Feb. 5, 1935. G. A. KOHOUT 1,989,809

AIR REGULATOR FOR FURNACES

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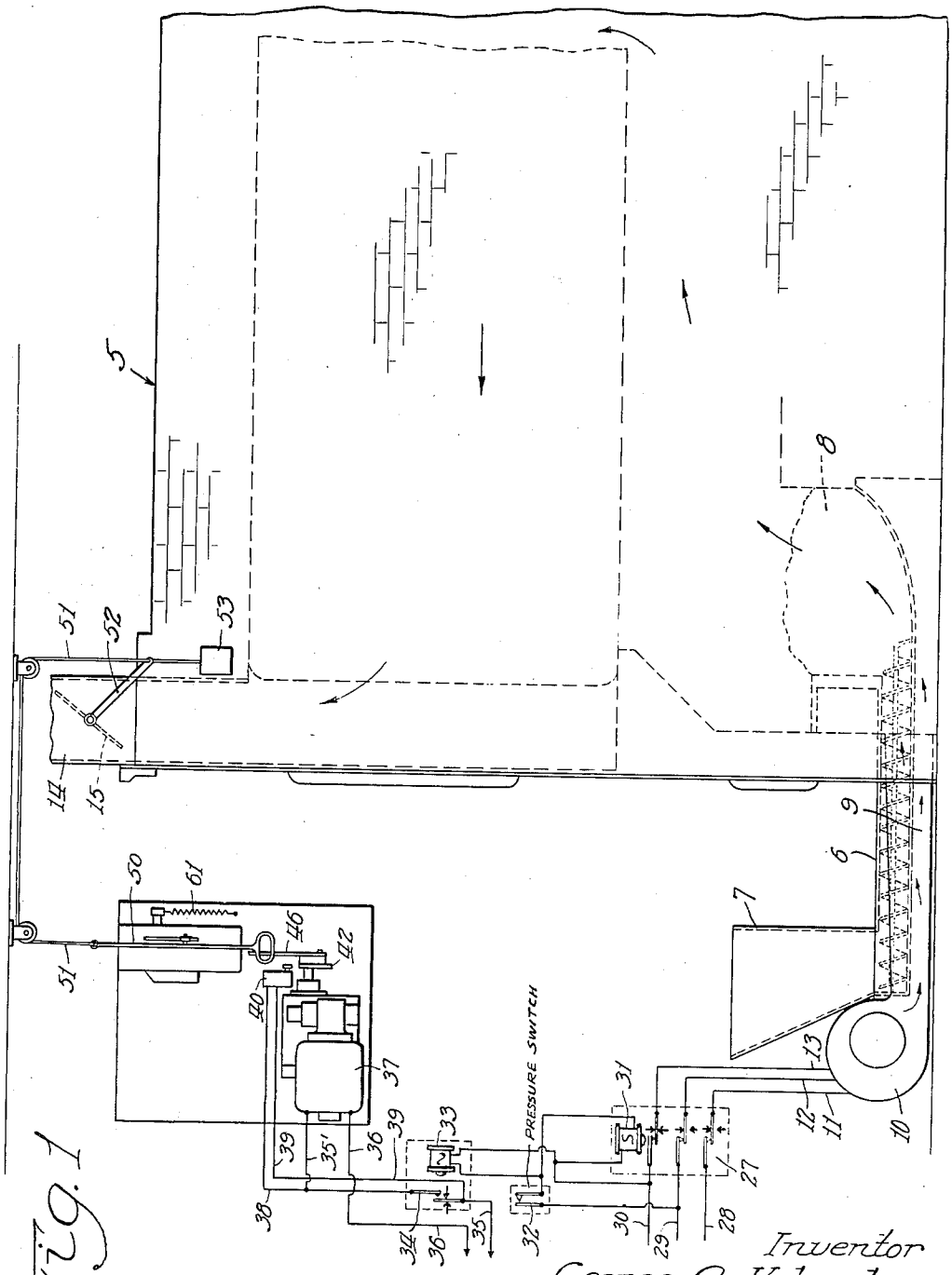


