Oct. 4, 1949. H. C. LITTLE 2,483,978

TRAY TYPE OIL BURNER

Filed May 12, 1944 2 Sheets-Sheet 1

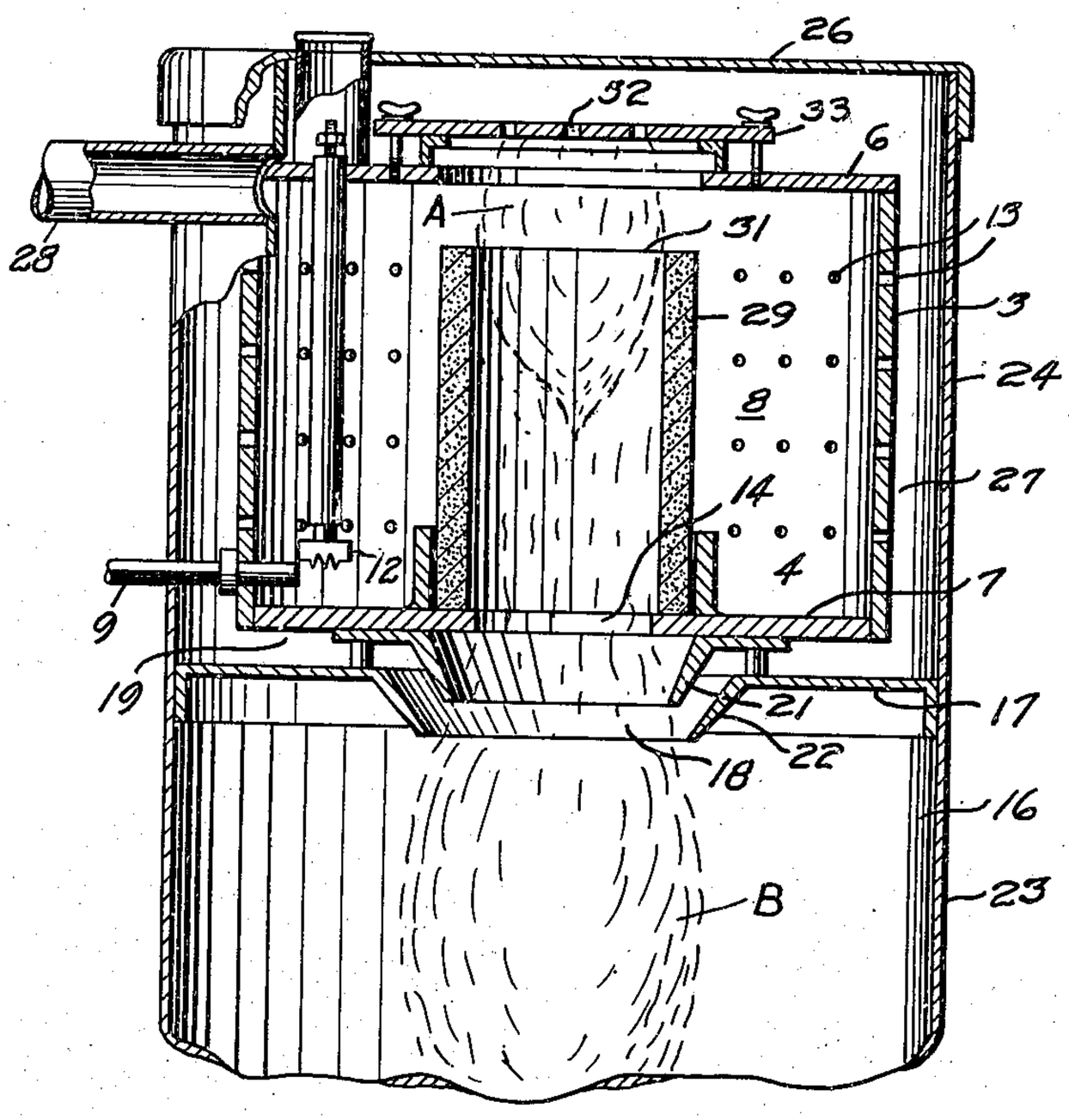

FIG_1_

