

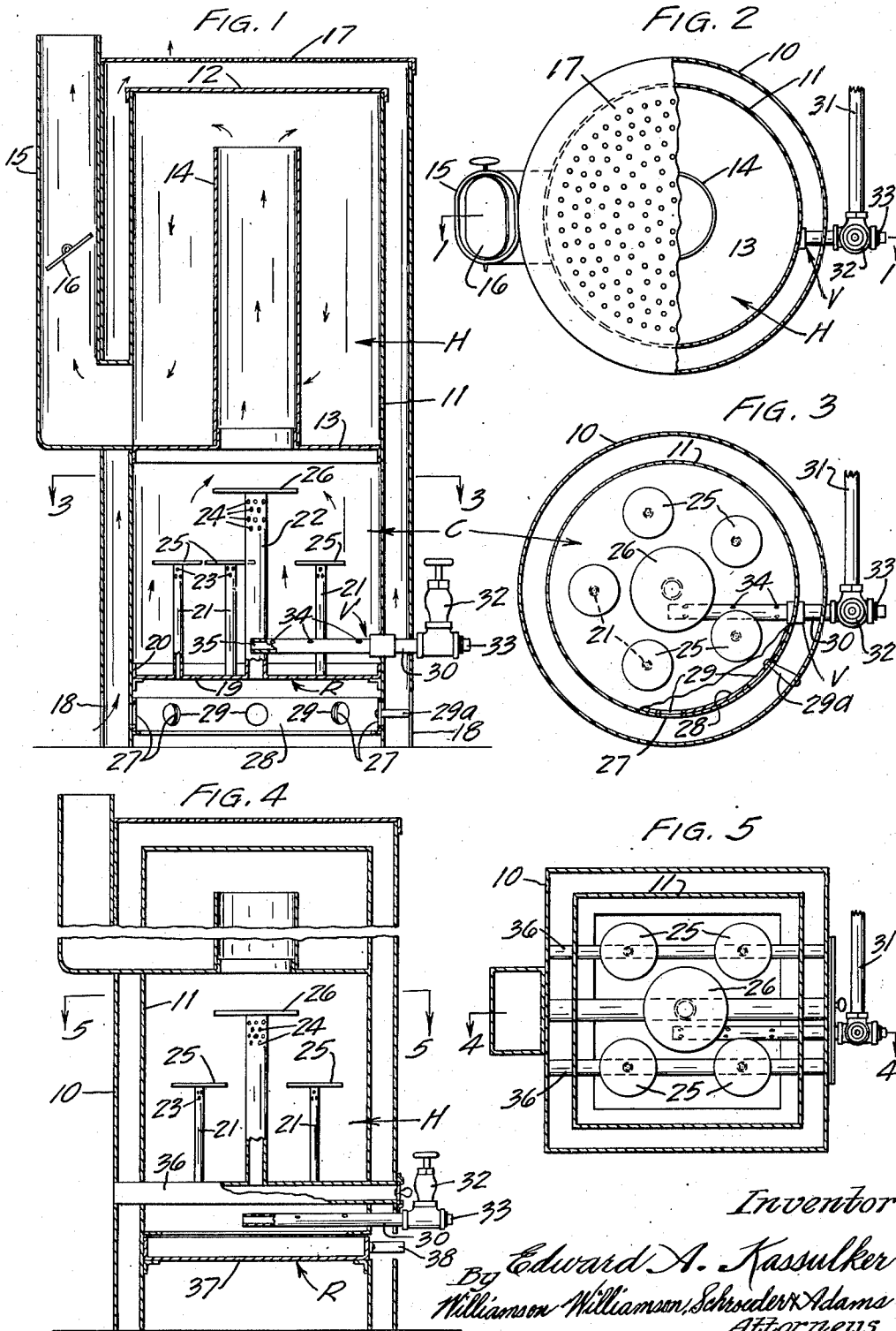
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LIQUID FUEL BURNER

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LIQUID FUEL BURNER

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This invention relates to the burning of combustible liquid fuels such as hydrocarbons and has particular application to the burning of waste and crude oil products containing in many instances, difficultly combustible materials, sludge, non-combustible solid and liquid materials and materials which may be dissolved or suspended therein.

Heretofore to my knowledge, it has been difficult to burn for heating or other purposes, waste oils obtained as for example from automotive crank cases as well as crude oils often containing tars, sludge and some non-combustible materials. Most liquid fuel burners become clogged and fail to adequately vaporize the less volatile combustible ingredients with the result that an exceedingly low efficiency of combustion is obtained through the use of such devices. Free passage of solid particles and facilities for readily cleaning out the burner structure are requisites to the provision of a highly satisfactory burner of the class described.

