Sept. 10, 1940. H. B. DONLEY 2,214,664

OIL BURNING APPARATUS

Filed April 26, 1937

Fig. 3.

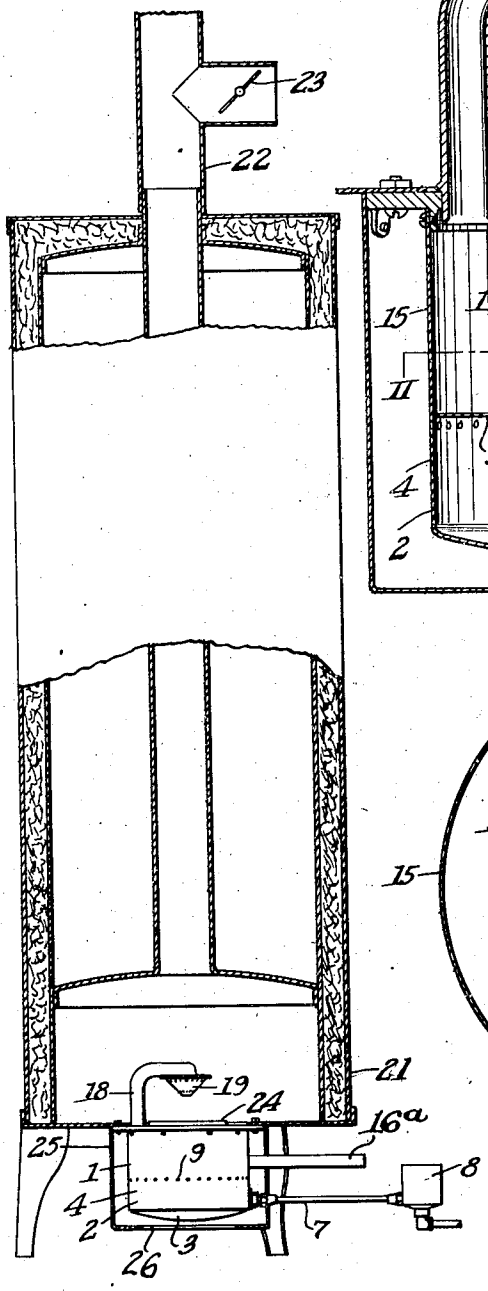


Fig. 1.

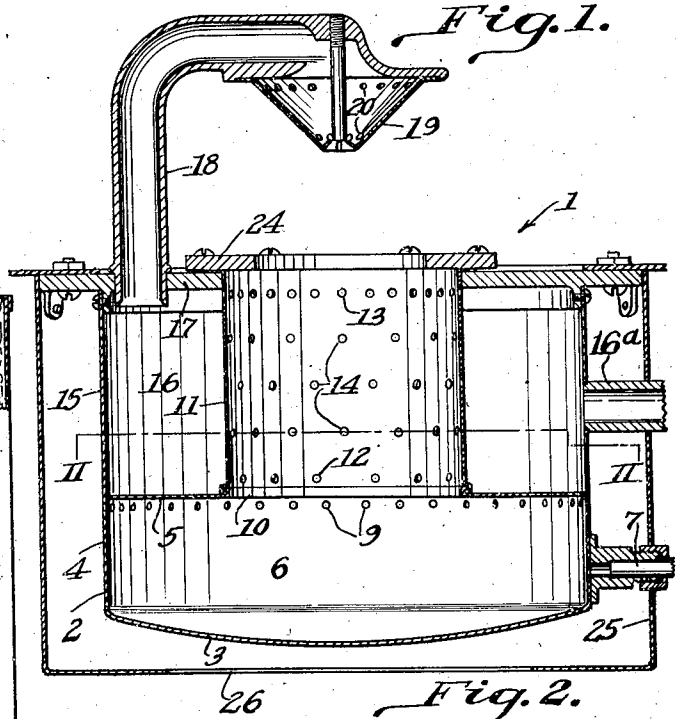
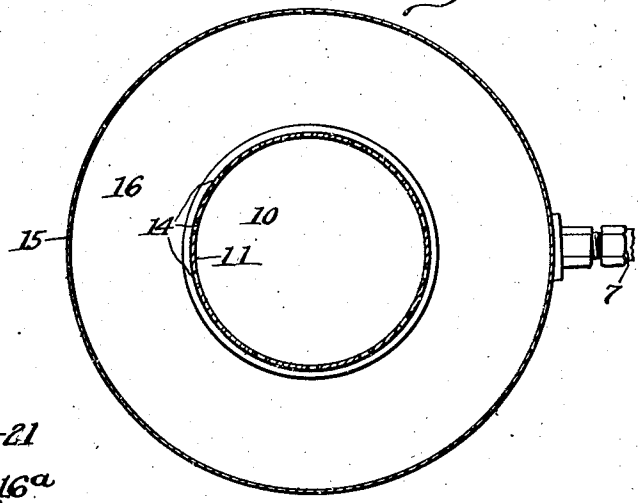


