March 9, 1943. J. W. MILLER 2,313,568

COMBUSTION APPARATUS

Filed Dec. 6, 1939 3 Sheets-Sheet 1

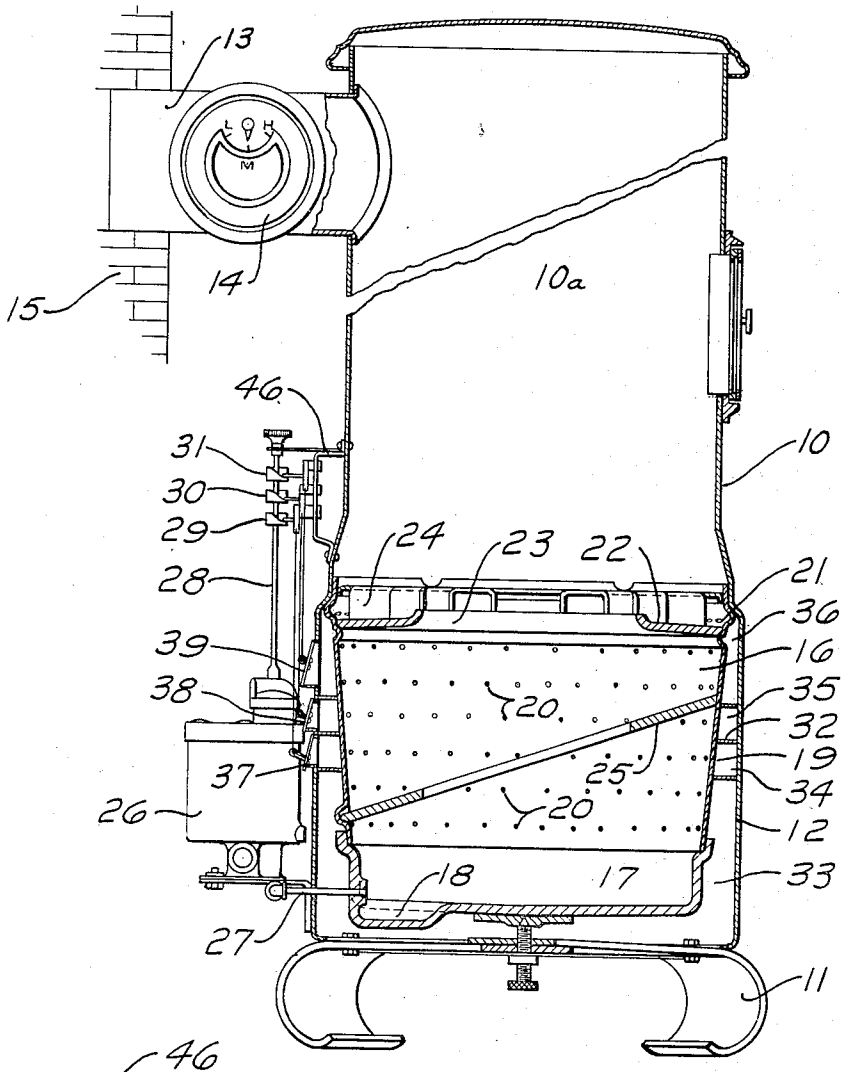


FIG. 1

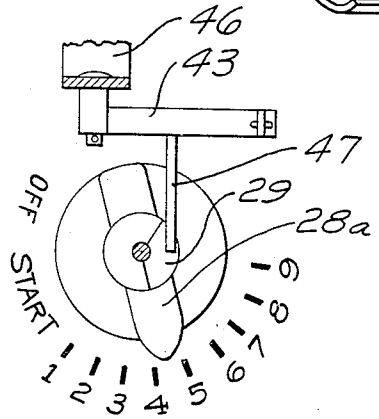


FIG. 2

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COMBUSTION APPARATUS

