July 9, 1929. J. W. MOWBRAY 1,720,374

OIL BURNER

Filed Feb. 9, 1925 2 Sheets-Sheet 1

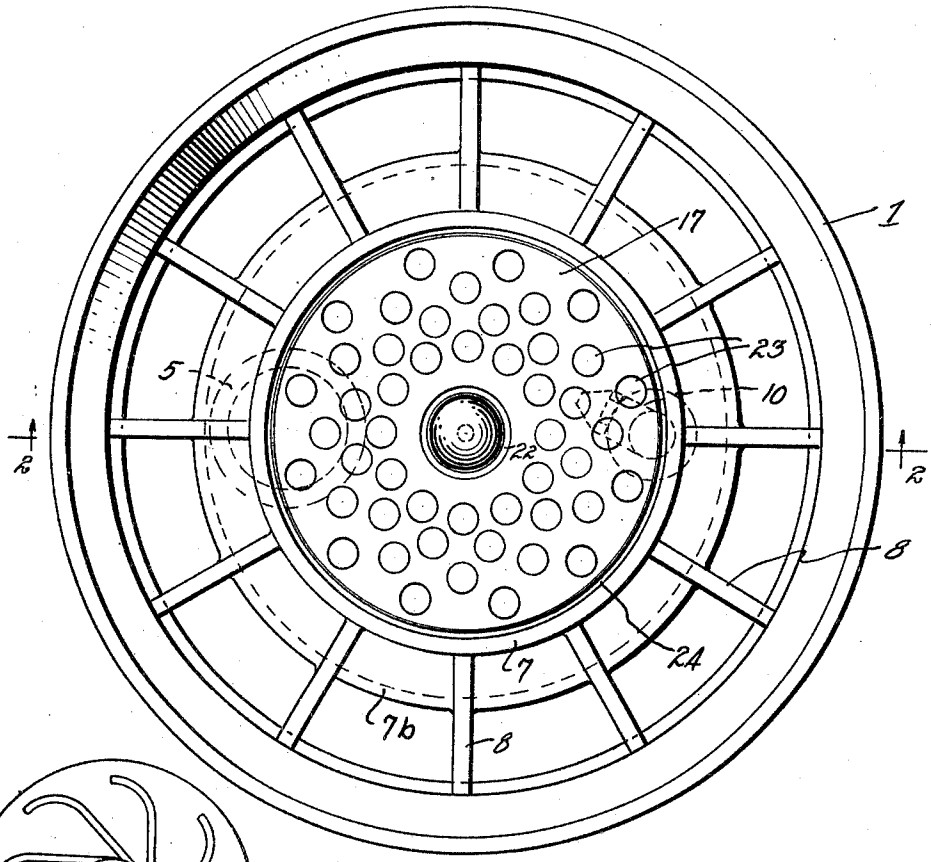


Fig. 1

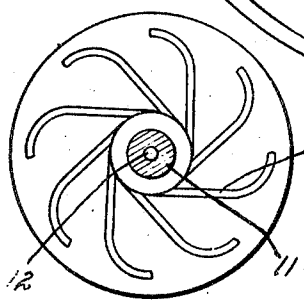


Fig. 3

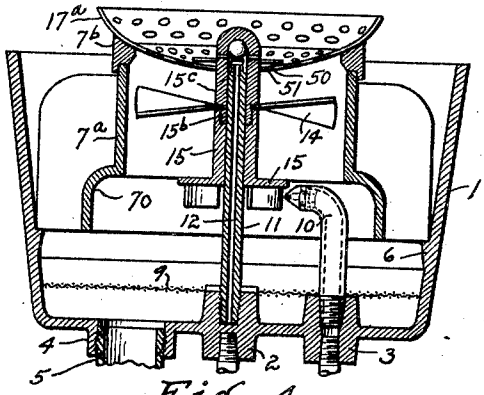


Fig. 4.

