

March 11, 1958

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2,826,249

MULTIPLE NOZZLE GAS BURNER

Filed Sept. 12, 1952

2 Sheets-Sheet 1

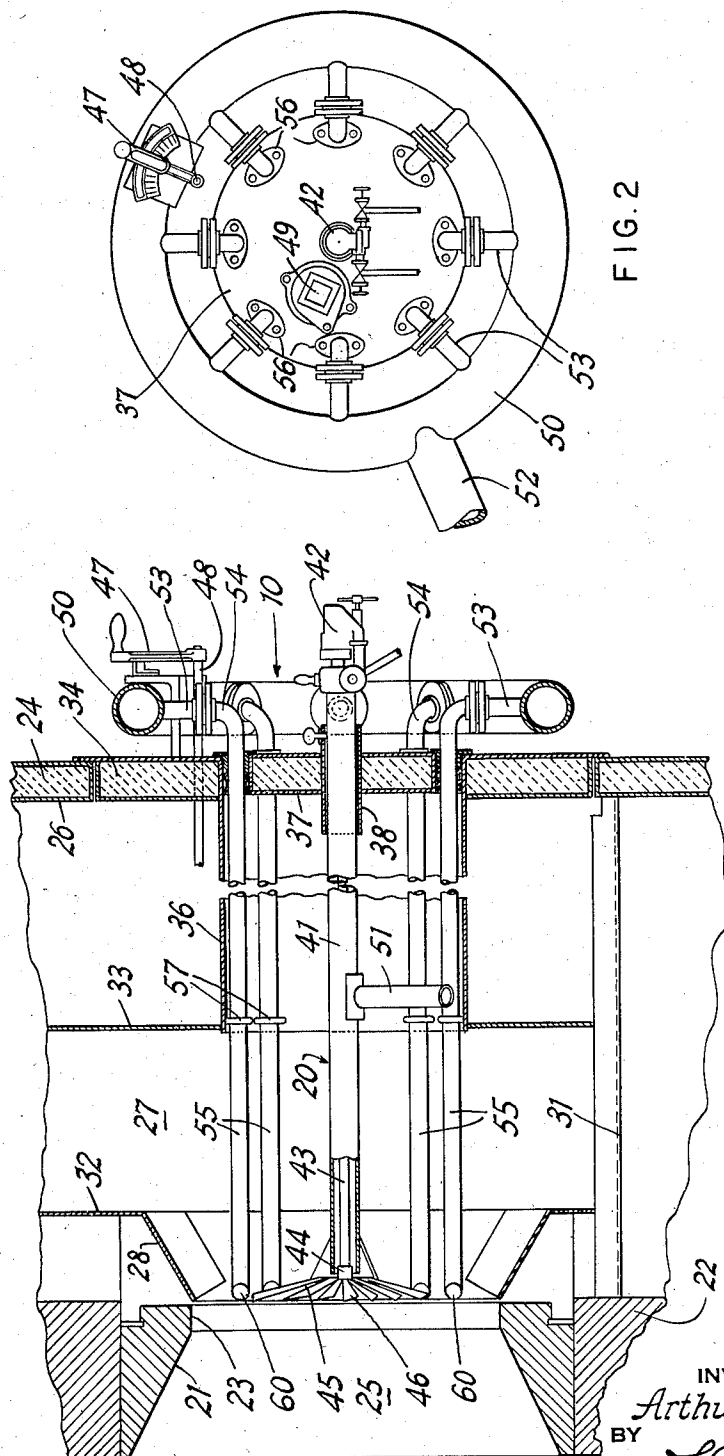


FIG. 2

FIG. 1

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FIG. 3

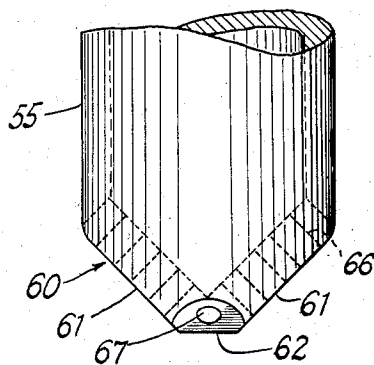
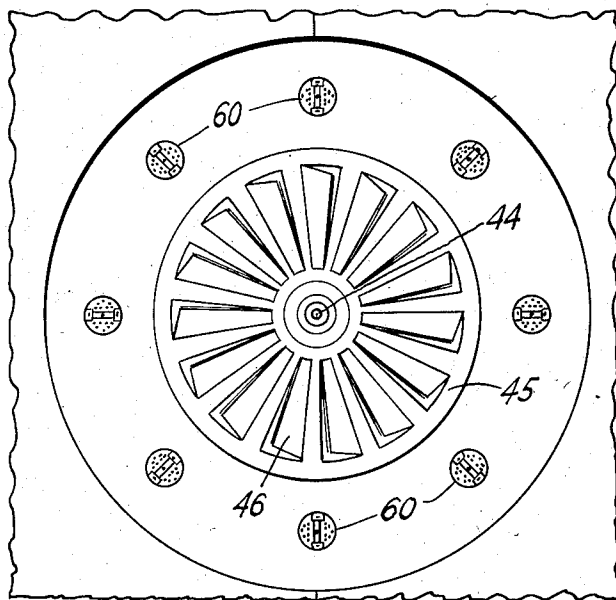


FIG. 4

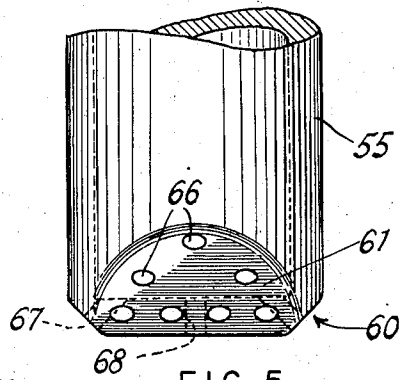


FIG. 5

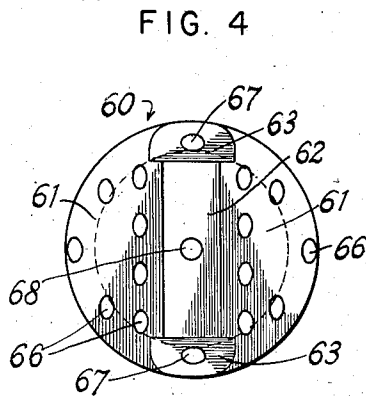


FIG. 6

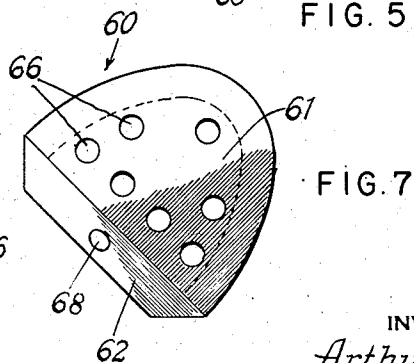


FIG. 7

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MULTIPLE NOZZLE GAS BURNER

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10 Claims. (Cl. 158—104)

This invention relates to burners for gaseous fuel, and more particularly, to an improved multiple nozzle or multiple spud burner. The invention burner may be used either alone or as a supplementary burner operatively associated with a different type of fuel burner, such as an oil burner or a pulverized fuel burner.

In many processing operations, and particularly in refinery operations, so called process gas or refinery gas is available as a by-product. For economy of operation, this by-product gas is burned to provide all or part of the heat requirements of the process. Quite frequently, this by-product gas has a high content of sulphur and other corrosive elements.

As the by-product gas may be available during only part of the time, and not always in sufficient quantity to carry the entire heating load, the by-product gas burners are generally supplemented by oil or pulverized fuel firing of the steam generators. In the usual construction, these burners are arranged to fire the furnace or combustion chamber through burner ports. To provide a compact firing arrangement for utilizing the by-product gas whenever available to improve the over-all fuel economy, gas burners are mounted in the burner ports in closely associated relation with the pulverized fuel burners or the oil burners.

