March 29, 1932. F. F. NEUMANN 1,851,919

LIQUID FUEL BURNER

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Fig. 1.

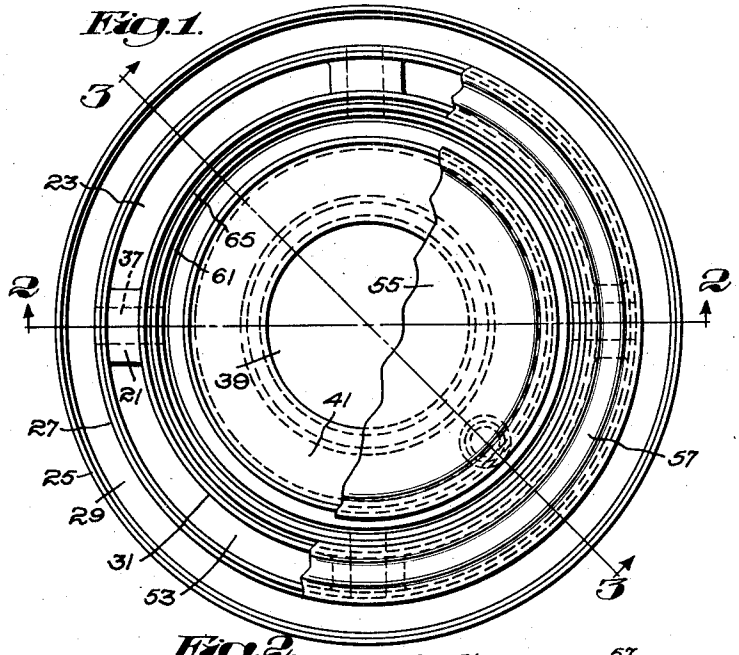

Fig. 2.

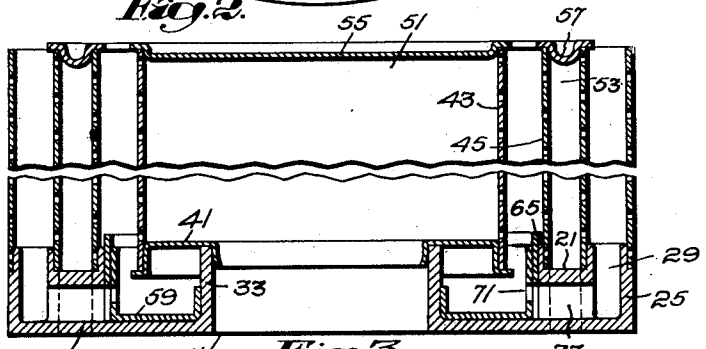

Fig. 3.

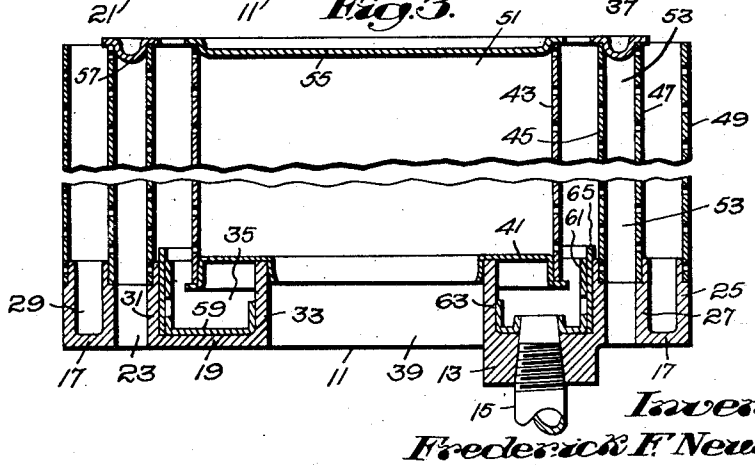

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Fig. 4.

