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3,164,200

MULTIPLE FUEL BURNER

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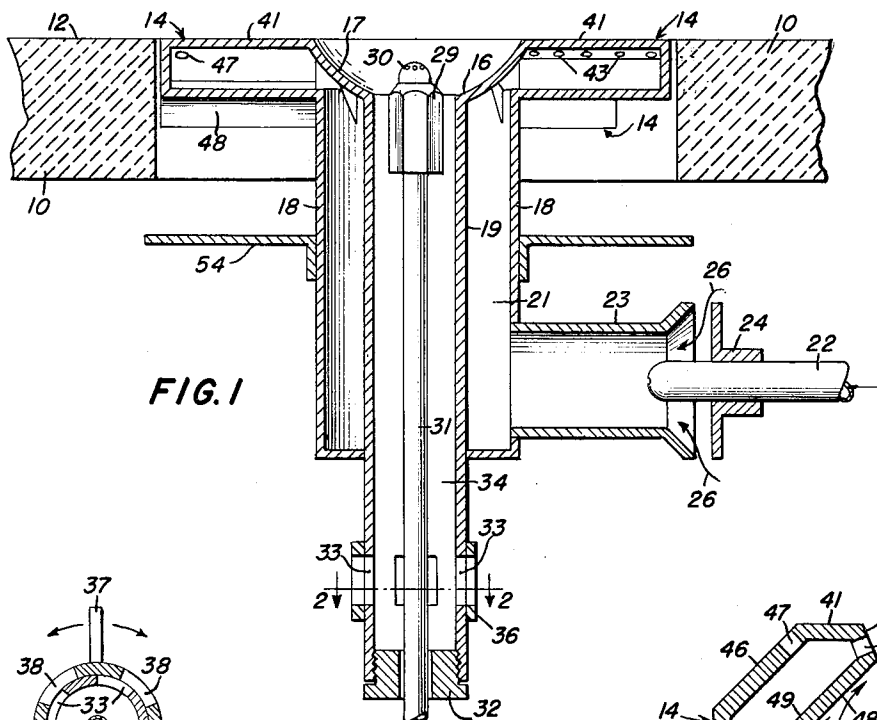


FIG. 1

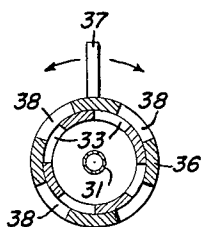


FIG. 2

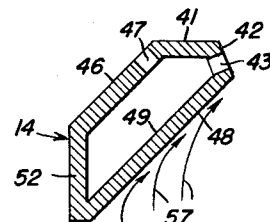


FIG. 4

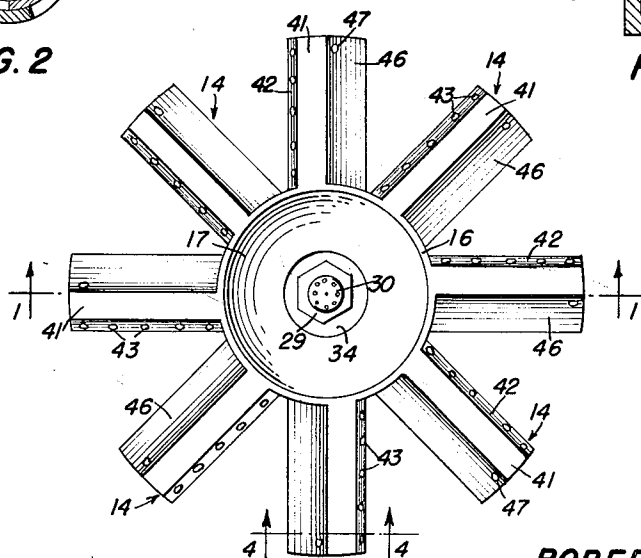


FIG. 3

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MULTIPLE FUEL BURNER

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Continuation of abandoned application Ser. No. 622,603, Nov. 16, 1956. This application June 27, 1962, Ser. No. 205,771

4 Claims. (Cl. 158—11)

The present invention relates to a fuel burner for industrial purposes and more specifically pertains to a structure for burning liquid and gaseous fuels and adapted for vertical firing. This application is a continuation of my application Serial No. 622,603, filed November 16, 1956, and now abandoned.