Generally, these gas burners have taken the form of an annular header or nozzle formed with gas discharge ports. Difficulty has been experienced with these gas burners, as the high temperatures involved result in high expansion stresses being set up in the gas burners, and which may eventually cause failure of the burner or of its connection to a gas supply conduit. Additionally, the corrosive nature of the by-product gas results in fairly rapid deterioration of the burner, due to attacks on the metal by sulphur or other corrosive constituents of the by-product gas.

These high temperature stresses on the gas burner are particularly pronounced when the gas burner is idle and the heating load is supplied solely by the main coal or oil burner. Due to the location of the annular gas burner adjacent the burner port, it is subjected to intense radiant heat absorption from the furnace. When gas is being burned, the flow of relatively cool gas through the burner absorbs sufficient heat so that the temperature stresses on the gas burner are maintained within acceptable limits. However, when no gas is being burned, and thus no gas is flowing through the burner, all the radiant heat must be absorbed by the metal of the gas burner. In the case of an annular burner, the amount of metal exposed to the radiant heat from the burner port is very substantial, and severe internal stresses, leading to structural failure of the element, result.

In accordance with the present invention, a novel multi-nozzle or multiple spud gas burner is provided which produces better combustion of the by-product gas, is much more resistant to corrosive atmospheres than such annular burners, is resistant to temperature induced stresses, and yet may be easily mounted in compact relation with

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a main fuel burner while still having its nozzles easily accessible for inspection, repair, or replacement.

More specifically, the invention burner comprises an annular header arranged to be disposed in spaced parallel relation to the plane of a burner port, and formed for connection to a source of gas under pressure. A plurality of conduits or pipes are connected in peripherally spaced relation to the annular header and extend perpendicularly to the plane of the latter. These conduits are substantially of equal length and, when the gas burner is mounted in operative relation adjacent a burner port, the ends of the conduits lie at the entrance to the burner port. The inner, or furnace, ends of the conduits are formed with novel means for discharging gaseous fuel toward the burner port for admixture with and combustion of the discharged gaseous fuel in the presence of combustion air delivered to and through the burner port by the usual air directing means of the main burner.

The invention gas burner is so designed that the annular header lies outside the fuel supply means at the outer end of the main burner, and the conduits or spuds extend in surrounding relation to the main burner toward the burner port. The conduits are detachably secured, by bent portions on their outer ends, to the inner periphery of the gas supply header, so that any conduit can be readily detached from the header and withdrawn for inspection, repair or replacement.

The gas discharge means comprise discharge nozzles included within the peripheral outline of the relatively small diameter spuds or conduits. Thus, these nozzles present only a very small surface area to radiant heat from the burner port, particularly as compared to an annular gas burner arranged in embracing relation with a main fuel burner. Thus, the heat induced stresses, during times when the gas burner is idle, are greatly reduced as compared to the stresses in annular burners of equal capacity.

For an understanding of the invention principles, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings. In the drawings:

Fig. 1 is a longitudinal section view through a burner port, illustrating a main fuel burner and the invention gas burner both mounted to fire through the burner port;

Fig. 2 is an outer end elevation view of the burner arrangement shown in Fig. 1;

Fig. 3 is an inner end elevation view of the burner arrangement shown in Fig. 1;

Figs. 4 and 5 are views, at right angles to each other, of the inner or tip end of one of the conduits or spuds, illustrating the gas discharge arrangement;

Fig. 6 is an inner end elevation view of the burner tip; and

Fig. 7 is an elevation view of one side face of a burner tip.