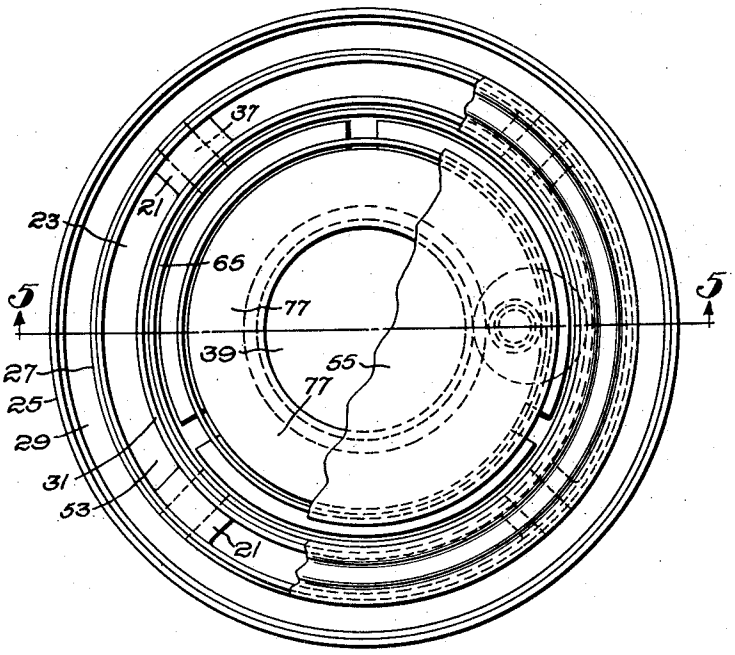

Fig. 5.

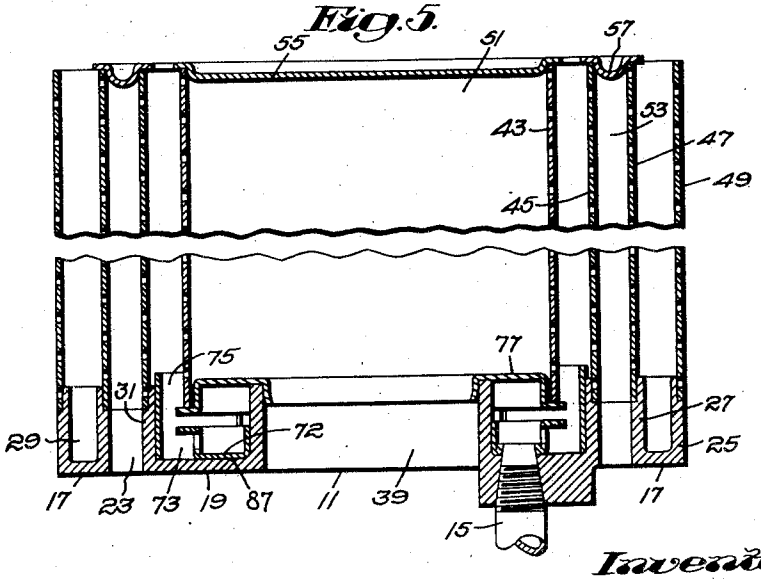

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Fig. 6.

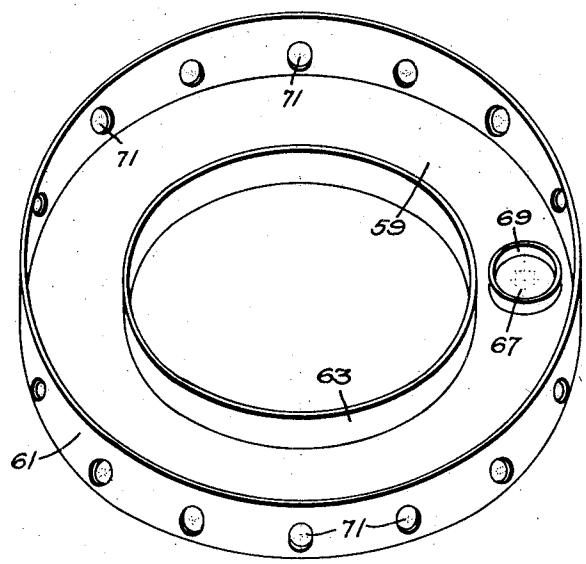


Fig. 7.

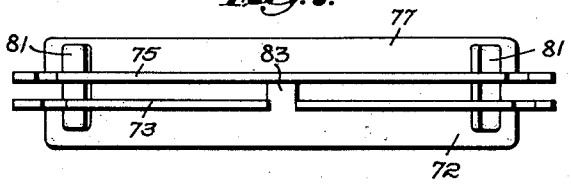
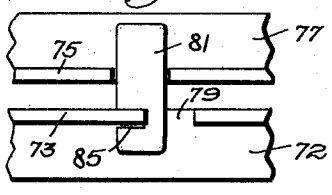


Fig. 8.



