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B. VALJEAN
COMBUSTION APPARATUS

2,073,270

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2 Sheets-Sheet 1

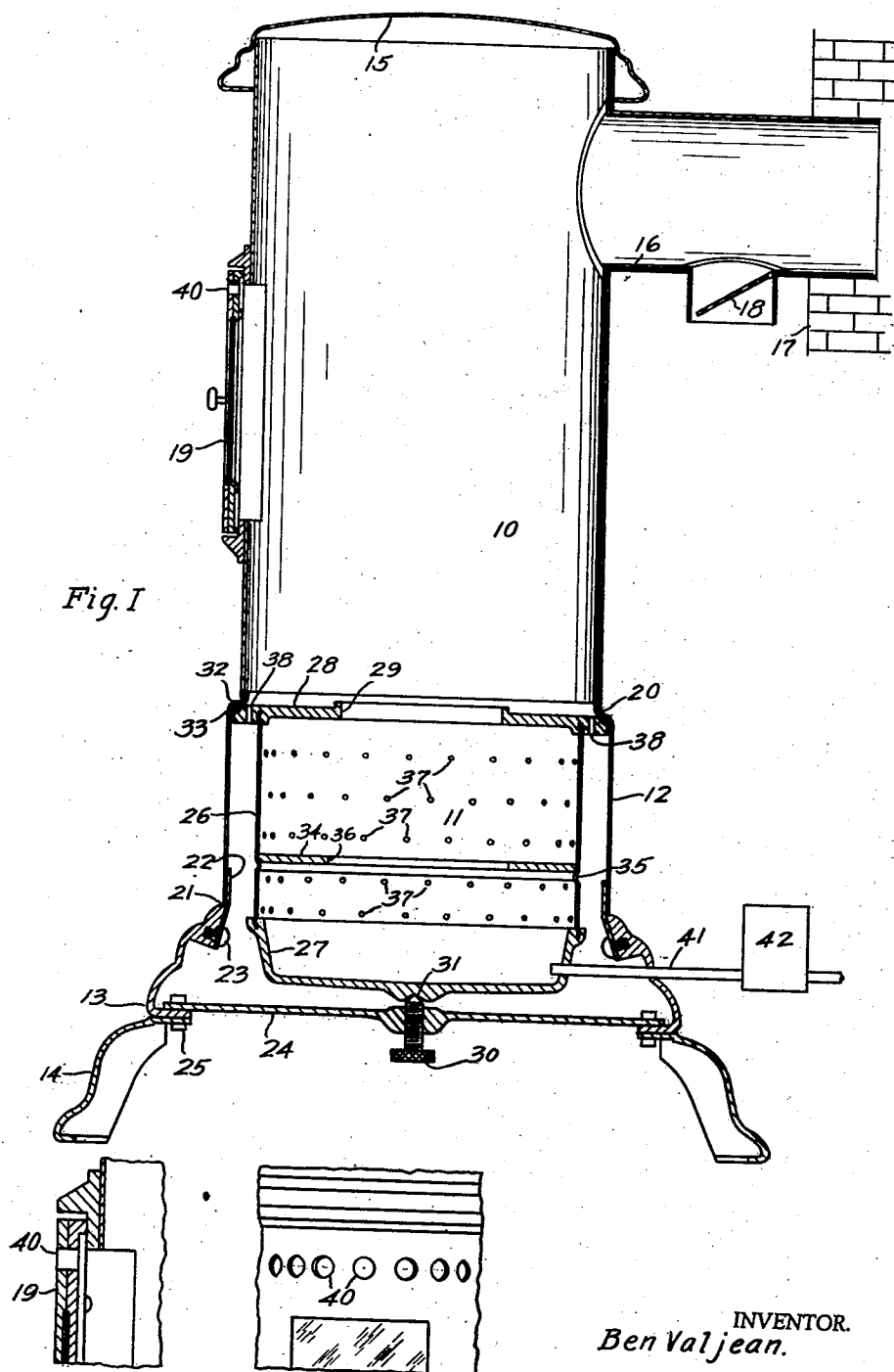


Fig. II

Fig. III

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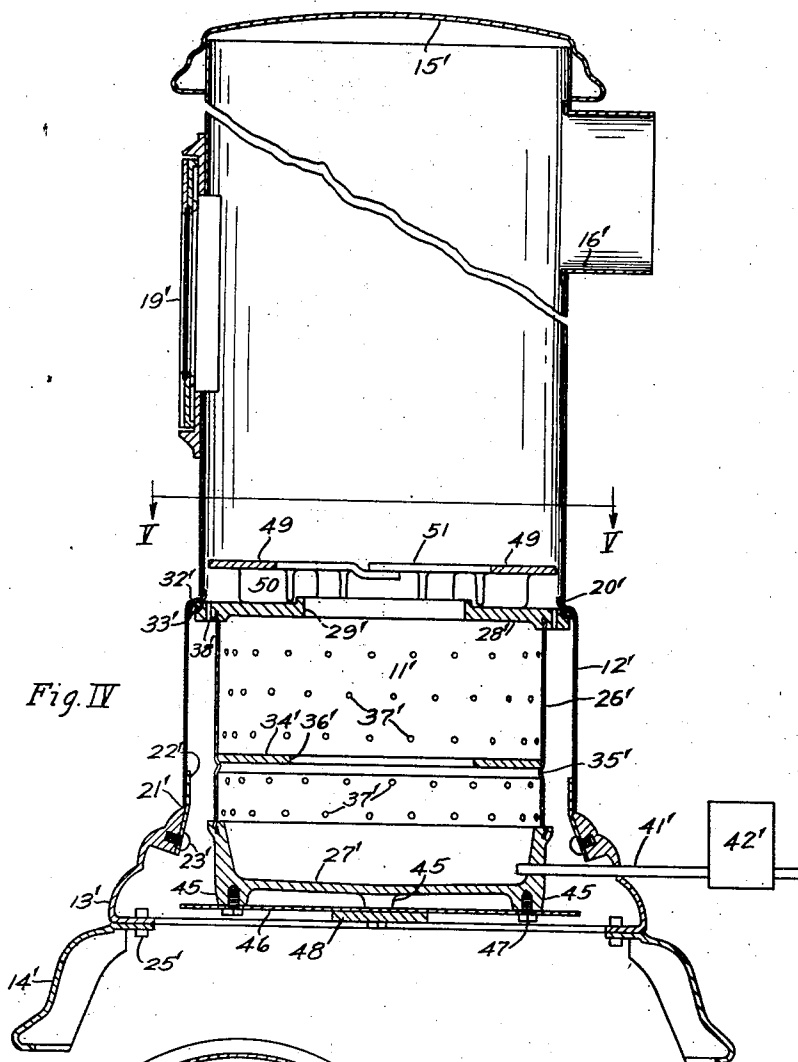


Fig. IV

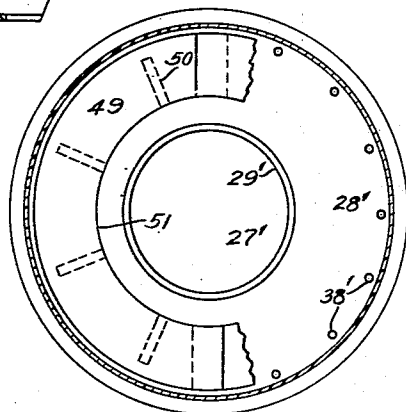


Fig. V

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COMBUSTION APPARATUS

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8 Claims. (Cl. 158—92)

This invention relates to combustion apparatus and more particularly to oil burners of the so-called vaporizing type. It is especially adapted for use in connection with that type of apparatus known commercially as space heaters.

The present invention has for its object the provision of an oil burner of the character referred to having a wide range of economical, quiet and safe operation. This object is attained through the provision of a novel burner chamber and a novel arrangement of the air supply to the apparatus.

A further object of the invention is the provision of an oil burning space heater which may be readily and easily assembled and disassembled. This object is attained primarily by the provision of a novel arrangement for connecting the burner chamber to the combustion chamber.

The invention resides in the novel construction and arrangement of the essential features of the apparatus embodying the invention.

In the drawings:

Figure I is a cross sectional view of an oil burning space heater embodying the preferred form of the present invention;

Figure II is an enlarged fragmentary sectional view of the door construction forming a part of the construction illustrated in Figure I;

Figure III is a side view of the door construction shown in Figure II;

Figure IV is a sectional view of a space heater embodying a modified form of the invention; and

Figure V is a sectional view taken substantially on the line V—V of Figure IV and with a portion of the baffle plate broken away.

The space heater illustrated in Figure I comprises a combustion chamber 10, a burner chamber 11, enclosed within a jacket 12, and a supporting frame 13 mounted upon legs 14. The combustion chamber 10 as here shown is of cylindrical formation having a top wall 15 and a flue outlet 16 adjacent its upper extremity. The flue outlet 16 is adapted to be connected to a chimney 17 whereby the draft of the chimney is communicated to the apparatus. An automatic draft regulator 18 is preferably associated with the outlet 16. The combustion chamber 10 is also provided with a door 19 which will be described more in detail presently.

