July 13, 1948. A. CLARKSON 2,445,302

APPARATUS FOR BURNING LIQUID FUELS

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Fig. 2

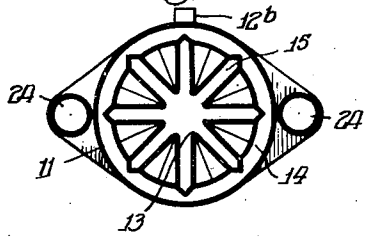

Fig. 1

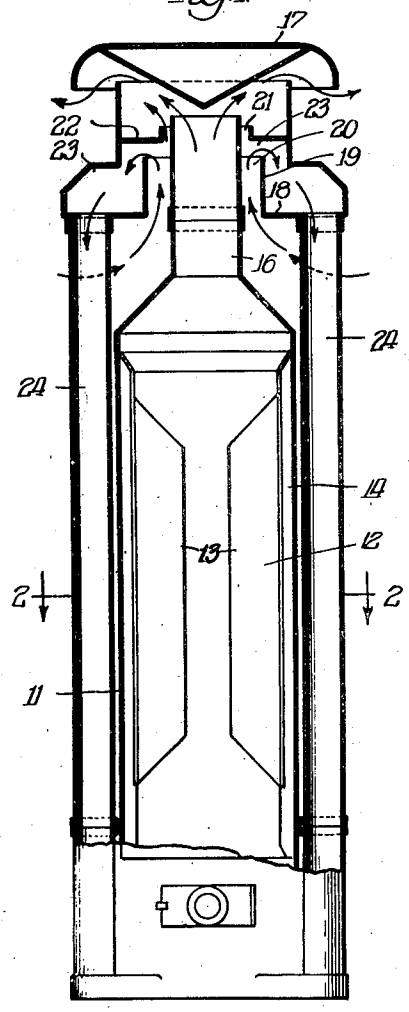

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Fig. 5.

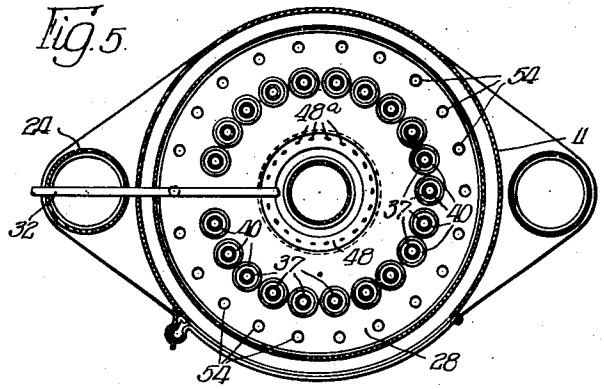


Fig. 4.

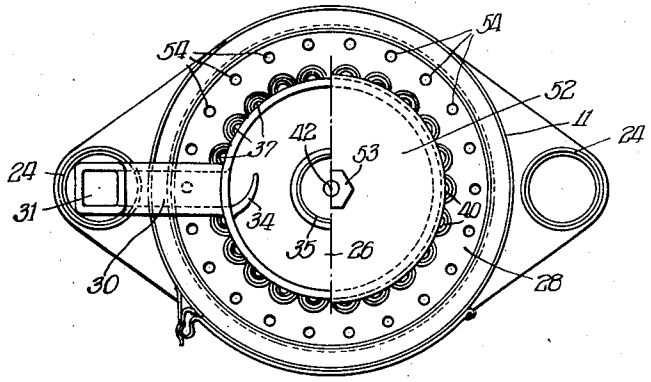
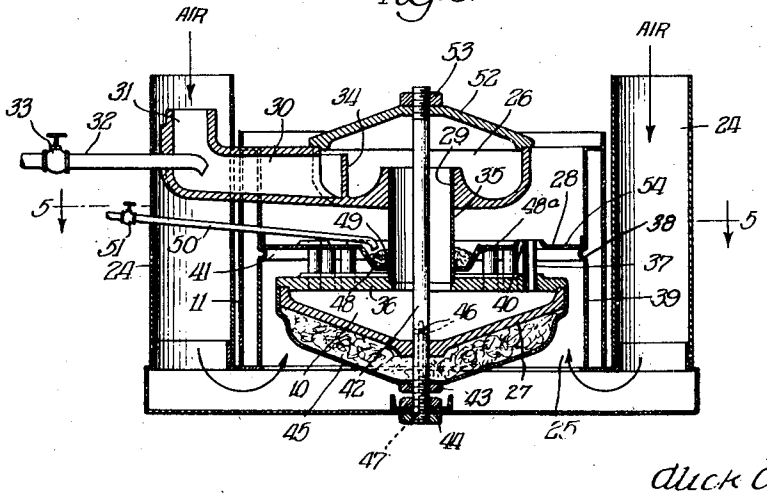


