

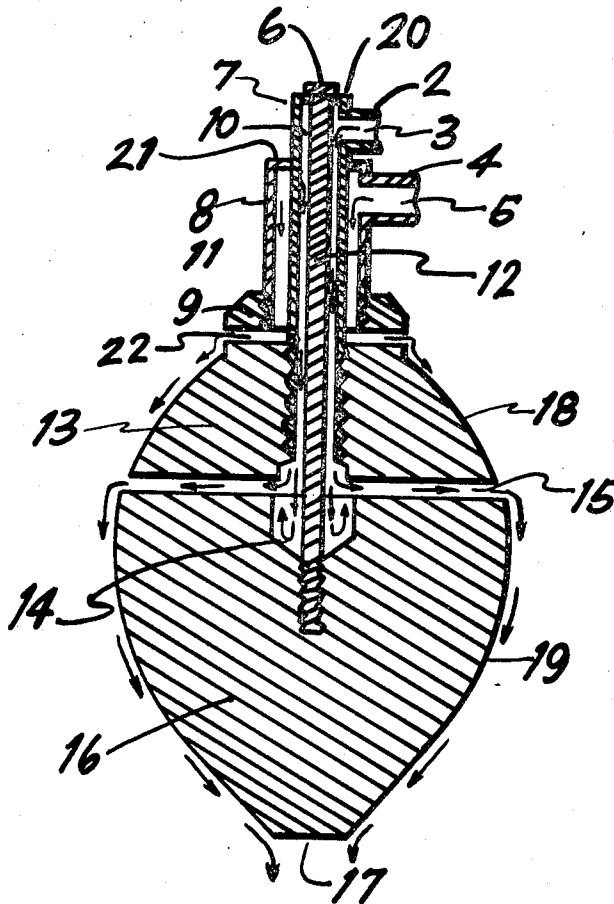
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[45]	Patented	Dec. 21, 1971
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[56] **References Cited**
UNITED STATES PATENTS
3,367,581 2/1968 Kizilos et al. 239/DIG. 7
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[54] FUEL NOZZLE
8 Claims, 5 Drawing Figs.

[52] **U.S. Cl.**..... **239/426,**
239/434, 239/DIG. 7
[51] **Int. Cl.**..... **B05b 7/08**
[50] **Field of Search**..... 239/417.5,
418, 433, 434, DIG. 7, 426

ABSTRACT: An atomizing nozzle assembly wherein a plurality of fluids enter a first body portion of the assembly in separate conduits and discharge individually in a radially outward direction at openings disposed at selected points downstream of the first body portion. The design of the nozzle is of such a configuration that the discharging gases follow the contour of the outer periphery of a second and third body portion of said nozzle.



