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OIL BURNER

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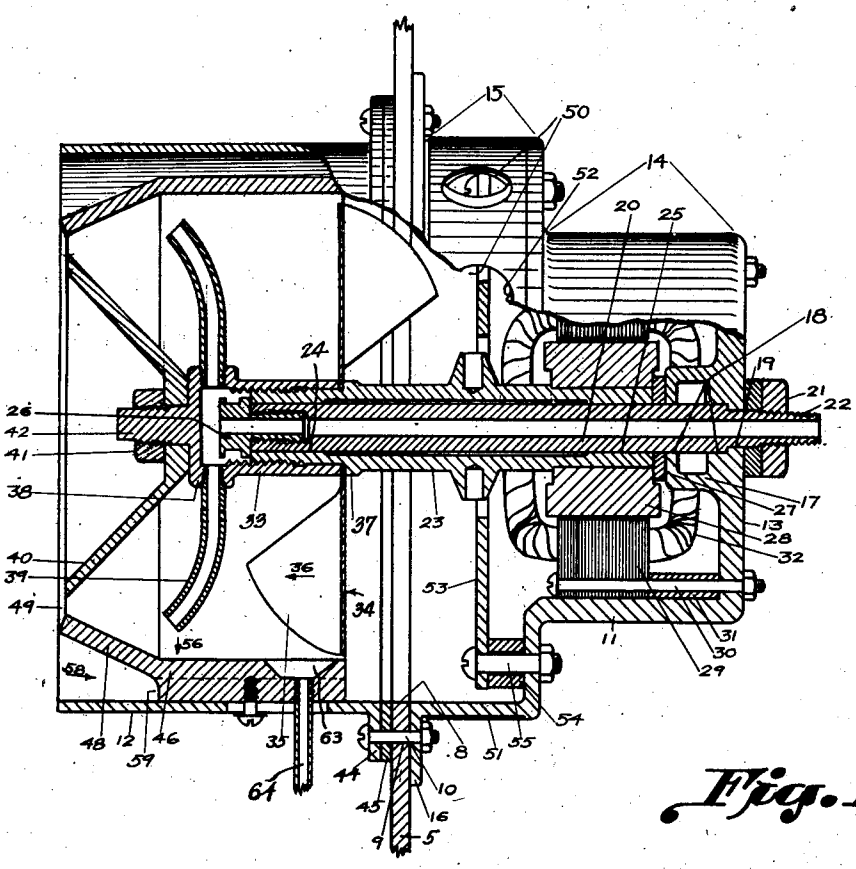


Fig. 1.

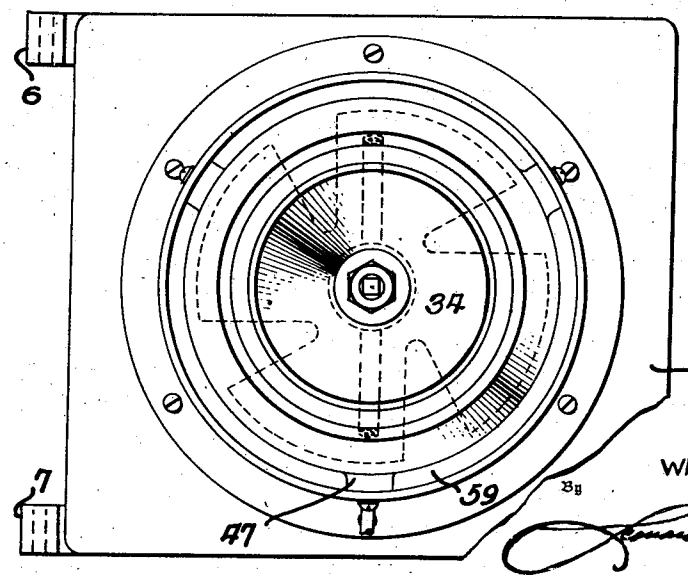


Fig. 2.

