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SAFETY DEVICE FOR PREVENTING HOPPER FIRES IN COAL FURNACES

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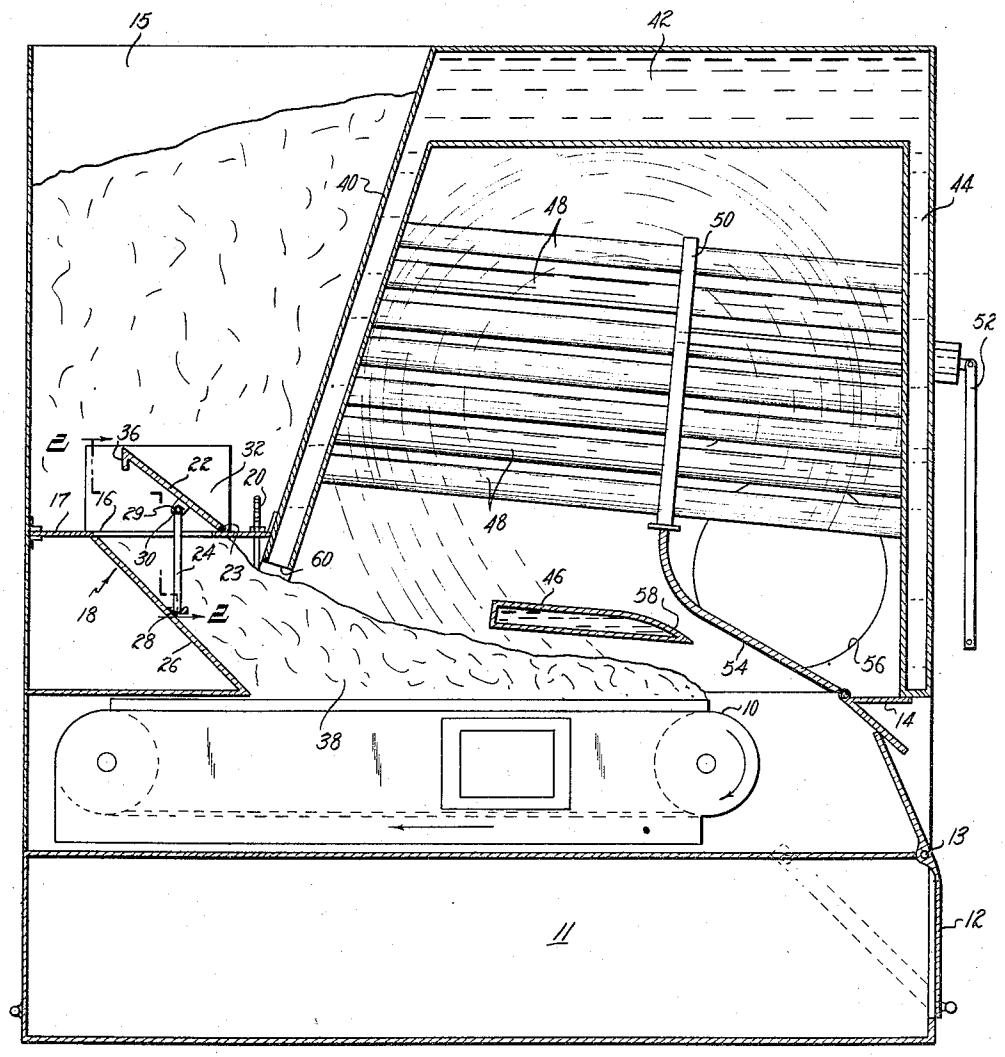


Fig. 1

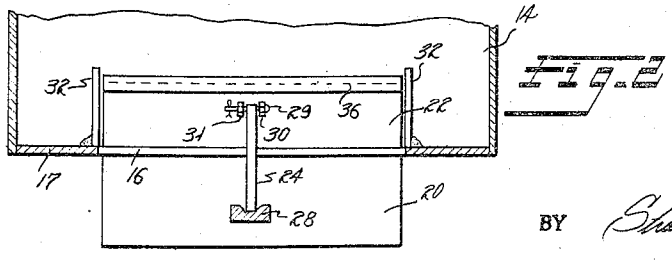


Fig. 2

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SAFETY DEVICE FOR PREVENTING HOPPER FIRES IN COAL FURNACES

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3 Claims. (Cl. 110—108)

This invention relates to safety devices for furnaces for burning solid fuels such as bituminous coal, anthracite coal and derivatives thereof in sizes from screenings to that of briquettes, and more particularly to a safety door for preventing hopper fires.