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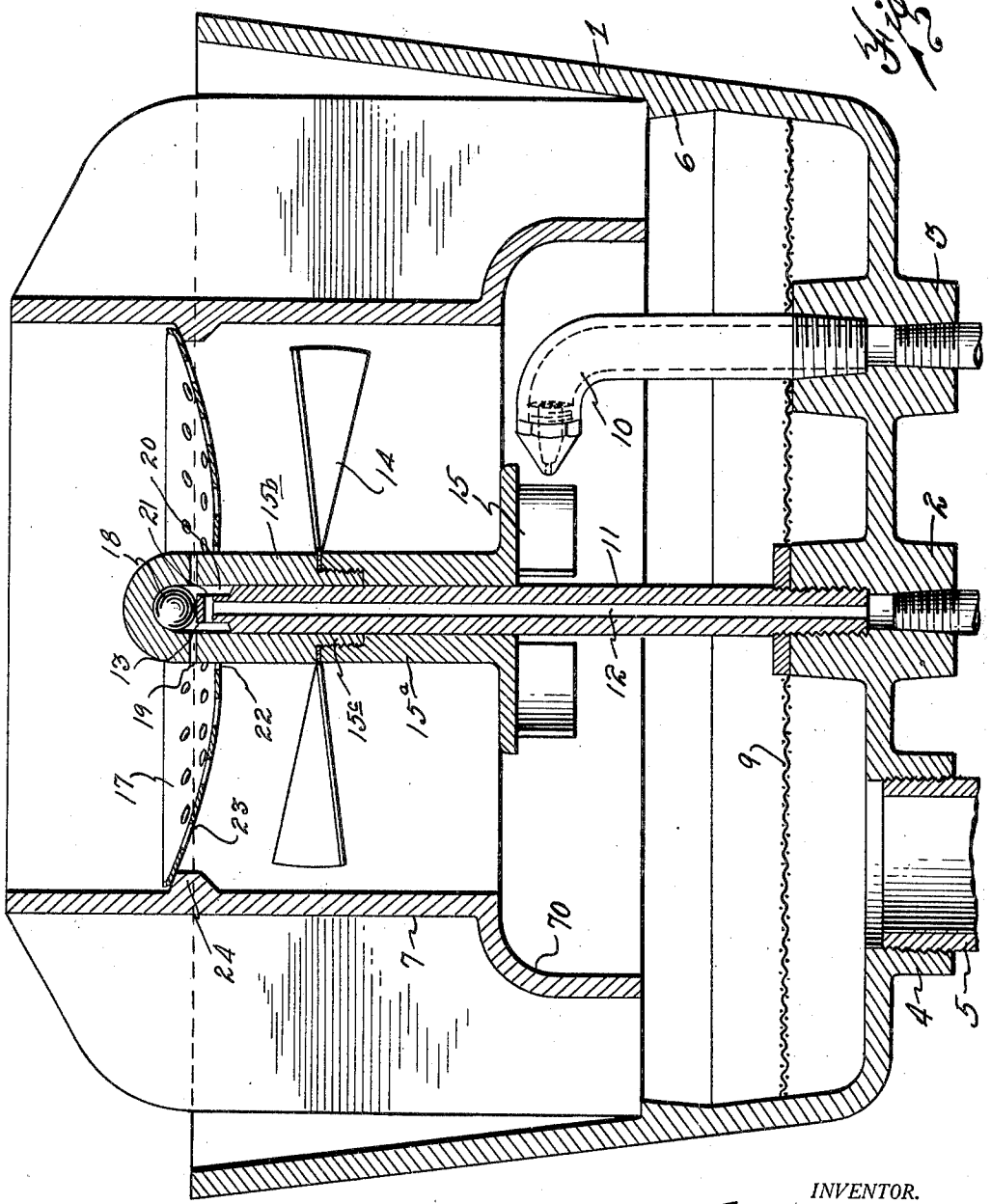
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July 9, 1929. J. W. MOWBRAY 1,720,374

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Filed Feb. 9, 1925 2 Sheets-Sheet 2

Fig. 2



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1,720,374

UNITED STATES PATENT OFFICE.