Filed Dec. 6, 1939 3 Sheets-Sheet 2

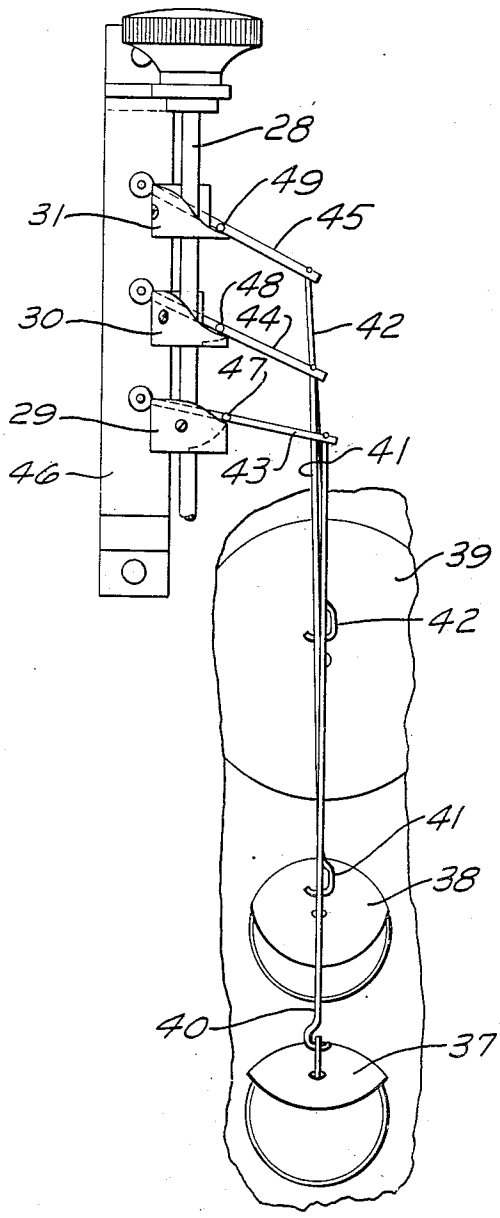


FIG. 3

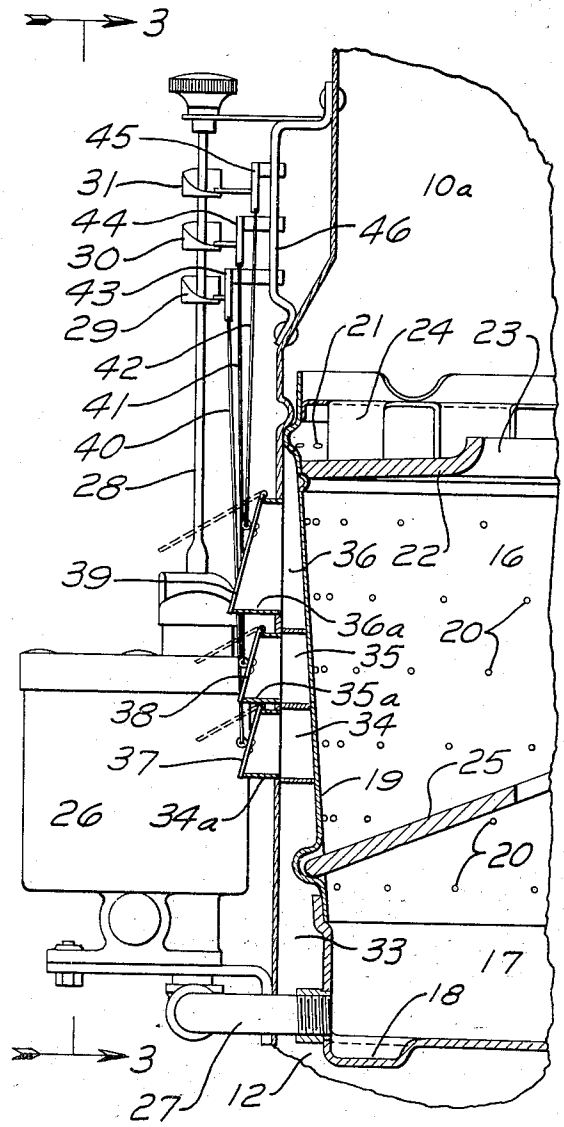


FIG. 4

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March 9, 1943. J. W. MILLER 2,313,568