Referring to Figs. 1, 2 and 3, the invention gas burner, generally indicated at 10, is illustrated as arranged in compact embracing relation with a liquid fuel burner 20 which may be, for example, of the type shown in U. S. Patent No. 2,260,062. Liquid fuel burner 20 is mounted centrally of a circular burner port 25 formed in one of the walls 22 of a combustion burner or furnace. The port 25 is formed of suitable refractory and includes a cylindrical, relatively short entrance section 23 which is continuous with a diverging conical section 21 leading into the interior of the furnace. Spaced from wall 22 is an outer casing 24 of refractory material having a metallic covering 26. The space between wall 22 and casing 24 forms a passageway 27 for the flow of combustion air from a forced draft fan (not shown) to burner port 25. Air directing means are provided immediately to the exterior of port 25 to direct the air into the port. In the illustrated arrangement, this comprises

a truncated air directing cone 28 converging toward the entrance section 23 of port 25, cone 28 being supported on a structural framework 31 extending between wall 22 and casing 24. The combustion air is directed to cone 28 through an air register including an inner wall 32 and an outer wall 33, inner wall 32 being integral with or united to cone 28.

An annular cover plate 34 closes an access opening in casing 24, and a cylindrical housing or casing 36 extends inwardly from the inner periphery of plate 34 through air register wall 33. Casing or housing 36 embraces the burners 10 and 20 which are mounted there-through. The two burners extend through a smaller circular plate 37 closing the central opening in annular cover plate 34 and acting as an outer closure for casing or housing 36.

Cover plate 37 supports a central hub member 38 through which extends a distance piece 41 forming part of burner 20, the latter being adjustable axially of hub member 46. On the outer end of distance piece 41 is a liquid fuel supply assembly generally indicated at 42 and communicating with a fuel pipe or burner barrel 43 disposed centrally through distance piece 41. On the inner end of barrel 43 is a fuel atomizing head disposed a short distance outwardly of port 25. The atomizing head 44 is preferably of the type producing a conical spray of atomized liquid fuel with the axis of the spray coaxial with cone 28 and burner port 25.

Concentrically attached to the inner end of distance piece 41 and exteriorly surrounding atomizer head or nozzle 44 is an impeller plate 45 shaped as a truncated cone with the base toward the furnace chamber. The conical surface of impeller plate 45 has a series of equally spaced air openings and corresponding air deflector plates 46 associated therewith for imparting a whirling motion to the air entering burner port 25 through impeller plate 45. Adjustment of the usual louvers (not shown) controlling the flow of air through register 27 is effected by crank 47 secured to a shaft 48. An observation port 49 is provided in circular cover plate 37. Intermediate its ends, the burner 20 is supported by a support member 51 connected between distance piece 41 and casing 36.

The gas burner 10 includes an annular, preferably circular, header 50 having communicating therewith a pipe 52 for connection to a source of gaseous fuel under pressure, such as refinery or by-product gas. Spaced around the inner periphery of header 50, and in communication therewith, are flanged nipples 53 extending radially inwardly from the header. Connected to the flange of each nipple is a mating flange on the outer bent end 54 of an elongated gas conduit or spud 55. For the major portion of their lengths, conduits 55 extend parallel to burner 20 and to the axis of burner port 25. It should be noted that the diameter of header 50 is larger than that of cover plate 37 and nearly equal to that of annular cover plate 34. The header surrounds and is preferably concentric with the liquid fuel burner 20, and the lengths of nipples 53 and bent portions 54 are such that the conduits 55 form a cylinder of larger diameter than that of the base of impeller plate 45. The spacing of spuds 55 circumferentially of header 50 is dependent upon the arrangement of burner 20, and is preferably uniform where installation conditions permit.

The conduits 55 extend through flanged packing glands 56 arranged in a circle near the periphery of circular closure plate 37. Intermediate their ends, the conduits 55 extend through guides 57 secured to the inner surface of casing 36.

The conduits 55 are substantially equal in length and their inner ends terminate adjacent the base of impeller plate 45. The inner end of each conduit is formed with a novel gaseous fuel discharge means comprising a closure tip 60 secured to close the inner end of each

conduit. These closure tips are best illustrated in Figs. 4 through 7.

