Oct. 26, 1937. C. L. RAYFIELD 2,096,859

OIL BURNER

Original Filed Jan. 29, 1931 2 Sheets-Sheet 1

Fig. 1

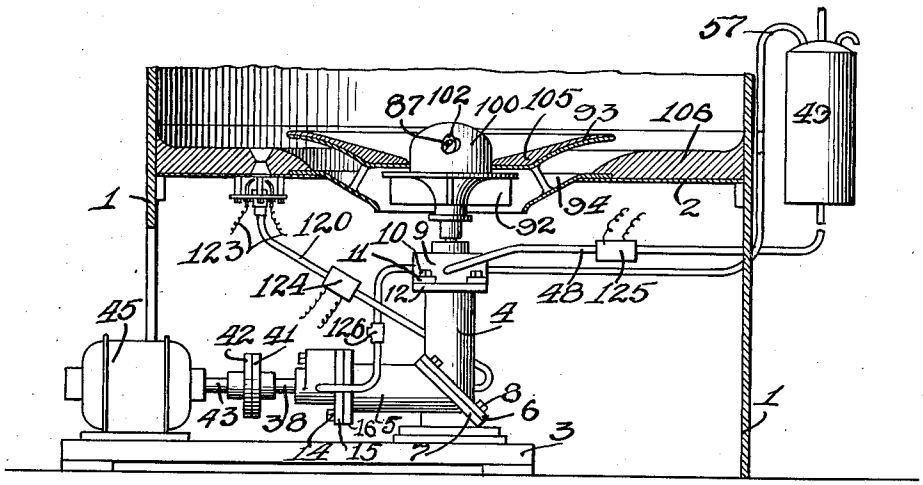
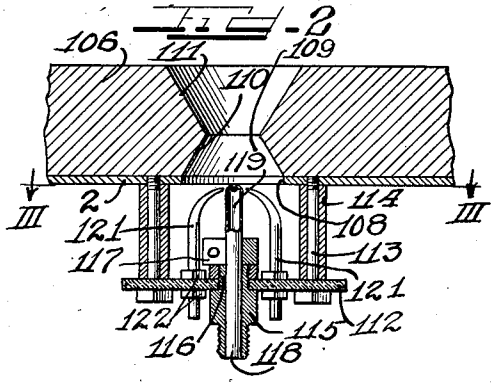