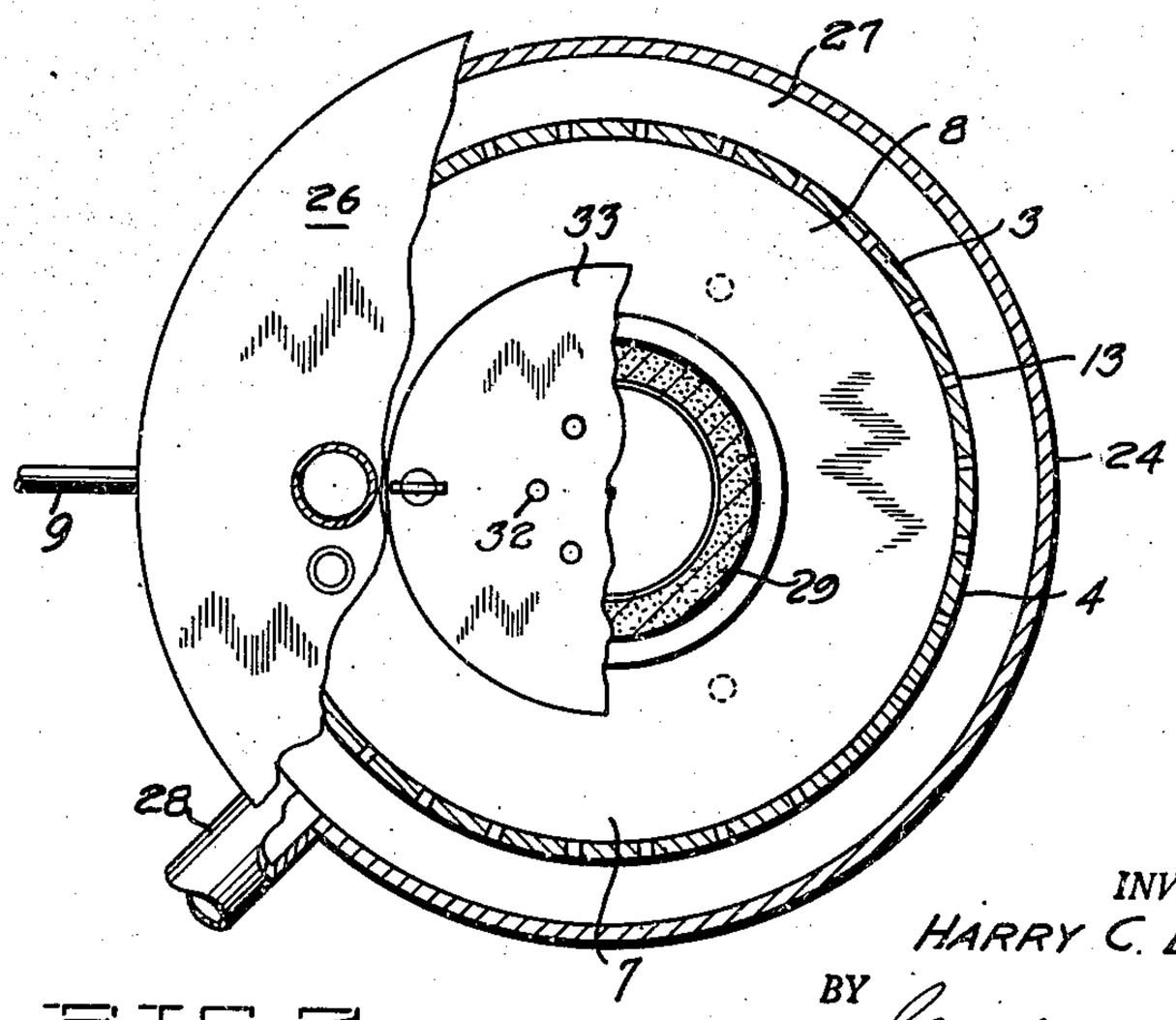

FIG_2_

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TRAY TYPE OIL BURNER