Each closure tip includes a pair of truncated side faces 61, 61 disposed in planes extending at equal and opposite oblique angles to an axial plane of the conduit. These oblique planes intersect in the axial plane, but the side faces terminate short of such intersection and are joined by a relatively narrow central face 62 perpendicular to the conduit axis. The central face 62 terminates in end faces 63 in planes extending at equal and opposite oblique angles.

Each side face 61 is formed with a series of discharge orifices 66, and each end face 63 is formed with a discharge orifice 67, the central face having a single aperture 68. The conduits are so disposed that the end faces 62 extend radially of burner port 25.

The burner tips 60 are preferably made of a high alloy steel for best resistance to corrosive elements when burning refinery by-product gas. Preferably, the heat exposed portions of the spuds or conduits 55 are also made of a corrosion-resistant alloy.

Due to the unsupported free length of spuds 55 adjacent the burner port, where the highest temperatures occur, these elements can expand without imposing any particularly excessive strains on the remainder of the assembly. The spuds 55 and their tips 60 are the parts of the burner most subject to conditions producing strains and corrosive deterioration, the annular header 50 being located entirely outside the furnace. Hence, spuds 55 and tips 60 are made easily removable for inspection, replacement or repair. To remove any spud, it is merely necessary to remove the bolts from the flanged connections between nipples 53 and bent sections 54, and then pull the spud longitudinally outwardly through the closure plate 37. A new spud can be just as readily inserted in position.

In this connection, it will be noted that the tips 60 are disposed entirely within the peripheral outline of spuds 55. Thus, the tip surface areas exposed to radiant heat absorption are greatly reduced as compared to an annular burner of equal capacity arranged adjacent burner port 25 in embracing relation with liquid fuel burner 20.

While the invention gas burner has been illustrated as arranged for conjoint mounting with a liquid fuel burner, it is equally adaptable for conjoint mounting with a pulverized fuel burner, being similarly mounted in embracing relation with the pipe or conduit delivering the pulverized fuel to burner port 25. Also, the burner may be used separately rather than conjointly with another burner. In practice, it has been found that the invention burner produces a clean blue flame close to the tips 60, with gas pressures ranging from $\frac{1}{2}$ p. s. i. to $6\frac{1}{2}$ p. s. i. When burning the refinery gas alone, very little visible flame is apparent in the furnace.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In combination with a furnace having a wall formed with a burner port therethrough and a second wall spaced outwardly from said furnace wall and forming therewith a passageway for flow of combustion air to said port, the second wall having an access opening axially aligned with the burner port and provided with a removable closure; a fuel burner including an annular header mounted outside said closure in parallel relation to the plane of, and axially aligned with, said burner port, and having means for connection to a source of gaseous fuel under pressure; and a plurality of elongated conduits disengageably connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header in fluid-tight relation through said closure, toward

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the burner port; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of side faces, disposed in planes which are oblique to an axial plane of the conduit and intersect therein, the side faces being formed with apertures for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit, whereby each conduit may be withdrawn outwardly through said closure for inspection of the burner tip or replacement.

2. In combination with a furnace having a wall formed with a burner port therethrough and a second wall spaced outwardly from said furnace wall and forming therewith a passageway for flow of combustion air to said port, the second wall having an access opening axially aligned with the burner port and provided with a removable closure; a fuel burner including an annular header mounted outside said closure in parallel relation to the plane of, and axially aligned with said burner port, and having means for connection to a source of gaseous fuel under pressure; and a plurality of elongated conduits disengageably connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header, in fluid-tight relation through said closure, toward the burner port; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of side faces, disposed in plane which extend at equal and opposite oblique angles to an axial plane of the conduit and intersect therein, the side faces being formed with apertures for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit, whereby each conduit may be withdrawn outwardly through said closure for inspection of the burner tip or replacement.

