Feb. 22, 1949. J. S. ZINK 2,462,704

BURNER AND BURNER NOZZLE

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Fig. 1

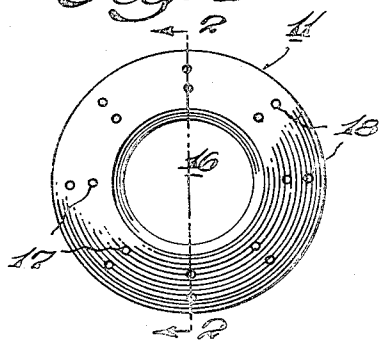


Fig. 2

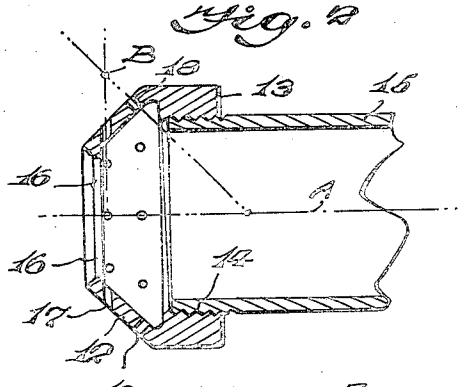


Fig. 3

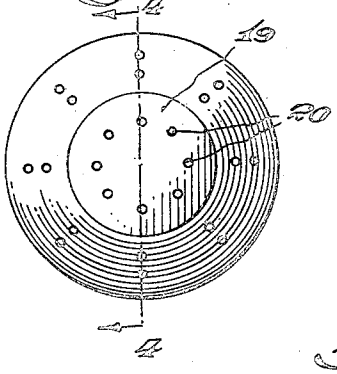


Fig. 4

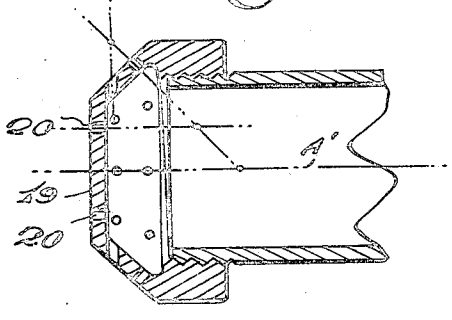


Fig. 5

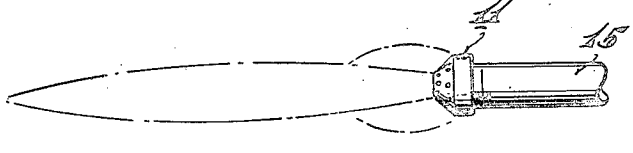
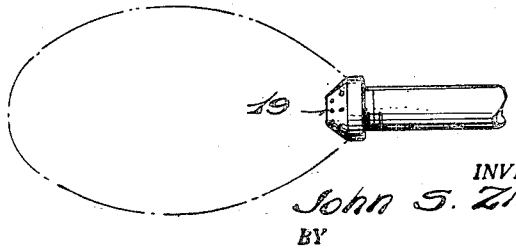


Fig. 6



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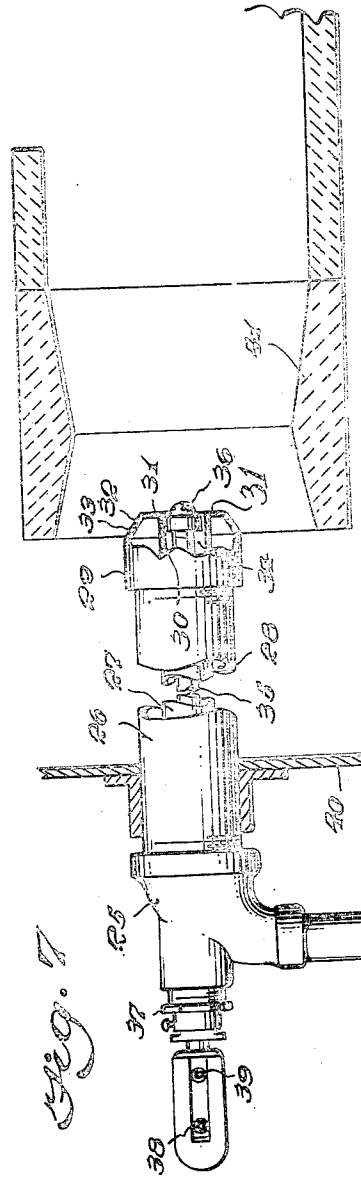