COMBUSTION APPARATUS

Filed Dec. 6, 1939 3 Sheets-Sheet 3

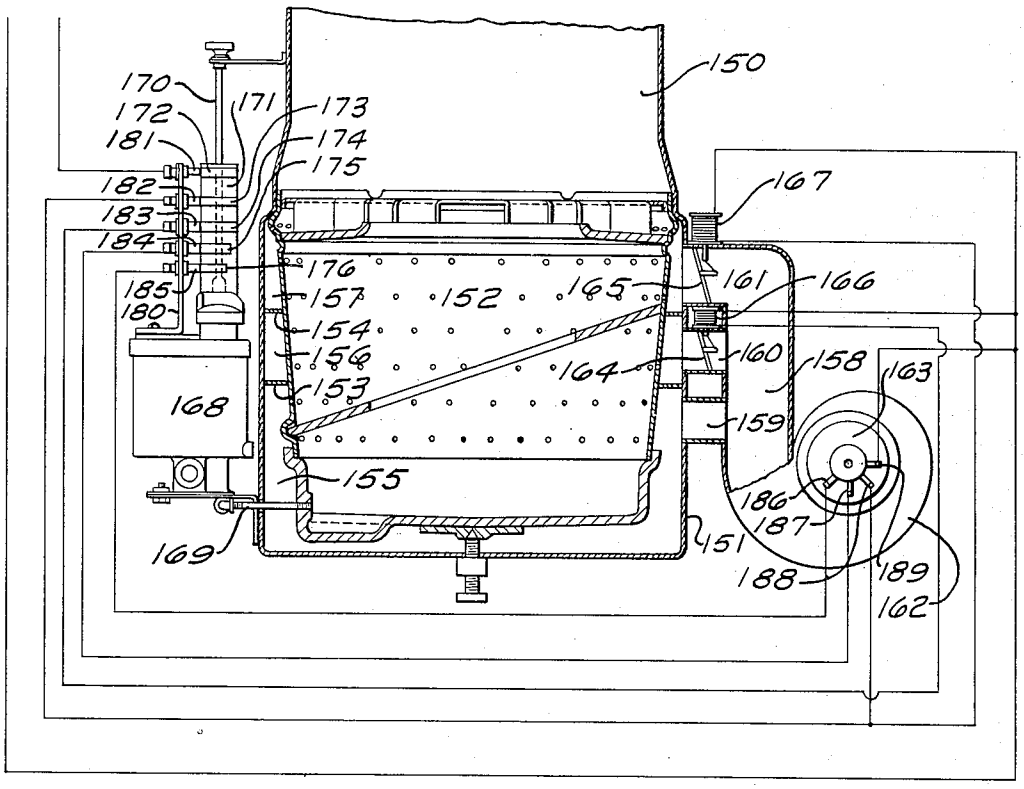


FIG. 5.

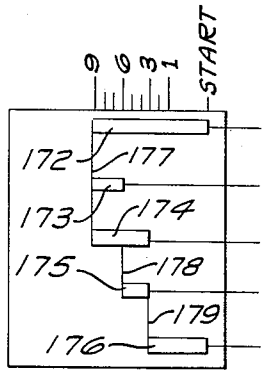


FIG. 6.

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COMBUSTION APPARATUS

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10 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.

Previous vaporizing pot type burners, and by that term is meant pot type burners having air inlet openings in the side walls thereof and in which the height of the fire may be regulated by varying the rate at which oil is supplied thereto, have not been provided with really efficient air control means. This is due to the fact that air is admitted through all of the air inlet openings in the burner side wall at all stages of combustion, whereas the lower limit of the zone of combustion may be located at various heights from a point adjacent the bottom of the burner up to the opening in the top wall.