Fig. 1

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Fig. 3

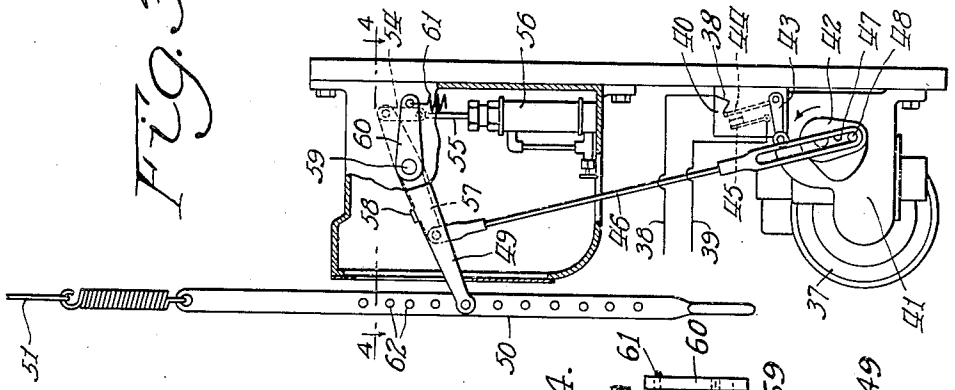


Fig. 4.

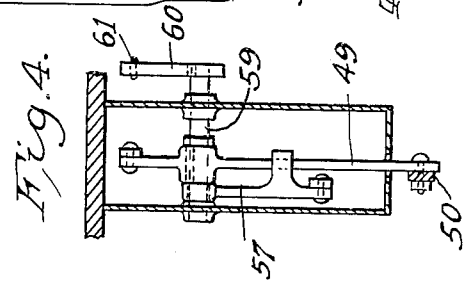
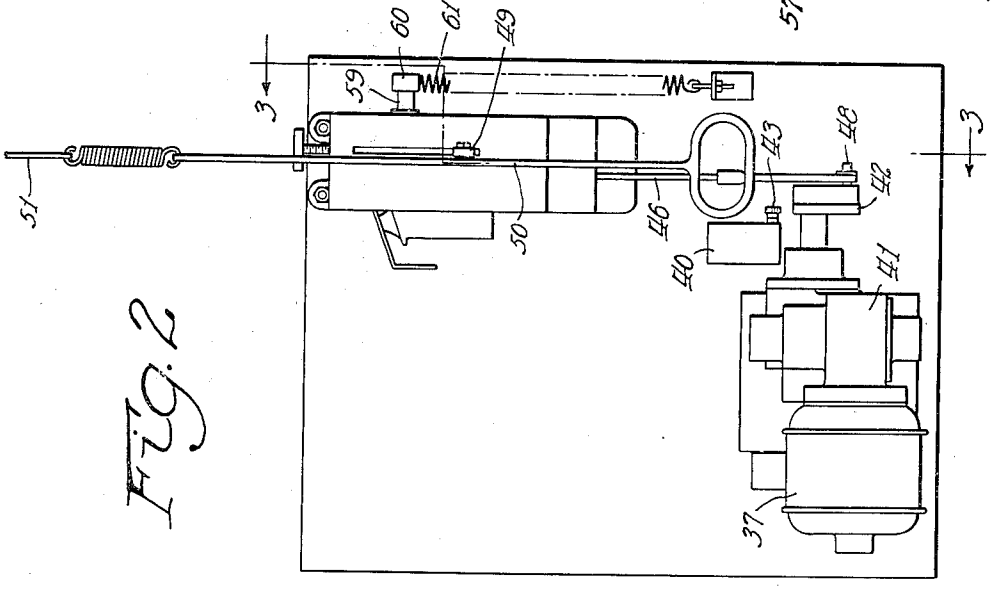


Fig. 2



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UNITED STATES PATENT OFFICE

1,989,809

AIR REGULATOR FOR FURNACES

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Application September 1, 1932, Serial No. 631,359

2 Claims. (Cl. 110—163)

My invention relates to air regulating means for furnaces and has for its principal object the provision of a novel control system whereby the ingress of air to the furnace and the outlet of the gaseous products of combustion from the furnace may be regulated together to avoid excess losses owing to too much or too little air in the furnace.

A supply of excess air to a furnace above the requirements necessary for the proper combustion of the fuel involves a tremendous waste of heat. Also, the lack of air necessary for a proper combustion results in an imperfect or partial combustion only and also causes a great waste of heat energy.

