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INDUSTRIAL BURNER

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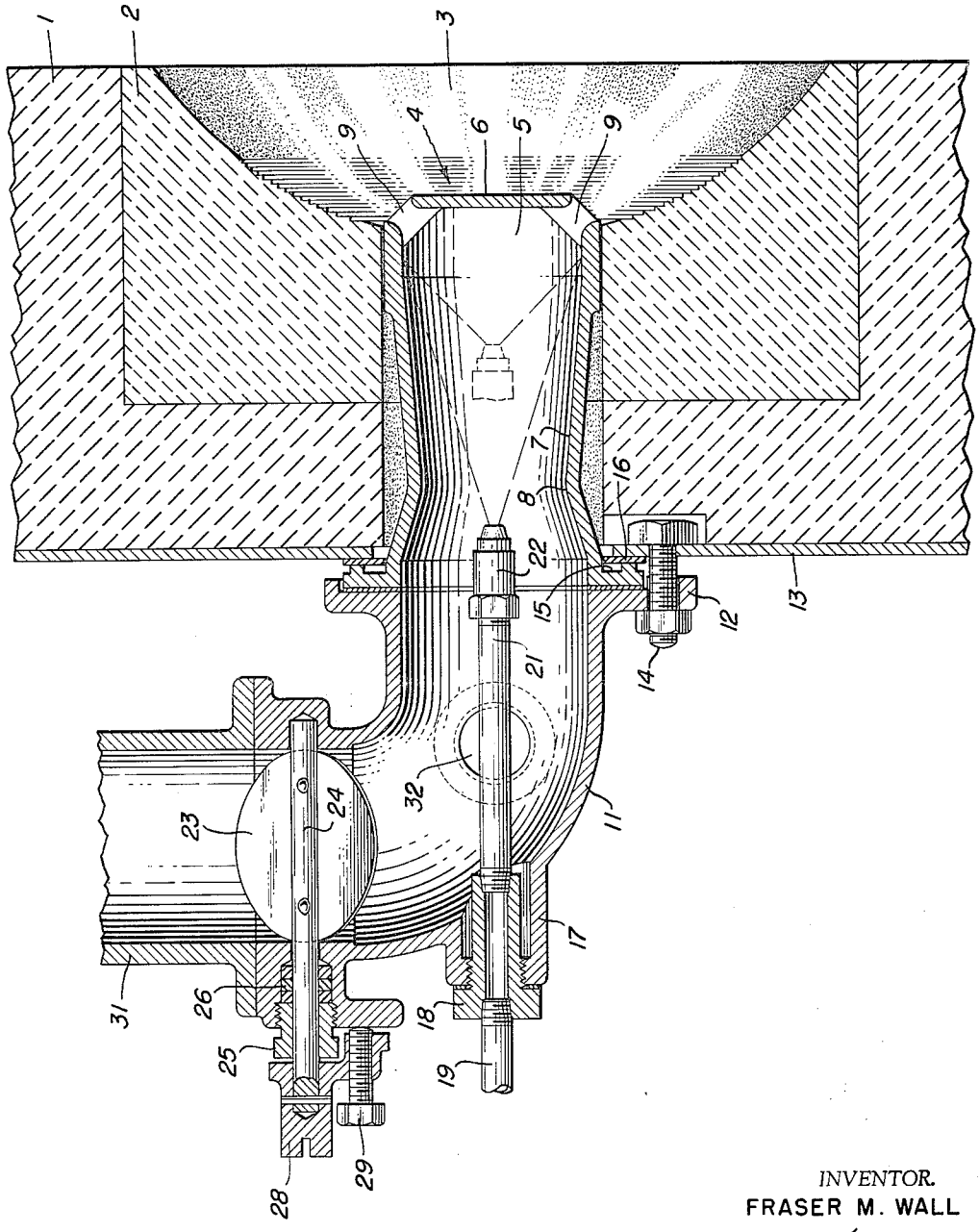

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INDUSTRIAL BURNER

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The present invention relates to industrial burners, and more particularly to a burner that is adapted to use gas or light oils, generally from No. 2 fuel oil to naphtha, as fuel.

It has been difficult to design burners of the radiant cup type which use a liquid fuel because of the tendency of the fuel to burn as droplets or to produce tongues of flame that burned away from the surface of the cup, thus reducing its incandescence. This is due, in large part, to incomplete vaporization of the fuel and to incomplete mixing of the fuel and air prior to the time it is discharged into the cup.