In order to promote efficient operation of the burner it is necessary to coordinate the quantity of air admitted to the burner with the quantity of fuel which is delivered thereto. This has been done in previous burners by regulating the draft on the burner. Such a system has the disadvantage, however, of reducing the velocity of the jets of air entering the air inlet openings at the lower stages of operation of the burner, and as a result the flame is inclined to be smoky. On the other hand, if sufficient air is delivered to the lowermost air inlet openings to produce a clean fire at the lowest stage of operation, then a great excess of air is admitted to the burner in the openings above the flame which have no other effect than to absorb heat and carry it up the chimney.

Accordingly, the principal object of this invention is to overcome the disadvantages of previous types of burners by not only coordinating the air and fuel supplied to the burner but in delivering the air only to the zones in which vaporization, premixing and combustion of the fuel occur. This is accomplished by providing a plurality of closure means 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.

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

Figure 1 is a vertical 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 plan view of a portion of the air control and fuel regulating means of the device shown in Figure 1;

Figure 3 is a fragmentary elevational view of a portion of the fuel regulating means and the air control means shown in Figure 1;

Figure 4 is an enlarged fragmentary cross-sectional view of a portion of the device shown in Figure 1;

Figure 5 is a cross-sectional view of a modified form of the invention showing in diagrammatic form the wiring diagram for the controls; and

Figure 6 is a view of the developed surface of the control drum for the device shown in Figure 5.

The modification shown in Figures 1 to 4 is embodied in a radiant type of space heater. The heater comprises an outer casing 10 supported on legs 11. The legs 11 consist of a pair of crossed straps with their ends spaced sufficiently to admit air to the lower portion of the casing. The casing consists of an upper combustion chamber 10a and a lower air jacket 12. A flue outlet 13 having an automatic draft regulator 14 pivotally mounted in one side thereof connects the combustion chamber 10a to a chimney 15 to permit the escape of exhaust gases from the interior of the combustion chamber.

Mounted within the air jacket 12 of the casing 10 is a vaporizing pot type burner 16. The burner includes an oil pan 17 forming the bottom wall of the burner. In the bottom of the oil pan 17 and adjacent one side of the burner is a depression 18 to collect the fuel admitted to the burner at low fire whereby to provide for ready ignition of the fuel. Secured to the upper edge of the oil pan 17 and in sealed engagement therewith is a substantially cylindrical side wall 19. The side wall 19 has a plurality of vertically spaced horizontal rows of primary air inlet openings 20 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 21. Located immediately below the secondary air inlet openings is a top wall 22 having a large central opening 23 therein. An anti-explosion baffle 24 is positioned directly above the top wall 22 and above the secondary air inlet openings 21. Intermediate the top and bottom rows of primary air inlet openings 20 is a centrally apertured inclined partition 25. The lower edge of the partition 25 is located directly above the depression 18 in the oil pan 17 and above the lowermost row of air inlet openings 20. Its upper end is positioned below the two uppermost rows of primary air inlet openings 20.

Mounted on the side wall of the casing 10 is a metering device 26. The metering device is

connected to a suitable source of fuel and is also connected to the burner by means of a pipe 27 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 28 extending upwardly therefrom. Secured to the shaft 28 is a pointer 28a. On top of the metering device 28 is a dial (see Fig. 2) which together with the pointer 28a indicates the fuel control valve setting. The position marked "Start" shows the setting for low fire in the burner and "9" indicates the high setting.

Surrounding the burner side wall at points intermediate the upper and lower edges thereof are three annular rings 32 in sealed engagement with the air jacket 12 and the wall of the burner 19. These rings form with the air jacket 12 and the burner side wall 19 a plurality of vertically separated air compartments 33, 34, 35 and 36. The lowermost compartment is open at all times to the atmosphere through the openings between the legs 11. The other three compartments 34, 35 and 36 are provided with air inlet ducts 34a, 35a and 36a respectively at one side. The ducts are closed by pivotally mounted valves 37, 38 and 39 respectively, shown in closed position in full lines, and in open position in dotted lines in Figure 4.