Fig. 1

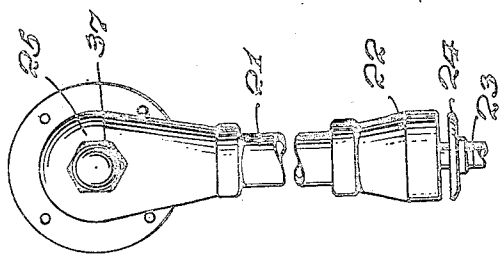


Fig. 8

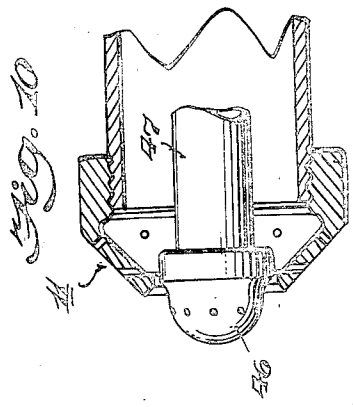


Fig. 10

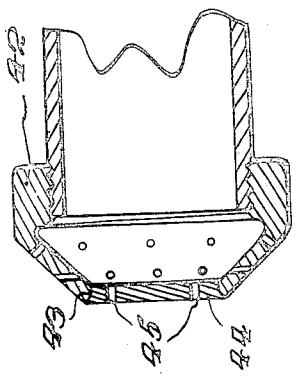


Fig. 9

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BURNER AND BURNER NOZZLE

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Application February 7, 1945, Serial No. 576,524

8 Claims. (Cl. 158—116)

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This invention relates to improvements in burners and burner nozzles and the primary object of the invention is to make ignition certain in the burning of gaseous and liquid fuels, as well as providing means of establishing any optimum flame or heat pattern.

The invention resides in a nozzle through which gaseous fuel, mixtures of air and gaseous fuel and also oil spray if desired, may be discharged for burning. The novelty lies particularly in the arrangement of ports through which the fuel is discharged. In accordance with the invention, the gaseous fuel, air-gas mixture and oil spray, if used, are supplied to the nozzle at a pressure substantially above that of the atmosphere into which the combustible mixture is discharged for burning. By altering the proportions of the orifices, it is possible to obtain any desired flame shape or heat pattern.

These and many other objects of my invention will appear to those skilled in the art from the following description, taken in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a front elevation of a burner nozzle in accordance with the invention and provided with a single relatively large central aperture.

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

Fig. 3 is a view similar to Fig. 1 but showing a number of small centrally disposed apertures used in place of the single large aperture.

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

Fig. 5 is a diagrammatic view illustrating the shape of the flame produced by the nozzle shown in Figs. 1 and 2.

Fig. 6 is a similar view of a bushier flame produced by the nozzle shown in Figs. 3 and 4.

Fig. 7 is a side elevation partly in vertical section of one of my burners, employing both oil and fuel gas and shown in connection with a fragment of a fuel burning apparatus, illustrated in section.

Fig. 8 is an elevation of the burner structure shown in Fig. 7.

Fig. 9 is a diametrical sectional view of a modified nozzle.

Fig. 10 is a view similar to Fig. 2 but showing an oil spray head extending through the large orifice of the nozzle.

Referring first to the embodiment illustrated in Figs. 1 and 2; 11 designates a nozzle having a frusto-conical head 12 merging with a substantially cylindrical sleeve 13 provided with internal threads 14 having threaded engagement with a

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pipe 15 supplying fuel gas or a mixture of fuel gas and air to the nozzle under super-atmospheric pressure.

The frusto-conical head is provided with a large central aperture 16 and with rows of substantially radial orifices 17 and 18. The orifices 17 are defined by walls preferably arranged perpendicular to the central axis A of the burner and these orifices extend through the frusto-conical portion of the nozzle anterior to the large aperture 16. The walls defining the orifices 18 are arranged at obtuse angles to the axis A so that jets of gas issuing from the holes 17 and 18 will impinge against one another as indicated at B.

The construction shown in Figs. 3 and 4 is similar except that the nozzle terminates in a flat disc 19 provided with a circular series of relatively small axially disposed apertures 20 and the walls defining these apertures are positioned parallel to the axis A' as indicated in Fig. 4.

Nozzles having the above characteristics may be combined with an oil burner, as shown in Figs. 7 and 8. In these figures a pipe 21 has an inlet throat 22 receiving fuel gas from a nipple 23. The latter extends into the throat and is provided with a damper 24 to control the supply of primary air admitted to the throat. At its end opposite that where the throat is positioned, the pipe 21 joins an elbow 25 connected to an outer pipe 26 and an inner pipe 27, spaced apart to provide an annular passageway 28 through which the mixture of gas and primary air passes to a modified form of nozzle 29 secured to the discharge ends of pipes 26 and 27. The modified form of nozzle is similar to the one shown in Figs. 3 and 4 except that it has an inner cylindrical wall 30 forming a continuation of the pipe 27. The gaseous mixture is discharged from this nozzle through a circular series of holes 31 arranged parallel to the axis of the burner; radial apertures 32 positioned normal to said axis and other apertures 33 arranged at obtuse angles to such axis.