Fig. 3.



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2,445,302

APPARATUS FOR BURNING LIQUID FUEL

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4 Claims. (Cl. 158—53)

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This invention relates to certain new and useful improvements in apparatus for burning liquid fuel.

The principal object of the invention is to provide an improved burner apparatus in which liquid fuel is first converted into a gas and mixed with a quantity of air insufficient to support combustion and thereafter passed to the burner where it is mixed with additional combustion air.

Various apparatus have been heretofore proposed for burning vaporized liquid fuel. The earlier developments were particularly objectionable and subject to explosion, since the liquid fuel was usually vaporized in a closed retort without satisfactory means for controlling the development of excessive pressure therein. Further developments included the instantaneous vaporization of the liquid, as by dripping the fuel onto a hot plate and simultaneously mixing it with combustion air and burning it at the point of vaporization. These burners are of low efficiency and have no satisfactory means for controlling the volume or quality of the flame. Another development includes the idea of maintaining a pool of liquid fuel in an open pot wherein it is vaporized by radiant heat and mixed with combustion air and burned near the upper portion of the pot. While such pot burners have been satisfactory in some situations, they are not regarded as suitable for use in extremely low temperatures or in situations where a high volume of heat is required from a relatively small burner.

According to the present invention the liquid fuel is vaporized at atmospheric pressure in a retort and simultaneously mixed with air to form a rich gaseous mixture. The retort is positioned above the burner so as to be thoroughly heated by the flame and thereby insures efficient operation in sub-zero temperatures. This position insures complete evaporation of the liquid fuel and also superheats the air with which the vaporized fuel is mixed. The air stream for this purpose is caused to flow through the vaporizing chamber by virtue of the stack drafts created by the discharge of the products of combustion.

The vaporized fuel mixed with the hot air stream is carried into the burner chamber. From this chamber the rich gaseous mixture is caused to discharge through jet nozzles or slits arranged

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in close association with surrounding air ports from which auxiliary air is supplied in suitable quantity to support combustion and provide a flame of the desired quality. The auxiliary combustion air, like the rich gaseous mixture, is drawn downwardly into the space surrounding the burner by suction created by the discharge of the products of combustion. The quality of the flame is controlled by raising and lowering, as the case may be, an air control plate relative to the upper edge of the gas nozzles and thereby vary the amount of air supplied to the rich gaseous mixture at the point of combustion. The flame does not contact the nozzle and therefore makes it practicable to use high octane or leaded gasoline as a fuel without danger of building up lead deposits on the nozzle, likely to delay or otherwise interfere with the proper mixing of the gaseous fuel and the auxiliary air. An additional blanket of air is discharged upwardly around the burner to provide a blanket of air intervening between the flame and the side walls of the combustion chamber. This blanket serves to supply additional air for combustion and keeps the flame from actual contact with the side walls of the combustion chamber.

It is, therefore, a specific object of the invention to provide an improved liquid fuel burner constructed and operating as herein above briefly described and which will be reliable in its operations and function efficiently in relatively low temperatures.