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OIL BURNER

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11 Claims. (Cl. 158—53)

The present invention relates to a new and useful oil burner, which may be mounted in any suitable furnace or boiler, either in an opening especially provided therefor, or may be mounted in one of the door openings of the furnace, or may be mounted directly upon one of the doors of the furnace.

The object of the present invention is to provide an oil burner which will be efficient, simple in construction, durable, and of low cost, and which will operate silently.

With the above and other objects in view, the present invention consists of an oil burner, wherein the oil is projected by centrifugal force against a generally cylindrical wall, where it is broken up and transformed into vapor, partly by the impact of the oil against said wall and partly by the heat of the wall, the inner surface of said wall forming the outer boundary of a main air passageway through which air is forced by a suitable air mover, and the outer surface of which wall forms one of the walls of an annular passageway through which heated or burning gases are drawn into the air mover.

The present invention further consists in forming a generally annular air passageway which may gradually diminish in effective cross-sectional area towards the discharge end thereof, and against the outer boundary surface of which oil is adapted to be projected by centrifugal force, in a zone spaced inwardly of the discharge end of said air passageway, said outer boundary wall of said air passageway being maintained at a high temperature by heated or burning gases drawn back and past said wall.

The present invention further consists of other novel features and details of construction, all of which will appear more fully from the following detailed description.

For the purpose of illustrating the invention, there is shown in the accompanying drawing a form thereof which is at present preferred, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

Referring to the drawing in which like reference characters indicate like parts,

Figure 1 represents a side elevational view, partly in section, of an oil burner embodying the present invention.

Figure 2 represents an end elevational view of the oil burner embodying the present invention.

The oil burner of the present invention may be mounted in any suitable opening in the wall of a furnace, although it is preferably mounted in the door opening of the furnace. This may be the fuel door or the lower door of the furnace, or, in the case of furnaces especially designed, a special door may be provided for the burner. In either event, the oil burner is preferably mounted upon a door 5, which is suitably hinged to the furnace wall by hinge members 6 and 7, which are adapted to coact with corresponding hinge members on the furnace wall and to be hingedly united thereto by means of a suitable pintle, not shown in these drawings.

The door 5, usually of cast iron or other suitable metal, is provided with a suitable sized round opening 8, and a series of small perforations 9 surrounding the main opening 8, for the reception of the fastening bolts or screws 10, by means of which the outer and inner frame or housing members 11 and 12 of the oil burner of the present invention may be secured to the door 5.

The outer frame member 11 may be formed of cast metal or sheet metal or the like, either integrally or built-up, and includes the terminal wall portion 13, the generally cylindrical motor housing 14, and the generally cylindrical air-inlet chamber 15, of relatively larger diameter, and the flange 16, by means of which said frame or housing member 11 may be secured to the outer side of the door 5, by means of the bolts or screws 10.

The center of the terminal wall 13 is provided with a central boss 17, through which an axial hole 18 is provided, the outer portion 19 of which is of slightly reduced diameter. Into the hole 18 and 19, a tubular pivot stem or stationary spindle 20 is inserted, which is held rigidly in place by the nut 21, which is threaded onto the outer threaded end 22 of said stationary spindle 20.

The inner tubular stem or stationary spindle 20 serves as an oil conduit for the conveyance of the fuel oil to the inner end of the burner, and also serves as a supporting member for the rotary parts of the burner. Thus, a tubular outer shaft or rotary spindle 23 surrounds the inner stationary spindle 20, and is suitably journalled thereon at the bearing or journal portions 24 and 25.

A retainer member 26 is threaded into the internally threaded inner end of the stationary spindle 20, and serves as a retainer for the outer

rotary spindle 23, because said nozzle 26 is provided with an annular shoulder which overlaps and engages the inner end of the spindle 23, and thereby locks the same against axial movement. A suitable fibre or other thrust washer or member 27 may be interposed between the inner end of the rotary spindle 23 and boss 17.

