

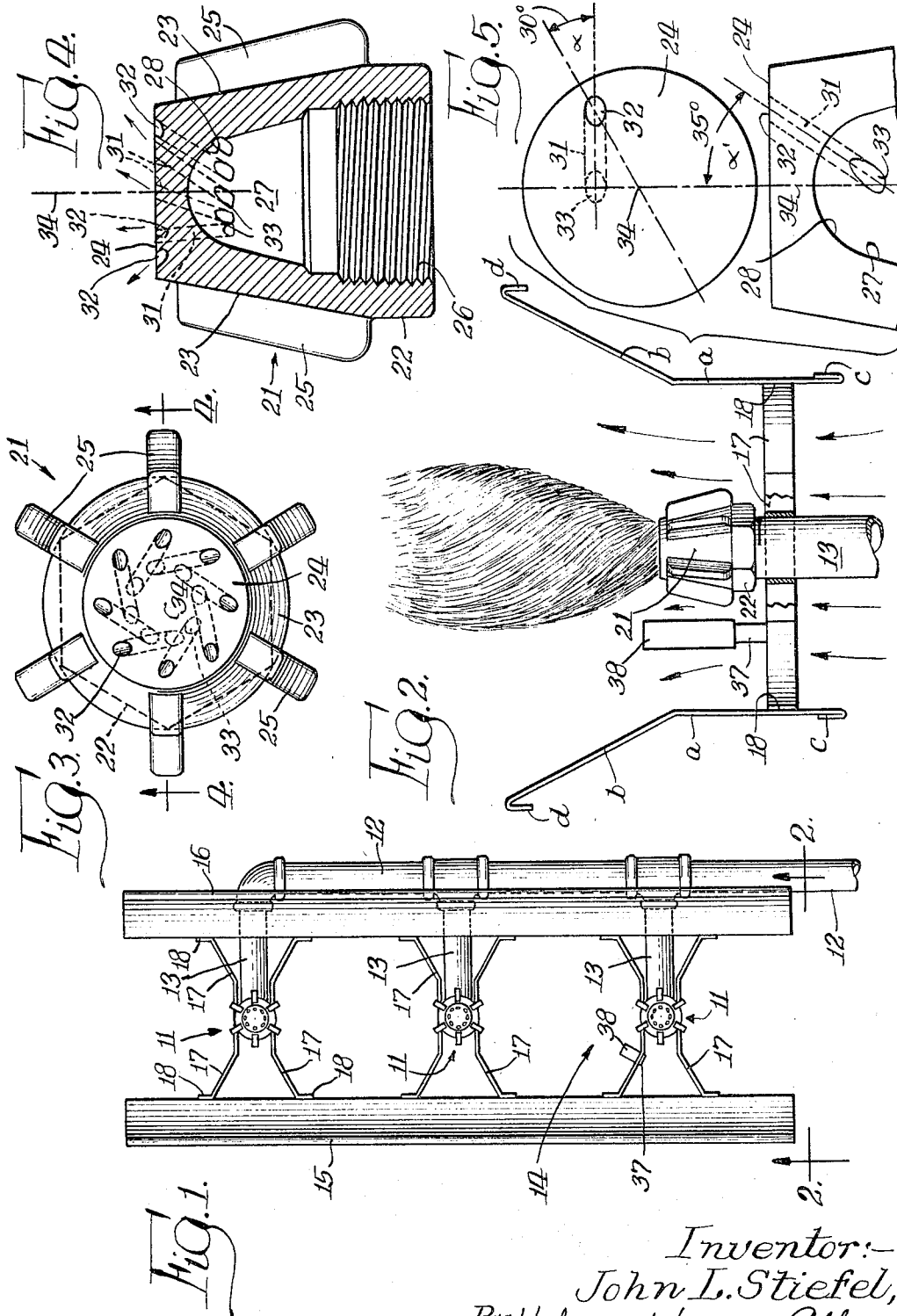
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GAS BURNER NOZZLE

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GAS BURNER NOZZLE

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This invention relates to burners and nozzles for supplying fuel to support a flame. More particularly, this invention relates to a new nozzle construction and to a burner assembly including one or more nozzles.

