Aug. 15, 1944. R. G. WYLD 2,355,897

DRAFT REGULATION FOR FURNACES

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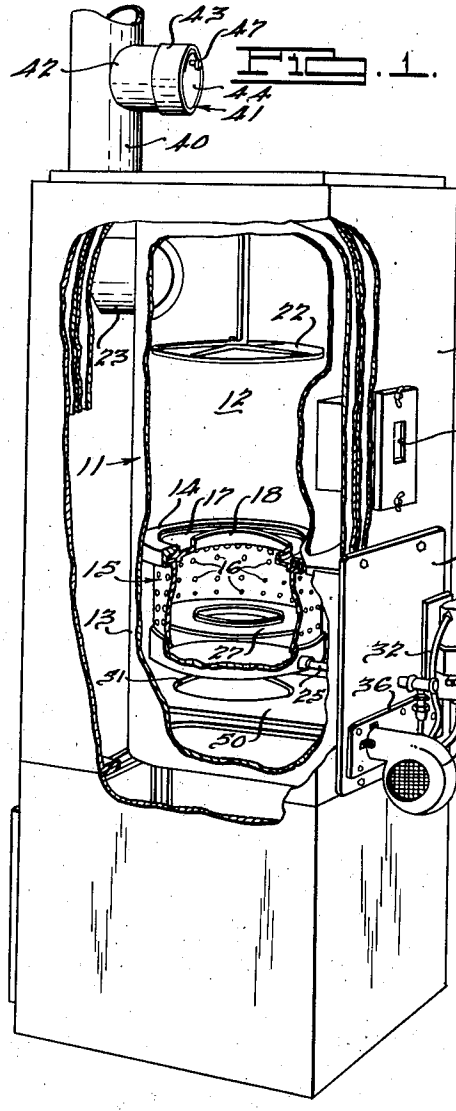


Fig. 1.

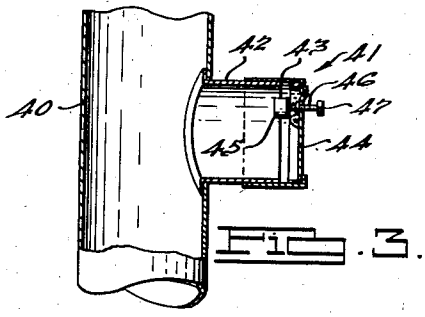


Fig. 3.

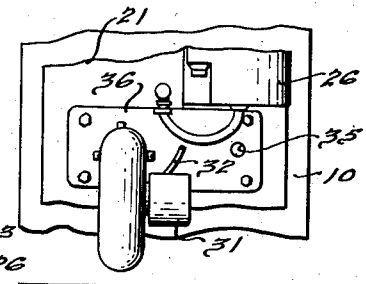


Fig. 2.

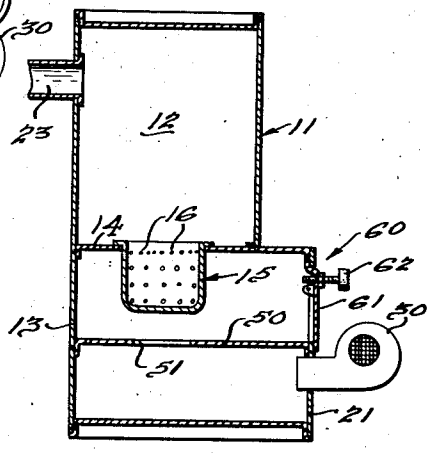


Fig. 4.

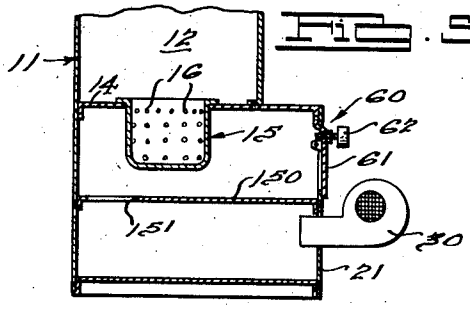


Fig. 5.

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DRAFT REGULATION FOR FURNACES

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Application April 6, 1942, Serial No. 437,787

3 Claims. (Cl. 158—28)

My present invention relates to fuel burning appliances of the fuel vaporizing type, the combustion of the fuel being accomplished in a burner comprising a receptacle having perforations therethrough for admitting combustion supporting air into vapors formed by the vaporization of liquid fuel by the heat of previously consumed fuel. The present invention is illustrated in connection with a warm air furnace, but it is to be appreciated that it is of utility in any heating appliance, such as boilers, water heaters, space heaters, and the like.

The primary object of the present invention is to maintain a stable flame in a fuel vaporizing burner. It is common knowledge that fuel vaporizing burners operating under natural draft are subject to a number of influences which upset the character of the flame, possibly causing warping, cracking, or burning through of portions of the burner, excessive and flame-choking formation of soot or carbon deposits, reduction of combustion efficiency, or other harmful effects. With the present invention the fuel is consumed at a constant rate and in a stable manner at high efficiency by the establishment of flow of combustion supporting air in constant quantities and at constant pressures regardless of fluctuations in the stack pressures or other factors commonly causing difficulties.