3. In combination with a furnace having a wall formed with a burner port therethrough and a second wall spaced outwardly from said furnace wall and forming therewith a passageway for flow of combustion air to said port, the second wall having an access opening axially aligned with the burner port and provided with a removable closure; a fuel burner including an annular header mounted outside said closure in parallel relation to the plane of, and axially aligned with, said burner port, and having means for connection to a source of gaseous fuel under pressure; and a plurality of elongated conduits disengageably connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header in fluid-tight relation through said closure, toward the burner port; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of truncated side faces, disposed in planes which are oblique to an axial plane of the conduit and intersect therein and joined by a central face perpendicular to the conduit axis, the side faces being formed with apertures for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit, whereby each conduit may be withdrawn outwardly through said closure for inspection of the burner tip or replacement.

4. In combination with a furnace having a wall formed with a burner port therethrough and a second wall spaced outwardly from said furnace wall and forming therewith a passageway for flow of combustion air to said port, the second wall having an access opening axially aligned with the burner port and provided with a removable closure; a fuel burner including an annular header mounted outside said closure in parallel relation to the plane of, and axially aligned with, said burner port, and having means for connection to a source of gaseous fuel under pressure; and a plurality of elon-

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gated conduits disengageably connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header in fluid-tight relation through said closure, toward the burner port; said conduits being substantially equal in length; the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of truncated side faces, disposed in planes which are oblique to an axial plane of the conduit and intersect therein and joined by a central face perpendicular to the conduit axis, the side faces being formed with apertures for discharge of gaseous fuel; the central face terminating in end faces in planes oblique to the conduit axis, and the central face and each end face having an aperture for discharge of gaseous fuel; and the diameter of the base of the cone being not greater than the outer diameter of the associated conduit, whereby each conduit may be withdrawn outwardly through said closure for inspection of the burner tip or replacement.

5. A burner as claimed in claim 1 including an air impeller plate disposed at the entrance of said burner port substantially in the plane of the discharge ends of said conduits and within the cylinder formed by said conduits; and means supporting said air impeller plate from said closure and coaxially of said burner port.

6. A gaseous fuel burner comprising, in combination, an annular header having means for connection to a source of gaseous fuel under pressure; and a plurality of elongated conduits connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of side faces, disposed in planes which are oblique to an axial plane of the conduit and intersect therein, the side faces being formed with apertures for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit.

7. A gaseous fuel burner comprising, in combination, an annular header having means for connection to a source of gaseous fuel under pressure; and a plurality of elongated conduits connected to said header at circumferentially spaced points therearound and having the major portion of their length extending parallel to the axis of said header; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of side faces, disposed in planes which extend at equal and opposite oblique angles to an axial plane of the conduit and intersect therein, the side faces being formed with apertures for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit.

8. A gaseous fuel burner comprising, in combination, an annular header having means for connection to a source of gaseous fuel under pressure; and a plurality of elongated conduits connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of truncated side faces, disposed in planes which are oblique to an axial plane of the conduit and intersect therein, and joined by a central face perpendicular to the conduit axis, the side faces being formed with apertures for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit.

9. A gaseous fuel burner comprising, in combination, an annular header having means for connection to a

source of gaseous fuel under pressure; and a plurality of elongated conduits connected to said header at circumferentially spaced points therearound and having the major portion of their lengths extending parallel to the axis of said header; said conduits being substantially equal in length; and the free end of each conduit being formed as a substantially truncated conical burner tip having a pair of truncated sides faces, disposed in planes which are oblique to an axial plane of the conduit and intersect therein, and joined by a central face perpendicular to the conduit axis, the side faces being formed with apertures for discharge of gaseous fuel; the central face terminating in end faces in planes oblique to the conduit axis, and the central face and each end face having an aperture for discharge of gaseous fuel; the diameter of the base of the cone being not greater than the outer diameter of the associated conduit.

10. A burner as claimed in claim 6 in which the outer

ends of said conduits are bent radially outwardly and connected to the inner periphery of said header.

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