Fig. 2.



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OIL BURNING APPARATUS

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7 Claims. (Cl. 158—91)

This invention relates to improvements in oil burners, and more particularly to oil burners of the vaporizing or hydroxylating type. Among the objects of the invention, I aim to provide a safe, economical and efficient burner of the type indicated wherein the burner possesses an unusually wide range of operation by which the burner is adapted for high and low stages of combustion without involving the use of ignition or pilot flames for effecting or sustaining low stage operation, and wherein clean steadily maintained combustion is provided at all stages, accidental flame extinguishing avoided and smoke or soot formation precluded or rendered negligible.

These general objects are attained by the provision of a burner vessel of peculiar configuration, the said vessel being formed to include an oil receiving and vaporizing chamber in the base thereof with the side wall of the chamber provided with restricted openings providing for the admission of limited quantities of air into the chamber for admixture with the fuel, the horizontal top of said chamber having formed axially therewith an upstanding, cylindrical, open-ended duct of reduced diameter as compared with the internal diameter of the base chamber, the walls of said duct being formed with rows of spaced openings of such number, arrangement and proportion as to admit controlled amounts of air into the duct to either hydroxylate gaseous fuel mixtures passing through the duct or to effect complete combustion of such mixtures, depending upon the stage of operation of the burner.

Another object of the invention resides in the provision of a mechanically simplified type of burner which is easy to clean and maintain in proper working condition.

For a further understanding of the invention, reference is to be had to the following description and the accompanying drawing, wherein;

Fig. 1 is a vertical sectional view taken through a vaporizing oil burner constructed in accordance with a preferred form of the present invention;

Fig. 2 is a horizontal sectional view taken through the burner on the plane indicated by the line II—II of Fig. 1.

Fig. 3 is a vertical longitudinal sectional view taken through a storage type water heater provided with a burner constructed in accordance with the present invention.

Referring more particularly to the drawing, the numeral 1 designates the improved oil burner comprising the present invention in its entirety. The burner may be adapted for many uses as, for instance, the heating of hot water tanks, in the construction of room or space heaters or in centralized house heating plants, the size or capacity thereof varying with the heat requirements of the apparatus or systems associated therewith.

In the particular embodiment of the invention illustrated, the burner comprises a vessel or vaporizing pot 2, which is preferably formed from sheet metal and includes a closed bottom wall 3, an annular side wall 4, and an inwardly and substantially horizontally extending top wall 5. The walls 3, 4 and 5 define an enlarged oil-receiving and vaporizing chamber 6. Oil from any suitable source of supply may be introduced into the bottom of the vessel by means of a pipe line 7 in which may be installed a conventional constant level or metering device 8, whereby the quantity of fuel delivered to the burner may be controlled. The wall 4, adjacent to the upper part thereof, is provided with a plurality of restricted air inlet openings 9, which openings are arranged above the level of the pool of oil which is normally present in the bottom of the chamber 6. The number of the openings 9 and their total area is such that but limited quantities of air may enter the chamber therethrough, the amount of air being sufficient to combine with oil vapors or gases to provide a hydroxylated fuel mixture but insufficient to support complete flame producing combustion of any appreciable character.

