CONTROL MECHANISM FOR HOT BLAST STOVES

Fig. 5.

Inventor:
FRANK R. McGEE,

by:

D. Anthony Usina
his Attorney.
This invention relates to hot blast stoves and, while not limited thereto, relates more particularly to a novel valve control for said stoves, and has for one of its objects the provision of a novel control mechanism which will insure the proper sequence of operation of the valves of said stoves.

Another object is to provide a novel valve control mechanism for stoves of this class which will be automatically operated to shut off the fuel supply, close the chimney valve, and when air to support combustion is supplied to the stove by a fan, will stop said fan in the proper sequence when the stove has reached a predetermined temperature.

A further object is to provide an automatic safety control for closing the fuel valve in case the fan operating motor should become deenergized for any reason.

In the drawings:

Figure 1 is a sectional side elevation of a stove having my invention applied thereto.

Figure 2 is a side elevation taken at right angles to Figure 1.

Figure 3 is an enlarged fragmentary view of the gas control mechanism.

Figure 4 is a view taken on the line IV—IV of Figure 2.

Figure 5 is a schematic wiring diagram showing the control circuits.

Referring more particularly to the drawings, the letter A designates the hot blast stove as a whole, which is of single pass construction and comprises a cylindrical checker-chamber 2 and a separate outside combustion chamber 3 which is connected to the upper end of the checker chamber 2 by a conical distributing chamber 4. A gaseous fuel burner 5 is provided at the lower end of the combustion chamber and is provided with a gas inlet port 6 and an air inlet port 7. The gas port 6 is connected by a conduit 7a to a supply main 8, and a vertically swinging valve 9 is provided for controlling the flow of gas through the conduit 7a to the burner 5. The air port 7 is connected by a conduit 10 with a fan 12 adapted to be operated by an electric motor 13.

A water cooled slide valve 14 is provided at the lower end of the combustion chamber 3 to close said chamber from said burner when the stove is on blast.

A stack conduit 15 leads from the lower end of the stove to a chimney valve casing 16 which has a conduit 17 leading therefrom to a stack. A cold blast conduit 18 is connected with and extends into the casing 16 adjacent its lower end and is adapted to deliver cold air under pressure to the stove. A valve 19 is provided to control the flow of air through the conduit 18. A stack or chimney valve 20 is mounted for vertical movement in the casing 16 and is adapted to seat against a seat 21 to close the path to the stack conduit 17 when in its uppermost position, and to rest on a support 22 on the cold blast conduit 18 when in its lowermost or open position.

A valve rod 23 is connected to the chimney valve 20 and extends vertically through the valve casing 16. A yoke member 24 is slidably mounted on the rod 23 and is adapted to engage a collar 25. A pair of cables 26 have their lower ends secured to the opposite ends of the yoke 24 and their upper ends secured to drums 27 of a hand operated hoisting apparatus 28, so that the valve 20 may be manually operated, if desired.

The gas valve 9 is provided with a crank-shaped operating arm 29 which is mounted on a shaft 30 journaled in the valve casing 9, which shaft is provided with an operating lever 31. A pair of link members 32 and 33, having a turn-buckle adjustment 34, are provided for operating the valve 9 by hand. The upper link member 32 has a loose connection with the lever 31, as at 33, while the lower link member 33 has a pivotal mounting on a fixed pivot 36 on a frame 37 and the links have their adjacent ends threaded into the turn-buckle 34, so that they may be drawn toward and away from each other to operate the valve.

In order to provide for the proper sequence of operation of the valves 9 and 20 the following interlocked mechanical mechanism is provided.

A motor 40 is mounted on a stationary base and is adapted to operate a drum-shaft 41 through a speed reducing mechanism 42.
A drum 43 is mounted on one end of the shaft 41. A cable 44 has its one end anchored to the shaft 41 and is trained over a sheave 45 mounted in a sheave-frame 46 suspended from one end of a cable 47. The cable 44 extends down and is secured to the drum 43. As the drum 43 is rotated, the cable 44 will be either wrapped on or unwrapped from the drum 43 according to the direction of rotation of the drum. The cable 47 is trained over an elevated sheave 48 and extends down and has its other end secured to a counter-weight frame 49 carrying a counter-weight 50.

A sheave 51 is journaled in the counter-weight frame 49 and a valve operating cable 52 is trained under the sheave 51 and is extended up and over a series of elevated sheaves 53 and 54 downwardly and is secured to the valve rod 23 of the chimney valve 20. The other end of the cable 52 is extended up and over a series of elevated sheaves 55 and 56 downwardly and is secured to one end of a rod link 55.

The rod link 55 extends downwardly through the framework 37 and is connected to one end of a short length of cable 57 which extends downwardly and is trained under a sheave 58 journaled in a counter-weight frame 59 carrying a counter-weight 60. The cable 57 extends upwardly from the sheave 58 and is secured to the lever 31 which operates the shaft 30 and gas valve 9.

The counter-weight 60 extends into and is adapted to have a limited movement relative to a casing 61. A swinging stop member 62 is mounted on the casing 61 and is adapted to be normally moved into the casing 61 into the path of travel of the weight 60, so as to stop said weight. A toggle mechanism 63 is provided for holding the stop member 62 in position in the casing, and a weight operated tripping lever 65, having an attached weight 65a, is provided for tripping or breaking the toggle and permitting the stop member 62 to swing out of operative position. A magnet 66 is provided for normally holding the tripping lever 65 in inoperative position.

A switch 67 is provided on the framework 37 and is adapted to be operated by a tripping 68 on the rod link 55 to energize the fan motor 13.