A further specific object of the invention includes the provision of the improvements above mentioned whereby deposits of carbon upon any part of the burner parts is wholly prevented, and in which the quality of the flame may be adjustably controlled by movement of one element of the burner relative to another, thereby varying the amount of auxiliary combustion air supplied to the gas jet and flame.

The principles of operation and the improved constructions for applying those principles with maximum efficiency are illustrated in the accompanying drawings wherein:

Fig. 1 is a vertical sectional view of a hot water heater showing the improved liquid fuel burner installed therein and illustrating also the air passages for supplying air for the preliminary gaseous mixture and for combustion.

Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a vertical section on a larger scale than shown in Fig. 1 to illustrate the construction and assembly of the various parts of the improved burner.

Fig. 4 is a plan view of the structure illustrated in Fig. 3.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 3.

The burner structure shown in the drawings is designated generally by the reference numeral 10 and is illustrated, for purpose of convenience, in connection with a water heater. The said heater in so far as its water heating function is concerned constitutes a separate invention but is shown herein for the purpose of convenience, since the special construction of the water jacket forms flue passages connecting the combustion chamber of the present invention with the stack for discharging the products of combustion. The heater comprises an outer casing 11, an inner water jacket 12, the latter of which extends from a position near the burner to the upper end of the casing. The said jacket is formed with a plurality of inwardly projecting V-shaped ribs 13 which are hollow and communicate with the outer cylindrical portion 14 of the jacket. The spaces 15 between the said V-shaped ribs constitute flue passages for the hot products of combustion. In view of the fact that the present embodiment of the burner is intended to be used in unprotected situations where it is likely to be subjected to low temperatures and inclement weather, the said stack flue 16 is enclosed within a storm hood. The said storm hood includes a cowl 17 having a central conical portion extending downwardly toward the open upper end of the stack flue 16 but spaced therefrom so that the products of combustion will follow the paths indicated by the arrows in Fig. 1. The storm hood includes also a base portion 18 provided with a central cylindrical baffle 19 extending around the flue 16 to provide an air space 20 through which air is caused to pass upwardly. Part of this air may be drawn through a restricted central passage 21 formed in an overlying horizontal baffle 22, but most of the air is diverted downwardly by said baffle 22 and is drawn, by the suction of the stack draft, through passage 23 and thence downwardly through the passages in the vertical columns 24 to the space 25 beneath the burner.

The burner mechanism comprises a retort 26, a burner body 27, and an air control plate 28 associated with the burner body. The retort 26, as herein illustrated, is in the form of a bowl, the bottom of which is raised at the center so that the lower portion of the bowl-like retort defines an annular channel surrounding the central raised portion 29. An air supply passage 30, preferably rectangular in cross section and having an upturned end portion 31, extends outwardly from the retort. The upturned end 31 of said passage extends into one of the air supply passages formed by the column members 24. A fuel feed pipe 32 extends into the retort passage 30 to supply the desired amount of liquid fuel. The fuel supply may be controlled by any suitable means, for example, a valve 33. The fuel thus supplied will flow downwardly over the inclined bottom of passage 30 into the bowl portion of the retort. A deflector rib 34 is preferably positioned in the retort at the discharge end of passage 30 so as to direct the incoming air and fuel in a circular path through the retort.

