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2,363,192

COMBUSTION APPARATUS

Original Filed Dec. 6, 1939

2 Sheets-Sheet 1

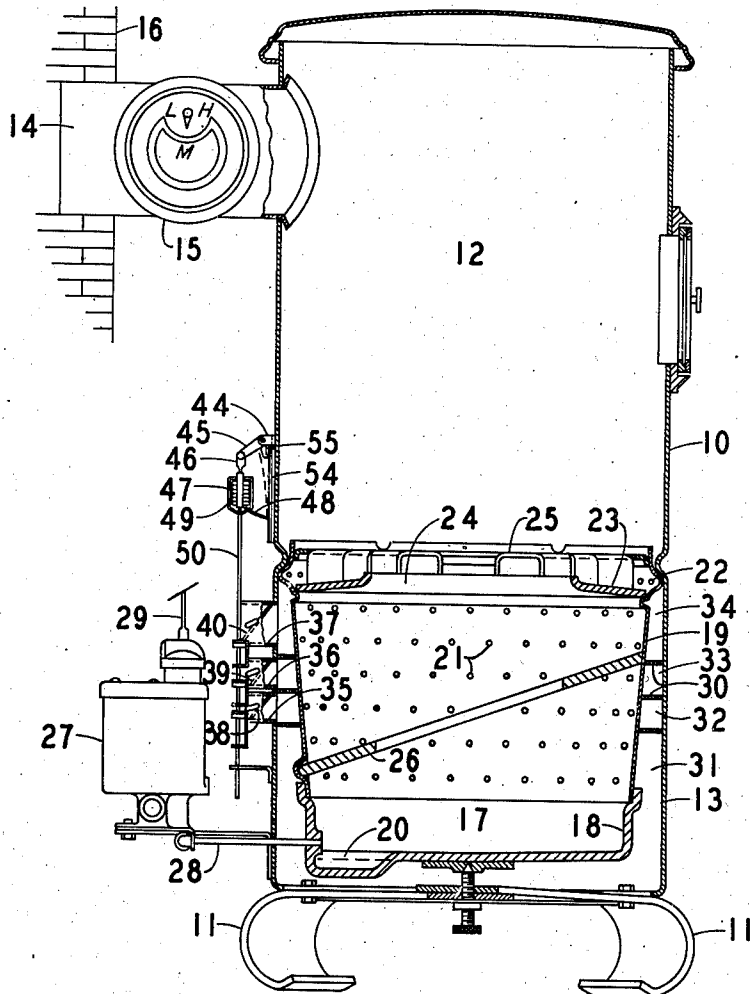


FIG. 1

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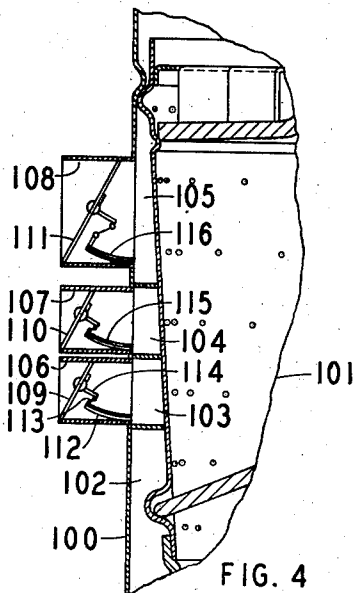
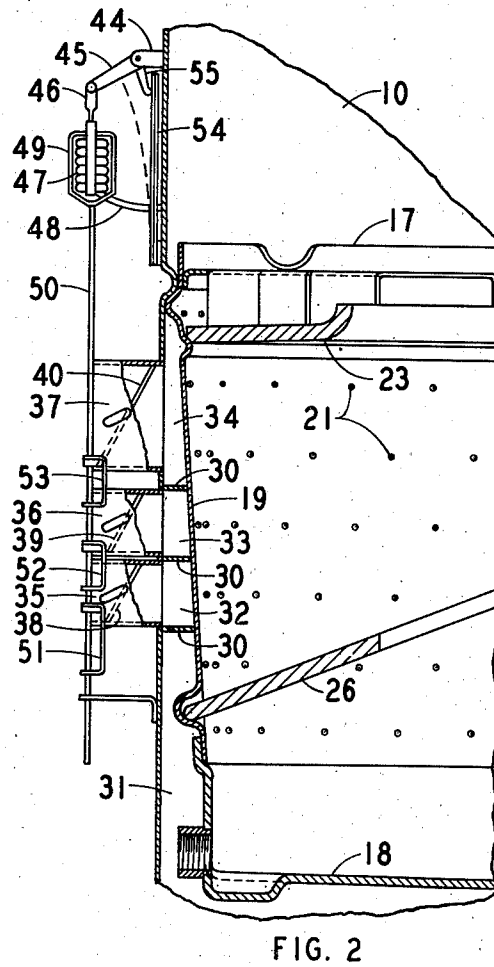
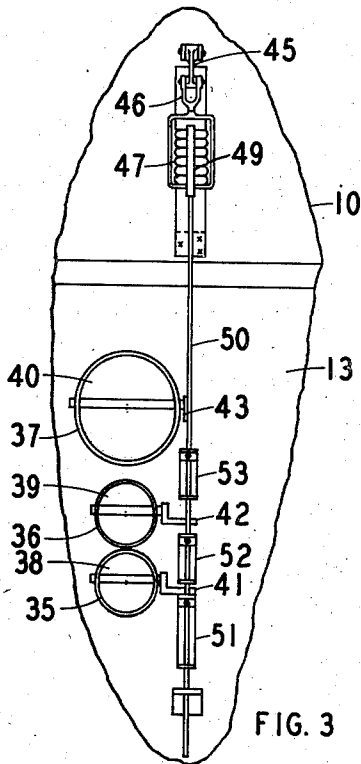
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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COMBUSTION APPARATUS

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Original application December 6, 1939, Serial No. 307,734. Divided and this application June 24, 1942, Serial No. 448,275

8 Claims. (Cl. 158—91)

This invention relates to oil burners of the vaporizing pot type, and more particularly to the means for controlling the air admitted thereto.

This application is a division of my co-pending application for Combustion apparatus, Serial No. 307,734, filed December 6, 1939, now Patent No. 2,213,568 dated March 9, 1943.

The principal object of the invention is to provide a simple and effective means for coordinating the quantity of air admitted to the burner with the quantity of fuel supplied to the burner during the combustion period so as to effect most efficient combustion of the fuel.

Another object of the invention is to provide means associated with the burner for confining the air admitted to the burner to those zones in which vaporization, premixing and combustion of the fuel occur.

A further object is to provide means for compensating for fluctuations in draft on the burner.

These objects are accomplished in part by providing a plurality of closure means spaced from the burner side wall which confine the admission of air to the aforementioned zone or zones and which closures can be opened successively as the fuel supply is increased. Opening and closing of the closure means is effected automatically through thermostatic devices located in heat exchanging relation to the combustion apparatus.