Upon the inner end of the rotary spindle 23, the armature 28 is mounted in any suitable manner, and is keyed or otherwise fixed thereto. The armature may be a wound armature or it may be merely a cage type or induction type armature, depending entirely upon the character of electrical motor desired. A suitable electrical field member, in the form of the laminated field pole 29 surrounds the armature 28, and is fixedly secured to the housing, by means of bolts 30, and a suitable spacer member or members 31. Any suitable electrical winding 32 is provided for the field.

The inner end of the rotary spindle 23 is externally threaded, and to this externally threaded inner end, a cap member 33 is threadedly secured.

The air mover, in the form of a multi-bladed propeller 34, may be formed of a single piece of sheet metal, stamped to the form indicated in dotted lines in Figure 2, with a central opening sufficient to fit over the inner end of the rotary spindle 23. The blades 35 of the propeller 34 are pitched at a suitable angle, as indicated in Figure 1, so as to move air with suitable velocity and in suitable volume in the direction of the arrow 36. The propeller may be secured and locked to the rotary spindle 23 by the inner end of the cap 33, and the shoulder 37 of the spindle 23.

The cap member 33 is hollow, and within it is disposed the spindle retaining member 26. The cap 33 is provided with a pair of diametrically opposed and generally radial apertures 38, which are internally threaded, and into which the generally radial oil-distributing jets or tubes 39 are inserted and fixedly secured. Any suitable number of apertures 38 and oil distributing tubes 39 may be provided. Thus, two, three, four, or five such oil distributing tubes may be provided, as desired.

To the outer end of the cap 33, a cone member 40 is fixedly secured by the means of the nut 41, which is threadedly fastened to the outer threaded end 42 of the cap member 33.

The inner housing member 12 is also provided with a flange 44, whereby it is secured to the inner side of the door 5. An asbestos gasket 45, is preferably interposed between the flange 44 and door 5, thereby to insulate the door and the housing member 11 from the heat of the inner housing member 12.

Within the inner housing member 12, a generally cylindrical wall 46 is stationarily mounted by means of any suitable spacer members 47, which hold said cylindrical member 46 in fixed spaced relation to the housing member 12. The inner end of the cylindrical member 46 is preferably coned slightly inwardly, as indicated at 48. By reason of the inclination of the inner portion 48 of the annular member 46, and the inclination of the cone 40, the air passageway which is formed within the generally cylindrical member 46 is gradually tapered to an annulus of gradually decreasing cross-sectional area, as seen particularly in Figure 1. Thus, the air which is moved in the direction of the arrow 36, by means of the propeller 34, increases in velocity gradually as it nears the exit 49, because the cross-sectional area of the air passageway gradually decreases towards said exit 49.

The stationary cylindrical wall member 46 is preferably adjustably secured by any suitable means, such as the screws 60, which extend through longitudinally disposed slots in the housing member 12 and which are threaded into correspondingly threaded holes in the spacer members 47.

The oil distributing tubes 39 are so arranged, that they will distribute the oil in a generally radial direction, in a zone spaced inwardly from the exit 49, that is, at a zone where the air passing through the member 46 has not yet reached its highest velocity, and sufficiently back of the exit to permit the oil particles directly or indirectly to contact with the heated cylinder 46, sufficiently long to efficiently vaporize the oil prior to its exit from the burner and its entry into the combustion zone. So too, the length of the oil distributing tubes 39 may be varied to secure the most efficient vaporization of the oil and its distribution in the air stream. In the present embodiment of this invention, the distribution of the oil is effected by the centrifugal force. Thus the oil is fed through the stationary spindle member 20 and through the generally tubular retainer member 26, and hence into the tubes 39. The oil may be fed to the spindle member 20 by any suitable pump or by gravity means, and through any suitable conduit or tubing, which are not shown in the drawing.