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Patented Mar. 29, 1932

1,851,919

UNITED STATES PATENT OFFICE

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LIQUID FUEL BURNER

Application filed April 24, 1931. Serial No. 532,643.

This invention relates to liquid fuel burners of the type supplied with oil or other hydrocarbon fuel in liquid form, the fuel being vaporized in the burner and burned with a suitable mixture of air. The invention consists in improvements designed, among other things, to facilitate vaporization of the fuel and the quick starting of the burner from a cold condition and to make provision tending to prevent the accumulation of unconsumed carbon in the fuel spaces, while permitting the ready clearing from the fuel spaces of any such accumulations. For descriptive purposes the fuel is herein referred to as oil, although other forms of liquid fuel may be employed.

The invention will be best understood by reference to the following description when taken in connection with the accompanying drawings, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a plan view, partly broken away, showing a burner embodying one form of the invention;

Fig. 2 is a central, sectional elevation, partly broken away, of the burner shown in Fig. 1, the section being taken on the line 2—2 in Fig. 1;

Fig. 3 is a similar section, taken on the line 3—3 in Fig. 1;

Fig. 4 is a plan view similar to Fig. 1, showing a modified form of the invention;

Fig. 5 is a section similar to Fig. 2 taken on the line 5—5 in Fig. 4;

Fig. 6 is a perspective of the removable vaporizing plate employed in the burner shown in Figs. 1, 2 and 3;

Fig. 7 is a side elevation of the vaporizing bottom and cover plates employed in the burner shown in Figs. 4 and 5; and

Fig. 8 is a detail, on a larger scale, showing a connection between the vaporizing bottom and cover plates of Fig. 7.

Referring to the drawings (Figs. 1, 2 and 3) and to the type of burner to which, for illustrative purposes, one form of the invention is there shown applied, the burner is of the so-called combustion tube type having a cast iron base 11 supported in any suitable manner and having on its under side a boss 13 for the attachment of a fuel supply pipe 15. The base plate comprises an outer annular plate 17 and an inner annular concentric plate 19 connected one to the other by a series of webs 21 (Fig. 1), herein four in number, and providing for an annular air admission space 23 between the plates, interrupted only by the webs 21.

The outer plate is provided with spaced, annular, upstanding walls 25 and 27 forming between them a fuel space, herein in the form of a relatively narrow, annular channel or groove 29. The inner plate is provided with similar walls 31 and 33 forming between them a relatively broad fuel space 35 in the form of an annular channel of greater radial width than the channel 29, there being provided fuel supply ducts 37 in the webs 21 connecting the inner and outer fuel spaces. A central air supply opening 39 is formed in the bottom of the base within the inner upstanding wall.

The top of the inner broadened fuel space is closed in part by a removable cover plate 41 seated on the top of the inner flange or wall 33 and having a down-turned lip fitting within the flange and positioning the cover plate thereon. The walls of the cover plate extend outwardly over the fuel space 35, terminating in a down-turned flange and an outwardly turned lip, which latter is spaced from the opposite wall 31 of the fuel space to provide a fuel or vapor groove underlying the overhead combustion chamber and an annular exit slot for the passage of vaporized oil into the combustion chamber.

An inner combustion chamber aligning with the annular exit slot is formed between the combustion tubes 43 and 45, the latter being in the form of perforated sheet metal cylinders, the tube 43 being seated on the outturned lip of the removable cover 41 and the tube 43 on the outer shoulder of the annular wall 31. Another combustion chamber aligning with the outer fuel groove 29 is formed between similar combustion tubes 47 and 49 seated respectively on the shouldered edges of the upstanding walls 27 and 25. There is thus formed an inner air chamber

51 enclosed within the combustion tube 43 to which air is supplied through the central opening 39 in the base and an intermediate air chamber 53 between the combustion tubes 47 and 49 to which air is supplied through the annular opening 23. The inner air chamber is closed by the plate 55 resting on the top of the tube 43 and the intermediate air chamber by a plate 57 resting on the tops of the tubes 45 and 47, these plates leaving annular exit passages for the products of combustion from the two combustion chambers.

It will be observed that oil is supplied through the pipe 15 and the inner fuel chamber near the inner covered part thereof, the covered portion functioning as a vaporizing space in which, during the normal established operation of the burner, the oil is vaporized and from which it passes in vaporized form into the uncovered portion of the fuel space and thence into the overhead combustion chamber between the tubes 43 and 45, and also passes in vaporized form through the ducts 37 into the outer fuel or vapor groove 29 and the outer combustion chamber between the tubes 47 and 49.