Various types of atmospheric gas burners are commonly in use. For example, such burners of the pre-mix type employ a venturi or similar device to pre-mix a portion of the combustion air with the gas fuel prior to ejection of the gas fuel from the burner nozzle outlet for supporting a flame. However, because the total volume of combustion air and gas is much greater than the volume of gas alone, large conduits and large burner outlet orifices are required for supplying a given volume of gas for supporting the flame. The large size of the parts involved often limits the heat released per square foot of burner grate area.

Other types of burners rely on the fuel gas to draw in part of the combustion air into the burner chamber. Sleeves and other devices are placed adjacent to the gas outlet orifice to function as venturis or the like. Such burners have the advantage of greater heat release per square foot of grate area; however, the sleeves or the like used in the structure add to the complexity and cost of the burner.

It is a general object of this invention to provide a new and useful nozzle having good combustion efficiency without requiring pre-mixing, complex sleeve structures or the like.

It is also an object of this invention to provide a simple low-cost means for introducing gas to a combustion chamber with combustion efficiency approximately equal to or greater than that of the usual atmospheric gas burner without requiring attentive provision for pre-mixing or the like.

It is another object of this invention to provide a new and useful burner nozzle capable of discharging combustion fuel as a spiral flowing stream for supporting combustion.

A further object of this invention is to provide a nozzle for discharging fuel gas in a compound spiral path, preferably diverging at the nozzle discharge, for more intimate mixing of the gas with combustion air and for providing a strong and stable flame in a combustion chamber so that the flame remains anchored on the nozzle in the presence of air rushing into the combustion chamber.

It is also the object of this invention to provide a new and useful burner assembly, including a plurality of nozzles in accordance with any of the foregoing objects.

Other objects of this invention will be apparent from the following description and the drawings in which:

FIGURE 1 is a top view of a burner including a plurality of nozzles in linear array and illustrating a form of the present invention;

FIGURE 2 is an enlarged view of a portion of the burner of FIGURE 1 along line 2-2 of FIGURE 1, with a portion cut away to shown a nozzle feed line;

FIGURE 3 is an enlarged view of the discharge end of a nozzle of the burner of FIGURE 1 showing concealed structure in broken lines;

FIGURE 4 is a section through the nozzle of FIGURE 3 along line 4-4; and

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FIGURE 5 is a schematic showing of a discharge bore illustrating its disposition in the nozzle of FIGURES 3 and 4.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a specific embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated.

A burner provided in accordance with the present invention may include one or more nozzles, each of which nozzles supplies fuel to a separate flame. The structure shown in FIGURES 1 and 2 is exemplary of a burner provided in accordance herewith. Considering the structure of FIGURES 1 and 2 in detail, it is seen that the burner illustrated includes a linear array of three cast iron nozzles, each of which is designated by reference number 11. Each of nozzles 11 is supported in a preselected nozzle position and supplied with gas from a common tubular manifold 12 by means of a supply conduit 13 in the form of a seamless tube. Each nozzle position is within a burner drawer indicated by reference numeral 14 between opposing sheet members 15 and 16. Each supply conduit 13 is of elongate elbow configuration for supplying gas to the nozzle 11 from a position below the nozzle. The supply conduits are supported at their inlet ends by their intercommunicating connection with manifold 12 and each conduit 13 supports a nozzle 11 at its other or outlet end. Manifold 12 is secured by suitable mounting means (not shown) and extends by a conduit to and is connected to a fuel supply (not shown), e.g. a supply of gas under pressure, from which fuel is conducted through manifold 12 and conduits 13 to each nozzle 11. Suitable valving means for control of flow of gas through manifold 12 or conduits 13 may be provided in conventional manner as desired.

The opposing sheet members 15 and 16, defining the burner drawer 14 therebetween, function to guide the in-rushing combustion air through the burner drawer 14 for supplying combustion air to the outlets of nozzles 11. Sheet members 15 and 16 are generally parallel with respect to each other and are spaced from each other by braces 17, two of the braces 17 being positioned to straddle each burner position. Braces 17 are secured by feet 18, e.g. by welding, to the facing surfaces of sheet members 15 and 16.

