rates and simultaneously feeding air thru an air duct at corresponding rates; of a one-way, banking damper in said air-duct of such weight as to close under the effect of gravity when the stoker motor is not delivering air and to assume intermediate positions when the stocker is delivering air thru the air duct, such intermediate positions varying with the velocity of the air in the duct, and means for indicating the position of said damper, whereby the stoker tender may be apprised of any variation from the proper rate of air flow for the chosen rate of fuel feed in which adjustable members are positioned on both sides of the indicating means to engage this indicating means at the upper and the lower limits of the range of air-flow suitable for the speed of the motor.

4. The combination with a multi-speed, motor driven stoker for feeding fuel at any one of a number of different rates and simultaneously feeding air thru an air duct at corresponding rates; of a one-way, banking damper in said air-duct of such weight as to close under the effect of gravity when the stoker motor is not delivering air and to assume intermediate positions when the stoker is delivering air thru the air duct, such intermediate positions varying with the velocity of the air in the duct, and means for indicating the position of said damper, whereby the stoker tender may be apprised of any variation from the proper rate of air flow for the chosen rate of fuel feed in which adjustable members are positioned on both sides of the indicating means to engage this indicating means at the upper and the lower limits of the range of air-flow suitable for the speed of the motor, and in which the lower limit adjustable member is connected with an alarm to signal the air flow is too small for the rate of fuel feeding.

5. In combination with a multi-speed, electric-motor driven stoker for feeding fuel at any one of a number of different rates and for simultaneously feeding air thru an air duct at corresponding rates; a one-way, banking damper pivoted in said air-duct in a manner to swing to a duct closing position upon failure of the stoker motor to deliver air thru the air-duct, a latch adapted to catch and lock the damper as it swings to closed position, electro-magnetic means for releasing said latch and connected to be energized upon energization of the motor, said means and connections including a delayed action relay whereby the latch holds the damper in closed position for a time after such energization and thereby prevents delivery of air until after the motor delivers a certain amount of fuel.

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