It is known to burn liquid fuel by providing a nozzle therefor at the center of a burner for gaseous fuel. The patent to Zink 2,531,316 is an example of such a structure and the multiple burner thereof has been in use and functions satisfactorily for horizontal firing. When the burner structure of Zink Patent 2,531,316 is oriented to fire vertically upward difficulties are encountered. When the control of the volume of secondary air and the temperature thereof are not maintained within proper limits there is a tendency for coke to form at the nose or tip of the liquid fuel burner. Such coke accumulations fall from the tip and when the burner is in the horizontal position it functions satisfactorily. When the burner structure of the Zink patent is so disposed as to fire vertically upward any accumulation of coke at the tip of the liquid burner does not readily detach itself from the liquid burner tip and such solids tend to block the streams of atomized fuel issuing from the burner tip and this liquid fuel drips from the burner to provide for unacceptable operation.

It is an object of the present invention to provide improvements in a multiple fuel burner providing for the combustion of gaseous fuel and a liquid fuel at the center of the burner assembly wherein the quantity and temperature of the secondary air moving into the presence of the liquid fuel burner is so controlled as to avoid the development of coke at the tip of the liquid fuel burner and to thereby adapt such a burner structure or operation for vertical upward firing.

A more specific object of the invention is to provide a spider type burner structure for a gaseous fuel including a liquid fuel burner mounted at the center thereof with the arms of the spider so shaped as to cause the secondary air to spin and pass through the flame of the burner to be heated to such an extent that upon arrival in the presence of the burning liquid fuel will promote a stable flame for the liquid fuel and avoid the formation of solids at the nose of the liquid fuel burner.

A still further object of the invention is to provide an improved star shaped or spider type burner for gaseous fuel including an angular disposition of the upstream faces of the hollow arms so as to deflect air moving downstream over the burner circumferentially and impart whirling movement of the secondary air.

Other objects and features of the invention will be appreciated and become apparent to those skilled in the art to which this invention pertains as the present disclosure proceeds and upon consideration of the accompanying drawing and the following detailed description

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wherein a typical embodiment of the invention is disclosed.

In the drawing:

FIG. 1 is an axial sectional view of a multiple fuel burner embodying the invention and taken on the line 1—1 of FIG. 3.

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

FIG. 3 is a plan view of the burner assembly with the floor of the combustion chamber omitted.

FIG. 4 is a sectional view of one of the arms of the star shaped or spider type burner taken on the line 4—4 of FIG. 3.

Referring to the drawing the bottom wall or floor for a structure or combustion chamber to be fired is indicated at 10. The mounting of the burner so as to provide a vertically upward directed flame has the advantage of permitting use of the side walls of the structure for heat transfer purposes and processing industries require such an arrangement which provides the further advantage of reducing the size of the structure to be fired. The floor or bottom wall of the structure is provided with a circular opening as shown in FIG. 1 for accommodating the burner structure which may be supported therein in any suitable manner so that the downstream portions of the burner structure are substantially flush with the upper surface 12 of the floor 10.

A multiple fuel burner exhibiting the invention includes a star shaped or spider type portion for burning gaseous fuel. This part of the burner includes a plurality of hollow arms 14 which extend radially from a hub 16 of the assembly. In the embodiment illustrated, eight of such arms are provided but the number may be varied in accordance with requirements and to provide a burner of the desired capacity. The hollow arms 14 are carried and supported by the hub 16 which includes a wall 17 having an annular concave contour as provided by a segment of a sphere so that the downstream face of the wall forms an inverted frusto-conical cavity in the hub. The hollow arms 14 are also supported by a tubular member 18 which is of relatively large diameter and extends downwardly or upstream from the hollow arms. The inner portion of the wall 17 may be formed integral with or connected to a tube 19 which extends downwardly from the burner within the tubular member 18. The axis of the tube 19 is aligned with the axis of the tubular member 18 so as to form an annular passage 21 between the periphery of the tube 19 and the inner annular surface of the tubular member 18. The inner ends of the hollow arms 14 are in open communication with the downstream or upper end of the annular passage 21 whereas the wall 17 closes the downstream end of this annular passage in the areas between the inner ends of the hollow arms 14.

