

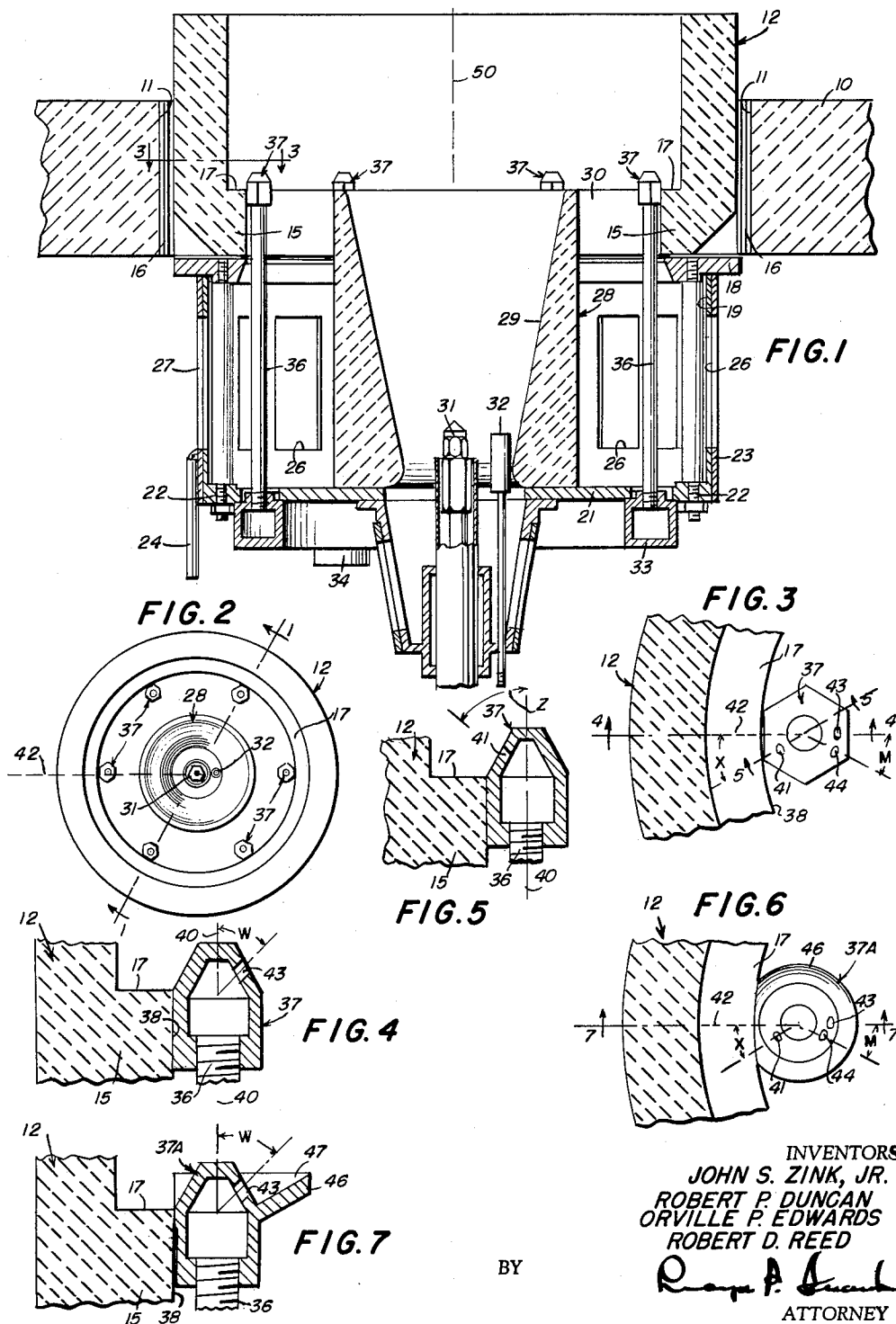
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FUEL BURNER ASSEMBLY

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FUEL BURNER ASSEMBLY

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The present invention relates to fuel burners and more specifically pertains to such equipment for industrial purposes for burning gaseous fuel and atomized liquid fuel. This invention pertains to improvements over the multiple fuel burner disclosed and claimed in Zink et al. Patent 2,851,093.

An object of the invention is to provide a continuous annular ledge on the burner assembly adjacent the burner tips for the gaseous fuel and to provide for a discharge of gaseous fuel along the downstream face of the ledge and into a low pressure zone downstream of the ledge so as to maintain stable kindling of the gaseous fuel about the entire circumference of the ledge and maintaining stable burning of the gaseous fuel throughout extreme ranges of fuel flow and providing a burner assembly wherein the shape of the flame may be adjusted.

Other objects and features of the invention will be appreciated and become apparent to those skilled in the combustion art as the present disclosure proceeds and upon consideration of the following detailed description taken with the accompanying drawing wherein one general organization of the burner is disclosed along with a modification of the burner tips for the gaseous fuel.