For a more detailed description of the invention reference is had to the accompanying drawings, wherein:

Figure 1 is a cross-sectional view of an oil burning heater having a vaporizing pot type burner therein in which the invention is embodied;

Figure 2 is a fragmentary cross-sectional view on an enlarged scale of a portion of the device shown in Figure 1;

Figure 3 is a fragmentary side elevational view of a portion of the apparatus shown in Figure 1; and

Figure 4 is a fragmentary cross-sectional view of a modified form of the invention.

The invention shown in the drawings, and particularly Figures 1 and 2 thereof, is embodied in a radiant type space heater. The heater comprises an outer casing 10 supported on a plurality of legs 11. The legs 11 consists of a pair of crossed straps with their ends spaced apart sufficiently to admit air to the lower portion of the casing 10. The casing consists of an upper combustion chamber portion 12 and a lower air jacket portion 13. A flue outlet 14 having an automatic draft regulator 15 pivotally mounted in one side

thereof connects the combustion chamber 12 to a chimney 16 to provide for the escape of exhaust gases from the interior of the combustion chamber.

Mounted within the air jacket portion 13 of the casing 10 is a vaporizing pot type burner 17. The burner includes an oil pan 18 forming the bottom wall of the burner and a tubular side wall 19 welded thereto. In the bottom of the oil pan 18 and adjacent one side of the burner is a depression 20 to collect the fuel admitted to the burner at low fire whereby to provide for ready ignition of the fuel.

