Oct. 1, 1940. M. M. CASTAGNA 2,216,109

AUTOMATIC FUEL BURNING DEVICE

Filed Nov. 22, 1937

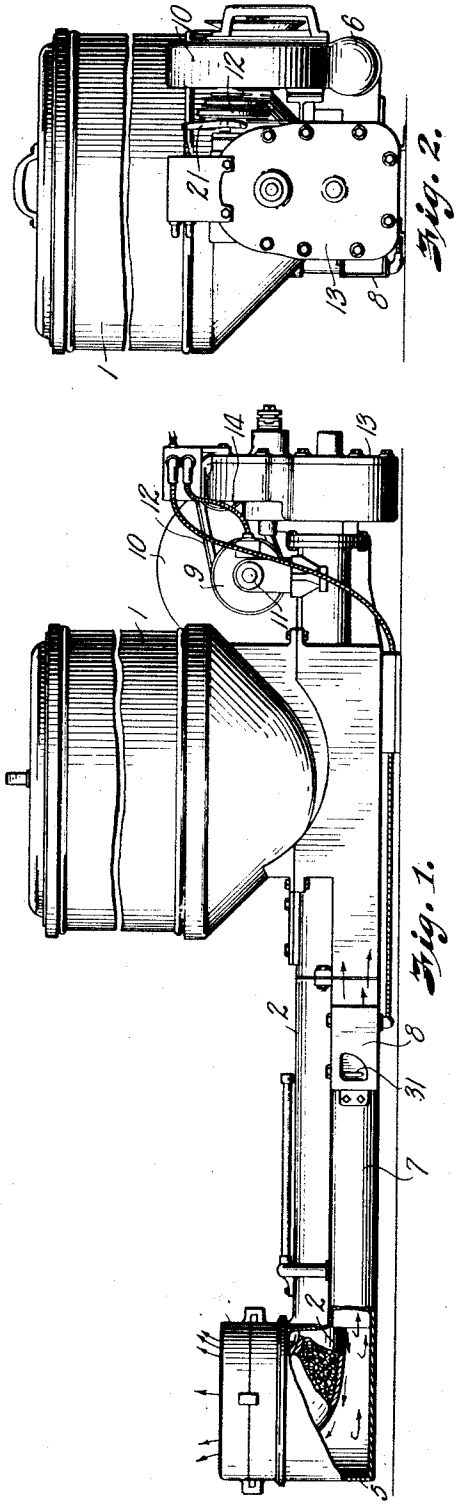


Fig. 1.

Fig. 2.

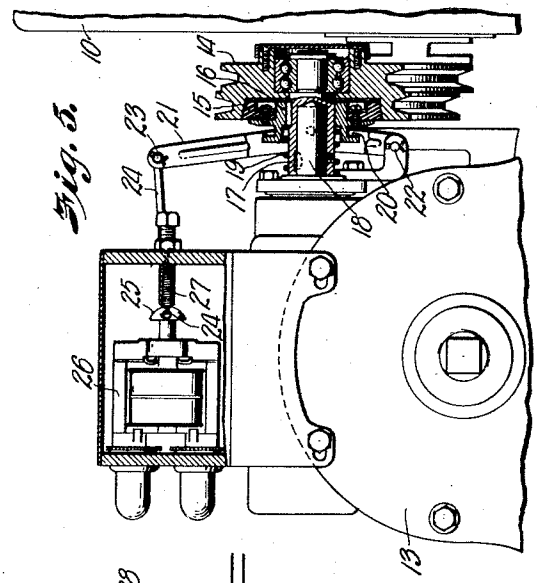


Fig. 5.

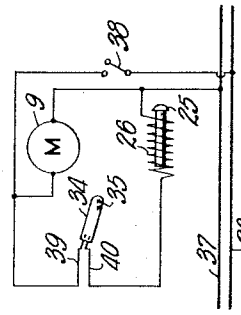


Fig. 6.

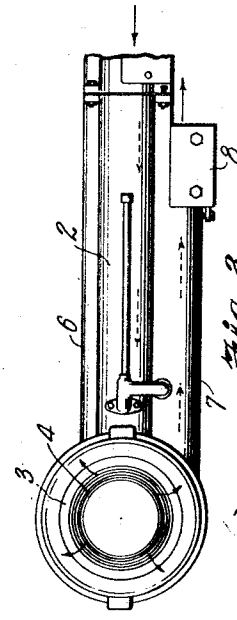


Fig. 3.