In the described form of burner, to hasten the initial vaporization of the oil and facilitate the cleaning of the vaporized space, special provision is made for the vaporizing space comprising an oil-receiving, heat-conducting lining and a vaporizing cover plate 41 of particular construction.

For this purpose the broad fuel channel is provided with a removable annular vaporizing plate 59, presenting a trough-like structure, herein of the construction shown in Fig. 6. This plate is preferably formed of thin sheet metal, preferably one-thirty-second of an inch or less in thickness, and composed of material having a relatively high heat conductivity, such as copper or aluminum. The plate is provided with an outer up-turned flange 61 and an inner up-turned flange or lip 63, the dimensions of the structure being such that it fits the bottom of the channel beneath the vaporizing space but may be readily slipped into place therein or removed therefrom. Where it is desired to employ a wick for starting the burner, the plate is so dimensioned that when positioned in the base it leaves an annular space between the outer flange 61 and the upstanding wall 31 adapted to contain the asbestos or other wick 65 of the type ordinarily employed for this purpose.

The vaporizing plate is provided in its bottom with an opening 67 surrounded by a raised lip 69 which, when the plate is in place, is adapted to register with and seat over the upwardly projecting end of the fuel pipe 15, so that all the liquid oil is delivered onto the bottom of the vaporizing plate.

To permit the oil to saturate the wick preliminarily to starting the burner, the outer flange 61, which is next adjacent the wick, is provided near, but preferably spaced above, its bottom with a number of apertures 71, certain ones of which also register with the fuel supply ducts 37, so that the oil vapor may pass without hindrance to the outer fuel grooves 29, the wick being also cut away where it overlies the mouths of such ducts.

In the operation of the burner, the latter is preliminarily heated either by igniting the wick 65 which is first saturated with oil admitted through the supply pipe 19, or by means of a priming fluid alone placed in the fuel space, or in any other desired manner. Oil is admitted through the supply pipe under the regulation of any of the usual feeding devices. These commonly provide for the flow of oil from a feeding device at some definite level which may be accurately regulated so that the flow of oil may be maintained at an approximately predetermined level over the bottom of the vaporizing plate and a flow thereby maintained of relatively shallow depth, spreading over the plate in a more or less film like form. Such regulating devices may be of the usual or common construction and are not herein shown.

As soon as the combustion gets under way, the combustion tubes soon become red hot and the central air chamber 51 which is enclosed by the walls of the inner combustion tube becomes highly heated. The cover plate 41 (shown of exaggerated thickness in the drawings) is preferably formed of thin sheet metal, such as chromium steel, and preferably about one-thirtysecond of an inch or less in thickness. A suitable alloy for the cover plate may be had by using a chrome steel containing from 16% to 18% of chrome. Such a cover plate is thereby adapted to heat rapidly from the heat transmitted from the combustion chamber and conducted to the cover plate from the inner chimney 43, as well as by conduction and radiation from the inner air chamber which the cover plate underlies and to which its upper surface is exposed. The thin sheet metal cover plate therefore takes up and acquires almost instantly the heat from the inner chimney and the inner air chamber and quickly becomes red hot, reflecting the heat against the adjoining walls of the underlying vaporizing plate 59 and upon any liquid oil flowing over the surface thereof. The vaporizing plate itself, being of high conductivity, transmits rapidly to the oil heat received from the cover plate and from the adjoining walls of the base, so that by the joint action of the cover plate and the vaporizing plate vaporization of the oil starts quickly throughout the vaporizing space soon after the combustion is initiated and continues with still greater effectiveness and efficiency as the combustion proceeds. Accordingly, early in the starting period of the burner, vaporization takes place

wholly in the vaporizing space which is formed by the broad, covered, inner part of the chamber 35, the oil passing in vaporized form into the outer part of the fuel space and through the ducts into the outer fuel groove to be burned in the combustion chambers communicating therewith.

By constructing the cover plate of thin sheet metal, it is not only adapted efficiently to radiate and reflect the heat from the air chamber and combustion chamber to the vaporizing chamber, but it may be made in the form of a stamping fitting the base more accurately than a casting and restricting less of the cross-sectional area of the central air opening 11 and the fuel spaces which it covers, thereby increasing the underlying available space which, in the course of long continued use, may be subject to accumulations of unconsumed carbon. Being formed of a non-oxidizable alloy, such as chrome steel, the cover plate is capable of withstanding intense heat without burning out and without oxidization and requires no cleaning.