My invention contemplates as its principal purpose the provision of a novel means whereby the inlet or outlet or both of the furnace may be controlled and regulated in combination with means for indicating the pressure drop between different parts of the furnace so that the draft of the furnace may be properly set for the most efficient operation whether it be during the building up of the fire when new fuel is being fed into the furnace or during a more or less quiet period when no new fuel is being added.

Other and more specific objects and advantages of the invention will appear as the description proceeds in connection with the accompanying drawings. It is to be understood, however, that the drawings and description are illustrative only and are not to be taken as limiting the invention except in so far as it is limited by the claims.

In the drawings—

Fig. 1 is an assembled view of a furnace equipped with my control means, the back part of the furnace which does not enter into the combination in any way except in its usual function being broken away;

Fig. 2 is an enlarged front view of a portion of the control mechanism; and

Fig. 3 is a side view partly in section of the mechanism shown in Fig. 2.

Fig. 4 is an enlarged detail section along line 4—4 of Fig. 3.

Referring now in detail to the drawings, I show the invention as applied to a furnace 5 equipped with an underfeed stoker 6 of the screw type having a hopper at 7 for receiving coal. The fuel bed is shown dotted at 8. The air inlet duct is shown at 9 coming from a motor operated fan at 10, the motor receiving its power from a three-phase line over the conductors 11, 12, and 13. The passage of the gas through the furnace as indicated by the arrows brings it finally to the stack at 14 in which is located a control damper 15. The fan 10 forces air into the furnace while the damper 15 controls the outlet of the air and the other gases produced by combustion through the stack.

Mounted on a panel adjacent to or upon the furnace is a control mechanism by means of which the position of the damper 15 may be controlled in conjunction with the fan 10 which forces air into the furnace. The lines 11, 12, and 13 which feed current to the fan motor are connected through the relay switch 27 to the incoming power lines 28, 29, and 30, and this switch 27 may be controlled by means of the relay coil 31 and another suitable switch 32 which is preferably controlled by the heat condition of the furnace as for example by boiler pressure or by furnace temperature. The switch 32, it will be noted, is connected across the two lines 29 and 30 so as to energize coil 31 when it is closed. Coil 33 is also energized by the closing of switch 32 to control switch 34 which is located in one of the feed lines 35 of the lines 35 and 36 feeding current to the motor 37 which is mounted directly beneath the indicator 17. Lines 36 and 35 may be connected to any suitable source of potential such as the usual 110 volt supply line. I have shown the motor operated fan 10 as being operated from a three-phase source of current but it is obvious that a single phase or other source of current such as direct current might be used in the same fashion.

The action is as follows: When switch 32 is closed, the contacts of switch 27 are closed owing to the fact that coil 31 is energized and the fan 10 is operated. Also, when switch 32 is closed, coil 33 is energized and switch 34 is therefore closed to energize the motor 37 for a purpose which will presently appear. In conjunction with the leads 35 and 36 to the motor, leads 38 and 39 are connected in parallel with the motor leads and they in turn lead to a switch 40 which is controlled by the motor 37.

The manner of control of switch 40 by motor 37 is best illustrated in Fig. 3. The motor 37 drives a suitable reduction gear 41 which in turn drives a cam 42 in the direction of the arrow as shown in Fig. 3. This cam 42 is adapted on each revolution to strike the lever arm 43 which is connected to one contact 44 of switch 40 so as to rock this contact away from the other contact 45. The weight of arm 43 is sufficient to cause it to swing contact 44 back into engagement with contact 45 after the cam 42 moves out of the way.

In this way, the circuit through switch 40 is broken on each revolution of the cam 42.

The result is that when switch 34 is opened, if this does not happen to occur when switch 40 is open that is when the cam is in engagement with arm 43, the motor will still receive current over a line extending from lead 35 around switch 34 over lead 39 to switch 40 and from switch 40 over leads 38 and 35' to the motor and then from the motor over the lead 36 to the other side of the source of current. Motor 37, therefore, remains energized any time switch 34 opens until the cam 42 is in raised position, that is, in a position opposite to that shown in Fig. 3.

The purpose of this stopping the motor with the cam raised is to permit the link 46 to rise. This link, it will be noted is slotted as shown at 47, and the slot fits over a pin 48 on the cam 42 so that while the motor 37 is running link 46 is pulled down to the position shown in Fig. 3 upon each revolution of the cam 42.