The cylindrical portion 15 of the outer housing member 11 is provided with any suitable number of holes, or air-inlet openings 50, of any suitable size, through which new or fresh air is sucked in by means of the propeller 34 and also partly by the stack or chimney draft. This cylindrical portion 15 of the outer housing member 11 is surrounded by an air-intake adjustment sleeve or collar 51, which may be a band of sheet metal having a series of apertures or holes 52 corresponding generally to the holes 50 in the housing portion 15, and said collar or sleeve 51 being so arranged as to be retained in place, either frictionally or positively by any suitable locking means, such as a radial set screw or a tangentially clamping screw, or the like. By rotating the sleeve or collar 51, the holes 52 in the collar may be brought into registration with the holes 50 in the housing to a greater or lesser extent, thereby regulating the amount of air admitted from the outside. A shield plate 53 is preferably provided, in a manner shown in Figure 1, supported upon suitable spacer washers 54, and suitable bolts 55. The shield plate 53 serves to shield the field pole members 29, the field winding 32 and the armature 28 from the heat of the fire.

In the operation of the novel oil burner of the present invention, the oil is projected by centrifugal force, in a generally radial direction (indicated by the arrow 56) towards the inner surface of the cylindrical wall or member 46. Any oil particles which, when leaving the rotary distributing members, are minute enough to be picked up and carried forward by the air stream moving toward the combustion zone, are carried to the combustion zone in such finely divided state by direct entrapment in said air stream. Such oil particles which are to large to be directly and effectively entrapped and dispersed in the air stream, are partly vaporized by the heat of the air stream, as such particles travel towards the cylindrical wall or member 46, and are partly broken up by

the force of the impact of such particles against said stationary solid surface 46 and are partly vaporized by the heat of said surface. Thus, any minute oil particles which may be dispersed in the air stream and carried forward thereby without coming in contact with the cylinder 46, will not hinder the efficient operation of the burner.

The oil thus dispersed, broken up and vaporized, is mixed in and carried forward by the air stream in the direction of the arrow 36. This air and oil vapor mixture burns beyond the annular exit 49. The air stream in the direction of the arrow 36, created partly by the propeller or other gas mover 34 and partly by the stack or chimney draft, is composed partly of fresh air and partly of heated air and products of previous combustion drawn in from the vicinity or zone of combustion by the propeller 34 or other suitable gas moving means, in the direction indicated by the arrow 58. Thus, the propeller 34 draws in fresh air through the apertures 50 and draws in burning or heated gases or air from the vicinity or zone of combustion, through the annular space 59 between the cylindrical wall 46 and the cylindrical housing member 12. The burning or heated gases combine with the fresh air and are forced out together by the propeller 34 in the direction of the arrow 36. These burning or heated gases, drawn back from the combustion zone, serve not only to heat the cylindrical wall 46, and to maintain the same at a high temperature at all times, but also serve to warm the incoming fresh air by contact and by admixture therewith. Thus, the oil, dispersed through the tubes 39, is carried in the direction of the arrow 36 by a stream of heated air, in which a certain proportion of pre-heated air and products of combustion are included. The dilution of the fresh air by means of the hot products of previous combustion, also serve to silence the resulting flame. Hence a noiseless operation of the burner is obtained.

It will thus be seen, that the efficiency of the oil burner is always maintained, by reason of the breaking up and volatilization of the oil by projection against, or by contact with, the constantly heated metallic cylinder 46, and also by entrapment or dispersion of heated gases from the previous combustion. The extent of the admixture or proportion of pre-heated gases or hot products of previous combustions, may be regulated by the adjustment of the collar or sleeve 51, or by longitudinal adjustment of the cylinder 46 or by both. Thus, the control of the fresh air may be effected by the collar 51 and this may also affect the proportion of return gases. The return gases may also be regulated by the positioning of the cylinder 46. These adjustments are preferably set to admit merely sufficient fresh air to supply the amount of oxygen necessary to produce the desired combustion required by the amount of oil, plus a certain excess necessary to insure complete combustion.

In the installation and operation of this oil burner, any suitable fuel supply means and fuel regulating means may be employed, and any suitable pilot, either electrical, gas flame, or other pilot may be employed for igniting the oil in the initial stage of the operation of the burner. So too, various means may be employed for automatically shutting off the oil supply in the event of a failure to ignite.