Fig. 2



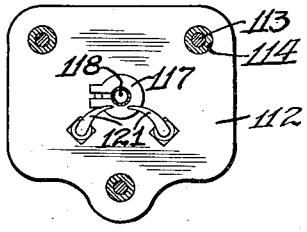


Fig. 3

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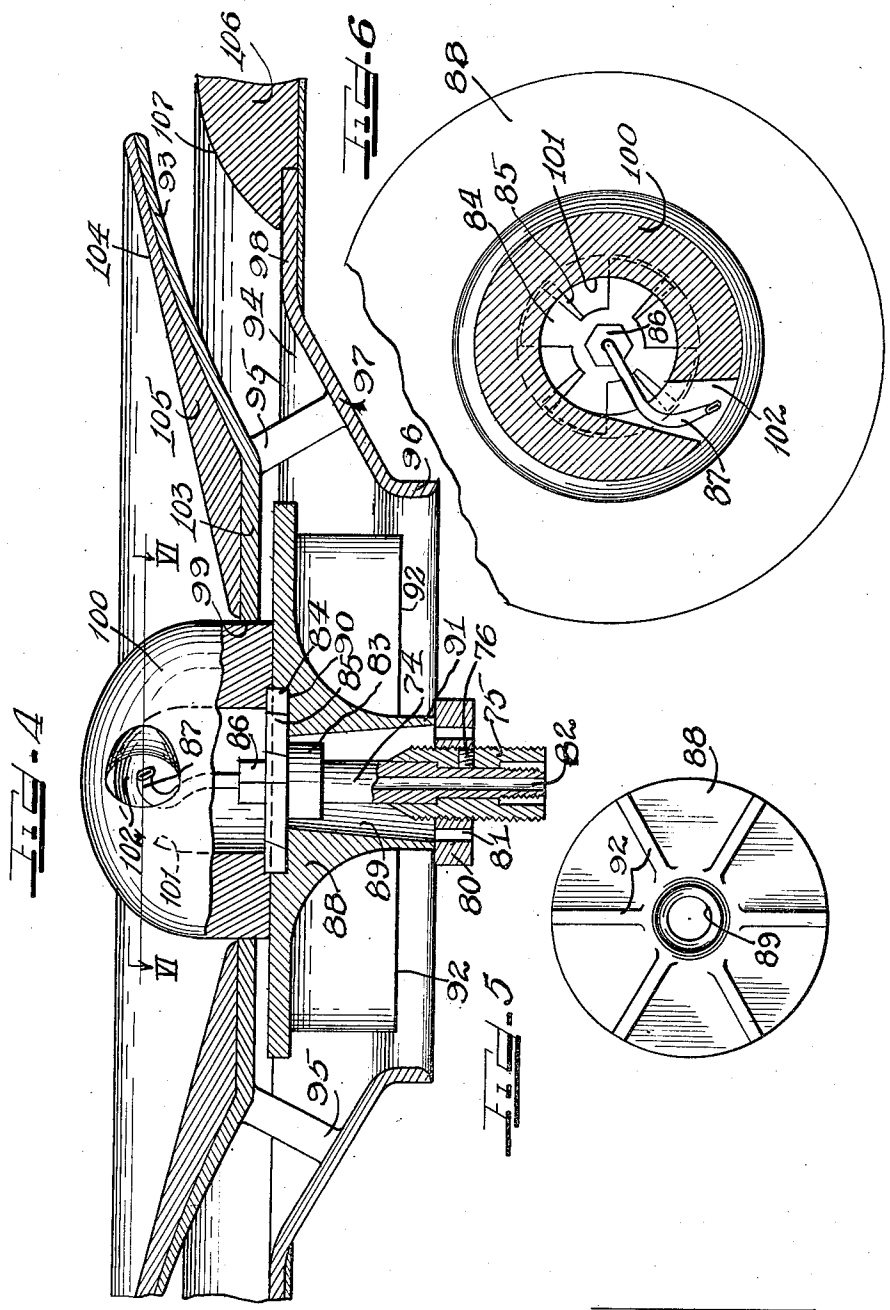
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OIL BURNER

Original Filed Jan. 29, 1931 2 Sheets-Sheet 2



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Patented Oct. 26, 1937 2,096,859

UNITED STATES PATENT OFFICE

2,096,859

OIL BURNER

Charles L. Rayfield, Chicago, Ill.

Original application January 29, 1931, Serial No. 511,986. Divided and this application July 24, 1934, Serial No. 736,638

7 Claims. (Cl. 158—77)

My invention relates in general to oil burners and more particularly to improvements in that type having a rotatable burner head and pumping apparatus for delivering a fuel mixture to the burner head, the head and pump being motor driven.

The present application is a division of my copending application, Serial No. 511,986, filed January 29, 1931.

It is an important object of the present invention to provide in an oil burner, an improved burner head which is simple in construction, simple and efficient in operation, and inexpensive to manufacture.

A further object of the invention resides in the provision of an improved burner head of the rotatable type, wherein a cyclonic flame is attained by rotating the burner nozzle and discharging the combustible mixture in a direction opposed to the direction of movement of the nozzle and tangential to its path of rotation.

A still further important object of the invention is to provide in an oil burner an improved burner head of the rotary type which is adapted to prevent carbonization of the burner nozzle and is designed so as to enable the combustible mixture to be discharged tangentially into the combustion chamber.

It is also an important object of this invention to provide an improved burner head which is designed to discharge the combustible mixture in a manner to form a cyclonic flame and supply a layer of air between this flame and the peripheral wall of the combustion chamber, thereby causing the heat from the flame to be concentrated where it may be utilized most efficiently for heating the furnace or boiler.