A gaseous fuel may be supplied by a pipe 22 and discharged through a limiting orifice (not shown) into a conduit 23 carried by the tubular member 18. The means for supplying a gaseous fuel mixture includes a disc shaped door 24 slidable on the pipe 22 for controlling the volume of primary air that may enter the conduit 23 in the direction of the arrows 26. The gaseous fuel mixture moves in the annular passage 21 and into the hollow arms 14.

The tube 19 is open at its upper or downstream end and

provides space for accommodating a liquid fuel nozzle 29. The nozzle or tip 29 is supported by a liquid fuel supply pipe 31 which extends along the axis of the tube 19. The upstream end of the tube 19 may be closed around the supply pipe 31 by means of a plug 32. The nozzle 29 is provided with discharge openings 30 through which liquid fuel is discharged to provide atomized liquid fuel downstream from the nozzle.

The tube 19 is provided with a plurality of circumferentially spaced openings 33 for admitting air to the annular passage 34 between the periphery of the supply pipe 31 and the interior of the tube 19. The volume of secondary air may be controlled by a damper mechanism which includes a sleeve 36 surrounding the tube 19 and rotatable thereon. The sleeve 36 may be turned by a handle 37. The sleeve is provided with circumferentially spaced apertures 38 which are adapted to register with the openings 33 in one rotated position of the sleeve and in others to close or partly close the openings 33 to thereby control the quantity of secondary air admitted to the annular passage 34 and consequently the volume of air moving into surrounding relationship with the nozzle 29.

The hollow arms 14 of the spider type burner are provided with flat downstream surfaces 41 which may be arranged flush with the top surface 12 of the floor 10. Each hollow arm includes a wall 42 which is arranged at an obtuse angle with respect to the plane of the wall 41. A plurality of discharge orifices 43 are provided in the wall 42 and arranged at spaced intervals along the length of the hollow arms 14. Another wall 46 is arranged at an obtuse angle with respect to the plane of the wall 41 and is wider than the transverse dimensions of the wall 42. The wall 46 is provided with at least one discharge orifice 47 therein adjacent the free end of the arm 14. Thus the gaseous fuel mixture moving into the hollow arms 14 from the annular passage 21 is discharged through the orifices 43 in each arm and through the discharge orifices 47 in arms of the spider type burner.

The under or upstream surface 48 of each hollow arm 14 is formed on a wall 49. The surface 48 is arranged at an angle of between thirty-five and fifty-five degrees and preferably at a forty-five degree with respect to the longitudinal axis of the burner or with respect to the direction of movement of the secondary air as it moves through the opening in the floor 10. The surface 48 is arranged at an angle of thirty-five to fifty-five degrees with respect to the plane of the wall 52 which connects the wall 46 with the wall 49 and completes the closure of each hollow arm 14.

The volume of the secondary air passing into the opening in the floor may be controlled by a disc 54 which is mounted for sliding movement on the exterior of the tubular member 18. The secondary air upon engagement with the sloping surfaces 48 forming the upstream face of each hollow arm 14 is deflected circumferentially of the burner assembly and in the direction of the arrows 57 in FIG. 4. All of the inclined faces 48 deflect the air so that the air stream is caused to spin tangentially as it moves forwardly or downstream of the burner. The secondary air is thus deflected into the fuel burning downstream of the burner and is heated. The secondary air as thus preheated moves into the presence of the burner so as to stabilize the flame and particularly that developed from the liquid fuel issuing from the nozzle 29. Such preheating of the secondary air promotes stability of the flame and provides for controlling the temperature in the vicinity of the tip of the nozzle 29. The stability of the flame is further promoted by controlling the quantity of secondary air admitted to the presence of the nozzle 29 by adjusting the rotated position of the sleeve 36 with respect to the tube 19.