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OIL BURNER.

Application filed February 9, 1925. Serial No. 7,746.

This invention relates to oil burners, and the object is to provide an improved burner for the burning of a liquid hydro-carbon fuel for heating purposes either in stoves or ranges or more particularly in heating furnaces of any type such as steam, hot water and hot air heating furnaces.

The burner is of that type in which oil is sprayed or discharged from a nozzle in fine streams and air by means of a rotating fan discharged through the streams to break and distribute the same and provide oxygen for combustion.

One of the principal features of this invention is in the provision of a stationary apertured burning plate on to and over which the oil is discharged by the nozzles and through which the air is forced by the fan.

An additional and principal feature in conjunction with the burning plate is in the provision of a moist air to the burning plate to provide some amount of steam to maintain the surface of the plate clean or comparatively clean.

A further feature of the invention is in the provision of a fan below a burning plate and a water turbine for rotating the fan, the said water turbine lying in the air passage leading to the fan whereby air flowing to the burning plate through operation of the fan passes through the spray produced in the driving of the fan by a water jet as hereinafter described.

It is also an object of this invention to provide a construction in which the air is heated as it passes to the air passageway and thus tends to vaporize water through which it passes.

An additional object of the invention is to provide a very simple and inexpensive construction enabling the burner to be practically completely disassembled in the furnace or other heating appliance without disturbing the oil and water connections or other piping connected with the burner thus enabling every necessary part of the burner to be readily taken out and examined or cleaned and replaced without necessity of any fine adjustment of any part. By such construction an unskilled person may assemble or disassemble the device without possibility of arranging the parts in other than their required relationship for effective operation.

A burner embodying my improved features of construction is shown in its preferred form in the accompanying drawings in which—

Fig. 1 is a plan view of an oil burner embodying my invention.

Fig. 2 is a vertical section thereof taken on line 2—2 of Fig. 1.

Fig. 3 is a detail showing the turbine blades.

Fig. 4 is a detail showing an alternative form of the burning plate.

The burner is best understood from an examination of Fig. 2 in which 1 indicates the base which is of a bowl like form provided with a central threaded boss 2 in the bottom and another similar threaded boss 3 at one side thereof and a third boss 4 with which an outlet pipe 5 may be connected. The central boss 2 is threaded to receive an oil supply conduit (not here shown) and the boss 3 is threaded to receive a water supply connection or piping (not here shown). The side walls of the bowl are preferably outwardly flared to a slight extent and at a little distance from the bottom is provided with an interior rib 6 on which is supported the cylindrical member 7 providing a combustion chamber. As will be understood from Fig. 1, this member 7 has a series of radial ribs 8 extending longitudinally of the member and these ribs serve to properly space the cylindrical member 7 in the bowl in assembling the parts with the lower ends of the outer corners of the ribs resting on the rib or shoulder 6 of the bowl. The space between the bowl 1 and member 7 provides a circular air inlet or passageway. Preferably, there is a screen 9 lying on the bosses 2 and 3 as will be seen from Fig. 2. The nozzle 10 and the oil conduit 11 are secured to the inner ends of the respective bosses 3 and 2. This screen is used to prevent carbon from passing down into the outlet 4 but if a sufficiently large diameter outlet 5 is provided the screen may be dispensed with. The oil conduit or stem 11 has a longitudinal bore 12 for the oil and this stem is reduced in diameter providing a flat ended portion 13 at the upper end less in diameter than the stem. Rotatable on this stem is the fan 14 and turbine 15 having a central body which is bored or ground to fit the stem 11. This central body member is made of two parts