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2 Sheets-Sheet 2

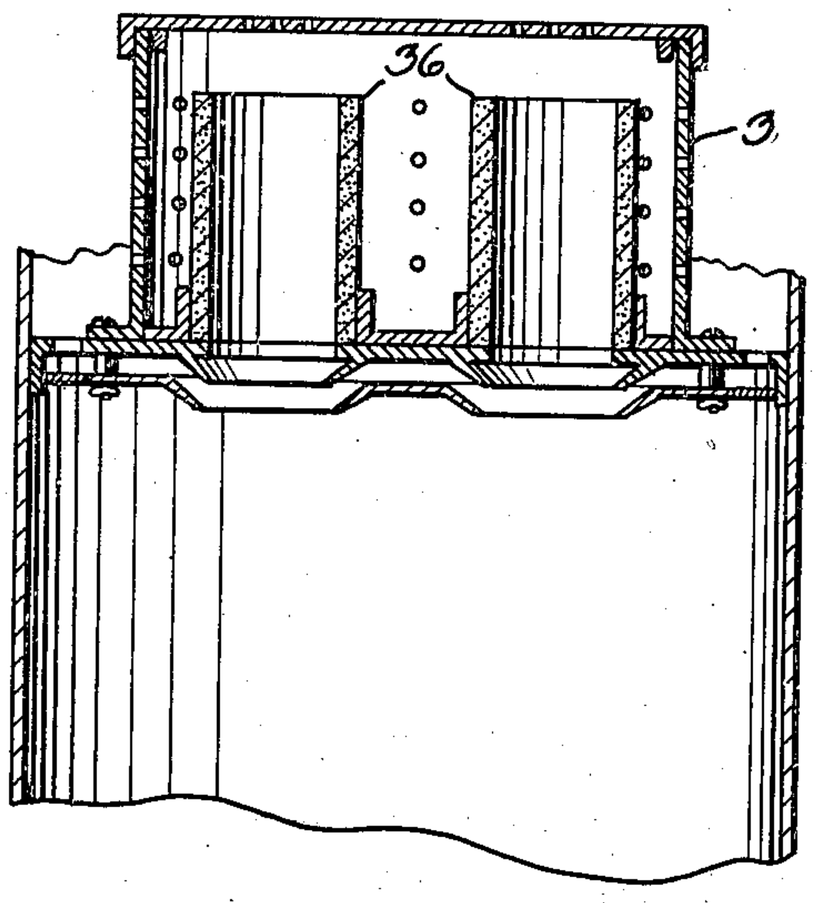

FIG. 3.

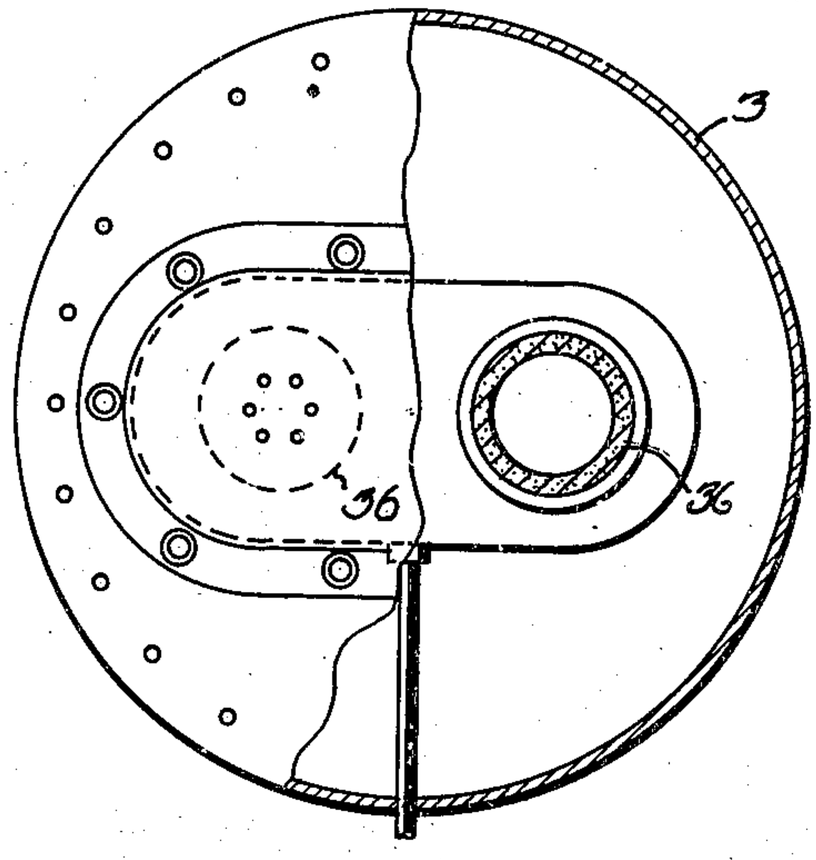

FIG. 4.