Sheet members 15 and 16 are each configured as elongate open angle members having interconnected legs *a* and *b* forming an outward diverging open angle with respect to burner drawer 14. A stiffening hem *c* is provided along the end edge of leg *a* and a stiffening flange *d* is provided at the end edge of leg *b*.

It will be noted that the burner drawer 14 includes a throat portion between surfaces *a* of members 15 and 16 which widens to a mouth portion between the diverging surfaces *b* of members 15 and 16, with the lips of the mouth portion defined by flanges *d*. The nozzle positions are generally within the throat portion for discharging fuel outward through the mouth portion. The braces 17 in the throat portion of burner drawer 14 are of a configuration and extent providing only little resistance to flow of air as air is drawn through the burner drawer.

Referring now to FIGURES 2 through 4, the main structure of nozzle 11 is a cast iron fitting 21 having a hexagonal wrench engaging portion 22 on the outer surface. The outer surface is tapered in front of portion 22, as shown at reference numeral 23, toward a flat nozzle

discharges end 24. Projecting outward from surface 23 are a plurality of radially extending ribs 25 which may afford some cooling effect on the nozzle by increasing the surface area exposed to air being supplied to the nozzle. Six ribs 25 are shown in the illustrated form, each spaced approximately 60° from the next adjacent rib.

Fitting 21 includes an inlet 26 at the opposite end from discharge end 24. Inlet 26 is provided with female threads for cooperation with male threads on the end of conduit 13, by which fitting 21 is secured to conduit 13. Communicating with inlet 26 and within fitting 21 is a domed cavity 27 having a generally spherical end surface 28. The walls of cavity 27 taper in a conical configuration from a wider inlet end, communicating with inlet 26, to merge with the peripheral portion of spherical end surface 28.

Bores 31 are provided for discharging gas from cavity 27 through the discharge end 24 of the nozzle. Each of bores 31 extends from an orifice or opening 32 at outer surface 24 to an orifice or opening 33 at inner surface 28. As best seen in FIGURE 3, orifices 32 are disposed in a circular array at outer surface 24 and orifices 33 are disposed in a circular array at inner surface 28. The axis of the circular array of orifices 32 is shown at 34 as an imaginary line perpendicular to the plane containing the centers of outlets 32. The circular array of orifices 32 has a diameter greater than the diameter of the circular array of orifices 33. Thus, bores 31 project from a more central position to a more peripheral position during their extent from surface 28 to surface 24, serving to direct gases from the nozzle in outwardly diverging sprays from the orifices 32. Further, the outlet orifice 32 for each of bores 31 is disposed circumferentially from the radius of spherical surface 28 bisecting the inlet orifice 33, thereby also directing the gas emitted from orifice 32 partially in a circumferential direction.

As can best be seen by the schematic showing of FIGURE 5, in the preferred form of nozzle the spherical surface 28 and the circular arrays of orifices 32 and 33 are coaxial. Also in the preferred form, each bore 31 is aligned with, but angular to, a chord of the circle defining the peripheral limit of spherical surface 28 and is, in effect, tangential to the spherical surface 28. The bores 31 may conveniently be provided by drilling from surface 24 toward the inner surface 28. I have found that a particularly advantageous nozzle discharge system is provided by drilling the bores 31 at an angle α' of about 35° relative to an imaginary plane containing the axis 34 of the circular array of orifices 32 where the imaginary plane is perpendicular to an imaginary line dropped as a perpendicular from the center of orifice 32 to axis 34, and at an angle α of about 30° with respect to said imaginary line. In the preferred form, the center of the sphere of spherical surface 28 and the center of the array of orifices 33 fall on axis 34; thus, the resulting bore is disposed at an angle of about 35° from the imaginary plane containing the center of the spherical surface 28 and the radius of the spherical surface crossing the centerline or axis of bore 31 at its orifice 33. Such orifices are particularly preferred since it has been found that orifices having as axes extended radii of the spherical surface 28 create a very soft and unstable flame during use of the nozzle.