It is an object of my invention to provide a comparatively simple but highly efficient burner device for successfully burning waste oils and other combustible liquid fuels containing non-combustible ingredients, sludge and solid particles and the other constituents previously referred to.

A further object of a burner device of the class described wherein the waste or crude fuel supply is initially conducted through a combined vaporizing and fuel-distributing medium or conduit subjected to heat largely through radiation from the subsequent combustion of vapor mixtures and wherein selective discharge of vapors from the fuel ingredients of higher volatility is initially obtained from said conduit with subsequent delivery of the less volatile ingredients and non-combustible and solid constituents in a stream flowed to a collection and vaporizing surface which may constitute the bottom of the burner chamber or housing.

Another object is the provision of burner apparatus of the type described wherein the close cooperation of said combined vaporizing and fuel-distributing conduit with efficient primary and secondary fuel mixing media produces an exceedingly hot combustion with the attendant function of substantially complete vaporization of all combustible constituents through radiation of heat.

Still another object is the provision in structure of the class described of primary and secondary fuel vapor oxidizing media which determines the area of combustion and through its inherent structure and relation with the burner chamber produces spreading and dispersion of the fuel vapors with subsequent recongregation thereof followed by a secondary admixing and subsequent combustion.

Another object is the provision of a simple, inexpensive and highly efficient method of burning waste oil products and crude hydrocarbons of the type described, wherein incombustible residue from the fuel will not interfere with the trouble-free operation of the burner for a comparatively long period of time and in which ultimate

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accumulations of incombustible material may be cleaned and removed from the burner with a minimum of effort.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a vertical section of my liquid fuel burner with some of the parts thereof shown in full;

Fig. 2 is a top view of the burner shown in Fig. 1 with a portion of the foraminous top cut away to show the interior thereof;

Fig. 3 is a horizontal section of the form of fuel burner shown in Fig. 1 taken on the line 3—3;

Fig. 4 is a vertical section of another form of my liquid fuel burner with some of the parts thereof in full and some in section;

Fig. 5 is a horizontal section of the form of liquid fuel burned in Fig. 4 taken on the lines 5—5.

Referring now more particularly to the drawing, Fig. 1 shows a vertical section of one form of my liquid fuel burner which may be equipped with a conventional outer casing 10 and an inner heat-exchanging casing 11. The inner casing 11 in the form shown is circular in shape and is closed at the removable top 12 and supplied with an intermediate annular sheet 13 which divides the inner portion into a combustion chamber indicated generally at C and a heat-exchange chamber indicated at H. The annular plate 13 has an upstanding pipe or tube 14 which extends near the top 12 but not so close thereto as to shut off the circulation and withdrawal of combustion gases coming upwardly from the combustion chamber C to the heat-exchange chamber H. Communicating with the heat-exchange chamber at a lower portion thereof is the outlet pipe or chimney 15 which extends upwardly and discharges the exhaust gases to the atmosphere in the ordinary manner. A damper 16 may be situated within the pipe 15 so as to control the rate of withdrawal of exhaust gases. The outer shell 10 may be equipped with a removable foraminous top 17. Air or other fluid to be heated may be circulated through bottom openings between legs 18 on the outer shell 10 and in contact with the casing 11 of the stove proper, from whence the heated fluid will circulate upwardly through the foraminous openings in the top 17. At the bottom of inner shell or casing 11 is fuel receiving member R which, in the form shown in Fig. 1 is a circular plate 19 with upstanding flanged edges 20.

Disposed in spaced relation with the surface of the fuel receiving member 19 are upstanding air supply tubes which constitute a media for admixing combustion supporting gas with the vapors of liquid fuel arising in the combustion chamber C. The air supply media in the form shown consist of upstanding air supply tubes 21 which are arranged in a circular fashion as shown in Fig. 3 about a larger centrally disposed air supply tube 22 the outer end of which extends for a greater distance than the ends of smaller air supply tubes 21. Adjacent the ends of the air supply tubes 21 and 22 are air discharge areas which have restricted openings such as holes 23 in tubes 21 and holes 24 in air supply tube 22. It is understood, of course, that all the air supply tubes communicate with atmospheric air and in the form shown in Fig. 1 are fixed to the fuel receiving member R which is also the bottom of the combustion chamber C. At the other extremities of the air supply tubes are positioned flame spreading and vapor mixing means such as plates or flame spreaders 25 on tubes 21 and flame spreader 26 on air supply tube 22. The flame spreaders 25 and 26 are preferably formed of refractory material and close off the outer ends of the air supply tubes. I have found it useful to form the refractory flame spreaders in a circular form as more readily

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seen in the top view of Fig. 3. Air furnished to the air supply tubes may enter between legs 18 of the outer shell of my stove and progress through openings 27 which, for convenience, may be arranged circularly so that an annular ring 28 having corresponding openings 29 may be circularly moved so as to bring the holes 29 in register or out of register with the holes 27. Annular ring 28 may thus be manually controlled through handle 29a.