By reason of the impact of the oil against the metallic cylinder 46, a sufficient amount of the oil is broken up and entrapped and dispersed in the airstream, so that the air stream passing through the cylinder 46 will pick up sufficient oil, even while the burner is cold, thereby permitting the starting of the burner while cold.

The instant the flame starts, a portion of the burnt or partly burnt gases or heated air, resulting from the combustion, is drawn back, thus heating the cylinder 46, which thus aids the vaporization of the oil. This in turn helps to establish the flame and the result is therefor cumulative, so that efficient operation of the burner is established rapidly. It is thus seen that it is unnecessary to wait for the main body of the furnace or any auxiliary brickwork to heat in order to supply the heat for efficient combustion.

A slight depression 63 may be provided in the lower portion of the stationary cylinder 46, towards the rear end thereof, for the purpose of collecting any drippings of oil while the burner is not in operation. These drippings may be carried off by any suitable drain tube or pipe 64.

By reason of the use of burnt or partly burnt gases or products of the previous combustion, and the admixture of the same with the fresh air, not only is the temperature of the fresh air supply raised, and the fuel more completely vaporized, before reaching the zone of combustion, but the rate of combustion is also suitably moderated and the sound or noise of the flame and of the burner as a whole greatly minimized, if not in fact altogether silenced.

By reason of the use of relatively small openings 50 for the inlet of fresh air, relatively little air is drawn in through said openings into the furnace by stack draft while the burner is inoperative or temporarily shut down. By reason of this, heat losses due to cold air being drawn into the furnace by the stack draft while the burner is inoperative, are considerably reduced. Thus, the furnace is not unduly chilled while the burner is intermittently stopped.

The invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description, to indicate the scope of the invention.

The invention having been thus described, what is hereby claimed as new and desired to be secured by Letters Patent is:

1. In a liquid fuel burner, two generally concentric and generally annular shells, defining two generally concentric passageways, one disposed within the other, the inner shell being in the form of an annular metallic wall, an air mover for effecting a movement of air and gases through said two passageways in opposite directions, the intake end of each of said passageways being generally adjacent to the discharge end of the other passageway, a rotary oil distributor coaxially disposed with respect to said mover adapted to project oil against the inner surface of said metallic wall separating the two annular passageways, at a zone intermediate the ends of said wall, said oil distributor being disposed within one of said air passageways, and the passageway in which said oil distributor is disposed being of gradually decreasing cross-sectional area towards its discharge end.

2. In a liquid fuel burner, two generally concentric and generally annular shells, defining two generally concentric gas passageways, one dis-

posed within the other, the inner shell constituting a generally tubular fuel-vaporizing member, a gas mover for effecting a movement of gas through said two gas passageways in opposite directions, the intake end of each of said passageways being in communication with the discharge end of the other passageway, a liquid fuel distributor coaxially disposed with respect to said gas mover adapted to project liquid fuel towards said generally tubular fuel-vaporizing member separating the two generally annular gas passageways, at a zone intermediate the ends of said fuel-vaporizing member, said fuel distributor being disposed within the inner one of said gas passageways.

3. In a liquid fuel burner, two generally concentric and generally annular shells, defining two generally concentric gas passageways, one disposed within the other, the inner shell constituting a generally tubular fuel-vaporizing member, a gas mover for effecting a movement of gas through said two gas passageways in opposite directions, the intake end of each of said passageways being in communication with the discharge end of the other passageway, and the intake end of one of said passageways and the discharge end of the other of said passageways being disposed at the end of said shells nearest to the zone of combustion, the former passageway being adapted to take in heated gases from the zone of combustion and being adapted to discharge said heated gases into the latter passageway at the intake end of the same, and a liquid fuel distributor coaxially disposed with respect to said gas mover for projecting liquid fuel towards said generally tubular fuel-vaporizing member intermediate the ends of said fuel-vaporizing member, and through the gas stream in one of said gas passageways.