In accordance with the general features of the invention, I propose to provide a burner head in the form of a dished member which is rotatable about a vertically disposed central axis and is provided on its upper surface with a dome-shaped cap or shield having an aperture thru which the combustible material is projected tangentially. The lower surface of this plate is formed with blades for supplying a cylindrical column of air around the central flame of the burner. This column of air protects the wall of the combustion chamber and prevents the loss of heat therethrough by radiation.

Other objects and features of this invention will more fully appear from the following detail description taken in connection with the accompanying drawings which illustrate a single embodiment thereof, and in which

Figure 1 is a diagrammatic view showing a burner embodying the features of my invention applied to a furnace or boiler;

Figure 2 is a vertical section through the pilot burner showing the relationship of the pilot burner nozzle and the spark gap for igniting the pilot burner;

Figure 3 is a sectional view of the pilot burner, taken substantially on line III—III of Figure 2;

Figure 4 is a vertical diameterical section showing the details of the component parts of the rotary burner head;

Figure 5 is a plan view from beneath of an impeller having radial blades formed thereon; and

Figure 6 is a sectional view of the burner head showing the relative position of the discharge nozzle in the refractory shield, and blades for directing air into the interior of the shield, taken substantially on line VI—VI of Figure 4.

As illustrative of my invention, I have chosen to show in Figure 1, the fire pot of a furnace or boiler of conventional type to which an oil burner embodying the features of my invention has been applied. This furnace or boiler comprises a vertically disposed peripheral wall 1 which is separated into an upper compartment and a lower compartment by means of a transversely extending plate member 2 that is secured at its outer edge to the wall in any suitable manner, the upper compartment forming the combustion chamber of the furnace. The burner head, which will be described in detail subsequently, extends through the plate member 2 into the combustion chamber and is operably connected to a mechanism located in the lower compartment of the furnace. This mechanism is mounted on a base structure 3 and serves not only to drive the head, but furnish a combustible material under pressure thereto.

The pump shown in Figure 1 is preferably of the type described in my Patent No. 1,967,260 although it will be apparent to those skilled in the art that other types of pumps may also be used, if desired.

In general this pump is of the angular type having, as shown, angularly disposed housing sections 4 and 5 which enclose pumping instrumentalities for pumping air and oil for the burner.

These sections are secured together at their inner ends along a 45° plane by means of their respective flanges 6 and 7 and screws 8. A head 9 is applied to the outer end of the housing 4 and detachably secured thereto by means of screws 10 which pass through a head flange 11 and a flange 12 of the housing. A head 13 is

similarly applied to the outer end of housing 5 and is detachably secured thereto by screws 14 which pass through a flange 15 on the head and engage a flange 16 of the housing.

The pump just described not only serves to pump the air and oil to be utilized in the burner, but also serves as a driving connection between the burner and a suitable source of power.

In this instance the pumping parts are driven through a shaft 38 which extends axially from the head 13 and is connected at its outer end to a coupling member 41. This coupling member mates with a coupling member 42 which is carried by the driving shaft 43 of a suitable electric motor 45.

Power from the motor 45 is transmitted through the internal pumping instrumentalities to a shaft 74 of the burner head as shown in Figure 4, this shaft being connected to the pumping instrumentalities by a sleeve connecting member 75 which is secured for rotation with the shaft 74 by means of a suitable set screw 76.

Oil to be pumped is supplied to the head 9 through a suitable pipe 48 from an oil supply reservoir, which in this case is shown as being a vacuum tank 49 of the type commonly used in automobiles. Air is supplied to the pump through a pipe 57 which is connected to the vacuum connection of the vacuum tank 49, and additional air may be supplied through an air valve 126 which is provided in a pipe connection interconnecting the two pumping sections of the pump. The pumped air and oil are then combined in the pump and delivered from the pump through a delivery pipe 120 to the pilot burner, and through a bore passageway 82, as shown in Figure 4, which is provided in the shaft 74, to the main burner nozzle.