The raised central portion 29 of the retort is formed with an opening in which a pipe 35 is fixedly secured. The lower end of pipe 35 is fixed in a central opening of a burner plate 36. The said burner plate 36 serves as a top cover for the burner body, and, by means of the pipe 35, supports the retort in a fixed position relative to the burner. The said pipe 35 provides a passage for the vaporized fuel and air leading from the retort 26 into the distributing chamber of the burner body 27, whereby the rich mixture of fuel, vapor and air is uniformly distributed to the various discharge openings of the burner. The said discharge openings may be in the form of slits, but they are preferably shown herein in the form of cylindrical nozzles 37 from which the fuel mixture is discharged in the form of jets. The fuel mixture thus discharged is too rich for complete combustion and is, therefore, supplied with additional combustion air at the point of its discharge into the combustion chamber. This additional combustion air is supplied by means of opening 40 formed in the air control plate 28. The said air control plate is supported, preferably, on a fixed shoulder 38 on the side wall 39 of the combustion chamber so that the openings 40 therein are concentric with the upper edges of the nozzles 37. By this arrangement of the nozzles 37 and the concentric air openings 40, the air drawn upwardly through each opening by the suction of the stack draft will form an envelope of combustion air surrounding each jet of gaseous mixture discharged. The amount of auxiliary air supplied to each jet of gaseous mixture may be varied to change the quality of the flame by adjusting the nozzles 37 relative to the plate. In the present instance, however, the air control plate 28 is seated on a fixed support 41 which extends inwardly from the inner surface of the combustion chamber. The burner is adapted to be raised and lowered relative to the plate so as to vary the position of the nozzles 37 relative to the plate. This is accomplished by raising and lowering the central supporting shaft 42 on which the burner body is supported. The said shaft has threaded engagement with adjusting nuts 43 and 44 by which the above adjustment may be accomplished. The burner body is preferably protected from the cooling effects of the air in chamber 25 beneath the burner by providing the burner body with a liberal coating of insulating material enclosed in a jacket 45. Ordinarily the burner body will be maintained sufficiently hot to prevent any condensation of liquid fuel therein regardless of the external temperatures. However, if any appreciable amount of fuel, for any cause, should collect in the bottom of the burner body, it may be drained out through openings 46 and 47 formed in said shaft 42.

The central portion of the air control plate is provided with a dish-shaped recess 48 for containing a wick 49 adapted to be impregnated with liquid fuel for the purpose of preheating the retort when lighting the burner. A series of small air openings 48a extend around the said dished portion of the plate so as to supply the needed air during the preheating operation. The said preheating fuel may be supplied to the wick through a pipe 50 controlled by means of a hand valve 51. The retort is closed by a removable cap 52 which is held in place by means of a clamping nut 53 threaded on the upper end of the supporting shaft 42.

The operation of the above described embodiment is as follows: A quantity of liquid fuel passes

through pipe 50 to the wick 46. The pipe is then closed by means of the valve 51 and the wick 46 is lighted by any suitable torch so as to heat the bottom and side surfaces of the retort 26. When the retort is sufficiently heated to vaporize incoming liquid, the liquid fuel is supplied in controlled amounts through pipe 32 and valve 33, the liquid entering the air passage 30 of the retort so as to flow downwardly on the inclined bottom thereof into the annular channel portion of the retort. The liquid fuel is vaporized by the heat of the retort and is simultaneously mixed with air which enters the retort through the passage 30. This air is insufficient to support combustion. Consequently, the rich mixture of vaporized fuel and air passes from the retort down through the pipe 35 and into the distributing body portion of the burner. The rich mixture is then discharged through a series of nozzle members 37 into the combustion chamber where it is ignited. Auxiliary combustion air is supplied to the jets of rich mixture by means of the concentric openings 40 formed in air control plate 28 and surrounding the upper edges of the discharge nozzles 37. By raising or lowering the nozzles 37 relative to the upper edges of the openings 40, the volume of auxiliary air can be varied and thereby alter the quality of the flame as may be desired. The discharge nozzles are so arranged that the flame therefrom is projected against the retort so as to insure that this element is kept hot regardless of the external temperatures in which the burner may be operating. The flames from the several nozzles are deflected outwardly by the retort toward the side walls of the combustion chamber, but are prevented from contacting the said wall by reason of a blanket of auxiliary air which is drawn into the combustion chamber through a series of small openings 54. This blanket of air in addition to preventing actual contact of the flame with the side walls of the combustion chamber provide additional combustion air to support complete combustion.