A further object of the present invention is to provide means for preventing the formation of "hot spots" in the walls or bottom of a vaporizing burner so as to eliminate failures due to warping, cracking, or the like.

These and other objects and advantages of the present invention will be more readily apparent from an inspection of the accompanying specification and drawing wherein like numerals refer to like parts throughout.

In the drawing,

Fig. 1 discloses a warm air furnace having the present invention associated therewith;

Fig. 2 is a partial front view of a portion of the furnace disclosed in Fig. 1;

Fig. 3 is an enlarged sectional view of a portion of the furnace disclosed in Fig. 1;

Fig. 4 is a schematic representation of a modification of the invention; and

Fig. 5 is a schematic representation of a further modification.

Referring to Figs. 1, 2, and 3, the invention is disclosed as being associated with a warm air furnace comprising an insulated jacket 10 enclosing and supporting a fire chamber 11 comprising an upper section 12 and a lower section 13. The upper and lower sections are separated from each other by a partition 14 as disclosed in my copending application, Serial No. 437,786, filed concurrently herewith. A burner 15 of the fuel vaporizing type having combustion supporting air openings 16 in the side wall thereof and including a top combustion ring 17 having a centralized flame opening 18 therethrough is supported by the partition 14 in such fashion that the only communication between the upper and lower sections of the fire chamber is through the perforations 16 and the flame opening 18. The flame may be inspected through an inspection door 20 and access to the burner may be had through a removable cover plate 21. The flame may be caused to wipe the walls of the upper section 12 before passing through the flue connector 23 by means of a flame spreader 22 suspended in the upper section. Fuel is admitted to the interior of the burner receptacle through an inlet tube 25 having connection to a fuel metering device 26 monuted on the cover plate 21 and which is adapted to admit metered quantities of fuel. A pilot ring 27 may be mounted in the burner receptacle for supporting low flame combustion. A forced draft blower 30 is mounted on the cover plate 21 and is preferably driven by an electric motor 31 having connection through cable 32 to a control device 33 adapted to coordinate the action of the blower with the action of the metering device so that the blower operates when high flame fuel quantity is being admitted to the burner and ceases to operate when pilot flame fuel quantity is being admitted to the burner.

Details of the fuel metering device 26, the blower control device 33, and the burner 15 in themselves are not essential to the present invention and further disclosures thereof are not thought necessary, there being many such devices known to those skilled in the art. The fire chamber 11 is illustrated as being built in the form of a drum but it should be obvious to those skilled in the art that other shapes may be utilized if desired. The burner is illustrated as being cylindrical in shape since such a shape is common and adapts itself to a drum shaped fire chamber, but it should be apparent to those skilled in the art that other shapes and types of fuel vaporizing burners having perforations for admitting air therethrough may be used. Further details of the furnace construction may be ascertained from the copending applications of Allen P. Livar, filed concurrently herewith and identified as Serial Nos. 437,799 and 437,801, respectively.

In order to maintain a stable flame when the

burner is on high flame operation I prefer supplying a forced draft blower capable of supplying more air than necessary to support efficient combustion against a static pressure higher than that desired. I have found that a positive static pressure maintained in the lower section 13 of approximately .05 inch W. C. is a desirable pressure for forcing air through the perforations 16, and I prefer to have the blower 30 capable of forcing a greater quantity of air than necessary and capable of operating against a static pressure of .07, .08, or more, inch W. C. In order to keep the static pressure at a lower point, I provide an opening 35 through the blower mounting plate 36 which communicates with the section 13 so as to permit the escape of air from the space 13. The size of the opening 35 is carefully selected in relation to the sizes and numbers of the perforations 16 and the maximum capacity of the blower 30 so as to maintain a constant flow of a desired quantity of air at the desired pressure through the perforations 16.

The quantity of air admitted into the burner 15 may vary if the stack pressure varies. It is well-known that the suction established by various chimneys varies considerably over a wide range and even in a single chimney the static pressure may vary when the wind changes, down drafts occur, the chimney is cold or hot, or other factors. Accordingly, I connect the flue connector 23 to a flue pipe 40 leading to the outdoor atmosphere for carrying away the products of combustion and I associate with this flue pipe a draft regulator 41 of any convenient type. In the illustration the draft regulator is shown as comprising a lateral extension 42 from a vertical section of the flue pipe 40, upon which is mounted a cap 43. A flapper plate 44 is pivotally mounted in the open end of the cap and is provided with a counterbalance weight 45 carried by an adjusting screw 46 having a knurled knob 47 which may be turned to adjust the moment arm of the counterbalance weight 45. As soon as the suction of the flue above the extension 42 exceeds a desired amount, the flapper plate 44 will open to admit air from the room and thus maintain the suction below the extension 42 at a constant desired negative pressure.