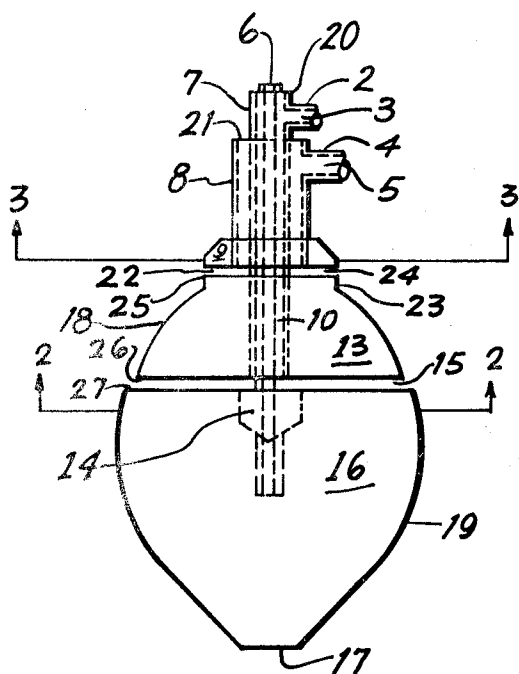


Fig. 1

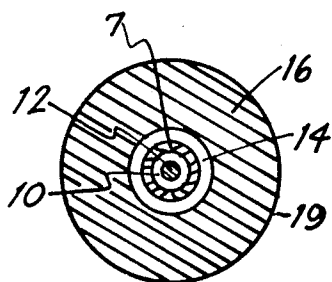


Fig. 2

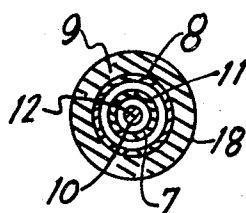


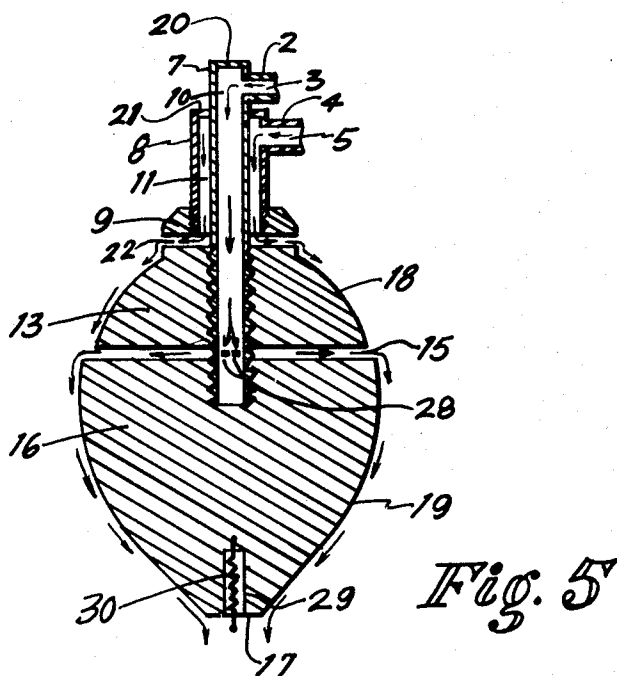
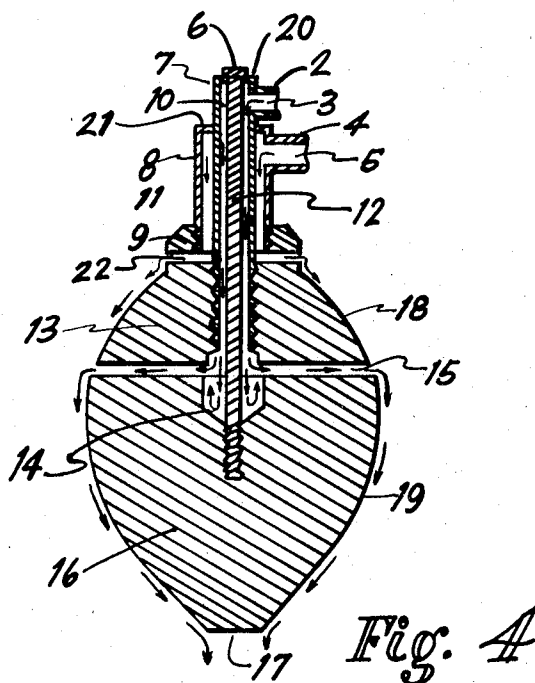
Fig. 3

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FUEL NOZZLE

BACKGROUND OF THE INVENTION

In the past few years there has been a considerable amount of research in the development of nozzles and burner assemblies which can be utilized in the burning of a varying number of grades of fuel. Specifically, there has been considerable concern and research in the design of nozzles for use with residential-type heating fuels. Most of the previous fuel nozzle arrangements have been designed to provide certain operating characteristics for specific fuels at specific temperatures. Thus, since residential-type heating fuels are of relatively low volatility and are predominately a mixture of compounds having different burning properties, the previous nozzle arrangements do no operate satisfactorily over a wide range of fuels.