In coal burning furnaces of the type where coal is automatically fed to a conveyor or moving grate, optimum operation requires that new coal be fed at a rate commensurate with the fuel consumption rate. The boiler pressure or water temperature is commonly used to control the draft by controlling operation of a blower in the flue. If there is excessive natural draft when the blower and stoker motors are turned off, rapid consumption of the fuel occurs and the fire may burn back to a dangerous position under the coal hopper. Also if the conveyor or moving grate jams and the blower in the chimney continues to operate, draft through the coal hopper causes the fire to burn back into the passageway and eventually into the hopper unless precautionary measures are taken.

It is accordingly a major object of this invention to provide a safety door between the coal hopper and the furnace to prevent further coal feed when excessive temperatures are detected automatically in the lower end of the hopper.

It is another major object of the invention to provide a seal effective to prevent air from being drawn to the furnace through the hopper when the fire burns to a position under the hopper.

A further object of the invention is to provide means for holding the safety door open including a peg preferably of wood which will ignite and burn away at a temperature lower than the combustion temperature of the coal.

Still another object of the invention is to provide a safety door having a turned-down lip which enables the safety door to seal off the opening as soon as the lip engages the bottom plate of the coal hopper.

A still further object of the invention is to provide a pair of plates on either side of the safety door to prevent safety door from failing to close due to coal wedged under the safety door edges and to aid in more quickly sealing the safety door opening.

These and other objects of the invention will become more fully apparent from the claims and as the description proceeds in connection with the drawings wherein:

Figure 1 is a vertical view in section of a furnace and a hopper incorporating the safety door of the present invention; and

Figure 2 is a front elevation of the safety door shown in its open position as seen along lines 2—2 of Figure 1.

A typical furnace in which the safety device of the present invention may be installed includes a conveyor or moving grate 10 supported above an ash chamber 11. Ash removal door 12 is pivotally mounted about pin 13 and holds drop cleaning door 14 in its closed position. Coal is stored in hopper 15 and is gravity fed through opening 16 in floor 17 of the hopper through chute 18 to conveyor 10. Plate 20 is vertically shiftable through floor 17 of the hopper and adjustable to regulate the thickness of the fire bed.

Safety door 22 according to the illustrated embodiment is pivotally mounted on floor 17 as by a pin or hinge 23 and is held in open position by a peg 24 of combustible material such as wood which burns at a relatively low temperature. Floor 26 of chute 18 has a ledge 28 secured thereto as by welding. Ledge 28 is preferably recessed or otherwise shaped to hold the bottom of peg 24 in its desired position so that coal passing through the safety door does not displace or dislodge the bottom of the peg and cause the safety door to shut inadvertently. The top of peg 24 is secured to the bottom side of safety door 22 in any desired manner. In the illustrated embodiment pin 29 holds the top of peg 24 between a pair of bosses 30 and 31 on the safety door.

A pair of plates 32 and 34 are welded or otherwise secured to floor 17 of the hopper at the edges of opening 16 to prevent coal from wedging between the edges of the safety door and the floor of the hopper. Plates 32 and 34 are sufficiently close to the edges of the safety door in its open position so that coal cannot lodge between the lower surface of safety door 22 and the sides of the plates to obstruct closure of the safety door.

Lip 36 on safety door 22 is provided to facilitate closure of the door when peg 24 no longer supports the safety door. The weight of the coal in the hopper pressing down on the top of safety door 22 will then cause the door to close as the coal under the door moves down chute 18. Lip 36, edging its way through the coal, assists and thus hastens closure of the safety door which blocks passage of further coal to fire bed 38.

In the illustrated furnace sloping wall 40 of hopper 15 is a water wall of the boiler which includes an upper chamber 42, rear wall 44 and two side walls (not shown), preferably of similar construction.

Hollow gas deflector 46 extends across fire bed 38 and is connected to the side walls thus forming an additional water chamber directly above the fire bed, and is formed to direct the hot gases toward the wall 40.