In the drawing:

FIG. 1 is an axial sectional view of a burner assembly exhibiting the invention and taken on the line 1—1 of FIG. 2

FIG. 2 is a plan view on a smaller scale with an illustration of a pilot for the gaseous fuel burner tips omitted.

FIG. 3 is an enlarged fragmentary section of a portion of the shroud taken on the line 3—3 of FIG. 1 with one of the gaseous fuel burner tips shown in plan.

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 3.

FIG. 5 is a fragmentary sectional view taken on the line 5—5 of FIG. 3.

FIG. 6 is a view similar to FIG. 3 illustrating a modification of a burner tip for the gaseous fuel.

FIG. 7 is a fragmentary sectional view taken on the line 7—7 of FIG. 6.

A fuel burner assembly exhibiting the invention is adapted for industrial purposes and is designed to be mounted on a wall 10 such as the floor of a structure or furnace to be fired. This wall is provided with a cylindrical shaped opening 11 for accommodating a generally cylindrical shaped ceramic or refractory shroud member or tile 12. This shroud or tile may be supported within the opening 11 by any suitable means and resilient or yieldable heat resistant material 16 may be provided within the opening 11 around the periphery of the tile 12 with the material 16 serving to accommodate expansion and contraction of the shroud and the wall 10. An annular flange 15 is carried by the upstream end of the shroud 12 and this flange may be formed integral with the ceramic member which make up the annular tile 12. The flange 15 provides a continuous ledge having a downstream face 17 which lies in a plane substantially at right angles to the axis of the burner assembly and the axis of the shroud 12.

The burner assembly includes means for supporting gaseous fuel burner tips and a burner for atomized liquid fuel for firing into the space to be heated and such means includes an annular member 18 which is adapted for attachment to the wall 10. A disc-shaped member 21 is

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maintained in spaced relation from the annular member 18 by a plurality of circumferentially spaced bolts 22. An air register stator 19 and an air register rotor 23 are provided between the disc-shaped member 21 and the annular member 18. The air register rotor or sleeve 23 may be rotated by means of one or more handles 24. The air register stator or sleeve 19 is provided with apertures 26 and the air register rotor or sleeve 23 is provided with apertures 27 which are adapted to register with the apertures 26 to control volume of secondary air admitted for movement through the large central opening 30 in the shroud 12.

A member 28 formed of refractory material is mounted on the disc-shaped member 21 and it has a cylindrical exterior surface. The refractory 28 has a frusto-conical shaped inner surface 29 which flares outwardly in proceeding downstream from a liquid fuel burner nozzle 31. The liquid fuel burner nozzle may be mounted on the disc-shaped member 21 in any suitable manner and supplied with primary air so as to provide for atomization of the liquid fuel issuing from the nozzle 31. A pilot 32 may be provided for the liquid fuel burner as shown. The disc-shaped member 21 carries an annular manifold 33 into which a gaseous fuel mixture is supplied under pressure through a conduit fitting 34. A plurality of pipes 36 are connected to and are in open communication with the manifold 33 and extend downstream therefrom. The pipes 36 may be equally spaced circumferentially of the burner assembly and each carries a burner tip 37 for gaseous fuel.

The structure of each burner tip 37 and its relationship with the shroud 12 and particularly the ledge face 17 will be best appreciated upon consideration of FIGS. 3, 4 and 5. Each burner tip 37 is connected to the upper end of its supply pipe 36 and this portion of the tip structure may have flat sides for threading the tips onto the respective pipes 36. One of the flat faces is adapted to lie along the inner circumference 38 of the annular flange 15. The downstream end portion of each nozzle 37 is frusto-conical shaped. One discharge port 41 is provided in each nozzle 37 as shown in FIGS. 3 and 5. The axis of the discharge port 41 is at an acute angle with respect to a radius 42 of the burner assembly and the angle indicated at X in FIG. 3 is desirably at thirty degrees. The discharge port 41 in each gaseous fuel burner tip 37 provides for the discharge of a portion of the gaseous fuel generally radially outward as will be apparent from a consideration of FIG. 3 and towards the inner surface of the shroud 12 downstream of the ledge 17 as will be apparent from a consideration of FIG. 5. The axis of each port 41 in relation to the axis 40 of the associated tip is at an acute angle and the angle indicated Z in FIG. 5 is desirably at forty-five degrees.