As shown most clearly in Figs. 1 and 3, the pulling down of link 46 pulls arm 49 down to its lowermost position and, through the means of the connector link 50 and the flexible lead 51, holds the lever arm 52 on the damper 15 up in the position shown in Fig. 1 so as to maintain the damper in open position. The weight 53 also connected to arm 52 tends to move the arm 52 down and close the damper at all times. Arm 49, however, is connected by means of the link 54 (see Fig. 3) to the piston 55 of a dash pot structure 56 such as that shown for example in my prior copending application Serial No. 589,078, filed January 27, 1932, for Grate control.

The function of the dash pot 56 is to oppose rapid rise of arm 57. The lever arm 57 has a lip 58 that rides on arm 49 to pull it down when the furnace starts. Arm 49 is fixed on shaft 59, but arm 57 is not. Shaft 59 also has fixed thereon an arm 60 which is pulled down by spring 61. Upon the initial rotation of cam 42, the arm 49 is pulled down by link 46, arm 57, and lug 58 thus opening the damper. The arm 49 is prevented from rising and therefore, so long as cam 42 rotates, it remains down as brought out in my prior application. When cam 42 stops in raised position, arm 49 may travel up and close the damper slowly.

In order that the device may be more clearly understood, I will describe one complete cycle of operation. I will assume that the pressure is not high enough to open switch 32. With this switch closed, the relay 31 is energized over a circuit extending from line 29 through switch 32, relay 31, to line 30. The contacts of switch 27 are therefore closed to supply current to the fan motor 10 over lines 11, 12, and 13. Relay coil 33 is also energized when switch 32 is closed and holds switch 34 closed to supply current to motor 37 over lines 35, 35' and 36.

Now so long as switch 32 remains closed, the fan motor 10 and motor 37 will be operated. Air will be supplied to the furnace by the fan, and the damper 15 will remain open. Motor 37 rotates cam 42, and pin 48 on the cam keeps pulling link 46 down, and link 46 through arm 57 and legs 58 keep arm 49 from rising to close the damper.

When the pressure controlling switch 32 rises high enough to open this switch, the armatures of relay switch 27 drop back because relay 31 is de-energized. This stops the fan 10 immediately. Relay 33 is also deenergized, and its armature drops back to open switch 34. The motor 37 may, however, remain energized if switch 40 is not open since leads 39 and 38 provide a bypass around switch 34 to motor lead 35'. When the cam 42 raises arm 43 to separate contacts 44 and 45 and raises pin 48 up so that link 46 may rise, the motor 37 is stopped and the damper controlling arm 49 can be moved up by means of arm 60 and spring 61, to allow the damper to move toward closed position.

When the pressure again drops and switch 32 again closes, relays 31 and 33 again attract their armatures to energize the fan motor and motor 37. Motor 37 then turns cam 42 to draw down link 46 and open the damper. The operation of the fan 10 continues until the pressure switch 32 again opens when the cycle of operations just described is repeated. Motor 37 continues to operate the cam 42, which, upon the upward movement of pin 48, would permit upward movement of link 46, but extensive upward movement of member 46 during the upper part of the cycle of pin 48 would be presented by the dash pot 56.

From the above description, it will be seen that the starting of the system causes the immediate opening of the damper to take care of the air driven into the furnace by the fan. The connection of arm 49 with 50 permits proper adjustment of the damper position by shifting the pin on the arm 49 to different holes 62 in the link 50. The draft of the furnace can thus be regulated to the proper value. Then, when the forced draft is stopped, the damper will remain open until motor 37 moves cam 42 to its upper position, and then switch 40 opens the circuit of motor 37 and stops it. This allows arm 49 to rise, and the damper is gradually closed.

Having thus described one specific form of my invention, what I claim as new and desire to secure by Letters Patent is:

1. An air regulating system for furnaces comprising a fan for forcing air into the furnace, a power device driving said fan, a damper controlling the outlet of gaseous products of combustion from the furnace, and means for actuating said fan and damper comprising mechanism connected to said damper normally holding it open, and means releasing said mechanism upon stopping of said fan to cause closing movement of said damper a predetermined time after the fan is shut off.

2. An air regulating system for furnaces having means for forcing air into the furnace, and a damper controlling the outlet of gaseous products of combustion from the furnace, said system including control mechanism interconnecting the air forcing means and the damper for moving the damper toward closing position a predetermined time after cutting off the supply air to the furnace.

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