15[a] and 15[b], the end of the lower part 15[a] being recessed and threaded to receive the projecting part 15[c] of the portion 15[b]. There is a shoulder provided between these two parts between which is secured the fan member 14. This fan has a central aperture practically fitting over the portion 15[c] and is provided with a series of radial plates so turned that on revolution of the member air will be forced upward in the member 7 and through the burning plate 17 hereinafter described. This member 15[b] at the upper end has a ball 18 seated in the end of the central bore which is preferably a press fit therein so that it will not fall out on removal of the turbine and fan portion from the stem 11. This ball rides on the flat upper end of the portion 13 thus providing a ball bearing for the fan and turbine. There is also a series of apertures 19 extending on radial lines from the center of revolution of the member 15[b]. The reduced end 13 of the stem provides a chamber 20 into which the apertures 19 lead and this chamber receives oil from the conduit or bore 12 which opens into the chamber 20 through the cross conduit 21 in the part 13. The oil is fed through the line 12 from a supply receptacle which should be located about four or five inches above the apertures 19 to produce sufficient pressure to cause the oil passing through the apertures to be forced out over the burning plate 17 in fine streams or sprays. The member 15[a] is driven at a comparatively high rate of speed by the water turbine and this also tends to throw the oil and spray it over the plate 17.

The plate 17, as shown in Fig. 2, is slightly saucer shaped and has a central aperture 22 through which the upper end of the portion 15[b] extends so that the apertures 19 are above the plate. This upper end of the member 15[b] in connection with the apertures 19 is hereinafter called a nozzle but it is to be understood that there are preferably several apertures positioned radially about this head. The plate 17 has a considerable number of apertures 23 formed therein which provide for the passage of air into the oil spray and the burning of the oil takes place on this plate and above the same. The plate may, as shown in Fig. 2, rest with the outer edges on lugs 24 provided in the inner walls of the member 7, which walls extend above the burning plate providing what may be termed a combustion chamber. By rapid rotation of the fan air is forced through the plate to mix with the oil spray and causes the flame to take a spiral form especially when the walls of the member 7 extend above the burning plate as shown in Fig. 2. The plate 17 is stationary and this is one of the principal features of the invention.

I am aware of burners of this type in which a rotating disk is provided as shown for instance in the U. S. patent to W. E. Gibbs No. 752,900 of February 23, 1904. In such previous types in which a rotating disk is employed there is an accumulation of carbon on the disk and upon the walls of the chamber in which the disk is rotated. I have assumed that the reason for the accumulation of carbon on the disk is that by reason of its rapid rotation there is a tendency to cool the plate. There is also, due to the throwing of the oil from the disk by centrifugal force into contact with the side walls of the combustion chamber, a tendency to pile up oil that is not in sufficiently thin film or mixed with air adequately to burn cleanly. With a stationary plate there is a perfectly equable distribution of the oil over the plate as the nozzle is rotated rapidly relative to the plate. The plate 17 is slightly saucer shaped so that the periphery is slightly above the level of the oil apertures of the nozzle. The oil therefore does not spray over the edge of the plate nor provide a sufficient body of oil at any one point to burn in such manner as to leave a rapidly accumulating carbon deposit.

I am also aware of a type of oil burner in which a rotating apertured disk is provided for a burning plate. Such rotating disk also tends to accumulate carbon indicating that the oil is not thoroughly consumed and that the lighter constitutents of the oil vaporize leaving the heavier constituents burning to a carbon on the plate. The rotating disk is inadequate for the purpose by reason of this accumulation of carbon and so far as I have been able to determine this accumulation of carbon is due largely to the fact that the movement of the disk is at the speed of movement of the fan producing the air flow through it.