It will be observed that in the normal operation of the burner, vaporization of the oil takes place wholly in the broad inner channel and on the vaporizing plate 59, liquid oil being delivered directly through the bottom of that plate so that it spreads thereover in a relatively thin film. Any accumulations of unconsumed carbon, therefore, form on the vaporizing plate itself, which is so constructed that it may be readily withdrawn and removed from the groove or channel by lifting out the cover plate 41 and inner chimney 43, permitting it to be cleaned while removed from the burner or to be discarded, if desired, and replaced by another similar vaporizing plate.

This construction provides an oil receiving, vaporizing chamber lined or fitted with a removable thin sheet metal vaporizing plate of high conductivity and adapted to effectively vaporize the oil through the joint action of the heat-conducting cover plate.

Referring to the modification of the invention shown in Figs. 4, 5, 7 and 8, the vaporizing plate 72 is similarly constructed of thin heat-conducting metal and is in the form of a channel having a width substantially the width of the covered portion of the vaporizing chamber and removably fitted into the inner part of that chamber. The plate is provided with an out-turned flange 73 which is spaced from but underlies the out-turned peripheral lip or flange 75 of the cover plate 77, the latter being formed of thin sheet metal similar to the cover plate 41. The flange 73 of the vaporizing plate is cut away at intervals to provide recesses 79, herein three in number, adapted to receive each a depending tongue 81 secured to the side of the down-turned flange of the cover plate by any suitable means, as by being spot welded thereto. Between successive recesses 79 the flange 73 of the vaporizing plate is struck up to present an upstanding tongue 83 constituting a spacing member between the two plates. The depending tongues 81 are provided with notches 85 of a width suitable to receive the walls of the flange 73. The cover plate may therefore be applied to the vaporizing plate so that its flange rests on the spacing tongues 83 with the tongues 81 entering the recesses 79, and when in that position given a partial turn which will lock the notched tongues into the opposing edges of the flange 73, securing the cover plate to the vaporizing plate, which structure thus integrally joined may be placed in that position on the burner base. The outer walls of the vaporizing plate are preferably provided with a plurality of apertures 87, serving the same function as the apertures 71 in the vaporizing plate 59, permitting an overflow of oil to saturate the wick in the starting of the burner and the escape of vaporized oil to the outer groove 29, while confining the liquid oil in the vaporizing plate during the normal operation of the burner.

The connecting tongues between the cover plate and the vaporizing plate not only permit the two to be installed and removed as a single piece, but also to provide a heat-conductive connection or contact between the cover plate and the vaporizing plate, accelerating the heating of the latter.

While I have herein shown and described for the purpose of illustration one specific embodiment of the invention as applied to one particular type of burner, it is to be understood that the details of construction may be varied within wide limits and that the invention has application to widely varying types of burners, all without departing from the spirit thereof.

I claim:

1. A burner having pairs of spaced, concentric, annular, combustion tubes forming spaced, inner and outer combustion chambers with an intermediate air chamber and inner air chamber enclosed by the inner combustion tube, a base having spaced, annular, upstanding walls presenting between them concentric, spaced, inner and outer fuel chambers underlying and communicating each with one of said combustion chambers, the inner one of said fuel chambers being of greater width than the outer chamber, said base having openings one into each of said air chambers, a removable thin sheet metal cover overlying and covering a part of the wider fuel chamber near one annular upstanding wall thereof but providing an uncovered opening near the opposite upstanding wall thereof, said opening registering with the inner combustion chamber and said cover underlying a part of one of said air chambers, a vaporizing member comprising a liquid-fuel-receiving, thin

sheet-metal, heat-conducting structure in the covered part of said wider fuel chamber, means for delivering liquid fuel to said vaporizing member, and a fuel supply duct connecting said inner and outer channels.

2. A combustion tube burner having a base provided with inner and outer fuel chambers, the inner chamber being broadened to provide a vaporizing space, inner and outer, spaced, perforated walls forming between them a plurality of combustion chambers in communication with and upstanding relation one above each of said fuel chambers, and forming also an intermediate air chamber between the combustion chambers and an inner air chamber within the inner combustion chamber, a wall overlying and covering a part of the inner fuel chamber but leaving a relatively narrow aperture at the outer side thereof opening into the overhead combustion chamber, said wall underlying one of said air chambers between the latter and the inner fuel chamber, a vaporizing member comprising a liquid-fuel-receiving, thin sheet-metal, heat-conducting structure in said broadened inner chamber, means for delivering liquid fuel to said member, and a fuel supply connection between the two fuel chambers.