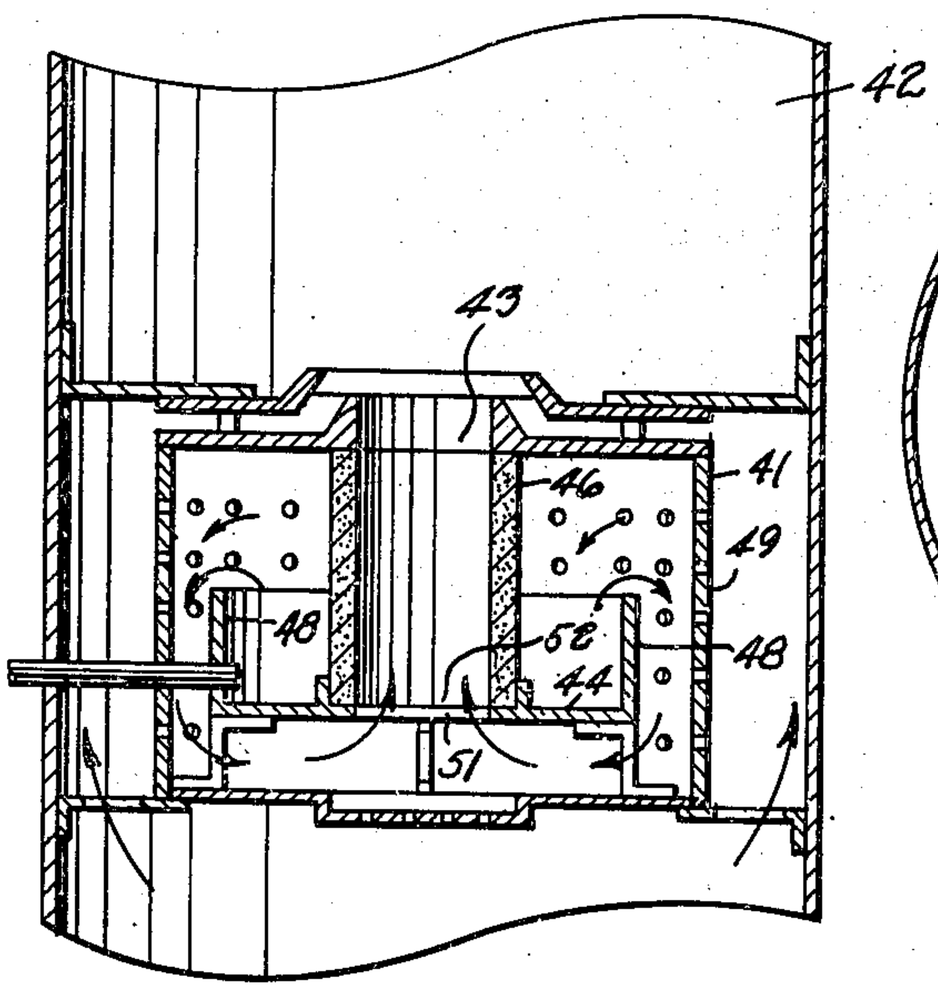

FIG. 5.