While the invention has been described with reference to specific structural features and with regard to an organization or assembly of elements it will be appreciated that changes may be made in the combination as well as

the structural characteristics thereof. 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 I claim and desire to secure by Letters Patent is:

1. A multiple fuel burner comprising, a spider type burner head including a plurality of hollow arms arranged in radially disposed positions about the burner head, longitudinally extending downstream extremities of said arms arranged substantially at right angles to the axis of said burner head and in a substantially common plane, means for supplying a gaseous fuel mixture into said hollow arms adjacent said axis, each arm having ports therein for the escape of the fuel mixture in directions generally downstream of the respective arms, an upstream face of each arm disposed at an acute angle with respect to said plane, each face sloping downstream from one edge to the other edge of each arm in the same direction in proceeding in one direction circumferentially about the axis of said burner head, means guiding air into engagement with said faces which deflect the air in swirling movement about the axis of the burner head downstream of said arms, and means for discharging atomized liquid fuel downstream from the burner head from the vicinity of the axis thereof and into the swirling air.

2. A fuel burner comprising, a spider type burner head including a plurality of hollow arms arranged in radially disposed positions about the axis of said burner head, a longitudinally extending downstream extremity on each arm all arranged in a substantially common plane disposed approximately at right angles to the axis of said burner head, means for supplying a gaseous fuel mixture into said hollow arms, each arm having ports therein for the escape of the fuel mixture in directions generally downstream of the respective arms, a substantially flat upstream face on each arm extending from one edge to the other edge of each arm, each flat face being disposed at an angle between thirty-five and fifty-five degrees with respect to said plane, each face sloping downstream from one edge to the other edge of each arm in the same direction in proceeding in one direction circumferentially of said axis and transversely of said arms, means guiding air into engagement with said faces which deflect the air circumferentially of the burner head as it moves downstream of said arms, a nozzle adjacent the axis of said burner head, means for supplying liquid fuel to said nozzle, and said nozzle having discharge openings therein disposed to direct the escape of liquid fuel in directions generally downstream from said burner head and into the circumferentially moving air.

3. A fuel burner assembly comprising, a spider type burner head including a plurality of hollow arms arranged in radially disposed positions about the axis of said burner head, an upper surface on each arm all arranged in a substantially common horizontal plane approximately at right angles to the axis of the burner head, means for supplying a gaseous fuel mixture into said hollow arms, each arm having a row of ports along a first edge for the escape of the fuel mixture in a direction generally downstream of the associated arm, an under face on each arm extending from said first edge to the second edge of the associated arm and at an acute angle with respect to said plane, each face sloping upwardly from the second edge to the first edge of each arm and in the same direction in proceeding in one direction circumferentially about said axis, means guiding air into engagement with said faces which deflect the air in swirling movement about the axis of the burner head above said arms, and means for discharging atomized liquid fuel upwardly from the burner head and from an area adjacent the axis thereof and into said swirling air.

4. A fuel burner assembly comprising, a generally horizontal wall having a circular opening therein, a spider type burner head including a plurality of hollow arms arranged in radially disposed positions about the

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axis of the burner head and in generally horizontal positions within said opening, means for supplying a gaseous fuel mixture into said hollow arms, each arm having discharge ports therein for the escape of the fuel mixture in a direction generally upwardly from the associated arm, an under face on each hollow arm sloping from one edge of each arm to the other edge of each arm with each face disposed at an angle between thirty-five and fifty-five degrees with respect to a horizontal plane, each of the said faces sloping upwardly from one edge to the other edge of each arm in the same direction in proceeding in one

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direction circumferentially about the axis of said burner head, said wall guiding air upwardly through said opening into engagement with said faces which deflect the air circumferentially of the burner head above said arms, and means for discharging atomized liquid fuel upwardly from the burner head at the axis thereof into the circumferentially moving air.

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