MULTIPLE FUEL BURNER

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Application December 26, 1956, Serial No. 630,615

3 Claims. (Cl. 158—11)

The present invention relates to fuel burners and more specifically pertains to industrial equipment for burning liquid and gaseous fuel wherein the capacity is enlarged without increasing the dimensions of the burner assembly.

It is known in the art to which the invention pertains to provide a liquid fuel burner at the center of a burner structure with a plurality of gaseous fuel burners disposed about the liquid fuel burner and to provide a shroud arranged about the atomized fuel issuing from the liquid nozzle so as to prevent secondary air from moving directly into the presence of the liquid fuel nozzle. A shroud of the ceramic type for such purposes is disclosed in application Serial No. 555,468, filed December 27, 1955, owned by the assignee of the present invention. In order to maintain ample free area for the flow of secondary air in the burners of the prior art particularly when a thick walled shield is provided for the oil burner nozzle, the overall structure of the burner must be increased to maintain proper free area for air flow in the burner for a given capacity.

An object of the present invention is to provide a shield embracing the liquid fuel nozzle having a relatively thin wall so as to increase the free area for secondary air and to thus reduce the overall dimensions of the burner without reducing the capacity or the heat output of the burner assembly.

A further object of the invention is to provide a multiple fuel burner wherein a given quantity of fuel may be more rapidly consumed and a burner wherein the liquid component of the fuel is burned at a higher rate and without a shorter flame than has previously been possible with burner structures of the type to which the invention pertains.

Another object of the invention is to provide a multiple fuel burner wherein there is more rapid mixing of the secondary air with the fuel at the desired zone to provide more stable operation of the liquid fuel burner and to shorten the length of the flame produced thereby.

A further object of the invention is to provide improvement in the shape of the tile into which the burning fuel from the liquid fuel nozzle and the gas burners is discharged and to provide a refractory element which may be shipped with the burner and erected therewith without the necessity of requiring separate shipment and installation of several burner blocks.

A still further object of the invention is to provide for the discharge of gaseous fuel downstream and circumferentially along an inner face of the refractory tile so as to maintain it at a high temperature and to thereby maintain a high temperature in the combustion area of the burner assembly and to avoid loss of heat from the burner and to thereby accelerate the combustion rate of the fuels and to release the maximum of heat into the structure to be heated.

Another object of the invention is to provide an annular shoulder within the refractory element so as to deflect the air in the presence of the gas burner tips to provide eddy currents which promote stabilization of the operation of the gaseous fuel burners.

Other objects and features of the invention will be appreciated and understood as the present disclosure proceeds and upon consideration of the accompanying drawings and the following detailed description wherein an embodiment of the invention is disclosed.

In the drawing:

Fig. 1 is an axial sectional view of a burner assembly embodying the invention.

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary section of a portion of the shroud with one of the gas burners shown in plan.

Fig. 4 is an enlarged sectional view of one of the gaseous fuel burner tips taken on the line 4—4 of Fig. 3.

Referring to the drawing there is shown at 10 a wall such as the bottom of a structure to be fired. The bottom wall 10 or floor of a furnace is provided with a cylindrical opening 11 for accommodating a generally cylindrical shape ceramic or refractory shroud member 12. The refractory member may be supported within the opening 11 by means of a sleeve 14. This sleeve may be supported on the furnace structure by a ring-shaped bracket 16 which may be secured to the wall 10 in any suitable manner. The sleeve 14 is provided with an end wall 17 on which the refractory member 12 rests and the end wall 17 provides means to which other portions of the burner structure as hereinafter described may be attached.

The inner surface of the refractory member 12 is of cylindrical shape throughout the downstream end thereof as shown in Fig. 1. A plurality of circumferentially extending shoulders 19 are provided on the interior of the ceramic member 12 near the upstream end. These shoulders provide a substantially annular rib with spaces 21 therebetween for accommodating the gas burner tips as hereinafter described. The circumferentially extending shoulders 19 may be formed integral with the refractory element 12.

An annular member 23 is disposed below the refractory element 12 and closes the opening in the upstream end thereof. The annular member 23 carries a flange 24 which is of ring shape and may be secured to the end wall 17 of the sleeve 14 in any suitable manner such as by means of cap screws. The upper end of the annular member 23 fits within the lower end of the shroud 12 and is in abutting relationship with the annular rib structure. A cylindrical member 26 is arranged below the annular member 23 and in abutting relationship with the lower end thereof. The cylindrical member 26 is provided with circumferentially spaced openings 27 and forms the stationary part of an air register. An end plate or disc 28 closes the free end of the member 26 and this disc is secured to the annular member 23 by means of cap screws 31 which extend through spacer elements 32. The disc 28 is thus maintained in rigid assembly relationship with the burner structure. A sleeve 33 is provided around the member 26 and may be rotated thereon by means of a handle 34. The sleeve 33 is provided with openings which are circumferentially spaced to provide an air register wherein the openings of the rotatable sleeve 33 may be brought into registration with the openings 27 and the volume of secondary air may thus be controlled.