The inner pipe 27 and wall 30 provide a passageway 34 for the reception of oil burning means consisting of a pipe 35 removably arranged in the pipe 27 and terminating at its discharge end in an apertured oil head 36. The opposite end portion of the pipe 35 is detachably connected by means indicated at 37, to the elbow 25 and is provided with nipples 38 and 39 for the reception respectively of oil and steam.

The pipe 26 may be supported in a wall 40 of any desired type of fuel burning apparatus, and the nozzles 29 and 36 may discharge into a Venturi throat 41 of such apparatus, in which it may

be mixed with secondary air introduced in any suitable way.

In the embodiment of the invention illustrated in Fig. 9, the gas burning nozzle may be constructed so that either a large central opening may be used or several smaller ones. For example, a nozzle 42 like the one shown in Fig. 2, may be provided with a large central aperture 43 which may be closed when desired by a removable plate 44 provided with a circular series of orifices 45. A nozzle of this type may also be employed with an oil head 46 as indicated in Fig. 10. In this case, when the plate 44 is removed the oil head carried by a pipe 47 may be introduced from the rear by means similar to that illustrated in Fig. 7.

From the foregoing it will be understood that each form of nozzle is open at one end for attachment to a supply of gaseous fuel, air-gas mixture or oil spray, while the other end is closed except for a plurality of orifices. One orifice, as shown in Figs. 1 and 2, substantially larger than the others is provided in the center of the closed end, with the axis of this orifice coincident with the axis of the nozzle. Additional orifices are provided near the small end of the nozzle with the axis of each of the additional orifices at a substantial angle in relation to the axis of the nozzle. These orifices extend through a substantially frusto-conical wall of the nozzle and are arranged in two adjacent rows with the ports so positioned that the streams of fuel emerging from the ports in one row impinge on the streams of fuel discharged from the ports in the adjacent row. This condition of impingement of the streams may be obtained by drilling the orifices in the row nearest the discharge end of the nozzle so that the axis of each is at a substantially greater angle to the axis of the nozzle than the angle of the axis of any of the ports in the row farthest from the discharge end. The arrangement thus described I believe preferable, but it is entirely possible to obtain desirable effects by reversing the angular relationship.

If the port in the center of the nozzle has a large area, the major portion of the fuel discharged from the nozzle flows through it and a much smaller portion flows from the radial or impinging ports, thus creating a long narrow flame pattern as shown in Fig. 5. If a more bushy heat pattern is required, the area of the port in the center of the small end of the nozzle is reduced or this end is closed, as shown in Figs. 3, 4 and 9, and a number of small parallel holes are employed instead so that the heat pattern is like that illustrated in Fig. 6.

My nozzles are intended for operation with the air supply for combustion either mixed with the fuel before the latter reaches the combustion zone; a portion of air for combustion mixed with the fuel before it reaches the combustion zone, and the remainder supplied in the combustion zone; or with all air for combustion supplied in the combustion zone.

I believe my invention is novel in that through its shape and the arrangement of the ports, permanence of ignition and complete burning of the fuel takes place despite extreme radiation from the flame to surrounding cold bodies; extreme velocity of discharge of the fuel from the nozzle; extreme velocity of air for combustion supplied in the combustion zone; and also despite heavy water spray delivered directly on the nozzle.

In general, the operation of my burners involves the inductive effect of the stream or streams of fuel flowing from the center port or ports, drawing flame from the fuel burning after emergence

from the radial ports into the stream or streams flowing from the center port or ports. Thus super-heated gases, the temperature of which is substantially above the kindling point of the fuel, are drawn into the fuel flowing from the center port or ports.

If the area of the center port is greater than the total area of the radial ports, the flame produced by the nozzle tends to be a narrow jet with but a slight bulge resulting from the flow of fuel from the radial ports. If less flow comes from the center port or ports and more from the radial ports, the flame tends to bushiness. With minimum flow from the center port or ports and maximum flow from the radial ports, the flame tends to assume the shape of a sphere. Heat pattern control may thus be had by establishing a proper ratio of areas between the center port or ports and the radial ports.

The fact that the inductive effect of the stream or streams of fuel flowing from the center port or ports pulls super-heated gases toward the projected axis of the nozzle tends to maintain extremely high flame temperatures which in turn accelerate combustion to assure complete burning of the fuel despite extremely rapid radiation to surroundings.

The condition of turbulence established by the burner further accelerates burning.