With my improved apparatus utilizing a stationary apertured plate after the manner indicated in Fig. 1 or the alternate form shown in Fig. 4, the flow of air is across the oil streams which serves to break up the oil streams and produce a proper combustion. While this plate is stationary in my device, the air flow tends to move in a spiral form causing the air to travel along the upper surface of the plate to some extent. The air flowing through the apertures of the plate therefore is not straight upward parallel with the axis of rotation of the fan but to some extent in the direction of rotation of the fan apparently in use at an angle of thirty to forty degrees to the vertical. The plate shown in Fig. 1 fits comparatively closely to the side walls of the cylinder 7, there being just sufficient space to allow the plate to expand under heat but this space is preferably maintained at a minimum to prevent an air flow about the edge of the plate which tends to concentrate the flame above. The greatest efficiency is secured by having

the flame spread out to some extent and the stationary plate secures this result particularly if there is little or no air space between the edge of the plate and the wall 7. In the alternative form of construction shown in Fig. 4, the plate seats on the top of the wall 7^a and extends outwardly therefrom a short distance which tends to cause the flame to "bush out" to an extent even greater than is the case with the form shown in Fig. 2. With either form of plate the outer edge of the plate is above the level of the oil apertures 19 so that there is no discharge of oil horizontally off from the plate as the oil streams strike the plate somewhere near the periphery depending upon the head of oil and any oil that is not broken up and discharged upwardly by the air flow falls on the surface of the plate and, due to the saucer like form of the plate, tends to flow toward the center of the plate. This causes the oil to be distributed in a thin film and the air flow through the apertures, and to some extent across the surface of the plate as heretofore mentioned, mixes with this oil or oil vapor causing the oil to be properly consumed. It is to be noted that this plate 17 during operation is hot and therefore any oil in the form of liquid striking the surface of the plate tends to be vaporized and is practically completely consumed and does not form a hard residue on the plate through vaporization of the lighter constituents only of the oil as sufficient oxygen is supplied for practically complete combustion by both air and water in the manner described.

As heretofore stated the air flow is through the water used in driving the fan by means of the turbine 15. The jet of water driving against the blade of the turbine 15 causes it to rotate, thus rotating the fan. This stream issuing from the nozzle 10 is broken up by the successive blades in contact with it and due to the high speed of the turbine is thrown outwardly from the turbine against the lower wall 70 of the cylinder 7 and tends to fall downwardly along this wall into the bottom of the bowl 1. Air therefore entering between the bowl and the member 7 passes downward into the bowl and thence toward the center through the spray falling from the wall 7^b and thence passes upwardly through the spray thrown centrifugally from the turbine. The air is heated slightly due to its coming in contact with the heated wall 7 and fins 8 and the water spray is heated due to its coming in contact with the walls 7 and 7^b. The water therefore tends to vaporize and some spray is also drawn upwardly against, through and onto the burning plate 17 by the air flow. This moisture is immediately converted to steam on coming in contact with the plate and flame and assists in the combustion of the oil and prevents an accumulation of residue on the plate. One of the principal features of this invention is in this provision of moisture laden air and I find it important in order to secure more perfect combustion and prevent an accumulation of a hard carbon residue on the burning plate which is produced in previous oil burners of this type. In my construction whatever carbon is produced in the burning of the oil is blown out of the burner as the carbon is loose and fluffy in character and does not burn hard on the plate. Any carbon that may fall below the burning plate will be deposited on the screen if one is utilized or will pass out through the discharge pipe 5.

In the form of plate and member 7 shown in Fig. 2 the flame discharges upward in a columa of a diameter practically equal to that of the member 7 in spiral form. This is probably due to the flame being confined within the upper end of the circular wall 7. When such wall is dispensed with and the burning plate 17^a extends outwardly beyond the exterior of the member 7 a short distance and is readily removed if for any reason it is desired to take out the fan or to make a repair. In both the forms of burning plate shown, the central aperture through which extends the part 15^a is slightly larger than the said part so that there is no possibility of the member 15^a binding in the burning plate and therefore is free to rotate on the stem.

Preferably the stem and members 15 and 15^a are ground to fit closely and still permit a free revolution of the turbine member. By having the parts closely fitting the possibility of leakage of oil between the stem 11 and the parts 15 and 15^a is reduced to a minimum.