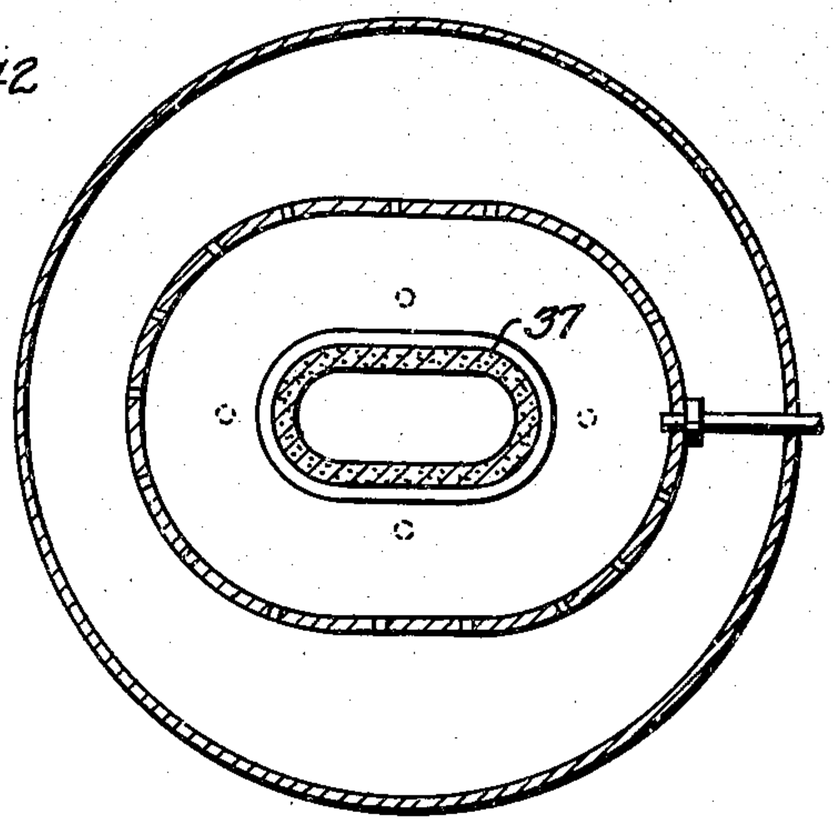

FIG. 6.

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UNITED STATES PATENT OFFICE

2,483,978

TRAY TYPE OIL BURNER

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Application May 12, 1944, Serial No. 535,321

4 Claims. (Cl. 158—91)

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The invention relates to an oil burner and more particularly to oil burners of the type where fuel oil is admitted to and vaporized in a generator or vaporizing chamber, mixed therein with primary air in proper combustion proportions and discharged in contact with secondary air for burning in a combustion chamber.

An object of the invention is to provide a burner of the character described in which vaporization of the oil in the generator chamber is effected by means of a source of high temperature located directly within the chamber and provided by burning of the vaporized oil and primary air mixed in the chamber, but so arranged that the products of combustion given off thereby will be kept from associating with the fuel mixture in the chamber.

Another object of the invention is to provide a burner of the character described in which the walls or other members associated with or comprising the throat of the burner are made to extend into the interior of the generator, and the fuel mixture caused to burn within or otherwise so as to heat such walls, and thereby permit a heat exchange between the walls and the fuel in the chamber in closely coupled relation and without admission of the products of combustion to the chamber and contamination with the fuel mixture generated therein.

A third object is to provide an oil burner in which heat transfer to the vaporizing chamber and oil vaporization temperature are automatically controlled and co-related with the fire magnitude.

A fourth object is to provide an oil burner having quick starting and rapid oil vaporization characteristics even with low fire operation, so that there will be no accumulation of carbon and other undesirable residue in the vaporizing chamber.

A fifth object is to provide an oil burner of the character described in which the relative position of primary and secondary air supply as well as of the combustion zone will be automatically altered as flame magnitude is changed.

A sixth object of the invention is to provide an oil burner in which the length of travel of the oil vapor and primary air in association and before burning, will be automatically varied in accordance with the amount of oil being consumed and the extent of the draft pressure, thereby insuring a proper mixing of the vapor and air under all conditions.

A seventh object is to so design the burner that the secondary air passing to the throat of the burner will be better conditioned to promote combustion and at the same time will aid in preventing complete cracking of the liquid fuel and the attendant formation of carbon and gum in the vaporizing chamber.

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The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

In the drawings:

Figure 1 is a vertical sectional view through a burner illustrating one form of the invention.

Figure 2 is a plan view with portions of the burner top broken away to reveal interior structure.

Figure 3 is a vertical sectional view through the generator and combustion chambers of a modified form of the invention utilizing a plurality of burner throats.

Figure 4 is a transverse partly broken away sectional view of Figure 3.

Figure 5 is a view similar to Figure 4 but showing a slight variation in design.

Figure 6 is a longitudinal sectional view of a burner of a still further modified form.

Briefly described my invention consists in arranging within the fuel generating or vaporizing chamber a tubular member through which the vaporized oil and air are required to pass to reach the throat orifice or other point at which the products are delivered from the generator to a combustion chamber or the like. At the time the vaporized oil and air reach the tube, the mixture is sufficiently conditioned to support combustion so that low stage operation or fire can be effected. This burning within the tube, creates even at low fire operation, an intense heat directly within the generating chamber, the walls of the tube serving to distribute throughout the chamber high vaporizing temperatures and at the same time guide the products of combustion to the delivery orifice and keep them separated from the vaporized oil and air in the generating portion of the chamber. On increasing the supply of fuel in the chamber and raising draft pressure, the flame in the tube will be advanced until at high fire operation, it will have moved through the orifice and become projected into the combustion chamber. In this latter position, it remains contiguous with the tube, and due to

its increased size, an even greater amount of heat is developed in the tube and passed through the walls to the interior of the generator. The burner is also designed in such manner, that as the operation changes from one fire to another, a corresponding change in location of the source of the air supply is effected, and as an important part of the preferred form of the invention, a radical departure is made from conventional burners of this type, in that the throat orifice of the burner is located at the bottom of the generator chamber whereby the flame will be directed downwardly instead of upwardly and the combustion chamber may be disposed underneath instead of being superimposed over the burner.