Each burner tip 37 for the gaseous fuel is provided with two additional discharge ports 43 and 44. The axis of the discharge port 43 is in alignment with the radius 42 as shown in FIG. 3. The axis of the discharge port 43 and the axis of the discharge port 44 are desirably at an acute angle with respect to the axis 40 of the associated burner tip 37 and the angle indicated at W in FIG. 4 is desirably at forty-five degrees for the discharge port 43 and for the discharge port 44. The ports 43 and 44 provide for the discharge of gaseous fuel in directions which are generally radially inward towards the axis 50 of the burner assembly. The axis of the discharge ports 43 and 44 diverge from each other in proceeding inwardly. In the embodiment illustrated in the drawing the angle M indicated in FIG. 3 is at about thirty-six degrees. The gaseous fuel discharged through the ports 43 and 44 provides for a flame having one length. If a longer flame is desired the angle between the axes of the ports 43 and

44 is decreased. If a short flame is desired the angle M is increased. If a still shorter flame is desired the axis of the port 43 is caused to deviate from the radial position shown in FIG. 3 and converge at a smaller angle M with respect to the axis of the discharge port 44.

A modified burner tip for the gaseous fuel is shown at 37A in FIGS. 6 and 7. This burner tip is cylindrical shaped in the portion where it joins the associated supply pipe 36. The burner tip 37A is mounted closely adjacent the inner surface 38 of the flange 15. This burner tip is provided with a discharge port 41 (FIG. 6) which is adapted to discharge the gaseous fuel over the downstream face 17 of the ledge and it is arranged at an angle X with respect to the radius 42 in a manner as hereinabove described. The discharge ports 43 and 44 of the nozzle 37A are arranged in the same manner as that described in connection with these discharge ports in the nozzle 37.

A frusto-conical shaped shield 46 is provided which surrounds a major portion of each nozzle 37A. A portion of the shield 46 is omitted in the vicinity of the downstream face 17 of the ledge as will be appreciated upon consideration of FIGS. 6 and 7. The downstream surface 47 of the shield 46 constitutes a projection of the ledge face 17. Thus the low pressure condition which exists adjacent the downstream face 17 of the ledge exists adjacent the downstream face 47 of each shield 46. The gaseous fuel which escapes through the discharge port 41 of any one of the burner tips 37 or 37A and upon kindling by a pilot (not shown) causes the flame to "run" along the downstream face 17 of the continuous ledge to provide for kindling of all of the burner tips 37 or 37A. Extremely stable kindling is maintained for the reason that the secondary air in moving through the annular area 30 creates a low pressure zone at the downstream face 17 of the ledge. This low pressure zone or an annular low pressure area results from the secondary air moving at substantial velocity and there is a pressure drop across the burner assembly. The low pressure is proportional to the square of the pressure drop and the greater the velocity of the secondary air the more extensive and the lower the pressure will be to thereby hold the gaseous fuel at the downstream face 17 of the ledge for extremely good kindling and stable burning of the gaseous fuel.

The gaseous fuel issuing from all of the discharge ports from each burner tip 37 or 37A provides for extremely stable combustion and this condition exists for maximum flow of the gaseous fuel or at a minimum flow. The burner operates well when turned down from a one hundred percent of designed gas flow to two percent of the designed gas flow with complete stability in a burner devoid of monitored automatic control and when the burner assembly is supplied with typical fuel gas and without reference to the required kindling temperature of the gas which is being used. This stability exists regardless of the air flow across the burner.

While the invention has been described with reference to specific structural features and with regard to a multiple fuel burner it will be appreciated that changes may be

made in the various elements of the combination and changes may be made in the overall assembly. 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 fuel burner assembly, a shroud having a substantially cylindrical inner surface, a continuous annular flange projecting inwardly from the inner surface of said shroud presenting a ledge having a continuous annular downstream face, a plurality of circumferentially spaced burner tips each having a side portion lying along and substantially in contact with the inner circumference of said flange with tip portions thereof extending beyond the downstream face of said ledge, means for supplying gaseous fuel under pressure to said burner tips, means guiding air for movement downstream of the assembly and axially over the inner circumference of said flange, means for controlling the volume of said air, each of said burner tips having a discharge port therein positioned downstream of said flange, and each discharge port directing gaseous fuel towards said inner surface downstream of said ledge and having its axis disposed at an acute angle with respect to a radial plane of the burner assembly which intersects the longitudinal axis of the associated burner tip.

2. In a fuel burner assembly, a shroud having a substantially cylindrical inner surface, a continuous annular flange projecting inwardly from the inner surface of said shroud presenting a ledge having a continuous annular downstream face, a plurality of circumferentially spaced burner tips mounted closely adjacent and substantially in engagement with the inner circumference of said flange with tip portions thereof extending beyond the downstream face of said ledge, means for supplying gaseous fuel under pressure to said burner tips, means guiding air for movement downstream of the assembly and axially over the inner circumference of said flange, means for controlling the volume of said air, each of said burner tips having a discharge port therein positioned downstream of said flange, each discharge port directing gaseous fuel towards said inner surface downstream of said ledge and having its axis disposed at an acute angle with respect to a radial plane of the burner assembly which intersects the longitudinal axis of the associated burner tip, a shield carried by each burner tip in the vicinity of said ledge and upstream of said port, and each shield extending throughout the portion of the associated burner tip inwardly of the inner circumference of said flange.

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