The upper end of the shaft 74 carries a fan member having a hub 83 which surrounds the shaft and abuts a shoulder on the shaft at its lower end. Integrally formed with the hub 83 and extending outwardly from the upper end thereof are a plurality of wings 84 which are circumferentially spaced around the hub and beveled at 85 so as to force air upwardly through the space between the wings, when the shaft 74 is rotated in a clockwise direction as viewed in Figure 6. The fan member is secured to the shaft 74 by a nut 86 which engages the upper surface of the fan member. Extending from the axis of the nut 86 is an upwardly and outwardly bent tube 87 which communicates at its lower end with the bore 82 of the shaft 74 and forms at its upper end a nozzle for discharging combustible fluid into the combustion chamber.

An impeller 88 having a central upwardly converging tapered bore 89 surrounds the shaft 74 and extends between the fan member 84 and a nut 80 which is threaded on the sleeve 75. The upper surface of the impeller is grooved as at 90 for receiving therein the peripheral margins of the wings 84 and the impeller is held against axial movement by the nut 80 which bears against the lower end of the hub portion 91 thereof. It will be observed that the nut 80 is provided with apertures 81 which communicate with the tapered bore 89 of the impeller, and also that the wings 84 extend across the upper open end of the tapered bore 89. The impeller 88 carries a plurality of radially extending blades 92 for discharging air in a radial direction.

This impeller is disposed within a housing formed by dish-shaped members 93 and 94 which are held in spaced relationship by means of ribs 95. The member 94 terminates in an annular flange 96 defining a central opening which forms an inlet passage for air to be circulated by the rotation of the impeller. From the flange 96 the member 94 is upwardly and outwardly flared as shown at 97 and terminates in a horizontally disposed rim 98 which is supported upon the upper surface of the partition member 2.

The upper member 93 has a central aperture 99 for receiving therethrough a dome-shaped refractory member 100 which is preferably of fire-resisting material, such as fire clay. The member 100 is supported upon the top surface of the impeller and the wings 84 and houses the tube 87 which is disposed within a central chamber 101. The outer end of the tube 87 is disposed within an aperture 102 having one end in communication with the chamber 101 and its other end opening into the combustion chamber, this tube being so disposed in the aperture that the tube will discharge combustible fluid in a substantially tangential direction to its path of rotation. From the member 100 the member 93 extends outwardly in a horizontal direction to form a bottom portion 103 which extends outwardly past the impeller and from whence it is then deflected upwardly and outwardly as shown at 104 to form the rim of the upper member. The upper surface of the member 93 is covered with a layer of material such as fire clay which is indicated at 105. The upper surface of this material extends upwardly and outwardly from the member 100 to form a conical surface terminating at the outer periphery of the rim 104. A contracted discharge opening for the air from the impeller is provided between the peripheral edges of members 93 and 94 by covering the member 2 with a material such as fire clay and as shown at 106, this covering extending upwardly from the upper surface of the member 94 in a sharp curve 107 until it is past the peripheral edge of the upper member 93, whence it extends horizontally until adjacent the wall 1 of the furnace where it is curved upwardly. It will be observed that the refractory member 100 protects the nozzle of the burner and prevents it from becoming carbonized or burned away.

At one side of the outlet from the impeller housing, the fire clay 106 and member 2 have intercommunicating apertures 108 and 109 through which the pilot burner discharges into the combustion chamber. The aperture 109 is formed to have oppositely extending conical walls 110 and 111. A member 112 of insulating material is supported below the aperture 108 by bolts 113 which extend through tubular spacing members 114 and threadedly engage the member 2. At the center of member 112 a sleeve 115 is arranged with its upper end 116 extending therethrough and threaded for anchoring a member 117 which clampingly engages a tube 118 having its upper end closed and provided with an outlet aperture 119 which is adjacent the aperture 108 and forms the discharge nozzle for the pilot burner. The lower end of the sleeve member 115 is threaded for making a suitable connection to the feed pipe 120 which communicates with the pump structure. There is also supported on the member 112 a pair of arcing horns 121 having their upper ends terminating and spaced apart adjacent the aperture 119 at the upper end of tube 118, each of these horns being secured to the member 112 by suitable nuts 122. The lower ends of the horns 121 are connected by means

of conductors 123 to a suitable source of electricity.