Pivotally attached to the respective valves 37, 38 and 39 are links 40, 41 and 42. The upper ends of the links 40, 41 and 42 are pivoted to levers 43, 44 and 45, respectively, the latter being pivotally secured to a bracket 46 mounted on the casing 10. Rigidly secured to the levers 43, 44 and 45 respectively, and extending laterally therefrom, are cam followers 47, 48 and 49. The cam followers cooperate with three cams 29, 30 and 31 secured to shaft 28 and rotatable therewith. The cam surfaces of the cams are so designed that as the shaft 28 is rotated counter-clockwise (as viewed in Figure 2) or from the "Off" position to position "9," the cam followers 47, 48 and 49 will be successively raised in that order, thus successively opening the valves 37, 38 and 39.

When the burner is operating at its lowest stage the fuel control valve will be nearly closed, or in other words, in such a position that the pointer 28a points to the word "Start" on the dial on the top of the metering device 26. Under these conditions the cams will all be inoperative and the valves 37, 38 and 39 will all be closed. Consequently, all of the air necessary for combustion will enter the burner through the two lowermost rows of air inlet openings 20. When it is desired to increase the amount of heat generated by the burner, the shaft 28 is rotated in a counter-clockwise direction (as viewed in Figure 2). When pointer 28a reaches point "3" on the dial cam 29 will begin to raise the corresponding arm 43 and open the valve 37, admitting air to the row of air inlet openings 20 communicating with compartment 34. A still further increase in the rate of fuel supply will be caused by continued rotation of the shaft 28. When pointer 28a reaches position "5" cam 30 comes into action and opens valve 38. In the same manner, cam 31 raises valve 39 when the shaft 28 has been rotated so that the pointer is at position "7" on the dial.

Thus, it will be seen that the air admitted to the burner is regulated in accordance with the quantity of fuel delivered to the burner. Also, the air is admitted only to the zones within the burner in which vaporization, premixing and combustion occur.

Figures 5 and 6 show a modified form of the invention. This device not only controls the air in proportion to the quantity of fuel admitted to the burner, but maintains by means of a blower a constant air supply to the burner at each stage of its operation. The invention shown in this modification is embodied in a radiant heater somewhat similar to that previously described, but in which the entire casing is completely closed except through ducts at the side of the burner.

The heater consists of a casing 150 having an air jacket 151 at its lower end. Mounted within the casing 150 is a burner 152 of exactly the same type as that previously described. Surrounding the burner is a pair of spaced annular rings 153 and 154 which divide the air jacket 151 into three compartments 155, 156 and 157. At one side of the burner, a manifold 158 is located. This manifold has three arms or ducts 159, 160 and 161 which communicate with the three compartments 155, 156 and 157 respectively. The other end of the manifold communicates with the housing of a centrifugal blower 162 driven by a multiple speed motor 163. The motor is provided with four motor brushes 186, 187, 188 and 189.

Pivotally mounted within the ducts 160 and 161 of the manifold are valves 164 and 165 respectively. The valve 164 is adapted to be actuated by a solenoid 166 mounted exteriorly of the duct 161 and a similar solenoid 167 is provided for actuating the valve 165.

Secured to the exterior of the casing 150 is a conventional fuel control 168 which is connected to the burner by means of a pipe 169. Extending upwardly from the fuel control 168 is a rotatable shaft 170 which is adapted to actuate the metering valve in the fuel control. Mounted on the shaft 170 is a control drum 171, a development of the surface of which is shown in Figure 6. This control drum has a plurality of horizontal metallic strips 172, 173, 174, 175 and 176 secured to the exterior surface thereof. The strips 172, 173 and 174 are connected together at their adjacent ends by means of a suitable electric conductor 177. Strips 174 and 175 are connected by a conductor 178, and strips 175 and 176 are connected by a conductor 179.

Mounted on the top of the housing of the oil control device 168 is an upstanding bracket 180 which supports five control brushes 181, 182, 183, 184 and 185. Each of these brushes is insulated from the others and is mounted in a manner to contact the metal strips 172 to 176 respectively on the drum.

The wiring diagram of the circuit of this construction is plainly indicated in Figure 5, so it is believed to be unnecessary to discuss it in detail.