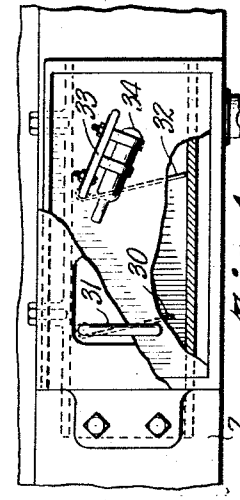


Fig. 4.

INVENTOR
Michael M. Castagna
BY Thos. E. Penfield
ATTORNEY

Patented Oct. 1, 1940 2,216,109

UNITED STATES PATENT OFFICE

2,216,109

AUTOMATIC FUEL BURNING DEVICE

Michael M. Castagna, Oglesby, Ill.

Application November 22, 1937, Serial No. 175,748

7 Claims. (Cl. 110—44)

My invention relates to an automatic fuel burning device and more particularly to a novel control for the same.

In automatic fuel burning devices such as coal stokers, motor driven means are provided for feeding coal to a combustion pot into which air is forced by means of a blower fan or the like. The stoker is usually governed by a thermostat in response to the heating requirements served by the stoker. These responses may be variable, with the result that fuel is fed at varying rates and for various intervals depending upon the demand. If the fire bed happens to be thick, a smaller volume of air than is necessary is usually supplied due to the resistance to the passage of air by the thick fire bed. If the fire bed happens to be thin, a greater volume of air than is necessary will pass therethrough, resulting in inefficient combustion and the cooling of the fire by the excess of air. In cases where the fire bed is thin, a large amount of fly ash is ejected. If the bed is excessively thick, clinker formation will be retarded.

One object of my invention is to provide a control for an automatic fuel burning device such as a stoker which will promote more efficient combustion by maintaining nearly constant a correct volume of air required for combustion.

Another object of my invention is to prevent the formation of an excessively thick bed of fuel.

Another object of my invention is to provide means for preventing operation with too thin a bed of fuel.

Other and further objects of my invention will appear from the following description.

In general, my invention contemplates controlling the feeding of fuel as a function of the velocity pressure of the air being supplied for combustion.

It will be obvious that, as the fire bed becomes thicker, the resistance to flow of air through the tuyères of the combustion pot of the stoker becomes increased and that, as the fire bed decreases in thickness, this resistance likewise decreases. A resistance to flow converts some of the kinetic energy of flow into static energy of pressure. It has been suggested by the prior art to employ the changes in pressure thus brought about to control the feed of fuel to the combustion pot. This method has many disadvantages. When the pressure is increased sufficiently to bring about the control of the fuel feeding arrangement, an excess of air is passing through the fire bed. The increase in pressure decreases the efficiency of the blower since the discharge pressure is thus increased.

In general, my invention contemplates maintaining the flow of air at a constant amount at all times and bypassing the excess when the thickness of the fire bed increases so as to offer increased resistance to flow. The control is made to operate as a function of the velocity of the air being bypassed, thus avoiding the disadvantages of the prior art and making the control substantially independent of pressure changes in the air being furnished to the combustion pot.

In the accompanying drawing which forms part of the instant specification and is to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views,

Figure 1 is an elevation of a coal stoker with parts in section, showing one embodiment of my invention.

Figure 2 is an end view of the stoker shown in Figure 1.

Figure 3 is a fragmentary plan view of a portion of the stoker shown in Figure 1.

Figure 4 is a fragmentary view of the elevation shown in Figure 1, upon an enlarged scale, with parts in section.

Figure 5 is an enlarged fragmentary view, with parts in section, of a portion of the end of the stoker shown in Figure 2.

Figure 6 is a diagrammatic view showing the electrical connections.