The combustion chamber 10 is supported upon the jacket 12 through suitable connection therewith as indicated at 20. The jacket 12 is mounted on the frame 13 as indicated at 21 and is secured in position thereon by means of a plurality of straps 22 removably connected to the frame 13

by the screws 23. The legs 14 are attached to the base 13 by means of bolts 25. A burner supporting strap 24 is also secured to the frame 13 as indicated.

The burner chamber 11 is preferably made up of a cylindrical sheet metal side wall 26, a cast metal pan-like bottom wall 27 and a cast metal top wall 28 provided with a large central opening 29. The upper and lower extremities of the cylindrical sheet metal portion 26 are preferably cast into the top wall 28 and the bottom wall 27, respectively. The burner chamber 11 is in open communication with the combustion chamber 10 through the opening 29 in the top wall of the former. It is held in operative relation to the combustion chamber by means of a screw threaded device 30 associated with the support strap 24 and adapted to engage a depression 31 in the bottom wall of the burner chamber. When the screw threaded device 30 is properly adjusted the upper wall 28 of the burner chamber 11 is pressed snugly against the shoulder 32 formed at the upper extremity of the jacket 12 and at the lower extremity of the combustion chamber 10. An asbestos ring 33 is preferably positioned between the edge of the top wall 28 and the shoulder 32 in order to insure a satisfactory joint.

The interior of the burner chamber 11 is divided into two vertically disposed compartments or chambers by means of a partition 34. The partition is preferably formed of cast metal and is preferably mounted upon an annular bead 35 formed in the sheet metal wall 26. Communication is provided between the two compartments of the burner chamber by a large central opening 36 formed in the partition 34. The opening 36 is arranged in alignment with the opening 29 in the top wall 28 although it need not necessarily be the same size as the latter opening.

Air is supplied to the apparatus through several groups of air inlet openings. The sheet metal cylindrical portion 26 of the burner chamber 11 is provided with five vertical spaced rows of openings 37. These openings are preferably of substantially uniform size and spacing. The partition 34 is preferably positioned above the second row of holes 37 from the bottom of the burner.

The upper wall 28 of the chamber 11 projects radially outwardly beyond the side wall 26 of the chamber. It is provided with a plurality of uniformly spaced air inlet openings 38 radially outward from the wall 26 and immediately adjacent the inner surface of the cylindrical wall of the combustion chamber 10. Openings 38 provide communication between the interior of the jacket

12 and the interior of the combustion chamber 10. The draft communicated to the apparatus from the chimney 17 causes air to be drawn into the jacket 12 and thence into the burner chamber 11 through the openings 37 and also into the combustion chamber 10 through the openings 38. The openings 38 are larger than the openings 37 and preferably more closely spaced. The size, spacing and location of the openings 37 and 38 determine to a considerable extent the character of the flame produced in the apparatus.

In addition to the air inlet openings 38 a plurality of openings 40 are formed in the door 19 for the admission of air to the combustion chamber. These openings 40 are relatively large and closely spaced whereby to deliver a concentration of air into the combustion chamber in a restricted zone. As will be explained presently this concentration of air effectively prevents extinguishment of the flame within the combustion chamber during the operation of the device and thus avoids the danger of explosion.

Liquid fuel is supplied to the bottom of the burner chamber 11 from a source of supply, not shown, through a supply pipe 41. A conventional constant level or metering device 42 is associated with supply pipe 41 whereby the quantity of fuel delivered to the apparatus may be controlled.

The apparatus illustrated in Figures IV and V is identical to the apparatus just described except for the provision of slightly different means for holding the burner chamber 11 in position and except for the elimination of air inlet openings 40 and the substitution therefor of a baffle ring adapted to produce the same result.

In the apparatus illustrated in Figure IV the burner chamber 11 is provided with a plurality of depending legs 45 to which a shield 46 is secured by means of screws 47. The burner chamber 11 is held in position by means of a support strap 48 secured to the frame 13 in any suitable manner at opposite sides of the burner.

An annular baffle 49 having depending radial vanes 50 is mounted upon the top wall 28' of the burner chamber. The baffle 49 is preferably formed in two sections as illustrated to facilitate assembly and removal thereof. A central opening 51 is formed in the baffle which is disposed in alignment with the opening 29 in the horizontal wall 28'. The baffle is of such size that the periphery thereof is spaced a very small distance from the side wall of the combustion chamber 10'.

It will of course be understood that the distinctive features of the apparatus just described are of importance by reason of the results obtained during the operation of the apparatus; consequently, the nature and scope of the invention can best be explained and understood in connection with the following description of the operation of the apparatus embodying the invention.