A detailed description follows:

In the preferred form of the invention which is illustrated in the Figures 1 and 2, the burner comprises casing 3 having cylindrical side walls 4 and top and bottom walls 6 and 7, all of such walls combining to define a fuel generating chamber 8. Oil in liquid form is supplied to the chamber 8 through a pipe 9, so as to spread over the bottom wall 7 and provide a large exposed oil surface or pan in the chamber. The level of the oil may be controlled by a suitable float valve (not shown) and ignition for starting may be effected by means of an electrically heated coil 12. Primary air for mixture with the oil in the chamber is admitted through openings 13 in the side walls 6.

Arranged as here shown in the bottom wall 7, is an orifice 14 designed to define in part the throat for the burner and the point at which the products are discharged from the casing. As both fuel oil and the orifice are thus disposed at the bottom of the chamber, a flange or other part is disposed around the orifice at the inner side of the wall 7 so as to retain the oil in the chamber.

The products discharged from the orifice 14 are introduced into a casing 16 which may serve as a combustion chamber for such products if not already burned, or as a discharge duct or flue for the products if already burned. The casing 16, as will be clear from Figure 1, is disposed immediately under the generator casing 3 and has provided in its top wall 17 an opening 18 which registers with the orifice 14 and admits the products therefrom. The walls 7 and 17 are preferably spaced to provide a passage 19 for secondary air for admixture with the products entering the combustion chamber, and desirably rings 21 and 22 are respectively associated with the openings 14 and 18 whereby a burner throat will be provided which will include such openings and the spaces within the rings.

As here shown the side walls 23 of the combustion chamber casing are extended upwardly to provide an enclosure 24 for the casing 3 and preferably a cover 26 is provided at the top so as to complete the enclosure. The enclosure 24 as will be noted is spaced from and defines with the casing 3 an air distributing chamber 27, and air may be admitted to this chamber for supplying the required primary and secondary air to the burner, by means of a conduit 28. The burner as will be understood may be operated under forced draft or simply under draft induced by a flue or stack (not shown) connected to the combustion chamber casing. Where, as here, it is preferred to utilize a forced draft a suitable blower may be associated with the inlet conduit 28. Furthermore where only a natural draft is desired, the enclosure 24 may be eliminated.

As will be understood, the oil in the generating chamber is to be vaporized by heat supplied to such chamber, and when changed to such form and mixed with primary air supplied as through the openings 13, is drawn toward the orifice 14. Heretofore, the heat for vaporizing the oil in the chamber was generally provided by a source of heat located entirely outside of the chamber or by means of fire located within the chamber and directly exposed to the vaporizing oil. In the former of these arrangements, the vaporizing temperatures were usually too low, while in the latter the products of combustion would expand toward and mix with the vaporizing oil and air, displace the free oxygen and thereby prevent the efficient combustion of the oil vapor. In accordance with my invention, the source of heat for vaporization, may be in the form of fire positioned directly within the oil chamber but without danger of the products of combustion therefrom mixing with the oil and air in the chamber, thus permitting high vaporizing temperatures as well as efficient burning of the fuel. Furthermore, with my invention, such effective vaporization and efficient burning will be provided for in low, high and intermediate fire operation of the burner, and in addition the vaporizing temperatures will be automatically increased or decreased as the operation of the burner is changed from low to high fire or vice versa.