3. A burner having a pair of concentric, spaced, annular combustion tubes forming between them a combustion chamber and having an inner air chamber enclosed by the inner combustion tube, a base having spaced, annular, upstanding walls presenting between them a broad, annular, fuel chamber, a removable heat-conducting cover plate covering a part of said fuel chamber near the inner, annular wall thereof and underlying a part of said inner air chamber but providing an uncovered opening in said channel adjacent the outer, annular wall thereof, said opening registering with said combustion chamber, a vaporizer comprising a liquid-fuel-receiving, thin sheet-metal, heat-conducting member in said channel beneath said cover plate, and means for delivering liquid fuel to said member.

4. In a liquid fuel burner, a base having spaced, upstanding, inner and outer walls which provide between them a wide fuel chamber, a cap removably seated on the top of said inner wall and extending over the top of said wide chamber but providing between it and said outer wall a relatively narrow opening for said chamber, spaced combustion tubes carried by said cap and said outer wall in surrounding relation with said opening and upstanding thereabove, a vaporizer comprising a liquid-fuel-receiving, thin sheet-metal, heat-conducting member in said chamber beneath said cap, and means for delivering liquid fuel to said member.

5. A combustion tube burner having a combustion chamber, a base provided with a vapor groove underlying said chamber, a vaporizing chamber in said base adjacent said vapor groove and communicating with the latter, a vaporizer comprising a liquid-fuel-receiving, thin sheet-metal, heat-conducting member for said vaporizing space, and a heat-conducting cover for the vaporizing space.

6. A combustion tube burner having a combustion chamber and provided with an inner air chamber, a base provided with a vapor groove underlying said combustion chamber, a vaporizing chamber in said base adjacent said vapor groove and communicating with the latter, a removable liquid-fuel-receiving, thin sheet-metal, heat-conducting member for said vaporizing space, and a removable heat-conducting cover for the vaporizing space underlying said inner air chamber.

7. A combustion tube burner having a base provided with an annular fuel channel, combustion tubes supported by the base forming between them a combustion chamber in upstanding relation to the fuel chamber and communicating therewith, an annular, liquid fuel vaporizing member of thin heat-conducting, sheet-metal in said fuel channel and freely removable therefrom on the removal of the combustion tubes from the base, and means for delivering liquid fuel to said vaporizing member.

8. A combustion tube burner having a combustion chamber, a burner base having a fuel channel beneath and communicating with the combustion chamber, and a vaporizing member in said channel comprising a liquid-fuel-receiving, thin sheet-metal structure of heat-conducting material, said member being of lesser width than the channel and providing for a wick space in said channel beneath the combustion chamber.

9. A combustion tube burner having a base provided with inner and outer fuel channels, a fuel supply duct connecting said channels, a vaporizing member in said inner channel comprising a thin sheet-metal, trough-like structure of heat-conducting material removably seated in the channel, said structure having one or more openings in its side and having a liquid-fuel-receiving opening in its bottom, and means for delivering liquid fuel to the inner channel on said vaporizing structure.

10. A burner having a pair of concentric, spaced, annular, combustion tubes forming between them a combustion chamber and having an inner air chamber enclosed by the inner combustion tube, a base having upstanding walls presenting between them a broad, annular fuel chamber, a removable thin sheet-metal, heat-conducting cover plate covering the inner part of said fuel chamber and underlying the inner air chamber and providing a fuel vaporizing space thereunder but leaving an uncovered opening adjacent the outer wall of the fuel chamber registering with the over-

head combustion chamber, and means for delivering liquid fuel to the fuel chamber.

11. A combustion tube burner having a combustion chamber, a base having a fuel vapor space beneath and communicating with the combustion chamber, a vaporizing space communicating with the fuel vapor space, a removable cover plate for the vaporizing space, a vaporizing member comprising a liquid-fuel-receiving, thin sheet-metal, heat-conducting structure in the vaporizing space, means connecting the vaporizing member to the cover, and means for supplying liquid fuel to the vaporizing member.

In testimony whereof, I have signed my name to this specification.

FREDERICK F. NEUMANN.