The top wall 5 is provided centrally with an opening 10 and disposed in registration with this opening and arising axially from the wall 5 is a cylindrical open-ended duct 11, the latter being of substantially the same diameter as the opening 10 but of considerably smaller diameter than the internal diameter of the chamber 6. The lower end of the duct 11 immediately above the opening or outlet 10 of the chamber 6 is formed with a row of spaced openings 12, and the upper end of said duct is provided with a corresponding row of openings 13. Between the rows of openings 12 and 13, the duct is further formed with a plurality of more widely spaced openings as indicated at 14. The gaseous fuel mixture developed within the base of the burner passes upwardly through the duct and is there further admixed with additional quantities of air drawn into the burner through the openings 12, 13 and 14.

When the burner is operating at low capacity, wherein it produces its smallest amount of heat development, the air entering the duct 11 through the lower row of openings 12 is sufficient to effect complete visible flame combustion within

the lower end of said duct, the flame being characterized by inwardly extending pencils of blue or luminous flame, which appear to extend inwardly from the openings 12. This limited flame combustion is sufficient to evolve heat to effect the vaporization at a desired rate of the limited supply of oil delivered to the bottom of the vessel 2. This limited low capacity or low stage combustion is effected with the aid of a hydroxylated gaseous fuel mixture, since the oil vapors are hydroxylated by the amount of air admitted into the vessel through the openings 9. This low stage combustion is steadily maintained and extinguishment thereof prevented by the inclusion of the cylindrical, straight walled duct 11, the top wall 5 and the enlarged gas generating chamber 6.

When additional amounts of fuel are introduced into the burner to promote high stage or high capacity combustion, wherein the maximum heat output of the burner is evolved, the amount of air passing into the duct through the openings 12 and 14 is insufficient to support complete or visible flame combustion, so that the openings 12 and 14, like the openings 9, merely provide sufficient air inflow to hydroxylate the increased quantity of oil vapors during the passage of such oil vapors throughout the major portion of the length of the duct. Complete combustion of the fuel mixture when the burner is operating at maximum capacity is provided by the admission of air through the openings 13 and/or from air obtained from atmospheric sources above the top of the duct 11, so that during high capacity operation, the visible flame observable is disposed immediately at the top of the duct or above the same.

Surrounding the duct 11 is an annular casing 15, which is sufficiently spaced from the walls of the duct 11 to provide a circular air space 16. Air may be delivered into the space 16 either by natural or forced flow through a pipe member 16a extending laterally from the casing 15 to the atmosphere exteriorly of the burner. The top wall 17 of the casing 15 is connected with a curved "goose neck" conduit 18 which has its outer end terminated in a conical head 19 arranged above and in axial registration with the top of the duct 11. The head 19 is perforated as at 20, so that air passing through the conduit 18, and obtained from the space 16, issues through the perforations in the head 19 to combine with the fuel mixture existing from said duct whereby to cause efficient flame producing combustion thereof.

The burner, as a whole, may be positioned within the bottom of a heater casing 21, and to the top of this casing there is connected an outlet flue 22, in which is arranged an automatic draft regulator 23 to control the draft pressure of the burner. The operating characteristics of the burner are improved by the provision of a ring 24, which is positioned on the top wall 17 of the casing 15 and overhangs the interior of the duct 11, the said ring eliminating down drafts which might otherwise interfere with the outflow of air through the openings 13 or other air admitting openings disposed at lower positions within the duct.