A pilot light 70 is provided in the combustion chamber 3 to initially light the gas, and after the stove has been once heated this light may generally be extinguished since the brick-work of the stove will remain sufficiently hot to ignite the gases.

The operation of the apparatus so far described is as follows:

Assuming that the stove A is on air with the stack valve and gas valve closed, the motor 40 will be energized in the forward direction to wind up the cable 44 on the drum 43, which will pull the cable 47 around the sheave 48, and elevate the counter-weight 50, thus relieving the tension on the cable 52. The chimney valve 20, being the heaviest mechanism connected to the cable 52, will thus drop to open position on the rest 22. After the chimney valve 20 has come to rest on the rest 22, the cable 52 will continue to be slackened and permit the opposite end to be lowered due to the pull of the weight 60. This movement will cause the rod 55 to move downwardly so that the trip-lug 65 will trip the switch 67 and energize the fan motor 13 to force air for supporting combustion into the combustion chamber.

After the weight 60 has moved a predetermined distance it will engage the stop 62 and come to rest. The main weight 50 will still be moving upwardly so as to further relieve the tension on the cable 52 and, as this tension is relieved, the gas valve 9 will open to permit the gas to enter the burner 5 and be ignited by the pilot light 70.

A limit switch is provided for stopping the operation of the motor 40 when the weight 50 has been lifted sufficiently to open both the stack and gas valves.

When the stove has been heated sufficiently and it is desired to put the stove on air, the motor 40 will be reversed so as to unwind the cable 44 and thereby lower the weight 50 which will pull or tension the cable 52. As the weight 50 is lowered and tension is applied to the cable 52, the gas valve 9, which is the lightest structure connected to said cable, will be first raised to closed position, the weight 60 will be next raised to its elevated position and permit the trip-lug 65 to operate and open the switch 67, so as to deenergize the fan motor 13. As the cable 44 is continued to be unwound and the weight 50 continues to drop and apply tension to the cable 52, the chimney valve 20, which is considerably heavier than the valve 9 and weight 60, will be closed.

In order to provide for automatically shutting off the fuel after the stove has been brought to the desired temperature, and also to provide for the automatic shutting off of the fuel supply in case the fan motor should be deenergized, I have provided the following mechanism, illustrated in the wiring diagram of Figure 5.

A thermo-couple 75 is provided at a convenient location in the conduit 15 leading to the stack so as to be heated by the stack or waste gases. The leads 76 and 77 from the thermo-couple 75 lead to a Standard Leeds and Northrup or other automatic recording controller 78, which is connected by leads 79 and 80 to a standard control panel 81.

Lines 82 and 83 lead from a source of current to the panel 81, and branch lines 84 and 85 are connected to the motors 40 and 13 by a hand operated switch 86 for com-
completing the circuit to the motor 40 and the cable operated switch 67 for completing the circuit to the motor 13. The magnet 66 is in series with the motor 13 so that if the motor 13 is deenergized the magnet 66 will also be deenergized to drop the weight 65.

The standard panel 81 is adapted to complete a reverse circuit to the motor 40 through leads 87 and 87' when the panel is energized by the current from the thermocouple 73. Therefore, when the temperature of the stove has been raised to a predetermined amount the panel 81 will be operated to complete the reverse current to the motor 40 and cause said motor to operate to close the gas and chimney valves and deenergize the fan motor 13.

The details of the automatic recorded controller 78 and the control panel 81 have been entirely omitted, since these are standard pieces of electrical apparatus well known in the art and to illustrate and describe their details of construction would only serve to confuse and obscure the invention.

While I have shown and described one specific embodiment of my invention I do not wish to be limited thereto, since various modifications may be made without departing from the scope of my invention, as defined in the appended claims.

I claim:

1. The combination with a hot blast stove having chimney and fuel valves, a fuel burner and a motor driven fan for supplying air to support combustion, of mechanical means for opening and closing said valves, said means including a prime mover, a flexible connecting member between said prime mover and said valves, said connecting member being so arranged that said valves are balanced against each other whereby said chimney valve due to its greater weight will open before said fuel valve and said fuel valve will close before said chimney valve, and means for automatically setting said prime mover in operation to close said valves when the temperature of said stove has reached a predetermined degree.

2. The combination with a hot blast stove having chimney and fuel valves, a fuel burner and a motor driven fan for supplying air to support combustion, of mechanical means for opening and closing said valves, said means including a prime mover, a flexible connecting member between said prime mover and said valves, said connecting member being trained over suitable sheaves and combined with weights so that said valves are balanced against each other whereby said chimney valve due to its greater weight will open before said fuel valve and said fuel valve will close before said chimney valve, and means operable by said flexible connecting member for energizing said motor driven fan prior to the opening of said fuel valve and for deenergizing said motor driven fan after said fuel valve is closed, and means for automatically closing said fuel valve if the circuit to said fan motor is broken while said fuel valve is open.

3. The combination with a hot blast stove having chimney and fuel valves, a fuel burner and a motor driven fan for supplying air to support combustion, of mechanical means for opening and closing said valves, said means including a prime mover, a flexible connecting member between said prime mover and said valves, said connecting member being trained over suitable sheaves and combined with weights so that said valves are balanced against each other whereby said chimney valve due to its greater weight will open before said fuel valve and said fuel valve will close before said chimney valve, and means operable by said flexible connecting member for energizing said motor driven fan prior to the opening of said fuel valve and for deenergizing said motor driven fan after said fuel valve is closed, and means for automatically setting said prime mover in operation to close said valves when the temperature of said stove has reached a predetermined degree.

In testimony whereof, I have hereunto set my hand.

FRANK R. McGEE.