I have determined that a desirable total pressure for the air admitted to the pot is approximately .08 inch W. C. Accordingly, I prefer to adjust the pressure regulator 41 to maintain approximately .03 inch W. C. negative static pressure in the upper section 12 and the interior of the burner 15. The resulting effective pressure differential between the interior and exterior of the burner pot is thus .08 W. C. thereby causing the quantity of air admitted to the fuel to be maintained constantly at that quantity which can pass through the preforations at .08 inch W. C.

In order to prevent excessive heating of the bottom of the burner 15 and to assure uniform distribution of air around the burner, I preferably divide the section 13 into an upper burner retaining space and a lower air admitting space by means of a second partition 50. This partition is provided with a large opening 51 directly beneath the bottom of the burner so that the air forced into the perforations 16 first flows across the bottom of the pot before approaching the perforations.

In the modification disclosed in Fig. 4, instead of the opening 35 I disclose a pressure regulating device 60, comprising a hinged flapper plate 61 and adjustable counterbalance 62, mounted at the front of the appliance in the cover plate 21. In this modification the positive static pressure forcing air through the perforations of the burner may be adjustably regulated by altering the moment arm of the weight 62 so as to change the characteristics of the burner operation to adjust the burner to some local condition. In addition, the excess air permitted to escape from the lower section 13 is air which has contacted some portion of the burner so that heat may be carried away from the burner or the walls of the lower section to maintain a safe temperature. A further function of the pressure regulating device 60 is to permit fluctuations in output of the blower 30 such as may be caused by changes in line voltage, etc., to be accommodated without resulting in changes in the positive static pressure forcing air through the perforations.

In the modification disclosed in Fig. 5, the opening 151 in the second baffle 150 corresponding to baffle 50 of Fig. 1 is located at the back of the space so that the flow of air through the opening 151 toward the draft regulating device 60 passes around the walls and bottom of the burner. Furthermore, there would be less tendency for stagnation of hot air between the burner and the closely adjacent rear wall of the heating drum in this modification.

It is to be appreciated that the draft regulating device 60 in each of the modifications disclosed in Figs. 4 and 5 constitutes an opening for the escape of excess air. The flapper plate 61 may be omitted in each case, if desired, and the size of the opening carefully selected in order that the opening may correspond to the opening 35 of the first modification.

Having illustrated and described several preferred embodiments of the present invention, it should be apparent to those skilled in the art that the same permits of various modifications in arrangement and detail. All such modifications as come within the scope of the following claims are to be considered a part of my invention.

I claim:

1. A heating appliance comprising a fire chamber, a partition dividing said fire chamber into upper and lower sections, a fuel vaporizing burner having perforations to admit combustion supporting air into the fuel vaporized by the heat of previously burned fuel and a top combustion ring having a flame opening therethrough, said combustion ring being associated with said partition so that the sole communication between said upper and lower sections is through said perforations and said flame opening, means to force air into said lower section in greater quantity than required for efficient combustion of the fuel, said means being capable of creating a static pressure in excess of the desired static pressure at the perforations of the burner, means to permit the escape of the excess air from said lower section whereby to maintain the flow of the desired quantity of air through said perforations at a desired static pressure lower than the pressure at which the air could be forced into the lower section by said air forcing means, and a draft regulator in communication with said upper section and atmosphere for maintaining a constant negative pressure in the interior of said burner.

2. A heating appliance comprising a fire chamber, a partition dividing said fire chamber into upper and lower sections, a fuel vaporizing burner having perforations to admit combustion

supporting air and a top having a flame opening therethrough, said top being associated with said partition so that the sole communication between said upper and lower sections is through said perforations and said flame opening, means to force air into said lower section, a second partition dividing said lower section into an air admission space and a burner containing space, said second partition having an opening therethrough so arranged as to direct the air flowing therethrough against portions of said burner likely to become overheated, and a pressure regulating device communicating directly with said burner containing space for maintaining a substantially constant positive static pressure in the later forcing air through the perforations of the burner.

3. A heating appliance comprising a fire chamber, a partition dividing said fire chamber into upper and lower sections, a fuel vaporizing burner having perforations to admit combustion supporting air and a top having a flame opening therethrough, said top being associated with said partition so that the sole communication between said upper and lower sections is through said perforations and said flame opening, means to force air into said lower section, a second partition dividing said lower section into an air admission space and a burner containing space, said second partition having an opening therethrough so arranged as to direct the air flowing therethrough against portions of said burner likely to become overheated, and a pressure regulating device associated with said burner containing space for maintaining a substantially constant positive static pressure forcing air through the perforations of the burner, the position of said burner being in the path of air flow intermediate said second partition and said pressure regulating device to thereby cause the air to flow in a stream surrounding said burner while travelling from said second partition opening to said pressure regulating device.

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