In accordance with the above, there is provided directly within the generating chamber 8, a tubular member 29 here shown of cylindrical form and coaxial with the walls 4 and extending from the orifice 14 so that in a sense such member provides an extension of the burner throat. The member 29 at its lower end is preferably in contact with the bottom wall 7 or the flange surrounding the orifice, while at the upper end 31 it is spaced from the top wall 6 or otherwise formed to permit access between the interior of the member and the exterior thereof within the chamber. Since the member 29 thus prevents access between the interior of the generator casing and the orifice 14 except by way of the interior of the member, the products in the chamber will be required to pass into the tube preparatory to discharging through the burner throat. It will thus be clear that during the operation of the burner the oil vaporized in the chamber together with the air admitted thereto will be drawn to the inlet end 31 of the tube member, and in the present design of the burner, the relationship of the parts is such that with a small amount of oil being supplied to the chamber, the vaporized mixture in the chamber will by the time it reaches said inlet be in condition for combustion and become ignited. To complete combustion at this point a plurality of holes 32 for admission of secondary air are provided in an offset portion 33 of the top wall directly overlying the tube, and in this manner there will be formed, as indicated in Figure 1, a well defined blue flame A extending from said offset portion to a point within the tube, such flame providing for low fire operation of the burner. Preferably the tube is made of a fire-resistant heat conducting material such as a refractory ceramic. The portion 33 is conveniently removable in order to permit the replacement of the tube and access to the chamber.

It is important to note that not only is the distance between the offset 33 and the inlet 31 relatively small, but the diameter of the tube is quite small as compared to that of the chamber, and

in this manner the velocity of the mass moving downward through the tube to the orifice 14 will be relatively great so that none of the products of combustion will spread into the chamber, displace the free oxygen therein, and thus prevent the efficient combustion of the vapor when it subsequently reaches the burning zone. It is this feature of preventing the spread of the products of combustion and of confining them to the tube that results also in keeping the vaporizing chamber clear of carbon at all times. I have found that very good results for this phase of the invention may be obtained by designing the burner with the parts in the following proportions. For instance when using a generating chamber of about eight inches in diameter, the inside diameter of the tube should be about two and three quarters inches, and as regards the height of the parts with the chamber about five and one-half inches, the length of the tube is desirably about four and one-half inches. The cross-sectional area of the tube may be increased without diminishing the flow, by restricting the inlet area to the tube such as by reducing the distance between the end 31 and the opposing wall portion of the chamber.

As oil in greater amount is supplied to the generator chamber and the rate of vaporization increased, the flame will be advanced down through the tube to provide for increased magnitude of fire until as indicated in Figure 1, a large white flame B is created which extends through the throat portion at the rings 21 and 22 and deep into the combustion chamber 16. The flame B provides for high-fire operation of the burner, and it is to be noted that as the burner has shifted to operation on high-fire the source of the secondary air supply has for the most part changed from the openings 32 to the passage 19, the openings 32 at this operation serving in part as an additional source of primary air.

A most important advantage arising out of the use of the tube and the burning of the fuel therein or contiguous thereto, is that of providing for the very effective vaporization of the oil in the generating chamber for all magnitudes of burner operation. As will be evident, due to the burning of the fuel in the tube, the entire wall of the tube will become intensely heated so that a tremendous amount of heat will be transferred from such wall directly to the interior of the chamber. This heat transfer will not only provide for high vaporizing temperature in the chamber, but due to the fact that the tube extends and is exposed for practically the full height of the chamber, such vaporizing temperature will be distributed through the chamber and follow through with the vapor until burned or drawn into the tube. It is important to note that as the magnitude of burner operation is increased or decreased, that is as the operation is increased from low to high-fire and vice versa, the vaporing temperature created by the tube will be correspondingly varied. Thus when the burner is operating on low-fire the flame is of relatively small size and is positioned at the greatest distance from the oil surface at the bottom of the vapor chamber, and when the supply of oil is increased the zone of intense burning will descend in the tube and thus not only come nearer to the oil surface but will increase in size. When high-fire operation is reached, the flame will have become so enlarged that it will direct a most intense heat throughout the interior of the tube to provide maximum vaporizing temperatures in the generator chamber. It will thus be clear that high and most effective vaporizing temperatures are made available for all burner operations with substantially no exposure of the flame to the vaporizing chamber and no opportunity afforded the products of combustion for spreading to the vaporized oil and air in the chamber. Furthermore, with the tube arrangement of my invention, not only is there thus afforded the high burning efficiency of the products in the tube and the high vaporizing temperatures in the generating chamber, but there is a substantially complete inhibition of combustion within the portion of the chamber devoted to vaporization and combining for burning. This characteristic of the burner is of utmost importance and constitutes a major improvement in the art.

As previously explained, the passage at the burner rings 21 and 22, is defined by the bottom wall of the casing 3 and the top wall 17 of the combustion chamber, and in this manner the continual passage of fresh air under the wall 7 will serve to prevent overheating of the unvaporized liquid in the generator and any resultant formation and accumulation of gummy products.