The side wall 19 of the burner has a plurality of vertically spaced horizontal rows of primary air inlet openings 21 therein to permit the entrance of air to the burner. Near the upper edge of the burner is a single horizontal row of secondary air inlet openings 22. Located immediately below the secondary air inlet openings is a top wall 23 having a large central opening 24 therein. An anti-explosion baffle 25 is positioned directly above the top wall and above the secondary air inlet openings 22. Intermediate the top and bottom rows of primary air inlet openings 21 is a centrally apertured inclined partition 26. The lower edge of the partition 26 is located directly above the depression 20 in the oil pan 18 and above the lowermost row of air inlet openings 21. The upper end of the partition 26 is positioned below the two uppermost rows of primary air inlet openings 21.

Mounted on the side wall of the casing 10 is a metering device 27. The metering device is connected to a suitable source of fuel (not shown) and is also connected to the burner by means of a pipe 28 for supplying fuel to the burner. The metering device is equipped with a fuel regulating valve (not shown) adapted to be rotated by a shaft 29 extending upwardly therefrom. Rotation of the shaft 29 in one direction opens the valve and increases the rate of supply of fuel to the burner while rotation of the valve in the opposite direction closes the valve and decreases the fuel supply.

Surrounding the burner side wall at points intermediate the upper and lower edges thereof are three annular rings 30 in sealed engagement with the air jacket 13 and the burner side wall 19. The rings 30 are spaced apart vertically and are so located that at least one row of primary air inlet openings 21 is included between two adjacent rings. The rings 30 form with the air jacket 13 and the burner side wall a plurality of vertically separated air compartments 31, 32, 33

and 34. The lowermost compartment 31 is open at all times to the atmosphere through the openings between the legs 11. The other three compartments 32, 33 and 34 are provided with air inlet ducts 35, 36 and 37, respectively. The ducts are closed by pivotally mounted closures 38, 39 and 40, respectively. The closures are pivoted within the air inlet ducts on transverse pivot shafts located slightly above the centers of the closures.

At one end of the pivot shaft of closure 38 is a crank arm 41 which extends laterally therefrom. A similar crank 42 is attached to the pivot shaft of closure 39, while a third crank 43 is secured to the shaft of closure 40.

Pivotally mounted on a bracket 44 rigidly secured to the casing 10 is a bell crank 45. One end of the bell crank 45 is pivotally connected to a downwardly extending link 46. The lower end of the link 46 is rigidly attached to a Syphon bellows 47 which is connected by means of a flexible tube 48 to the interior of the casing 10. The upper end of the bellows 47 is connected to a housing 49 through which the link 46 extends. The link 46 is freely movable relative to the housing 49.

The lower end of the housing 49 is connected to a rod 50. Rigidly attached to the rod 50 are three U-shaped closure operators 51, 52 and 53. The closure operators are spaced from each other in a vertical direction and are adjustable on the rod 50. The closure operators extend laterally from the rod 50 a distance sufficient to position their upper surfaces beneath the free ends of the respective crank arms 41, 42 and 43.

Rigidly attached at one end to the side wall of the casing 10 is a bi-metallic strip 54. The strip 54 is so constructed that it is adapted to bow toward the left, or to the position shown in dotted lines in Figures 1 and 2, as the temperature of the casing 10 increases. The upper or free end of the bi-metallic strip 54 slidably contacts the arm 55 of the bell crank 45.

When the burner shown in Figures 1 to 3 is operating at low fire the closures 38, 39 and 40 will all be closed and all the air necessary for combustion of the fuel will enter the lower compartment 31 through the bottom of the casing 10 and then pass into the burner through the two bottom rows of air inlet openings 21. Now, if the quantity of fuel admitted to the burner is increased by opening the metering device, the temperature of the burner and casing will rise, thereby causing the bimetallic strip 54 to bend to the left slightly and raise the rod 50 by rotating the bell crank 45 in a clockwise direction. The lower closure operator 51 will then strike the crank arm 41 and rotating the same in a clockwise direction will open the closure 38. Air will then be admitted to the row of air inlet openings 21 which communicate with the compartment 32. A still further increase in the oil flow will raise the rod 50 still farther, further opening the closure 38 and causing the closure operator 52 to strike the crank arm 42 and open closure 39. The same situation will occur with respect to the crank arm 43 and closure 40 if the fuel supply is increased still more.