In the construction shown in Fig. 4 the burning plate 17^a may rest directly upon the upper end of the wall 7^a corresponding to the wall 7 of the form shown in Fig. 2. This plate is apertured and is provided with lugs 7^b by means of which it is properly positioned on the cylindrical wall 7^a. This plate extends outwardly beyond the periphery of the wall as shown and is saucer shaped to provide a combustion chamber. There is a further feature in the construction of this burning plate shown in Fig. 4—that is, the upper end of the stem 15^a is provided with an imperforate circular disk 50 which is a press-fit thereon below the apertures 19. This disk 50 may be used with either of the types of the burning plate shown in Fig. 2 or 4, the said plate when the disk is used having a central aperture 51 slightly greater in diameter than the plate 50. The burning plate when used with the disks 50 is slightly lower than the disk so that any oil tending to run down the side of the member 15^a is thrown out over the burning plate into the air flow through the

apertures provided therefor. It will be noted that the fan at its center does not deliver very much air and, by use of this imperforate plate 50, there is a central column about the nozzle head in which there is no air or very little air for combustion. This arrangement therefore to a considerable extent prevents combustion at the center causing the combustion to take place at a distance therefrom over the burning plate and thus prevents to a considerable extent any accummulation of carbon on the nozzle.

One of the features of this invention is the ease of assembling or disassembling the burner parts. The burning plate, as previously stated, is not fastened in position and may be readily lifted from its place. The turbine member is simply a sliding fit on the stem and may be lifted therefrom, the ball 18 remaining in position due to its being a press fit in the recess therefor. The member 7 is readily removed as it merely rests on the annular ledge 6 and also the screen is readily removed as it is not fastened in place and is apertured to fit over the stem 11 and the water nozzle 10. Thus, by making the parts readily removable, all of the parts of the burner are easily cleaned or repaired and placed back in position without use of tools. One of the features of this invention is in arranging the parts in this unattached relationship and so constructed as to remain in the set position.

From the foregoing description it will be readily understood that the objects of the invention are secured by a construction that is economical and highly efficient, the stationary burning plate being productive of flame that is an incandescent white in character throughout the lower parts thereof changing to a slight orange color at the tips with no smoky vapor being produced. This is due to the fact that the proper amount of air for combustion can be supplied by the fan which can be varied in speed of rotation by means of a valve in the water supply line (not here shown) but as will be readily understood.

The production of carbon is reduced to a minimum by reason of the facility of supplying the required amount of air together with the moistening of the air which has a beneficial result in maintaining the burning plate free of carbon deposit and further that, in supplying air more or less heated due to its flow downward over the heat radiating fins of the inner member 7 tends to vaporize the water to some little extent. This vapor and such moisture as the air will absorb in passing through the spray is carried to the burning plate. Some of the moisture and spray will strike the under side of the plate and be vaporized by the heat of the plate and some will pass directly through the apertures of the plate thus providing steam mixing with the oil vapor.

The provision of water in spray form to the air body previous to its passage to the combustion chamber serves a double purpose. The water is at a temperature well below its boiling point. In fact is comparatively cold and, due to the arrangement of the turbine on the oil conduit and the movement of the air body about the oil conduit and to contact with the burning plate, the oil conduit and lower surface of the plate are bathed with a cool water and the temperature thereof is reduced. This prevents distillation of the oil in the conduit on its way to the combustion chamber which, if permitted to distill in the conduit, would tend to clog the same by residue. Therefore, in applicant's arrangement the oil is discharged at a temperature below its distillation point to the burning plate. The burning plate is also reduced in temperature. By contact of the spray with the plate steam is produced which passes to the combustion chamber and into the flame. This is not sufficient in quantity to drench the flame and therefore, due to the excess heat, the water is vaporized and through interaction with the oil produces a gas which assists in combustion and increases the temperature of the flame.