4. In a liquid fuel burner, two generally concentric and generally annular shells, defining two generally concentric gas passageways, one disposed within the other, the inner shell constituting a generally tubular fuel-vaporizing member, a gas mover for effecting a movement of gas through said two gas passageways in opposite directions, the intake end of each of said passageways being in communication with the discharge end of the other passageway, and the intake end of one of said passageways and the discharge end of the other of said passageways being disposed at the end of said shells nearest to the zone of combustion, the former passageway being adapted to take in heated gases from the zone of combustion and being adapted to discharge said heated gases into the latter passageway at the intake end of the same, a liquid fuel distributor coaxially disposed with respect to said gas mover for projecting liquid fuel towards said generally tubular fuel-vaporizing member separating the two generally annular gas passageways, at a zone intermediate the ends of said fuel-vaporizing member, and through the gas stream in one of said gas passageways, and the passageway having its discharge end in operative proximity to the zone of combustion having a decreased effective cross-sectional area towards its discharge end.

5. A liquid fuel burner, including a generally tubular stationary housing, open at the combustion end thereof, a generally tubular vaporizing member disposed within said housing at the combustion end thereof and being spaced from said housing, thereby to provide a passageway intermediate it and the housing, an air-inlet in said housing, a rotary gas mover generally coaxial with respect to said housing, disposed near the intake end of said tubular fuel-vaporizing member and in operative relation to both, thereby to draw in fresh air through said air-inlet and to force the same through said fuel-vaporizing member, said stationary housing and said fuel vaporizing member being so disposed in relation to each other, and in relation to said gas mover that the gas mover will tend to draw heated gases from the zone of combustion through the passageway intermediate said housing and said fuel-vaporizing member and will tend to mix said heated gases with the fresh air and to propel the admixed gases toward the zone of combustion through said fuel-vaporizing member, said stationary housing and said fuel vaporizing member being so disposed in relation to each other, and in relation to said gas mover that the gas mover will tend to draw heated gases from the zone of combustion through the passageway intermediate said housing and said fuel-vaporizing member and will tend to mix said heated gases with the fresh air and to propel the admixed gases toward the zone of combustion through said fuel-vaporizing member, and rotary fuel distributor means mechanically connected with said rotary gas mover, generally coaxial with respect to said fuel vaporizing member and disposed within the same and projecting liquid fuel towards said tubular vaporizing member, and generally transversely through the gases propelled through the fuel vaporizing member in a generally circumferentially distributed relation to the fuel vaporizing member.

6. A liquid fuel burner, including a generally tubular stationary housing, open at the combustion end thereof, a generally tubular vaporizing member disposed within said housing at the combustion end thereof, and being spaced from said housing, an air-inlet in said housing, a rotary gas-mover, disposed near the intake end of said tubular fuel-vaporizing member and in operative relation to both, thereby to draw in fresh air through said air-inlet and to force the same through said fuel-vaporizing member, said stationary housing and said fuel vaporizing member being so disposed in relation to each other, and in relation to said gas mover that the gas mover will tend to draw heated gases from the zone of combustion through the passageway intermediate said housing and said fuel-vaporizing member and will tend to mix said heated gases with the fresh air and to propel the admixed gases toward the zone of combustion through said fuel-vaporizing member, and a rotary liquid fuel distributor mechanically connected with said rotary gas mover and coaxially disposed with respect to said gas mover and said fuel vaporizing member, for projecting liquid fuel towards the inner surface of said fuel-vaporizing member at a zone intermediate the ends thereof in generally circumferentially distributed relation to said fuel vaporizing member.

7. A liquid fuel burner, including a generally tubular stationary housing, open at the combustion end thereof, a generally tubular vaporizing member disposed within said housing at the combustion end thereof, and being spaced from said housing, thereby to provide a passageway intermediate it and the housing, an air-inlet in said housing, a rotary gas mover generally coaxial with respect to said housing, disposed near the intake end of said tubular fuel-vaporizing member and in operative relation to both, thereby to draw in fresh air through said air-inlet and to force the same through said fuel-vaporizing member, said stationary housing and said fuel vaporizing member being so disposed in relation to each other, and in relation to said gas mover that the gas mover will tend to draw heated gases from the zone of combustion through the passageway intermediate said housing and said fuel-vaporizing member and will tend to mix said heated gases with the fresh air and to propel the admixed gases toward the zone of combustion

through said fuel-vaporizing member, means for adjusting the effective size of the air-inlet, and rotary fuel distributor means mechanically connected with said rotary gas mover, generally coaxial with respect to said fuel vaporizing member and disposed within the same and projecting liquid fuel towards said tubular vaporizing member, and generally transversely through the gases propelled through the fuel vaporizing member in a generally circumferentially distributed relation to the fuel vaporizing member.