Disposed within the combustion chamber C and overlying the fuel receiving bottom member R is a fuel distributing and vaporizing member V which is considerably smaller than the fuel receiving member R and constitutes a conduit 30 attached to supply line 31 having a fuel control such as valve 32 interposed therein. Aligned with the longitudinal disposition of the conduit 30 is a removable element 33 which is adapted to be taken off for cleaning of the conduit 30 and replaced subsequently thereto. The conduit 30 may be equipped with openings 34 through which the more easily vaporized liquids can escape in the form of a combustible gas. At the end of the conduit 30 is a discharge 35 which is unrestricted in nature so as not to prevent a cleaning instrument from projecting the entire length of conduit 30. I prefer to arrange my fuel distributing and vaporizing member V in such a manner that the area beyond the unrestricted discharge 35 will be free for the projection of a tool during the cleaning thereof. Thus the entire element V is disposed slightly to one side of the radial position so as not to be aligned with the air supply tube 22.

Another form of my invention is shown in Figs. 4 and 5 in which the air supply media and fuel distributing and vaporizing member cooperate in substantially the same manner. However, instead of having the air supply media connected directly with the fuel receiving member or bottom R as in the first form of my invention I have furnished a separate air duct means for both supporting and supplying the air supply media with atmospheric air. I may utilize several air ducts 36, some of which support and supply a plurality of tubes with a supply of air. The air ducts 36 may be conveniently mounted within openings through both the inner shell 11 and outer shell 10 of my stove structure. The fuel receiving member R in the form shown in Figs. 4 and 5 constitutes a pan or removable clean-out tray 37 which forms the bottom of the burner casing or housing of combustion chamber H. Tray or bottom 37 can thus be removed by means of handle 38 whenever a sufficient accumulation of sludge, metal filings and incombustible material has become deposited upon the surface thereof.

In the operation of my liquid fuel burner the fuel is conducted by gravity or otherwise through supply line 31 to controlling member 32 which regulates the rate of flow into the fuel distributing and vaporizing member V. The top 12 covering the hot air duct 14 may be removed and a preheating material such as newspaper or wood shavings may be lighted and thrown down the duct 14. The oil or liquid fuel entering the fuel distributing and vaporizing member will run out the open unrestricted discharge 35 and spread upon the fuel receiving member 19. After the preliminary burning has taken place so as to heat the interior of combustion chamber C and the housing walls 11 at the combustion chamber, the conduit 30 will then begin to heat to a point where the fuel supply will distill as it progresses along the bottom of the conduit 30. As a consequence, the lighter ends or more easily volatilized constituents of the liquid fuel will vaporize and rise through the openings 34 into contact with the atmosphere of the combustion chamber. The residue of the liquid fuel will progress to the end of conduit 30 and drip from the unrestricted discharge 35 on to the bottom of the combustion chamber which constitutes a fuel receiving member, since the area of the surface of the fuel receiving member 19 is considerably greater than the surface area of the fuel distributing and vaporizing member much more of it is subjected to heat radiation

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from the intense flames above. Thus the more difficultly distilled products which have dripped to the bottom of the chamber will be volatilized under this intense heat radiation and contribute to the combustible vapors available for burning. It is obvious, of course, that some of the constituents in the residue will be completely incombustible. There is a certain amount of sludge such as is present in the drainings from the crank case of automobiles which contains steel particles, carbon and dirt. Other waste oil products such as may be found in garages and filling stations may have products such as grease which contains soap and other difficultly combustible materials. On the other hand these waste oil products may contain such volatile constituents as gasoline and ether which may have been used in relatively smaller quantities for cleaning purposes. With such a wide variety of materials ranging from difficultly combustible substances to explosive substances I have found that my liquid fuel burner has accomplished an extremely efficient burning of the fuel over its entire range of volatility. As the combustible vapors rise in the chamber C air is drawn through the supply tubes 21 and 22 and is discharged through the restricted openings 23 and 24. An incomplete combustion is first obtained from the air being discharged through the restricted openings 23. The flaming vapors are then spread from beneath the flame spreaders 25 and are again congregated above the tops of the flame spreaders. The air being discharged from the larger openings 24 again mixes with the incompletely burned vapors so as to supply oxygen for the complete combustion thereof. This is done by a second spreading of the flames after having been first congregated and supplied with secondary combustion air. Following the second spreading the combustion products are discharged through the hot air duct 14 and are reversely drawn against the casing 11 at the heat-exchange portion thereof and finally discharged through chimney element 15.