If at any stage of operation of the burner the draft in the chimney tends to fluctuate, the difference in pressure between the interior of the burner and the exterior will change, thus varying the pressure on the bellows 47. This will cause the bellows to either expand or contract, depending upon which way the pressure varies

and either raise or lower the rod 50, thereby tending to open or close any of the closures 38, 39 and 40 which are partially opened. For example, if the draft increases, bellows 47 contracts, thus lowering rod 50 and allowing the open closures to close slightly and decrease the quantity of air admitted to the burner. It will thus be seen that provision is made for maintaining a constant supply of air at any stage of operation of the burner.

The modification shown in Figure 4 is another form of thermostatically actuated air control means which is operated by changes in temperature within the burner. The device shown in Figure 4 consists of a casing 100 having a burner 101 therein of exactly the same type as that previously described. Surrounding the burner are four vertically separated air compartments 102, 103, 104 and 105. The three upper compartments communicate with the atmosphere through ducts 106, 107, and 108, respectively. Each of the ducts is adapted to be closed by means of a pivoted closure 109, 110 and 111. A bimetallic strip 112 is secured at one end to the duct 106 and its free end is connected by a link 113 to a crank 114 rigidly secured to the closure 109. A similar bimetallic strip 115 is connected to the closure 110 in the same manner and another bimetallic strip 116 is connected to the closure 111. The bimetallic strips 112, 115 and 116 are resilient.

The bimetallic strips 112, 115 and 116 are designed so as to be actuated at different temperatures of the burner. Thus, at low fire all of the closures 109, 110 and 111 are closed, but as the fuel supply is increased and the temperature of the burner rises, first the strip 112 will open the closure 109 to admit more air to the burner. In a similar manner strips 115 and 116 will actuate the closures 110 and 111 respectively to admit more air to the burner at still higher levels.

The three closures 109, 110 and 111 are pivoted on horizontal axes slightly above the centers of the closures. Therefore, when the burner is operating at any stage and the draft on the burner tends to increase, the difference in pressure between that on the lower half of the closure and that on the upper part will tend to rotate the closure toward closed position. The resiliency of the bimetallic strips 112, 115 and 116 will yieldingly permit such rotation. On the other hand, if the draft decreases the closure will be opened slightly by the resilient bimetallic strips. In this manner the supply of air to the burner at any particular stage of operation thereof will be maintained substantially constant.

From the foregoing it will be seen that this invention provides means for automatically coordinating the air supplied to the burner with the fuel supplied because an increase in fuel is followed by an increase in temperature of the burner and combustion chamber, which is in turn followed by an increase in the air supply. Furthermore, the air is delivered to the burner at only those parts in which vaporization, premixing and combustion occur. When combustion occurs well down in the burner, air is not admitted above the fire where it only wastes heat.

In addition, the air control means compensates for changes in the draft on the burner which might tend to upset the operation thereof.

The scope of the invention is indicated in the appended claims.

I claim:

1. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of

vertically separated groups of spaced apart air inlet openings in the side wall thereof, means for delivering fuel to the burner including fuel regulating mechanism, means separate from each other for controlling the admission of air to each of the upper groups of air inlet openings, each of said means comprising an adjustable air regulating valve spaced from the burner side wall and means including a thermostat in heat exchange relation to the combustion apparatus connected to said valves for successively opening the valves in order from the lowermost to the uppermost and for closing the same in the reverse order as the temperature of the burner increases or decreases respectively.

2. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically separated groups of spaced apart air inlet openings in the side wall thereof, means for delivering fuel to the burner including fuel regulating mechanism, means separate from each other for controlling the admission of air to each of the upper groups of air inlet openings, each of said means comprising an adjustable air regulating valve spaced from the burner side wall, a thermostat located in heat exchange relation to the combustion apparatus, and means connected to the thermostat and successively engageable with said valves upon an increase in temperature of said thermostat for successively opening said valves in order from the lowermost to the uppermost and upon a decrease in temperature permitting the valves to close in the reverse order as the temperature of the thermostat is decreased.

3. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically and horizontally spaced apart air inlet openings in the side wall thereof, a plurality of independent air compartments surrounding the burner in sealed engagement with the side wall, each compartment having an aperture therein for the admission of air thereto, a closure for the aperture in each of the upper compartments for regulating the air admitted therethrough, means for delivering liquid fuel to the burner in regulatable quantities, a thermostat connected to each of said closures and located in heat exchange relation with the burner, said thermostats being successively operable upon predetermined successive increases in the temperature of the burner whereby to open said closures in order and upon predetermined successive decreases in the temperature of the burner to permit closing of the valves in the reverse order.

4. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically and horizontally spaced apart air inlet openings in the side wall thereof, a plurality of vertically arranged separate air compartments surrounding the burner in sealed engagement with the side wall, each compartment being in communication with some of said air inlet openings, each of said compartments having an aperture therein for the admission of air thereto, a closure in the aperture in each of the upper compartments for regulating the air admitted therethrough, means for delivering liquid fuel to the burner in regulatable quantities, and thermostatic means positioned in heat exchanging relation to the combustion apparatus and connected to the closures for successively opening the latter in order from the lowermost to the uppermost closure and for closing the same in the reverse order during the combustion period as the quantity of

fuel delivered to the burner is respectively increased or decreased.

5. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically and horizontally spaced apart air inlet openings in the side wall thereof, a plurality of vertically arranged separate air compartments surrounding the burner in sealed engagement with the side wall, each compartment being in communication with some of said air inlet openings, each of said compartments having an aperture therein for the admission of air thereto, a closure in the aperture in each of the upper compartments for regulating the air admitted therethrough, and means for delivering liquid fuel to the burner in regulatable quantities, and thermostatic means positioned in heat exchanging relation to the combustion apparatus for successively opening the closures in order from the lowermost to the uppermost closure and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased, and a connection between said means and said closures, said connection including mechanism tending to open or close said closures under the influence of changes in draft on the burner.

6. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically spaced apart groups of air inlet openings in the side wall thereof, means for delivering liquid fuel to the burner in regulatable quantities whereby to vary the level of the zone in which combustion of the fuel is initiated, means separate from each other for controlling the admission of air to each of the upper groups of air inlet openings, each of said means comprising an adjustable air regulating valve spaced from the burner side wall and a thermostatically controlled device positioned in heat exchanging relation to the combustion apparatus for moving said valves to increase or decrease the quantity of air admitted to the burner in accordance with an increase or decrease respectively in the rate of combustion to maintain a substantially constant ratio of fuel and air within the burner during the combustion period, irrespective of variations in the supply of fuel.

7. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically and horizontally spaced apart air inlet openings in the side wall thereof, a plurality of vertically arranged separate air compartments surrounding the burner in sealed engagement with the side wall, each compartment being in communication with some of said air inlet openings, each of said compartments having an aperture therein for the admission of air thereto, a closure for the aperture in each of the upper compartments only for regulating the air admitted therethrough, means for delivering fuel to the burner in regulatable quantities, and thermostatic means connected to the closures for opening and closing the latter to maintain a substantially constant ratio between the fuel and air supplied to the burner when the burner is operating, said last named means successively opening the closures in order from the lowermost to the uppermost closure and closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased by successive predetermined quantities.

8. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically separated groups of spaced apart air

inlet openings in the side wall thereof, means for delivering liquid fuel to the burner in regulatable quantities whereby to vary the rate of combustion in the burner, means for regulating the admission of air to the burner through certain of said groups of openings including movable valve means located outside of said burner and spaced from the side wall thereof, and thermostatic means in heat exchange relation with the appa-

5 ratus and connected to said valve means for moving the latter to admit air through said certain groups of openings in a predetermined sequence as the temperature of the burner increases or to interrupt the admission of air through said certain groups of openings in the reverse of said predetermined sequence as the temperature of the burner decreases.

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