8. A liquid fuel burner, including a generally tubular stationary housing, open at the combustion end thereof, a generally tubular vaporizing member disposed within said housing at the combustion end thereof, and being spaced from said housing, thereby to provide a passageway intermediate it and the housing, an air-inlet in said housing, a rotary gas mover generally coaxial with respect to said housing, disposed near the intake end of said tubular fuel-vaporizing member and in operative relation to both, thereby to draw in fresh air through said air-inlet and to force the same through said fuel-vaporizing member, said stationary housing and said fuel vaporizing member being so disposed in relation to each other, and in relation to said gas mover that the gas mover will tend to draw heated gases from the zone of combustion through the passageway intermediate said housing and said fuel-vaporizing member and for causing said heated gases to be mixed with the fresh air and to propel the admixed gases toward the zone of combustion through said fuel-vaporizing member, rotary fuel distributor means mechanically connected with said rotary gas mover, generally coaxial with respect to said fuel vaporizing member and disposed within the same and projecting liquid fuel towards said tubular vaporizing member, and generally transversely through the gases propelled through the fuel vaporizing member in a generally circumferentially distributed relation to the fuel vaporizing member, and means for longitudinally adjusting the position of said tubular fuel-vaporizing member with respect to the housing.

9. A liquid fuel burner including a generally tubular stationary housing open at the combustion end thereof, a generally tubular vaporizing member disposed within said housing and extending substantially to the combustion end thereof and being spaced from said housing, thereby to provide a passageway intermediate it and the housing for a return flow of combustion gases, said housing having an air-inlet, a rotary gas mover in said housing arranged to receive air from said inlet and recirculated gases from said passageway and to force its entire discharge of air and gases in a current through said vaporizing member so as to sweep the inner surface thereof, a centrifugal oil distributor mounted within said vaporizing member and arranged to discharge liquid fuel against a zone on the inner face thereof swept by said current whereby small particles of fuel formed by impact are picked up by said current and transported to the zone of combustion, and means contracting the opening in said member in the direction of flow of the gas therethrough to accelerate the current to produce turbulence therein and thereby thoroughly mix the fuel and combustion supporting gases.

10. In a liquid fuel burner, a generally tubular fuel-vaporizing member disposed remote from the zone of combustion and beyond the effective radiant-heating range thereof, said fuel-vaporizing member being open at its end nearest said combustion zone, said open end constituting a passageway generally parallel with the axis of said fuel-vaporizing member, means for imparting to said fuel-vaporizing member a fuel-vaporizing temperature by heat derived from the zone of combustion, said last-mentioned means including means for causing a flow of hot gases from the combustion zone to said fuel-vaporizing member, means for propelling a stream of combustion-supporting gases toward said combustion zone past and in contact with said fuel vaporizing member, and means having a common axis with the aforesaid propelling means for projecting liquid fuel in a direction generally transverse to the general direction of travel of said stream of gases and towards said fuel vaporizing member.

11. In a liquid fuel burner, means forming inner and outer passageways, the inner one forming a passageway for the flow of combustion-supporting air and constituting a substantially continuous fuel-vaporizing wall, fuel-distributing means for discharging fuel into contact with said vaporizing wall and fan means for effecting a flow of combustion-supporting air through said inner passageway, the outer passageway constituting a passageway for the flow of gaseous products of combustion and having one end disposed to receive gaseous products of combustion and its other end disposed to discharge gaseous products of combustion into the combustion-supporting air flowing through said inner passageway.

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