Water tubes 48 extend longitudinally of the fire bed and from rear wall 44 to sloping wall 40. Baffle 50 is slidably mounted on the water tubes and movable by handle 52 for removing flyash which accumulates on the outside of the water tubes when anthracite coal is used in the furnace. Baffle 54 extends between the side walls and functions in its normal position to direct the draft and hot gas flow through the furnace into flue opening 56. A motor driven blower (not shown) is in the flue to supply a controlled draft in addition to the natural draft provided by the chimney.

When the blower starts, a siphon action is created in the furnace which removes any gases that may remain under grate 10 due to poor natural draft of the chimney thus causing all the gases to be removed through the chimney. The introduction of draft air in the furnace is through the walls beneath grate 10 and substantially coextensive with the length of the fire bed or grate 10. The siphon action of the blower causes in addition to the draft flow through the fire bed, a draft gas flow from the ash end of the fire bed up toward gas deflector 46. Part of this gas flow passes under the deflector thereby forcing the heated gases across the fire bed toward sloping wall 40 and the remainder passes between baffle 54 and curved surface 58 on deflector 46.

The adjacent sections of baffle 54 and surface 58 are approximately two inches apart and shaped to form a venturi or throat of reduced size which directs a layer of draft air across the top of deflector 46. This nozzle action forces the combustion products against and along

sloping wall **40** thereby causing the combustion products to travel over the entire active surface of the boiler and increasing the efficiency by approximately 25 percent.

Reference is made to our copending application Serial No. 512,727, filed on even date herewith which claims that part of our novel furnace relating to control of combustion and flow of gases through the furnace.

A second venturi or restricted draft passage includes opening **60** of the coal chute **18** into the furnace. The blower in the flue also causes a suction down through coal hopper **15**, safety door opening **16** and chute **18** which causes removal of any gases present in this path through the flue.

It occasionally happens that the conveyor or moving grate is stopped while a large draft suction comes from the chimney. This may occur due to excessive natural draft, or if the blower is operating and the moving grate jammed or otherwise not moving fast enough. Under such abnormal conditions the draft through the coal chute will cause the fire from fire bed **38** to back up in the chute. The flame will eventually start up chute **18** toward fire door **22** and on into the coal hopper in the absence of intervening action.

According to our invention wooden peg **24**, which ignites and burns away at a temperature lower than the temperature at which the coal burns, is weakened and allows fire safety door **22** to automatically close as the coal under the door slides down chute **18** thus sealing off opening **16**. Side plates **32** and **34** prevent coal from wedging under the safety door and lip **36** aids the safety door in edging its way through the coal more readily than a flat surface. Lip **36** will seal off opening **16** as soon as it contacts floor **17** of the hopper due to the presence of slide plates **32** and **34**.

No more coal passes through chute **18** and the fire in the furnace will eventually become extinguished. Also the peg will burn away at a temperature sufficiently low so that the safety door has an opportunity to close and substantially seal opening **16** before the heat from the fire in coal chute **18** becomes sufficiently high to advance the fire into the coal in hopper **15**. There is thus provided a safety feature which is particularly useful in small unattended boiler and furnace installations which may be located in houses, stores, schools and other installations where the furnace room and furnishings are not of fireproof construction.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In combination, a furnace having a moving grate; a coal hopper disposed at an elevation higher than said moving grate; an inclined coal chute extending from the floor of said hopper downwardly toward said moving grate whereby coal feeds from the hopper onto the moving grate; a fire door hinged on the floor of said hopper and biased to a position closing the entrance to said chute; and support means positioned in said inclined coal chute normally holding said door open during passage of coal therethrough, said support means including a support member being made of a material combustible at a high temperature lower than the combustion temperature for coal.

2. In combination, a furnace having a moving grate; a coal hopper disposed at an elevation higher than said moving grate; an inclined coal chute extending from the floor of said hopper downwardly toward said moving grate whereby coal feeds from the hopper onto the moving grate; a fire door having one edge hinged on the floor of said hopper and biased to a position closing the entrance to said chute; a pair of plates secured to the floor of said hopper at opposite sides of said opening and extending closely adjacent the edges of the fire door at the ends of said hinged edge to prevent coal from wedging under and obstructing closure of the safety door; and support means positioned in said inclined coal chute normally holding said door open during passage of coal therethrough, said support means including a support member being made of a material combustible at a high temperature lower than the combustion temperature for coal.

3. The combination as defined in claim 2, further having a lip on the edge of said fire door opposite said hinged edge for assisting closure of the door when no longer supported by said support means.

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