Since the fuel distributing and vaporizing member V is primarily a distillation apparatus within the combustion chamber there will be a slow accumulation of incombustible material along the bottom of the conduit portion. Whenever the accumulation becomes serious enough to interfere with the operation of my burner I can merely remove the plug element 33 and clean conduit 30 by such means as a cleaning rod or tool. The scrapings or sludge removed therefrom will fall from the unrestricted discharge 35 and accumulate upon the surface of the fuel receiving bottom member which likewise will accumulate sludge and incombustibles over a much longer period of time. When the incombustible material becomes deep enough to approach the fuel distributing and vaporizing member V or so that fuel will overflow the upstanding flanges 20 then the burner may be disassembled by removing the annular plate 13, the fuel distributing and vaporizing member V and finally the fuel receiving bottom 19 together with its air supply media disposed thereon. After cleaning, the burner may be reassembled for another long and trouble-free operation.

In the form shown in Figs. 4 and 5 it is, of course, only necessary to clean the conduit 30 when desired and to allow the accumulated incombustibles to lie upon the pan or tray 37 until it is desired to remove the accumulation, at which time it is merely necessary to pull out the tray and scrape off or otherwise eliminate the material from the bottom thereof.

It may thus be seen that I have accomplished a highly efficient and simple method and apparatus for burning waste oil containing incombustibles and a wide range of volatile substances in a manner such as to be economical, both from the standpoint of first cost, as well as of operating cost and maintenance.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention.

What I claim is:

1. A burner for liquid fuel such as waste oil products and crude hydrocarbons having in combination a burner housing, a combined vaporizing and fuel-distributing conduit having a restricted delivery area in a portion thereof for discharge of vapors from the more volatile fuel products and having a substantially unrestricted discharge, a fuel receiving and vaporizing member disposed below the unrestricted discharge of said conduit, a first air supply tube having a restricted air discharge area adjacent the outer end thereof disposed in unobstructed spaced relation to said fuel receiving member, a second air supply tube disposed in spaced relation to said fuel receiving member and having a restricted air discharge area adjacent the outer end thereof, said outer end of the second air supply tube extending beyond the outward end of said first air supply tube, and means cooperating with the outward ends of each said first and second air supply tubes for spreading and mixing flames and vapors.

2. A burner for liquid fuel such as waste oil products and crude hydrocarbons having in combination a burner housing, a combined vaporizing and fuel-distributing conduit for preliminary vaporization of the light ends of said fuel and delivery of the heavier ends from an unrestricted opening therein, a fuel receiving and vaporizing member having an area disposed horizontally below the outlet of said conduit, first tubular air supply means communicating with atmospheric air through the wall of said burner housing and having a restricted air discharge with-

in the space defined by said burner housing, said first tubular air supply means having means above the restricted air discharge for spreading and mixing air with burning gases in substantially unobstructed clearance with the fuel receiving and vaporizing member, second tubular air supply means also communicating with atmospheric air through the wall of said burner housing and having a restricted air discharge within the space defined by the housing disposed upwardly beyond said first tubular means, said second tubular means having spreading and mixing means overlying its restricted discharge for additional oxidation of burning gases directed and recombined from said first spreading and mixing means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,702,929	Breese	Feb. 19, 1929
1,885,674	Beadle	Nov. 1, 1932
1,933,044	Cannon	Oct. 31, 1933
2,184,653	Sherrick et al.	Dec. 26, 1939
2,257,834	Behee	Oct. 7, 1941
2,292,339	Mayo	Aug. 4, 1942
2,333,815	Petsel	Nov. 9, 1943
2,367,460	Dekker	Jan. 16, 1945
2,373,310	Hayter	Apr. 10, 1945
2,501,116	White et al.	Mar. 21, 1950
2,511,932	McKenzie et al.	June 20, 1950
2,671,505	Dekker	Mar. 9, 1954