The supply of liquid fuel to the burner chamber 11 through supply pipe 41 may be controlled by suitable adjustment of the metering device 42. When the liquid fuel is ignited combustion initially occurs in the lower portion of chamber 11 and will remain in that portion of the chamber so long as but a limited supply of fuel is admitted to the chamber. As the supply of fuel to the chamber is increased, visible combustion (flame) rises in the chamber until finally at the maximum fuel feed it is localized wholly within the combustion chamber 10. By suitable adjustment of the metering device 42 the flame may be localized in any desired position within the chamber 11 or wholly within the combustion chamber.

This wide range of operation is made possible by reason of the size and spacing of the air inlet openings 37 and the relation of the total volume of air which is admitted therethrough to the total quantity of fuel supplied to the chamber 11. The holes 37 are relatively numerous and of relatively small area. They are substantially uniformly spaced throughout the entire vertical wall of the chamber 11. A definite relation exists between the total volume of air admitted to the chamber 11 under a constant draft condition and the maximum fuel supply admitted thereto. This relation is such that at maximum fuel feed the air admitted to the chamber 11 is insufficient to support complete combustion of the fuel vapors generated. At the minimum fuel feed the air admitted through the air inlet openings 37 is in excess of that required for complete combustion of the fuel vapors.

The size and uniform spacing of the holes 37 make it possible to localize visible combustion at substantially any desired position within the chamber 11 upon suitable adjustment of the metering device 42. The size and spacing of the holes 37 also permit the maximum amount of premixing at all stages of operation, thus assuring clean and efficient combustion at all times.

The upper wall 28 and the partition 34 serve the same function but at different stages of operation. The partition 34 in effect makes the lower portion of the chamber 11 a burner within a burner. It prevents eddy currents from entering the lower part of the burner chamber, thus assuring stable operation at low fire. It also confines the vapors generated therein affording opportunity for adequate premixing at all stages of operation. It also facilitates vaporization of the liquid fuel at lower fuel consumption by confining the heat adjacent the surface of the fuel. These several functions of the partition 34 are responsible for the satisfactory combustion obtained with a limited fuel supply.

The upper wall 28 functions substantially the same as the partition 34 at the higher stages of operation. It is primarily responsible for the stability of the fire at the high stages of operation and partially responsible for the cleanliness and efficiency at that stage.

In addition to merely supplying air whereby to increase the capacity of the apparatus, the openings 38 also serve to distribute the flame at the high stage of operation and cause it to spread out adjacent the side wall of the combustion chamber, thus assuring an efficient transfer of the heat generated to the medium to be heated.

Provision is made to prevent extinguishment of the fire with attendant possibility of explosion regardless of fluctuations in draft or fuel feed. This is accomplished in the apparatus of Figure I by the introduction of a concentration of air through the air inlet openings 40. Regardless of the amount of fuel vapors which may be generated, even if they completely fill the burner and combustion chambers, flame will be maintained adjacent the openings 40. These openings are of sufficient size as to permit air to enter the apparatus in a large volume, consequently there is always sufficient air adjacent the openings 40 to form a mixture of air and fuel vapors which will burn and thereby effectively prevent complete extinguishment of the fire in the apparatus except when the fuel is turned off.

Extinguishment of the fire, by reason of the generation of an excess of fuel vapors, is avoided in the apparatus of Figure IV by the use of the

baffle 49. The baffle is arranged with respect to openings 38' whereby to substantially confine a portion of the air entering therethrough in a limited zone and to effectively prevent contact therewith of any great quantity of fuel vapors. Thus there is always maintained beneath the baffle adjacent the openings 38' a mixture of air and fuel vapors containing a sufficient quantity of air to support combustion. So long as fire is maintained in the apparatus, the possibility of an explosion because of the generation of an excess of fuel vapors is effectively eliminated.

While only two different arrangements for preventing extinguishment of the flame have been shown and described, it should be understood that this may be accomplished in various ways. The essential requirement for this purpose is the provision of means for producing a combustible mixture in the apparatus regardless of the amount of fuel which may be generated. Of course, this mixture must be produced in a region where it will become ignited when the apparatus is operated at maximum fuel consumption. Likewise, it should be so located and of such a nature as not to impair the normal operating efficiency of the apparatus. For example, air should not be introduced for this purpose, in such volume as will naturally decrease the quantity of CO₂ in the flue gases. Nor should the air provided for this purpose be introduced in a quantity or a direction such as will influence adversely the stability or characteristics of the normal combustion.