The fuel control valve is adapted to be rotated by shaft 170 to eleven different positions. In one of these the fuel control valve is completely closed. The second position is labelled "Start" (see Figure 6) and thereafter the different positions are numbered "1" to "9" respectively. Assuming that the fuel control valve has been set to the "Start" position, the valves 164 and 165 are closed and the motor will be operating at its lowest speed. Under these circumstances control brush 181 touches strip 172 and control brush 185 is in contact with strip 176. Current then flows through the motor by way of motor brushes 189 and 186. All of the air for combustion will then be supplied through the duct 159 and at a relatively low velocity.

As the shaft 170 is rotated to open the fuel valve, more oil will be supplied but the motor will continue to operate at its initial speed until the valve is opened to the position marked "3" in Figure 6. At this point control brush 185 goes out of operation and current flows through the motor by way of brushes 187 and 189. At the same time solenoid 166 is actuated by the closing of the circuit through the strips 174 and 175 and conductor 178. This will speed the motor up and thereby deliver more air to the burner, and the air will then be delivered through compartments 155 and 156.

Still further rotation of the control drum from the points marked "6" to the position numbered "9" will throw the control brush 184 out of the circuit and cause control brushes 182 and 183 to contact strips 173 and 174 respectively. This will energize solenoid 167 and open valve 165 while leaving valve 164 open. At the same time the current will flow through the motor by way of motor brushes 188 and 189 and cause it to operate at its highest speed.

It will be apparent that in this modification the fuel supply and air supply are maintained at substantially the correct proportions at all times, and the quantity of air delivered to the burner cannot fluctuate as in the case of any of the previous burners which are dependent upon natural draft.

It is, of course, possible by multiplying the number of air compartments, manifold arms and valves, as well as the number of speeds of the motor, to increase the quantity of air delivered to the burner at each of the numbered settings of the fuel control valve instead of at positions "3" and "6" only. However, from a practical standpoint the number of valves and the number of motor speeds disclosed will provide very efficient operation of the burner. More motor speeds and valves necessarily complicate and increase the expense of the regulating system.

From the foregoing it will be seen that although the different modifications vary in detail they have as their basic features the coordination of the fuel and air supply to maintain substantially constant a predetermined ratio of fuel and air, and they admit the air to the burner at the points where the air is most needed to provide a clean fire at all stages of operation of the burner.

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 and horizontally spaced apart air inlet openings in the side wall thereof, a plurality of 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 and being arranged one above another, each of said compartments having an aperture therein for the admission of air thereto, a valve in the aperture in each of the upper compartments only for regulating the air admitted therethrough, means for delivering liquid fuel to the burner in regulatable quantities, and means operatively connected to said fuel delivering means for successively opening said valves in order from the lowermost to the uppermost valve and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased.

2. 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 separate air compartments surrounding the burner in sealed engagement with the side wall thereof, each compartment being in communication with some of said air inlet openings and being arranged one above another, each of said compartments having an aperture therein for the admission of air thereto, a valve 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 means coupled with the fuel regulating means and connected to the valves for successively opening the latter in order from the lowermost to the uppermost valve and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or 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 separate air compartments surrounding the burner in sealed engagement with the side wall thereof, each compartment being in communication with some of said air inlet openings and being located one above another, each of said compartments having an aperture therein for the admission of air thereto, a fan, a multiple speed motor for driving said fan, a manifold connected at one end to said fan and having a plurality of separate arms connected to the compartments at the respective apertures therein, a valve in the aperture in each of the upper compartments, means for delivering liquid fuel to the burner in regulatable quantities, means coupled with the fuel regulating means for increasing or decreasing the speed of the fan as the quantity of fuel is increased or decreased, and additional means coupled with said fuel regulating means and connected to the valves for successively opening the latter in order from the lowermost to the uppermost valve and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased.