From the foregoing it is believed the construction of my improved burners and the advantages thereof may be readily understood by those skilled in the art and I am aware that changes may be made in the details disclosed without departing from the spirit of the invention as expressed in the following claims.

What I desire to claim and secure by Letter Patent is:

1. A burner nozzle having a substantially frusto-conical wall arranged about an axis, means at the smaller end of said wall for discharging fuel axially from the nozzle, said frusto-conical wall being provided adjacent its smaller end with first ports arranged substantially at right angles to said axis and also provided with second ports arranged at obtuse angles to said axis, said second ports being arranged further away from the smaller end of the wall than the first ports and the first and second ports being so related that fluid discharged through them will impinge at points adjacent to the smaller end of the nozzle, and spaced from the outer surface of said wall, the exterior of the nozzle being unobstructed between said means and the first and second ports to permit duel discharged from the ports to comingle directly with fuel discharged from said means, and means for supplying fuel to the nozzle.

2. A burner nozzle having a substantially frusto-conical wall arranged about an axis and provided with substantially parallel inner and outer surfaces, means at the smaller end of the wall for discharging fuel axially from the nozzle, said frusto-conical wall being provided adjacent said smaller end with fuel discharge ports arranged substantially at right angles to said axis, said wall being provided at points further away from said smaller end than the first-mentioned ports with second ports arranged at obtuse angles to said axis for directing fuel substantially at right angles to the outer surface of said wall, said first and second ports and said means being so related that fluid discharged through the ports will impinge at points spaced from the outer surface of said wall and directly co-mingle with fuel dis-

charged from said means, and means for supplying fuel to the nozzle.

3. A burner nozzle having a substantially frusto-conical wall arranged about an axis, a disc-shaped wall positioned at the smaller end of the frusto-conical wall and provided with ports for discharging fuel axially of the nozzle, said frusto-conical wall being provided adjacent to the disc-shaped wall with first ports arranged substantially at right angles to said axis, the frusto-conical wall also having second ports positioned further away from the disc-shaped wall and arranged at obtuse angles to said axis for discharging fuel toward the plane of the disc-shaped wall, said ports being so related that fuel discharged through the first and second ports will impinge at points spaced from the outer surface of said frusto-conical wall and then travel forward to co-mingle with fuel discharged from the first-mentioned ports, and means for supplying fuel to the nozzle.

4. A burner nozzle as claimed in claim 3, in which the disc-shaped wall is detachably secured to the nozzle.

5. A burner as claimed in claim 1, in which the means at the smaller end of said wall for discharging fuel axially from the nozzle is of larger area than the combined area of said ports.

6. A burner nozzle having a substantially frusto-conical wall arranged about an axis and a relatively large orifice at the smaller end of said wall for discharging fuel axially of the nozzle, said frusto-conical wall being provided with first ports arranged substantially at right angles to said axis and positioned adjacent to its smaller end, said wall being provided also with second ports positioned adjacent to its larger end and arranged at obtuse angles to said axis so that fuel discharged from the second ports will impinge against fuel discharged from the first ports at points spaced from the outer surface of the wall near the smaller end of the latter, and means for supplying fuel to the nozzle.

7. A burner nozzle having a substantially frusto-conical wall arranged about an axis, means at the smaller end of said wall defining a relatively large aperture at that end of the nozzle, a removable plate closing said aperture and provided with ports for discharging fuel substantially axially from the nozzle, said frusto-conical wall being provided adjacent to said plate with first ports arranged substantially at right angles to the axis of the nozzle, said wall being also provided at points further away from the said plate with second ports arranged at obtuse angles to said axis, said first and second ports being so related

that fluid discharged through them will impinge at points spaced from the outer surface of said wall and near the smaller end of the wall, and means for supplying fuel to the nozzle.

8. A burner nozzle having a substantially frusto-conical wall arranged about an axis and provided with an outer surface, means at the smaller end of said wall for discharging fuel substantially axially from the nozzle, a circular wall arranged within the nozzle co-axial with its axis and merging at one end with the smaller end of the frusto-conical wall, an annular chamber in the nozzle between said walls, said frusto-conical wall being provided with first ports arranged substantially at right angles to the axis of the nozzle and positioned adjacent the smaller end portion of the frusto-conical wall, said frusto-conical wall being also provided with second ports arranged at obtuse angles to said axis and positioned adjacent to the larger end portion of the frusto-conical wall for discharging fuel from said chamber substantially at right angles to the outer surface of the nozzle, said ports being so related that fuel discharged from the first ports will impinge against fuel discharged from the second ports at points spaced from the outer surface of the frusto-conical wall and adjacent to the smaller end of the latter, and means for supplying fuel to said chamber.

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