It is an object of the invention to provide a radiant cup-type industrial burner that will burn oil with the same characteristics as gas. It is a further object of the invention to provide an industrial burner which will use oil or gas as a fuel interchangeably and with no apparent effect on its combustion characteristics.

In practicing the invention, there is provided a distributing member which projects into the base of a cup-shaped depression of a burner block. This distributor has a chamber that is in communication with the depression by a series of substantially radially directed passages. Fuel in the form of either gas or liquid is discharged into the chamber where it is mixed thoroughly with combustion air, which preferably is heated. The mixture is discharged through the passages where it is burned along the surface of the cup to heat said surface to incandescence.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

In the drawings:

The single figure drawing shows the burner in section.

Referring to that figure, there is shown a furnace wall 1 in which is placed a burner block 2, of ceramic material having a cup-shaped depression 3 formed in its face. This block and the wall immediately beyond it is provided with a coaxial opening extending from the base of the cup to the outer surface of the furnace wall in which is received a metal fuel and air distributor member 4 preferably made of heat resisting alloy. The distributor is cylindrical and has in it a chamber 5 the end of which toward the furnace, is closed by an end wall 6. The axially extending side wall 7 of the distributor is formed in the shape of a venturi with the large end terimnating adjacent to the end wall 6 and the throat 8 of the venturi being spaced from the end. Chamber 5 is connected with the burner cup by means of a plurality of radially extending passages 9 around the periphery of the distributor. As shown in the drawing, the distributor is snugly received in the opening in the furnace wall and projects beyond this opening so that passages 9 clear the surface of the cup 3, thus permitting unobstructed discharge of the fuel mixture from the chamber radially along the surface of cup 3.

Air is supplied to the distributor, and the distributor is held in position in the burner block, by means of an inlet casting 11 that can be either straight or in the form

of an elbow as shown. The advantage of making the casting 11 in the form of an elbow is one of space in that it does not project far beyond the furnace wall. The casting is provided with a radially extending flange 12 which is bolted to the metal shell 13 on the furnace wall by means of bolts 14. Flange 12 engages a radially extending flange 15 on the outer end of distributor 4 to hold the distributor in place in the burner block. A gasket 16 between the shell 13 and an axially extending ridge on flange 15 insures accurate alignment of the parts and that no gases can enter or escape around the distributor. A suitable gasket can be used, if desired or necessary, between flanges 12 and 15. This construction permits parts of the burner to be quickly and accurately assembled and replaced.

Axially aligned with chamber 5 and throat 8, is a boss 17 formed on casting 11 to receive the fuel oil supply parts. These parts include a connector 18 that is threaded into the boss and which receives a supply pipe 19, connected to a suitable oil supply. The other end of connector 18 has threaded into it a tube 21 which supports, axially of the chamber, an atomizer 22.

Air is supplied through casting 11, as noted above, and the flow of air can be controlled by a damper 23 extending across the upper end of casting 11. This damper is mounted on a shaft 24 that extends through a packing gland 25 and packing 26 with the outer end having attached to it an adjusting knob 28. The knob can be provided, if desired, with suitable indicia to indicate the position of the damper and with a locking screw 29 that can be used to hold the damper in any adjusted position. Air is supplied to casting 11 through a pipe 31 from any suitable source of supply.

The burner can be used with either liquid or gas as fuel, or a combination of the two. To this end, casting 11 is provided with a gas inlet 32 which is perpendicular to the axis of the casting and distributor and which is also perpendicular to the air inlet.

In assembling the parts of the burner, the distributor and casting 11 are moved together from the outside of the furnace until the distributor is received in the furnace opening as shown. The end wall 6 of the distributor and passages 9 can be accurately positioned with respect to the surface of cup 3 by using a gasket 16 of the proper thickness. In assembling the parts, the distributor is moved into the opening of the furnace wall until the back edges of passages 9 project slightly beyond the surface of the cup. The atomizer and its supporting tube 21, which have been mounted on connector 18, are then moved into position and threaded into boss 17. The location of the atomizer axially in the distributor will depend upon the angle of discharge of spray from the atomizer. The atomizer can ordinarily have a spray varying from about 30° to about 90°. The atomizer is adjusted axially so that its cone of spray will strike the inner surface 7 of chamber 5 at a plane substantially perpendicular to the axis of the chamber and slightly to the rear of passages 9. The solid line position of the atomizer in the drawing shows, in dotted lines, an atomizer spray of a relatively narrow angle, while the dotted line position of the atomizer shows a spray of a relatively wide angle. It will be noted in both cases that the atomizer is adjusted carefully to an axial location in which the discharge therefrom will strike the inner surface of the chamber at a point slightly back of the inner ends of passages 9. This position can be determined accurately and a tube 21 of the proper length used to support the atomizer. Although any type of atomizer with the proper spray angle can be used, it is preferred to use a pressure type atomizer in which no atomizing fluid is required for the fuel.