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 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 and being arranged one above another, each of said compartments having an aperture therein for the admission of air thereto, a valve in the aperture in each of the upper compartments for regulating the air admitted therethrough, and means for supplying liquid fuel to the burner and for regulating the quantity supplied thereto, said means including a rotatable shaft, a plurality of cams on said shaft rotatable therewith, and a plurality of cam followers associated with said cams and connected to the respective valves, said cams being arranged on said shaft in a manner to successively open the valves in order from the lowermost to the uppermost valve and to close the same in the reverse order as the shaft is rotated in one direction or the other to increase or decrease the quantity of fuel supplied to the burner.

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

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 and arranged one above another, each of said compartments having an aperture therein for the admission of air thereto, a valve in the aperture in each of the upper compartments only comprising a blade pivotally mounted on a horizontal axis above the center of the blade and being of a size to completely close said aperture in one position of the blade, means for delivering liquid fuel to the burner in regulatable quantities, and means operatively connected to said fuel delivering means for successively opening the valves in order from the lowermost to the uppermost valve and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased.

6. 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 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 and being arranged one above another, each of said compartments having an aperture therein for the admission of air thereto, a valve in the aperture in each of the upper compartments for regulating the air admitted therethrough, and means for supplying liquid fuel to the burner and regulating the quantity of fuel supplied thereto, said means including a rotatable shaft and means connecting said shaft to the respective valves to successively open the valves in order from the lowermost to the uppermost valve and to close the same in the reverse order as the shaft is rotated in one direction or the other to increase or decrease the quantity of fuel supplied to the burner.

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 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 and being arranged one above another, each of said compartments having an aperture therein for the admission of air thereto, a valve in the aperture in each of the upper compartments for regulating the air admitted therethrough, and means for supplying liquid fuel to the burner and for regulating the quantity supplied thereto, said means including a rotatable shaft, a plurality of cams on said shaft rotatable therewith, a plurality of levers pivotally connected to said apparatus, cam followers on said levers associated with the respective cams, and means connecting said levers to the respective valves whereby rotation of said cams will cause movement of said valves, said cams being arranged on said shaft in a manner to successively open the valves in order from the lowermost to the uppermost valve and to close the same in the reverse order as the shaft is rotated in one direction or the other to increase or decrease the quantity of fuel supplied to the burner.

8. In combustion apparatus of the vaporizing pot type which includes a burner having a plurality of vertically separated groups of spaced air inlet openings in the side wall thereof and means for delivering fuel thereto, said means including mechanism for increasing or decreasing the quantity of fuel supplied to the burner, the improvement which comprises closure means for certain of said groups of openings, and means coupling said closure means to said fuel regulating mechanism including a rotatable shaft, a plurality of cams on said shaft rotatable therewith, and means connecting said cams to said closure means whereby said closure means are moved to open an increasing number of groups of air inlet openings in order from the bottom to the top of the burner as the fuel regulating mechanism is operated to increase the fuel supplied to the burner.

9. Combustion apparatus comprising a burner of the vaporizing pot type having a plurality of vertically separated groups of horizontally spaced apart air inlet openings in the side wall thereof, independent closure means spaced from the burner side wall for each of the groups of air inlet openings except the lowermost group, means for delivering liquid fuel to the burner in regulatable quantities, and means operatively connected to said fuel delivery means for successively opening said closure means in order from the lowermost to the uppermost and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased.

10. 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 separate air compartments surrounding the burner in sealed engagement with the side wall thereof, each compartment being in communication with some of said air inlet openings and being located one above another, each of said compartments having an aperture therein for the admission of air thereto, a fan, a motor for driving said fan, a manifold connected at one end to said fan and having a plurality of separate arms connected to the compartments at the respective apertures therein, a valve in the aperture in each of the upper compartments, means for delivering liquid fuel to the burner in regulatable quantities, means coupled with the fuel regulating means for increasing or decreasing the quantity of air supplied to the manifold by the fan as the quantity of fuel is increased or decreased, and additional means coupled with said fuel regulating means and connected to the valves for successively opening the latter in order from the lowermost to the uppermost valve and for closing the same in the reverse order as the quantity of fuel delivered to the burner is respectively increased or decreased.

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