The burner mechanism described is characterized by its wide combustion range or "turn-down" ratio. No pilot flame is necessary to sustain the operation of the burner under low-fire conditions, i. e., low-stage operation. However, at all stages of operation, hydroxylation of the fuel mixture takes place prior to complete combustion thereof. Thus at low stage operation, the openings 9 constitute primary air inlets and the openings 10 secondary air inlets, the openings 9 providing air for hydroxylation and the openings 10 air for complete combustion. However, on high stage operation, the openings 9, 10 and 11, and possibly to a limited extent the openings 13, all become primary air inlet openings to produce hydroxylation of the fuel mixture, secondary bodies of air to complete combustion being obtained from the atmosphere around the burner or through the head 19. Another outstanding characteristic of the present burner is its stability in operation and its resistance to forces which tend to accidentally extinguish the flame particularly under low fire operation. These properties are attributable mainly to the provision of the horizontal top wall 5 of the vessel and the associated upstanding duct 11, which causes low fire combustion within the bottom of the duct 11, providing for the sustained evolution of oil vapor from the pool of oil delivered to the bottom wall 3 and the thorough mixture of such oil vapor with air entering through the openings 9 prior to complete combustion. Moreover, the shape of the burner protects these operations against down drafts tending to detrimentally affect low stage combustion.

The duct 11 may be formed from a chromium nickel alloy steel in order that it may successfully withstand high combustion temperatures, so that active flame producing combustion may take place within the confines of the duct when the burner is operating at its maximum capacity. This has the advantage of permitting lower grades of furnace oil (fuel oil) to be used as the operating fuel since the high internal temperatures within the duct are transmitted to the pool of oil in the bottom of the chamber 6 and thereby assist in its vaporization and/or gasification.

An exterior casing 25 surrounds the burner 1 to protect it from drafts which would tend to produce uneven temperatures in the wall 4. The casing 25 also provides a substantially constant supply of air to the openings 9. The reduced opening 26 in the bottom of the casing provides for the entrance of air into the casing without causing objectionable air currents.

The pipe 16a extends through the wall of the exterior casing 25 and serves to conduct air at atmospheric temperatures and pressures to the chamber 16. Air flow through the pipe 16a is established by the suction created within the chamber through the consumption of air by the flame and upward movement through the conduit 18. Satisfactory results have been obtained when air was permitted to flow by natural circulation through the pipe 16a but it is within the concept of the invention to connect the outlet of a blower with the outer end of the pipe if positive flow of air is desired.

What is claimed is:

1. In oil burning apparatus, an oil receiving and vaporizing vessel having bottom, side and top walls, said top wall being formed with an opening, an elongated tubular duct arising vertically from the top wall in registration with the opening therein, said duct being materially smaller in diameter than said vessel, a row of primary air inlets formed in the side wall of said vessel adjacent the top wall thereof, a plurality of longitudinally spaced rows of air inlets formed in the wall of said duct, an annular wall surrounding said duct and spaced therefrom, a casing spaced from and surrounding said vessel and annular

wall, said casing being formed with an opening at the lower end thereof, a top wall extending from said duct to said casing to provide annular concentric chambers, and conduit means leading from the inner chamber to the atmosphere.

2. Oil burning apparatus comprising a combustion vessel having bottom, side and top walls, said side wall having a row of openings adjacent its upper end and said top wall being formed with a centrally disposed opening, a duct arising from the top wall of said burner in registration with the opening therein, said duct being formed with vertically spaced rows of air admitting openings, a wall structure surrounding said duct and spaced therefrom to provide a closed annular chamber, a casing surrounding said combustion vessel and spaced therefrom to provide a second annular chamber having an opening in the bottom wall smaller in diameter than said vessel, the openings in the side wall of said combustion vessel being in communication with the atmosphere through the chamber surrounding said vessel to supply air at atmospheric pressure to said vessel, reduced tubular means for introducing air into the chamber surrounding said duct, and means for introducing liquid fuel to said combustion vessel.