More particularly referring now to the drawing, the stoker may be of any suitable design, being provided with a fuel hopper 1 from which fuel is adapted to be fed through a coal duct 2 in which is housed any suitable conveying means. The fuel is adapted to pass into a combustion pot 3 provided with tuyères 4. The combustion pot is surrounded by a tuyère box 5 into which air is supplied through an air conduit 6. A bleeder conduit 7 is provided through which the excess of air from the tuyère box 5 may flow into the atmosphere through a control fitting 8. A motor 9 is adapted to drive a blower fan within the blower casing 10, the blower fan being directly connected to the shaft 11 of the motor. The motor is adapted to drive the coal feeding means disposed within the coal duct 2, through a belt 12, which drives a wheel 14 adapted to be clutched to a transmission housed within transmission case 13. The wheel 14 and the clutching arrangement are shown in detail in Figure 5. The wheel 14 is provided with a cone shaped

seat adapted to coact with complementary clutch member 15. The clutch member 15 is secured to a bushing 16 which is slidably mounted upon and keyed to sleeve 17 which is in turn keyed to shaft 18, the rotation of which operates the transmission housed within housing 13. A spring 19 normally urges the bushing 16 carrying the clutch member 15 into clutching engagement. The member 16 is provided with an annular groove 20 in which lugs (not shown) carried by the lever 21, ride. The lever 21 is pivoted at 22 at its lower end. The upper end of the lever 21 is connected at 23 to a connecting rod 24 which is adapted to be actuated by the armature 25 of a solenoid 26. A spring 27 urges the armature 25 out of the solenoid, thus moving the connecting rod 24 to the right as viewed in Figure 5 and pivoting the lever 21 clockwise about its pivot 22, thus assisting the spring 17 in holding the clutch in engagement.

From the foregoing, it will be obvious that the motor 9 will drive the blower fan directly and will drive the coal feeding mechanism through the belt 12, the wheel 14, the clutch member 15, the bushing 16, the sleeve 17, the stub shaft 18, and the transmission positioned within housing 13.

It will be further obvious that, when the solenoid is actuated to attract the armature 25 against the action of spring 27, connecting rod 24 will be moved to the left, pivoting lever 21 counterclockwise around pivot 22, moving bushing 16 to the left as viewed in Figure 5, carrying clutch member 15 to the left end, unclutching the transmission from the drive wheel 14. When this occurs, the motor will continue to run the blower but the coal feeding drive will be rendered inoperative.

A blower furnishes air to the tuyère box through the wind duct 6. A bleeder duct 7 communicates with the tuyère or wind box 5 so that a portion of the air is constantly passing to the atmosphere through duct 7. The quantity of air can be readily adjusted by means of a damper 30 controlled by an operating handle 31. With the damper shown in the position of Figure 4, that is, when the handle is down, a smaller quantity of air will be bled than when the damper is raised. A vane 32 is pivoted freely in the bleeder duct. The vane is secured to the armature which carries an arm 33 which in turn carries a mercury tube 34. As the velocity of the air through the bleeder duct increases, it will tend to pivot the vein counterclockwise, raising the right hand end of the mercury tube, permitting the mercury to flow to the left. The movement of the mercury to the left of tube 34 completes a circuit, through the mercury there being a pair of conductor ends positioned in the left hand end of tube 34. This can readily be seen by reference to Figure 6, in which the mercury is indicated by the reference numeral 35. The circuit, which is closed by the movement of the mercury, is that through the solenoid 26. The main line wires are indicated in Figure 6 by the reference numerals 36 and 37. The switch 38 controls the operation of the stoker. When the switch is closed, the motor is across the main line and will be energized. The circuit through the solenoid 26 is open when the mercury is at the right hand end of the tube 34. When the vane 32 is moved counterclockwise sufficiently, the mercury flows to the left end of the tube 34 and completes the circuit through the solenoid 26 through conductors 39 and 40, the ends of which extend into the tube 34.

In operation, let us assume the stoker has been running for some time and the fire bed gradually becomes thick. The resistance to flow of the air therethrough becomes increased so that a greater proportion of the air being passed by the blower into the wind box will be bled through the bleeder duct 7, passing damper 30 acting upon the vane 32, rotating it counterclockwise, thus causing a completion of the circuit through solenoid 26 and unclutching the coal feeding drive from the motor. As long as the fire bed remains too thick, this circuit will be held closed by the velocity of the air through the bleeder duct. As the fire bed becomes burned, it becomes thinner and the resistance to flow of air therethrough becomes decreased. When this occurs, gradually more and more air will pass through the fire bed until the point is reached when the amount of air passing through the bleeder duct is insufficient to hold the vane 32 in a position sufficiently rotated to cause it to tilt the mercury tube 34 to maintain the solenoid circuit closed. When the point is reached when the right hand side of the mercury tube is lower than the left hand side thereof, as viewed in Figure 4, the mercury will flow to the right, opening the circuit through the solenoid, deenergizing it and permitting the springs 27 and 17 to again clutch the coal feeding drive to the motor, thus again feeding coal to the combustion pot. It will be further observed that the thickness of the fire bed can be governed by the positioning of damper 30 by means of handle 31.