In the operation of the burner, liquid fuel, that can vary

from naphtha to No. 2 fuel oil, is supplied to the atomizer and is discharged by it into chamber **5**. Air is supplied through pipe **31** to flow through chamber **5** and out of openings **9**. This air is heated to a temperature sufficient to vaporize the fuel being used and will vary from about 300° F. for naphtha to about 700° F. for No. 2 fuel oil. As the air is introduced through pipe **31** and casting **11**, it will flow axially through distributor **4**. Since the cone of oil from atomizer **22** has a direction to strike the inner wall of chamber **5**, the air flowing in an axial direction will pick up all of this oil and will vaporize it so that a mixture in the form of vapor and air is discharged across the surface of the cup. Throat **8** of the venturi section, with the subsequent enlargement of the chamber section, gives a pressure change to the air and sufficient turbulence so that the air is mixed thoroughly with the atomized oil. The fuel mixture, in the form of air and vaporized oil, discharged through passages **9** can be ignited and will burn with the characteristics of gas as it is flowing across the surface of the cup-shaped depression **3** in order to heat the surface to incandescence. Heat is, therefore, supplied by the burner, both in the form of radiant heat from the cup's surface as well as the hot products of combustion. When the burner has been operating a short time, end wall **6** will be heated to a point where it will radiate heat back into chamber **5** in order to assist in the vaporization of the oil that is being discharged from the atomizer. Sufficient heat is radiated back into the chamber so that when the burner is operating the temperature of the air supply does not necessarily have to be quite as high as would otherwise be necessary in order to vaporize the fuel.

In order for the burner to work best, it is necessary to supply fuel and air in stoichiometric proportions. This can be accomplished with any conventional control mechanism which, in this case, would preferably be responsive to pressure of the air and of the fuel. From time to time adjustments can be made to the air pressure by adjusting the position of damper **23**. These adjustments may be necessary as the temperature of the air is varied. In addition, if for some reason it is desired to shut off one burner of a number of burners, damper **23** can be closed for this purpose as well as to permit the removal of the atomizer for cleaning or replacement without shutting down the rest of the furnace.

As noted above, the burner can also be used with gas as a fuel. To this end, a gas supply is introduced into casting **11** through opening **32** that is at right angles to the axis of the distributor as well as to the supply of air. This arrangement insures that there will be enough turbulence produced in the casting and the distributor to insure complete mixing of the fuel and air prior to the time it is discharged through passages **9**. It is noted that whether the fuel is liquid or gas, or a combination of the two, the flow of this fuel through the distributor is sufficient to cool end wall **6** enough so that it will at all times be at a temperature below that which an alloy steel can satisfactorily stand.

From the above it will be seen that I have provided an oil or an oil and gas burner which is simple in construction, easily installed and repaired, and one which will burn oil with the characteristics of a gas,

While in accordance with the provisions of the statutes I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. In a burner, the combination of a hollow, cylindrical distributor member having a closed end to form a chamber therein, said member being provided with a plurality of substantially radial passages extending from said chamber adjacent to said end to the exterior of said member, the interior of said chamber having the shape of an unobstructed venturi with the large end thereof terminating at said passages and the throat thereof being spaced from said end of said chamber, a liquid fuel atomizer having a predetermined angle of spray, means to mount said atomizer adjacent to said throat and centrally of said chamber and directed axially toward said closed end, said atomizer being located a distance from said closed end such that the spray from the atomizer will strike the interior of said chamber adjacent to said large end of said venturi and the edges of said passages, and means to supply combustion air axially to said chamber from a location upstream of said atomizer whereby said combustion air will cross the spray of atomized fuel to mix therewith prior to being discharged through said passages.

2. The combination of claim **1** in which said means to supply combustion air terminates at said distributor in a passage axially aligned with said chamber, and means to supply fuel gas to mix with air flowing in said last mentioned passage, said fuel gas supply means directing the fuel gas into said passage at an angle to the flow of air therethrough.

3. The combination of claim **1** in which said closed end of said distributor is of metal to radiate heat to said chamber.

4. The combination of claim **1** in which said means to supply combustion air to said distributor includes a part having a passage therein for the air which terminates at said chamber, and adjustable damper means to vary the opening of said passage.

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