A gaseous fuel manifold 36 of an annular type is secured to the disc 28 in any suitable manner. An inlet opening 37 is provided in the manifold 36 for directing un premixed gas into the manifold for distribution to the gaseous burner tips as hereinafter described. The disc 28 is provided with an axially extending flange 39 around a central opening therein. A cylindrical shaped shroud 41 is arranged axially of the burner structure and maintained in position by set screws or the like (not
A primary air register is supported at the lower end of the shroud 41 and includes a stationary sleeve 43 provided with a flange at its upper end secured to the lower end of the shroud structure 41. An outer sleeve 44 is rotatable on the sleeve 43 so that circumferentially spaced openings in these two sleeves may be brought into partial or full registration as desired for controlling the volume of primary air. A tube 46 is supported by the lower end of the primary air register and extends axially therethrough and into the shroud 41. An oil supply pipe 47 extends through the tube 46 and a liquid fuel nozzle 48 is provided at the inner end of the pipe 47 for discharging liquid fuel such as oil through ports in the nozzle 48. It will be observed that the nozzle 48 is supported within the burner assembly and upstream from the downstream end of the shroud 41. The tube 46 is supported in position by means of a ring 49 carried by the primary air register structure.

A gas burner tip 51 is mounted within each space 21 provided between adjacent ends of the annular shoulders 19. The burner tips 51 are supplied with gas from the manifold 36 by supply pipes 52. Each burner tip 51 is provided with at least two discharge orifices 53 and 54 as shown in Fig. 3. These discharge ports are so disposed that gas from the port 54 is discharged at an angle of approximately sixty degrees with respect to the axis of the associated supply pipe 52. The included angle between the axes of the ports 53 and 54 is approximately ninety degrees as shown in Fig. 3. The unpremixed gas is thus discharged through the ports 53 and 54 so as to travel in a direction which is generally parallel to the inner surface of the shroud 12 and the gas streams move both forwardly towards the space to be fired and also tangentially with reference to the inner surface shroud 12. Air is drawn into the gas by virtue of the lower pressure area adjacent the gas streams issuing from the ports 53 and 54 and the gas is supplied to the manifold 36 at pressures in excess of three pounds. Such a structure produces a sheet of burning gas in close proximity to the inner surface of the refractory shroud 12. The circumferentially extending shoulders 19 deflect the air moving into the presence of the gas burner tips. These eddy currents tend to stabilize burning of the gas as it moves downstream from the burner structure. The burning gas is in contact with the inner surface of the refractory member which is heated to a high temperature. Loss of heat from the burning fuels is thus reduced and the flame temperature within the burner structure is maintained at a high level and the burning of both fuels and particularly the liquid fuel is accelerated.

The discharge ports for the liquid fuel burner 48 are so disposed that the atomized liquid clears the downstream end of the shroud 41. In view of the thin wall forming the shroud 41 the included angle between the conical periphery of the atomized liquid fuel as represented by the phantom lines in Fig. 1 may be as great as fifty-five degrees so as to provide a relatively short flame for the burning liquid fuel without having the liquid fuel engage the inner periphery of the ceramic shroud 12.

It will be appreciated that the path or paths for the secondary air entering through the openings 27 is of shorter length than is the case when the shroud around the liquid fuel burner has a thick wall. The secondary air moves radially inward over the downstream end of the shroud 41 into the presence of the burning liquid fuel. The thin character of the wall of the shroud 41 plus the higher included angle of the liquid fuel spray tends to shorten the flame and accelerate burning of the liquid fuel. Thus more fuel is maintained within the confines of the burning structure to assist in maintaining the ceramic structure at high temperature which further promotes rapid burning of both fuels.

While the invention has been described with reference to specific structural elements and with regard to one organization including members formed of various materials it will be appreciated that changes may be made in the assembly and in the combination. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What we claim and desire to secure by Letters Patent is:

1. In a multiple fuel burner assembly, a refractory member having a cylindrical inner surface, a plurality of circumferentially extending shoulders projecting inwardly from said inner surface of said refractory member adjacent the upstream end thereof, said shoulders having spaces between adjacent ends thereof, a gas burner tip mounted within each of said spaces, means for supplying gaseous fuel under pressure to said burner tips, a nozzle located centrally of said burner tips, means for supplying liquid fuel to said nozzle, a shroud of cylindrical shape surrounding said nozzle, said shroud having a wall thickness not greater than one-half an inch, means for controlling the volume of air admitted to the exterior of said shroud for movement over the downstream end thereof into the presence of the fuel issuing from said nozzle, and each of said burner tips having ports for discharging the gaseous fuel along the inner surface of the refractory member.

2. In a multiple fuel burner, a refractory member having a cylindrical inner surface, a plurality of circumferentially extending shoulders projecting inwardly from said inner surface, said shoulders having spaces between adjacent ends thereof, a gas burner tip mounted within each of said spaces, means for supplying gaseous fuel under pressure to said burner tips, a liquid fuel nozzle located centrally of said gas burner tips, a shroud of cylindrical shape surrounding said liquid fuel nozzle, means for controlling the volume of air admitted to the exterior of said shroud for movement over the downstream end thereof into the presence of the fuel issuing from said nozzle, said burner tips having discharge ports therein, said ports being disposed to discharge the gaseous fuel at an angle of approximately sixty degrees with respect to the axis of the tip and towards the inner surface of said refractory member.

3. In a multiple burner according to claim 2, wherein each burner tip is provided with two diverging discharge ports with the axes thereof displaced by approximately ninety degrees for directing the gaseous fuel in circumferentially opposite directions along the inner surface of the refractory member.

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