3. Oil burning apparatus comprising a combustion vessel having bottom, side and top walls, said side wall having a row of openings adjacent its upper end and said top wall being formed with a centrally disposed opening, a duct arising from the top wall of said burner in registration with the opening therein, said duct being formed with vertically spaced rows of air admitting openings, a wall structure surrounding said duct and spaced therefrom to provide a closed annular chamber, an air distributing head disposed above and in vertical registration with the open upper end of said duct, said head being in communication with said annular chamber, a casing surrounding said combustion vessel and spaced therefrom to provide a second annular chamber having an opening in the bottom wall smaller in diameter than said vessel, the opening in the side wall of said combustion vessel being in communication with the atmosphere through the chamber surrounding said vessel, reduced tubular means for introducing air into the chamber surrounding said duct, and means for introducing liquid fuel to said combustion vessel.

4. Oil burning apparatus comprising a combustion vessel having bottom, side and top walls, said side wall having a row of openings adjacent its upper end and said top wall being formed with a centrally disposed opening, a duct arising from the top wall of said burner in registration with the opening therein, said duct being formed with vertically spaced rows of air admitting openings, a wall structure surrounding said duct and spaced therefrom to provide a closed annular chamber, a casing surrounding said combustion vessel and spaced therefrom to provide a second annular chamber having an open bottom, the openings in the side wall of said combustion vessel being in communication with the atmosphere through the chamber surrounding said vessel to supply air at atmospheric pressure and temperature to said vessel, reduced tubular means for introducing air into the chamber surrounding said duct, and means for introducing liquid fuel to said combustion vessel.

5. Oil burning apparatus comprising a horizontally disposed ring, a cup-shaped vessel carried by the under side of said ring, the side wall of said vessel being provided with a horizontal row of openings, a horizontal partition wall disposed in said vessel above said row of holes, said wall having a centrally disposed opening, a cylindrical duct extending from said partition wall in registration with the opening therein to the opening in said ring, the partition wall and duct serving to divide said cup-shaped vessel into combustion zone, outlet duct and annular air chamber, said duct wall being formed with air admitting openings, means for introducing liquid fuel to said cup-shaped vessel, means for introducing air to the air chamber in said vessel, and a casing surrounding said vessel and spaced therefrom to provide a second air chamber open at its lower end to the atmosphere, the openings in said vessel wall establishing communication between said combustion zone and the atmosphere through said second air chamber.

6. In oil burning apparatus, an oil receiving and vaporizing vessel having bottom, side and top walls, the latter being formed with an opening, a tubular duct extending upwardly from said top wall in registration with the opening therein, a plurality of primary air admitting openings formed in the side wall of said vessel below the top wall thereof, said duct having spaced rows of air inlets provided therein, an annular wall extending upwardly from said vessel in spaced relation from said duct, a second annular wall spaced from and surrounding said vessel and said first annular wall, a substantially horizontal wall extending from the outer annular wall to said duct and closing the upper ends of the air spaces formed by the annular walls and said duct, the outer space being open to the atmosphere at the lower end, means for supplying air to the inner air space, a distributor head supported by said horizontal wall in registration with said duct, means establishing communication between said head and the inner air space, and means for supplying oil to said vessel.

7. In oil burning apparatus, an oil receiving and vaporizing vessel having bottom, side and top walls, said top wall being formed with an opening, an elongated tubular duct arising vertically from the top wall in registration with the opening therein, said duct being materially smaller in diameter than said vessel, a row of primary air inlets formed in the side wall of said vessel adjacent the top wall thereof, a plurality of longitudinally spaced rows of air inlets formed in the wall of said duct, an annular wall surrounding said duct and spaced therefrom, a casing spaced from and surrounding said vessel and annular wall, said casing being formed with an opening at the lower end thereof, a top wall extending from said duct to said casing to provide annular concentric chambers, a ring-member carried by the last-mentioned top wall and extending inwardly beyond the walls of said duct to reduce the outlet thereof and eliminate back drafts, and conduit means leading from the inner chamber to the atmosphere.

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