The quietness and stability of operation of the apparatus embodying the present invention is due partly to the fact that the fuel vapors and air passing into the combustion chamber, at the higher stages of operation, are not subjected to blasts of air directed transversely to the direction of flow thereof.

From the foregoing description it will be apparent that the several essential elements of the apparatus embodying the present invention cooperate and coact to make possible safe, clean and efficient combustion throughout a wide range of fuel consumption.

The term "primary air inlet openings" as used in the claims refers to those openings which at certain stages of operation of the burner introduce air for pre-mixing and at other stages of operation introduce air directly to the zone of combustion. These openings are exemplified by the openings 37 of this application.

The term "secondary air inlet openings" as used in the claims refers to those openings which serve only to introduce air above or directly into the zone of combustion and do not introduce air for pre-mixing with oil vapors in advance of combustion. These openings are exemplified by the openings 38 of this application.

Various modifications of the apparatus illustrated may be made within the scope of the present invention as defined by the appended claims. I claim:

1. Combustion apparatus comprising a casing, an open topped burner bowl within said casing, fuel supply means leading to the bottom of said bowl, a centrally apertured plate mounted at the top of the bowl and restricting the outlet thereof, a centrally apertured partition extending across said bowl at a point substantially removed from both the top and bottom of the bowl to form upper and lower combustion chambers, a plurality of spaced air inlet openings in the side wall of the bowl above and below said partition,

means to supply air to the space surrounding said bowl, and a flue outlet from said casing.

2. Combustion apparatus comprising a burner, a centrally apertured partition extending across the burner at a position substantially removed from both the top and the bottom of the burner to form upper and lower communicating compartments within the burner, a plurality of spaced primary air inlet openings in the side wall of the burner above and below said partition, and fuel supply means for delivering a regulatable quantity of fuel to the burner.

3. Combustion apparatus of the vaporizing pot type comprising a burner, baffle means positioned within the burner and substantially removed from both the top and bottom of the burner to form upper and lower compartments, said baffle means being constructed and arranged to provide a substantially central opening affording communication between said compartments, the burner being provided with a plurality of spaced primary air inlet openings arranged above and below the baffle means, and fuel supply means for delivering a regulatable quantity of fuel to the burner.

4. Combustion apparatus of the vaporizing pot type comprising a burner, baffle means positioned within the burner and substantially removed from both the top and bottom of the burner to form upper and lower compartments, said baffle means being constructed and arranged to provide a substantially central opening affording communication between said compartments, the burner being provided with a plurality of spaced primary air inlet openings arranged above and below the baffle means, the majority of said primary air inlet openings being above said baffle means, and fuel supply means for delivering a regulatable quantity of fuel to the burner.

5. Combustion apparatus of the vaporizing pot type comprising a burner having a top wall provided with an opening therein, partition means disposed within the burner to divide the burner into upper and lower compartments, said partition means being formed to provide an opening which is substantially removed from both the top and bottom of the burner and which is arranged in substantial alignment with the opening in the top wall, the burner being provided with a plurality of spaced primary air inlet openings above and below said partition means, and fuel supply means for delivering a regulatable quantity of fuel to the burner.

6. In a combustion apparatus of the vaporizing pot type including a burner provided with upper and lower primary air inlet openings for delivering air thereto and fuel supply means for delivering a regulatable quantity of fuel thereto and in which the vertical location of the zone of combustion can be varied by regulation of the quantity of fuel admitted thereto, the improvement comprising baffle means disposed within the burner between said upper and lower primary air inlet openings and in a position substantially removed from the top and bottom of the burner to form upper and lower combustion compartments, said baffle means providing an opening for communication between said compartments, said opening being spaced laterally from the lower primary air inlet openings.

7. Combustion apparatus of the vaporizing pot type comprising a burner, baffle means disposed within the burner in a position substantially removed from both the top and bottom thereof to divide the same into upper and lower combustion

compartments, said baffle means engaging a wall of the burner and providing restricted communication between said compartments, the burner being provided with a plurality of spaced primary
5 air inlet openings above and below said baffle means, the air inlet openings below the baffle means being formed in the wall of the burner engaged by said baffle means.

8. In combustion apparatus of the vaporizing
10 pot type including a burner provided with upper and lower primary air inlet openings for delivering air thereto and fuel supply means for delivering a regulatable quantity of fuel thereto and

in which the vertical location of the zone of combustion can be varied by regulation of the quantity of fuel admitted thereto, the improvement comprising baffle means disposed within the burner between said upper and lower primary air inlet openings and in a position substantially removed from both the top and the bottom of the burner to form upper and lower communicating combustion compartments in the burner, said baffle means being in peripheral engagement with
5
10 the burner.

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