Where an increased capacity is desired, the burner may as shown in Figures 3 and 4, be provided with a plurality of tubes 36, and where it is desired to provide a flame with a greater spread in one direction, a tube 37 of elongated cross sectional area may be utilized as shown in Figure 6.

While it is apparent that the burning and vaporizing features of my invention are most advantageous when incorporated in a burner with the throat at the bottom and the flame arranged to be directed downward and into a duct or combustion chamber under the generator chamber, it is possible to apply such burning and vaporizing features to burners of conventional forms such as where the generator casing is below the combustion chamber and the throat of the burner extends between the top of the generator and bottom of the combustion chambers. This type of arrangement is shown in Figure 5, where the generator chamber 41 is disposed under the combustion chamber 42 and has its throat 43 at the top of the generator and extending into the chamber 42. The oil is supplied to a slightly elevated pan 44 in the generator chamber, and the tube 46 rests on the pan and extends to the throat at the top of the chamber. Side walls 48 of the pan extend upward in spaced relation to the side walls 49 of the generator chamber casing and there is defined between these two walls and between the pan and the bottom walls of the casing. a passage 51 through which the vaporized oil from the pan may travel in company with the air to the inlet end 52 of the tube. It will be evident that with this arrangement the flame will be increased in magnitude and advanced toward the combustion chamber as more oil is supplied, and that the oil in the pan will be vaporized by the heated tube in substantially the same manner as in the embodiments of the invention first described.

I claim:

1. An oil burner comprising a casing providing an oil vaporizing chamber and having air inlets in the side walls thereof, an oil pan within but spaced from the bottom, top and sides of the casing to provide a passage at the bottom and sides of the chamber, means to supply oil to said pan, means adjacent the top of the casing providing a burner throat in communicating with said cham-

ber, said pan having an opening in the portion thereof defining the top of the passage and communicating with said passage, a tube extending between and registering with said throat and said opening and being closed to the chamber at the upper end of the tube, and means in the bottom of the chamber for supplying air to said passage adjacent said opening.

2. In an oil burner, a casing providing a substantially enclosed oil vaporizing and mixing chamber with a liquid oil receiving surface substantially at the bottom thereof, means on the casing providing a burner throat leading from the chamber, a tube providing a passage for burning oil vapor from the chamber to the throat extending into the chamber and substantially sealed from the chamber at said throat and having an end open to the chamber at a point relatively remote from said throat adjacent the top of the chamber, means at the sides of the chamber and opposite the sides of the tube and substantially below the top thereof for supplying air to the chamber over said surface, means for supplying air to said tube adjacent said end, the size and relationship of the tube, the chamber including said surface, and each of said means, being with respect to one another such that the vapor from the chamber passing to the tube will burn within substantially the entire length of the tube.

3. In a burner, a casing providing a substantially enclosed oil vaporizing and air mixing chamber with a burner throat leading from a wall thereof and a liquid oil receiving surface substantially at the bottom thereof, means in the sides of the casing for introducing air from the exterior of the casing to the interior of the chamber, a radiant tube extending upwardly from adjacent said surface to adjacent the top of said chamber and providing on the interior thereof a combustion zone and passage for the oil vapor and air mixture from the chamber to the throat, said air introduction means being substantially below the level of the upper end of said tube and means independent of said first means for introducing air substantially directly into said passage from without said chamber at an end of said tube, the chamber including said surface, and each of said means, being with respect to one another such that the vapor from the chamber passing to the tube will burn within substantially the entire length of the tube.

4. An oil burner comprising a casing providing an oil vaporizing and air mixing chamber with a surface for the reception of oil, means on said casing providing a burner throat communicating with said chamber, a tubular heat radiating member of refractory material within said chamber defining with a portion of said casing a reduced fuel burning passage from the chamber to said throat, the sides of said casing at portions at a level substantially below the top of said tube having air supply openings to the interior of the chamber, air conducting means from the exterior of the casing adjacent the entrance end of said heat radiating member and providing for a lesser supply of air than said first means, said heat radiating member extending and having its sides exposed to the interior of the chamber substantially for the full height of the chamber, and means surrounding and spaced from said tube at the base thereof to separate said tube from the oil on said surface, the chamber including said surface, and each of said means, being with respect to one another such that the vapor from the chamber passing to the tube will burn within substantially the entire length of the tube.

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