Suitable valves 124 and 125 are respectively inserted in the supply pipe 120 for the pilot burner and the supply pipe 48 of the main burner for controlling the supply of oil thereto. The valve 124 which may be electrically actuated is preferably of the all-on or all-off type, whereas the valve 125 in the supply pipe 48 may be either of the all-on and all-off type or partly-on and all-off type and is also preferably electrically operated.

The operation of my improved burner will be substantially as follows:

The motor 45 is started through the agency of suitable control equipment which may be manual or automatic depending upon the installation. The motor will then drive the pump through shaft 38 which will operate the pump to pump oil and air, and at the same time rotate the driving shaft 74 of the rotary burner head. Rotation of the shaft 74 will rotate the impeller 86 and the nozzle 87 in a clockwise direction. The valve 125 is then opened to enable the pump to draw in oil from the vacuum tank 49 through the inlet pipe 48. Simultaneously with the pumping of oil from the vacuum tank, the pump will draw air from the vacuum tank through pipe 57 and also take in air through atmospheric opening 126.

The air and oil are mixed in the pump to form a good combustible fluid which is conducted through the bore 82 to the tube 87 from whence it is discharged tangentially into the combustion chamber. Combustible fluid is also supplied through the pipe 120 from the pump to the tube 118 from which it is discharged from the opening 119 through the apertures 108 and 109. The pilot burner is turned on by actuating the valve 124 and then is ignited by energizing the arcing horns 121 through conductors 123, thereby causing a spark to jump between the horns and ignite the combustible fluid being discharged from the aperture 119.

As soon as the pilot burner is ignited, the combustible fluid issuing from the main burner nozzle will be ignited and, since the nozzle is discharging tangentially to its path of movement, a cyclonic flame will be produced which extends outwardly from the refractory member 100 over the surface of the fire clay material 105 which is thereby heated to a high temperature, the heat therefrom being reflected upwardly into the furnace. As soon as the main burner is ignited the pilot burner may be extinguished by closing the valve 124, since the pilot burner will no longer be needed.

By virtue of the rotation of the main burner head, the beveled edges 85 of the wings 84 will draw air upwardly through the apertures 81 and the tapered bore 89 of the impeller and discharge it through the aperture 102 where it combines with the combustible fluid issuing from the main burner nozzle. Since the impeller is being revolved, the blades 92 thereon will suck in cold air through the central opening defined by the annular flange 96 in the lower plate member 94 and discharge it outwardly between the upper and lower plate members 93 and 94, thereby tending to keep the upper plate member cool. As this air emerges at the peripheries of the upper and lower plate members it passes over the upper surface of the fire clay material 106 and is deflected thereby along the wall 1 of the furnace. It will be observed that this layer of air shields the wall 1 from the heat created by the burner flame, thereby serving to keep the wall cool at all times and concentrate the heat from the fire clay material 105 at the center of the furnace where it may be utilized most efficiently. The refractory member 100 serves to protect the main burner nozzle from carbonization.

When it is desired to shut down the burner, the valve 125 is closed, and the motor 45 continues to run a sufficient length of time to discharge the oil in the pump, after which the motor is shut down and the equipment is then in a condition to be started up again when needed.