Having thus particularly described my invention what I claim and desire to secure by Letters Patent of the United States is—

1. In an oil burner, a stationary apertured burning plate, means for discharging oil over the surface of the plate, and a rotatable fan below the plate for forcing air through the apertures thereof.

2. In an oil burner, a stationary apertured burning plate, a rotatable nozzle having a plurality of apertures for discharging oil in fine streams over the said plate, and a rotatable fan below the plate for forcing air through the apertures thereof.

3. In an oil burner, a stationary apertured burning plate, an oil discharge nozzle rotatably mounted and discharging oil laterally in a plurality of separate fine streams over the plate, and a blower device for discharging air through the apertures of the plate, said aperture providing the main passageway for combustion purposes.

4. In an oil burner, a horizontally positioned stationary burning plate provided with a series of apertures therethrough, means for discharging oil to the upper surface of the said plate in small streams, and means for forcing air upwardly through the plate, said apertures providing the main passageway for air to the upper surface of the plate.

5. In an oil burner, a discharge nozzle rotatable on a vertical axis, the nozzle dis-

charging oil horizontally, means for supplying oil to the nozzle, a stationary apertured burning plate having a central aperture through which the nozzle projects, the nozzle discharging oil in fine streams laterally over the said plate, a fan connected with the nozzle, and means for rotating the fan and nozzle whereby air is forced through the plate to mix with and break up the oil streams.

6. In an oil burner, a cylindrical shell, a fan rotatably supported therein, means for rotating the fan, a discharge nozzle rotated with the fan, means for supplying oil to the nozzle, a stationary apertured burning plate over which oil is distributed by the nozzle and through which practically all air for the purpose of combustion is driven by the fan.

7. In an oil burner, a shell or casing through which air is to be passed, a fan mounted for rotation in the casing, means for rotating the same, a rotary discharge nozzle for discharging oil laterally from the center of the shell, a stationary apertured plate over which the oil is sprayed by the nozzle and through which practically all air for the purpose of combustion is driven by the fan.

8. In an oil burner, a chamber open to atmosphere at one end, a fan in the chamber, a stationary apertured plate providing a burning plate above the fan chamber, the apertures of the plate providing the main passageway for air for combustion purposes, a nozzle rotatable with the fan and discharging oil streams outwardly over the plate through the air currents, and means for introducing moisture into the air current previous to its passage to the apertures of the plate.

9. In an oil burner, an open ended chamber, a fan therein, a stationary apertured plate forming the upper wall of the fan chamber, the plate being spaced slightly from the upper end of the chamber wall providing for an air flow on the under side of the plate to beyond its periphery, means for rotating the fan and driving the air through the apertured plate and the said space between the plate and the chamber wall, means for providing an oil spray over the said plate, and means for providing a spray of water in the air current previous to its passage through the apertures of the plate for cooling the plate and adding oxygen and hydrogen to the combustion chamber.

10. In an oil burner, a stationary apertured burning plate, means for distributing oil over the plate in fine streams, a tubular member supporting the burning plate, a fan in the said member for discharging air upward therethrough, the tubular member and burning plate being so arranged that a portion of the air currents produced by the fan are discharged from the fan chamber along the under side of the plate to beyond its periphery, and means for supplying a spray of water in the air current having a temperature below the boiling point of the water, the arrangement providing that the air current carries the water in a spray form to contact with the plate to cool the same and add oxygen for the purpose of combustion.

11. In an oil burner, an outer shell or casing of bowl like form, a shell of tubular form having its open lower end above the bottom of the bowl and spaced from the side walls thereof, a stem providing an oil conduit extending upward from the base centrally of the shell, an oil nozzle having a body rotatably mounted on the stem and provided with lateral apertures at the top in communication with the oil conduit, a turbine wheel on the said nozzle body, means for directing a jet of water against the turbine for driving the same and rotating the oil nozzle, an apertured burning plate over which the oil streams are discharged by the oil nozzle, a fan on the nozzle body rotatable for drawing air through the water spray and discharging the same through the apertures of the burning plate in a direction across the oil streams.