In the position shown in Figure 4, a thicker fire bed will be built up than when the damper is raised so as to increase the amount of air which can pass by damper 30 for action upon the vane 32.

It will be observed that I have accomplished the objects of my invention. I have provided a control for the automatic fuel feeding device such as a coal stoker, which will permit more efficient combustion by maintaining a nearly constantly correct volume of air. I have provided a simple control, which will prevent excessive fire beds thus permitting clinker formation with low fusion fuels and minimizing fly ash. I have avoided the use of complicated devices employing diaphragms and have provided a means of control in which the output of the blower is constant. My control operates as a function of the bleeder air and avoids the necessity of passing an excess of air through the fire bed in order to increase the pressure to operate a control.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. In a stoker, a combustion pot, means for feeding fuel to said combustion pot, means for feeding air to said combustion pot, a bleeder duct for relieving some of the pressure of the air being fed to said combustion pot by bleeding a portion of the air to the atmosphere, means con-

trolling said fuel feeding means, and means responsive to a predetermined maximum velocity of the air passing through the bleeder duct for operating said controlling means to stop said fuel feeding means.

2. In a stoker, a combustion pot, means for feeding fuel to said combustion pot, means for passing air to said combustion pot, bleeder duct means for relieving some of the static pressure of said air by bleeding a portion of said air to the atmosphere, manually operable means for controlling the quantity of air passing through said bleeder duct, means for controlling the operation of said fuel feeding means, and means responsive to the velocity of the flow of air through said bleeder duct for operating said controlling means.

3. An automatic stoker comprising in combination a combustion pot, a duct for passing coal to said combustion pot, a coal feeding means for feeding coal through said duct, an air feeding means, an air duct for passing air from said air feeding means to said combustion pot, a bleeder duct communicating with said air duct for reducing static pressure in said duct by passing a portion of the air to the atmosphere, said coal feeding means including a clutch, a solenoid for operating said clutch, a circuit to said solenoid, a switch in said circuit, and means responsive to the velocity of the air passing through said bleeder duct to the atmosphere for actuating said switch for unclutching said clutch.

4. A stoker, a combustion chamber, means for feeding fuel to said combustion chamber, means controlling said fuel feeding means, means for feeding air to said combustion chamber, an escape passage for relieving the pressure of the air being fed to said combustion chamber, means responsive to the velocity of the air passing through said escape passage to actuate said fuel feeding control means to stop said fuel feeding means, said air velocity responsive means being constructed to actuate said fuel feeding control means to operate said fuel feeding means upon the reduction to a predetermined point of the velocity of the air passing through said escape passage.

5. Means for maintaining a fuel bed comprising a stoker, a combustion chamber containing a fuel bed, means for forcing air into said combustion chamber, means for bleeding a portion of the air to the atmosphere, said air bleeding means acting to relieve excessive static pressure of said forced air, means controlling said stoker, and means responsive to an increased velocity of air passing through said air bleeding means for actuating said controlling means to stop said fuel feeding means, and responsive to a decreased velocity of air passing through said air bleeding means for actuating said controlling means to start said fuel feeding means.

6. An automatic fuel feeding device for a stoker, including a combustion chamber containing a fuel bed, means for feeding fuel to said fuel bed, air bleeder means, means for forcing air to said combustion chamber, said air bleeder means communicating with said air forced by said air forcing means to receive a portion of the air therefrom to bleed this air to the atmosphere, means for manually controlling the flow of air through said air bleeder means, means controlling the flow of air through said air bleeder means, means controlling said fuel feeding means, and means operable by the velocity of air passing through said air bleeder means to control said fuel feeding means controlling means.

7. An automatic fuel feeding device for a stoker including a fuel feeding means, a combustion chamber containing a fuel bed, an air draft duct to said fuel bed, means for forcing air through said duct, a bleeder duct to relieve excess static pressure in said air draft duct designed to convey air from said draft duct adjacent said fuel bed, means controlling said fuel feeding means, and means actuated by the velocity of air passing through said bleeder duct for operating said controlling means to stop said fuel feeding means, said control means being such that said means for forcing air through said duct will continue to operate after said fuel feeding means has been stopped.

MICHAEL M. CASTAGNA.