The heat from the upwardly moving products of combustion are absorbed by the walls of the water jacket 12. The vacuum created by the discharge of the products of combustion, as previously described, compels the gaseous mixture and the auxiliary air to follow the courses hereinbefore defined. The volume of the products of combustion discharged also vary the volume of air and fuel drawn into the burner.

While the invention is described in connection with one form of apparatus, it will be obvious that other burner constructions may be devised without departing from the spirit of the invention. It will be understood, therefore, that the invention contemplates all such modifications of structure as come within the scope of the appended claims. It will be also understood that forced and induced drafts may be used as alternatives for the stack draft herein mentioned.

I claim:

1. A liquid fuel burner comprising in combination, a burner member, a retort positioned above said burner member to be heated thereby and having a laterally extending conduit of suitable cross-sectional area for admitting a restricted quantity of air into the retort to be heated therein, means for delivering a controlled volume of liquid fuel into said retort, whereby the fuel is simultaneously vaporized by contact with the hot walls of the retort and by intimate contact with the heated air therein, to provide a rich gaseous mixture, means defining a passageway leading from the bottom portion of the retort at a location above its inner bottom surface into the underlying burner member, upwardly extending projections on the burner member having openings through which the gaseous mixture is discharged, means for directing a stream of combustion air around the discharged gaseous mixture comprising an air distributing plate formed with openings defining air passages adjacent said projections, and means for varying the quality of the flame by varying the elevation of the point of discharge of said gaseous mixture relative to said air control plate.

2. A liquid fuel burner comprising in combination, a burner member having a distributing chamber and a plurality of discharge nozzles, an enclosure for the burner member, a partition extending across the enclosure to divide it into an air supply chamber and a combustion chamber, a retort positioned in the combustion chamber and having an air inlet passage, a conduit connecting the retort to the distributing chamber of the burner member, means including delivery and exhaust conduits arranged in close relation to each other for causing a stream of air to flow through the retort and burner member into the combustion chamber, and means for delivering liquid fuel into said retort whereby it is vaporized and mixed with said air stream to provide a rich gaseous mixture; the said partition having air passages formed therein so that combustion air from said air supply chamber may flow into the combustion chamber to support combustion of said gaseous mixture.

3. A liquid fuel burner comprising in combination, a burner member having a distributing chamber and a plurality of discharge nozzles, an enclosure for the burner member terminating at its upper end in a discharge flue for discharging the products of combustion, a partition extending across the enclosure to divide it into an air supply chamber and a combustion chamber, a retort positioned in the combustion chamber and having an air inlet passage open to the atmosphere, a conduit connecting the retort to the distributing chamber of the burner member, means including the discharge flue for inducing a stream of air to flow through the retort and burner member into the combustion chamber, and means for delivering liquid fuel into said retort whereby it is vaporized and mixed with said air stream to form a gaseous fuel; the said partition having air passages formed therein so that combustion air from said air supply chamber is admitted into the combustion chamber to support combustion of said gaseous fuel.

4. A liquid fuel burner comprising in combination, a burner member having a distributing chamber and a plurality of discharge nozzles, an enclosure for the burner member, a partition extending across the enclosure to divide it into an air supply chamber and a combustion chamber, a retort positioned in the combustion chamber and having an air inlet passage thereto open to the atmosphere, a conduit connecting the retort to the distributing chamber of the burner member, means including a discharge flue for inducing a stream of air to flow through the retort and burner member into the combustion chamber, means for delivering liquid fuel into said retort whereby it is vaporized and mixed with said air to provide a gaseous fuel; the said partition having air passages formed therein surrounding said nozzles so that streams of com-

bustion air surrounding streams of gaseous fuel are admitted into the combustion chamber and having other air passages intervening between the discharge nozzles and the side wall of the combustion chamber for delivering a blanket of air between the flame and the side wall of the combustion chamber.

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