Thus, the orifices 31 are drilled at an angle, e.g. approximately tangential to the spherical surface 28, such that the openings in both the spherical surface 28 and the surface 24, i.e. orifices 33 and 32, are oval in shape. A varying wall length is thereby created along the circumference of each bore 31, causing the gas emitted from the orifice 32 to spin about the center line of the orifice 32 and bore 31. Such spinning action tends to draw surrounding air into the fuel and helps anchor the flame on the nozzle end by reducing the outward velocity

of the fuel in favor of the spinning velocity. Also, because the orifices are disposed to direct gases in a generally circumferential direction as they are emitted, e.g. due to tangential location of the bores 31, the bores tend to cause formation of a compound spiral, spinning, well-mixed flame, under influence of combustion air entering from below the burner 11 through the burner drawer 14 in the direction shown by the arrows in FIGURE 2.

Returning now especially to FIGURES 1 and 2, means are provided in the form of a mounting bracket 37 for mounting a pilot, such as identified by reference numeral 38, in lighting association with one of the nozzles 11 in the linear array. In operation, the pilot 38 is used to ignite one of the nozzles 11 with fuel gas being supplied through manifold 12 and conduits 13 to each of the nozzles. The flame from one nozzle, upon ignition, may be used to ignite the remaining nozzles, or other ignition means may be provided. The nozzles and burner of the present invention may be controlled in conventional manner and may be used by mounting the nozzles in an opening of a conventional combustion chamber so as to direct combustion flame into the combustion chamber. After the nozzles 11 in the illustrated burner system are ignited, air is drawn in from below the nozzles through the burner drawer 14 for admixture with fuel being discharged from ports 32 of each nozzle for supporting combustion with the combustion chamber.

It is apparent from the foregoing that I have provided a simple means for introduction of fuel gas into a combustion chamber without pre-mixing of the fuel gas with combustion air, and without the provision of sleeves or other attentive structures normally used for drawing combustion air to the nozzle outlet. The nozzle provides a flame which is well anchored to the nozzle outlet. The gases emitted from the nozzle outlet, and consequently the flame, are directed in a compound spiral path including individual spiral streams of gas from each nozzle orifice and an overall spiral direction of each orifice stream under burning conditions.

I claim:

1. An atmospheric gas burner nozzle comprising a fitting, a flat exterior face on said fitting, a fuel cavity within said fitting, said cavity having a spherical surface adjacent said exterior face an inlet through said fitting in communication with said fuel cavity, and a plurality of bores in generally circular array, each having its center line approximately tangential to said spherical surface.

2. A nozzle comprising a fitting with a tapered cylinder outer surface having an inlet at a wider end thereof, means at said inlet for connecting said nozzle to a fuel supply line for conducting fuel to said inlet, a domed cavity in said fitting generally enclosing the inner end of said inlet for receiving fuel therefrom, and a plurality of bores extending from their inner ends in communication with said cavity through the narrower other end of said fitting to their outer ends at the exterior surface of said fittings, said inner ends being of oval configuration and being angularly spaced in a first circular array, said outer ends being of oval configuration and being angularly spaced in a second circular array of larger diameter than said first circular array, the fitting outer surface and inlet and domed cavity being generally coaxial, each of said bores being at an angle of about 35° relative to the imaginary plane containing the center of the bore inner end and the axis of said domed cavity and at an angle of about 30° relative to an imaginary perpendicular from the center of the bore outer end to the axis of said second circular array.

3. An atmospheric gas burner nozzle comprising a fitting, a flat exterior face on said fitting, a fuel cavity within said fitting, said cavity having a domed end adjacent said exterior face, a plurality of gas outlet bores extending from their inner ends in communication with

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said cavity through the domed end thereof to the outer ends opening through said exterior face, said inner ends being angularly spaced in a first circular array and said outer ends being angularly spaced in a second circular array of larger diameter than the first circular array, with said bores being inclined to planes passing through the longitudinal axis of said cavity to direct fuel emitted from each of said bores in a spiral path.

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