12. An oil burner comprising a base of bowl like form, a hollow stem extending upwardly from the base providing an oil conduit, a tubular member in the base supported above the bottom thereof and having an open lower end spaced from the wall of the base providing an air inlet, a revoluble nozzle member on the stem having lateral apertures in the upper end in communication with the oil conduit, a fan on the nozzle member by rotation of which air is discharged through the tubular member, a stationary burning plate mounted above the fan and having a central aperture through which the nozzle end extends, the said nozzle member being rotatable with the fan and the lateral apertures discharging oil over the said plate and into the air current passing through the apertures thereof, and means for rotating the fan and nozzle member.

13. An oil burner comprising a base of bowl like form, a hollow stem extending upwardly from the base providing an oil conduit, a tubular member supported in the base above the bottom thereof and with the open lower end spaced from the wall of the base providing an air inlet about the tubular member to the open lower end thereof, an oil nozzle having a body rotatably mounted on the stem and having lateral apertures in the upper end for discharging oil radially therefrom, a turbine wheel at the lower end

of the oil nozzle body, and within the lower end of the tubular member, a nozzle for directing streams of water against the turbine wheel for rotating the oil nozzle and providing water spray in the lower end of the tubular member, a fan on the said oil nozzle body rotatable therewith by means of which air is drawn through the air inlet and upward through the water spray, an apertured plate over which the oil streams discharge and through the apertures of which the air current discharges in a direction contrary to the direction of flow of the air streams.

14. In an oil burner, a cylindrical shell, a fan therein for forcing air therethrough, a rotating discharge nozzle, an imperforate disk on the nozzle below the oil discharge apertures therein, a stationary burning plate supported by the cylindrical shell having a series of apertures therein through which air is forced by the fan, the nozzle and imperforate plate tending to discharge oil over the burning plate and into the air currents passing therethrough.

15. In an oil burner, a tubular member, a hollow stem extending upwardly therein providing an oil conduit, a member rotatable on the stem and having oil discharge nozzles at its upper end through which oil from the conduit flows, a plate to which the oil is discharged by the nozzle, means for supplying a current of air to the tubular member to discharge to the combustion chamber, and means for providing a spray of water having a temperature not greater than its boiling point to the air body to be carried thereby into contact with the tubular member and plate to prevent overheating thereof.

16. In an oil burner, a burning plate, a nozzle discharging oil to the plate, means for providing air to mix with the oil and oil vapor of the burning plate to provide a combustible mixture, and means for providing a spray of water at a temperature below the boiling point thereof to the burning plate to reduce its temperature during operation and provide steam on the combustion side of the burning plate.

17. In an oil burner, a combustion chamber, means for providing oil for combustion in the chamber, means for causing a flow of air to the chamber, a burning plate in the chamber to the upper side of which the oil is discharged, and means for supplying water having a temperature not greater than its boiling point and in the form of a mist or spray to the air current to contact with the under side of the burning plate to cool the same and to provide steam in such quantity as to aid in combustion.

18. In an oil burner, a combustion chamber, means for providing oil for combustion in the chamber, means for causing a flow of air to the chamber, and means for supplying a spray of water having a temperature below its boiling point to the air body during its passage to the combustion chamber.

19. In an oil burner, a combustion chamber, an oil supply conduit having a discharge aperture in the combustion chamber, means for providing a flow of air about the oil conduit and discharging to the combustion chamber, and means for supplying a spray of water along the oil conduit and to the air body thereabout to maintain the temperature of the conduit below the distillation point of the oil, the said water spray being carried by the air body to the combustion chamber.

20. In an oil burner, an apertured burning plate, means for discharging oil to the upper surface of the plate, means for forcing air through the plate, means for supplying water in the form of a spray at a temperature below its boiling point to the air previous to its passing through the apertures of the plate.

In testimony whereof I sign this specification.

JAMES W. MOWBRAY.