It will be appreciated from the foregoing that my invention provides a novel oil burner in which the pump is not only utilized for pumping oil and air but also serves as a drive between the pump motor and the burner head; in which the air and oil are combined in the pump to form a good combustible mixture, to be delivered to the burner head; a pilot burner which is also supplied from the pump; in which the combustible fluid is discharged tangentially to the path of movement of the burner nozzle to form a cyclonic flame; and in which cold air is circulated by the burner head for shielding the wall of the combustion chamber with the result that the heat from the burner will be concentrated where it may be utilized most efficiently for heating the furnace or boiler.

While I have shown and described my invention in a preferred form, changes and modifications in structure and arrangement may be made without departing from the spirit and scope of the invention and I, therefore, do not limit my invention except as defined in the appended claims.

I claim as my invention:

1. In an oil burner, a rotatably mounted dome-shaped refractory shield having an aperture in the wall thereof, a discharge nozzle for oil mounted within and rotatable with said shield as a unit, said nozzle projecting into said aperture and having its discharge axis positioned to discharge the oil tangentially of the refractory shield, means for rotating said shield and nozzle, and means adacent the base of said shield for forcing air into said shield and through said aperture.

2. An oil burner head comprising a vertically disposed rotatable tubular member for conducting oil, an oil discharge tube connected to said member and rotatable therewith, the discharge end of said tube being disposed to move in a circular path about the axis of rotation of said member and curved so as to discharge the oil tangentially to its path of movement in a direction opposed to its direction of movement, and a stationary deflector member disposed in the path of the tangentially discharged oil.

3. In an oil burner, a burner head comprising an air impeller mounted for rotation about a vertical axis, a hollow member carried by said impeller and rotatable therewith, said member having a side aperture, a nozzle for discharging oil outwardly through said aperture, a dished plate surrounding the hollow member and having its upper surface disposed in the path of the oil from said nozzle, a second plate spaced below the first plate and having an air inlet opening, said plates defining a stationary housing for the impeller, whereby the air from the impeller is directed outwardly and discharged at the plate peripheries and the upper dished plate is cooled.

4. In an oil burner, a burner head comprising a rotatable refractory shield shaped to form a dome with a side aperture, a deflector plate surrounding said shield, an oil discharge nozzle in said shield projecting into said aperture and having its dis-

charge end positioned to discharge oil tangentially of the shield against said plate, means for forcing air outwardly through said aperture, and means for forcing additional air along the under surface of said plate to cool the same.

5. In an oil burner, a burner head comprising a rotatable refractory shield shaped to form a dome with a side aperture, a deflector plate surrounding said shield, an oil discharge nozzle in said shield projecting into said aperture and having its discharge end positioned to discharge oil tangentially of the shield against said plate, a housing including said plate, said housing having a peripheral discharge opening, means in said housing for forcing air into said dome, and other means in said housing for forcing air outwardly along the under side of said plate to the peripheral discharge opening.

6. In combination with a furnace having a combustion chamber with a bottom wall and a side wall, an oil burner having a rotatable oil discharge nozzle disposed centrally of and above the bottom wall of the combustion chamber, a deflector plate surrounding said nozzle and supported on said bottom wall, said plate having its upper surface disposed in the path of the oil discharged from said nozzle, and means for forcing air outwardly along the lower surface of said plate onto the upper surface of said bottom wall, said upper surface of the bottom wall being formed adjacent the side wall of the chamber in a manner to deflect said air upwardly, whereby an air blanket is formed to shield the side wall from the heat resulting from the burning of said oil.

7. In combination with a furnace having a combustion chamber with a bottom wall and a side wall, an oil burner having a rotatable oil discharge nozzle disposed central of and above the bottom wall of the combustion chamber, a dished deflector plate surrounding said nozzle and supported on said bottom wall with its outer edge spaced above the same, the upper surface of said plate being disposed in the path of the oil discharged from said nozzle, and means for forcing air outwardly along the lower surface of said plate, said plate and bottom cooperating to direct the air along the upper surface of said bottom wall, and said bottom wall having an upwardly curved portion adjacent said side wall for directing the air upwardly to form an air blanket between the side wall and the interior of the combustion chamber.

CHARLES L. RAYFIELD.