One preferred oil burner taught in the prior art which is designed for the burning of residential-type heating fuels relates to an oil burner assembly wherein it is necessary to recirculate the products of combustion, providing heat for the vaporization of the fuel.

SUMMARY OF THE INVENTION

In the present invention, it is recognized that it is desirable to provide a nozzle for utilization in the burning of residential-type fuel. Furthermore, it is recognized that it is desirable to provide a burner nozzle which is so designed that highly volatile fuels as well as low-volatility fuels may be burned efficiently without recirculation of combustion products.

The present invention advantageously provides a straight forward nozzle assembly useful in the burning of high and low volatile fuels. The present invention further provides a nozzle assembly whereby the fuel and air atomizing from said nozzle are capable of being burned with a substantially high degree of efficiency.

Various other features of the present invention will become obvious to those skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides a nozzle for a fuel-burning device comprising: a first body portion, a second body portion, and a third body portion wherein said second body portion is in axial alignment with and in spaced relation to said first body portion and third body portion is in axial alignment with and in spaced relation to said second body portion; a first conduit means for passage of a first fluid through said first body portion whereby said first fluid passes from said first body portion and flows in a radially outward direction; a second conduit means for passage of a second fluid through said first and second body portion whereby said second fluid passes from said second body portion and flows in a radially outward direction; said second body portion and said third body portion providing a configuration whereby said first fluid flows in a downstream direction following the contour of said configuration to join and mix with said second fluid and further follow the contour of said configuration.

It is to be understood that the description of the examples of the present invention given hereinafter are not by way of limitation and that various modifications within the scope of the present invention will occur to those skilled in the art upon reading the disclosures set forth hereinafter.

FIG. 1 is an elevational view of a burner nozzle constructed according to one advantageous embodiment of the present invention;

FIG. 2 is a cross-sectional view taken in a plane passing through line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken in a plane passing through line 3—3 of FIG. 1; and,

FIG. 4 is a vertical sectional view of a burner nozzle of FIG. 1 taken along the centerline of the nozzle.

FIG. 5 is a vertical sectional view of a burner nozzle taken along the centerline of the nozzle of another embodiment of the present invention.

As may be seen from FIGS. 1 and 4 the burner nozzle of the present invention comprises a housing 9 which constitutes a

first body portion of the nozzle, an upstream curved body 13 which constitutes a second body portion of the nozzle, and a downstream curved body 16 which constitutes a third body portion of the nozzle. The housing 9 is provided with a central opening 11 (FIG. 3) for receiving the air discharge conduit 8. The upstream curved body 13 is provided with a central opening 10 (FIGS. 2 and 3) for receiving the fuel discharge conduit 7. The central opening 10 of the curved body 13 is axially aligned with and of smaller diameter than the opening 11 of the housing 9 to accommodate the fuel conduit 7 which also passes through body 9 and is in spaced relation to the air conduit 8.

FIG. 1 further discloses annular slit 22 formed by the spacing between the lower surface 24 of the housing 9 and the upper surface 25 of the curved body 13. Curved body 13 is further provided with an upstream lip 23 and an outer surface 18. The lip 23 is constructed so that a step is formed between the curved body and the slit 22. The configuration of the lip 23 and the outer surface 18 is such that air exiting from the slit 22 will cling to or near the lip 23 and the outer surface 18 instead of pursuing a course in a radially outward direction from the slit 22. In the advantageous embodiment described, the outer surface of lip 23 extends substantially parallel to the longitudinally extending axis of the nozzle. The outer surface 18 communicates with the downstream portion of the outer surface of the lip 23 and extends outwardly in a downstream direction.

A downstream curved body is provided with a plenum 14 which is centrally disposed within body 16 and in axially aligned relation with the opening 10. Plenum 14 is of a diameter greater than the diameter of opening 10. The curved body 16 is further provided with an upper surface 25, an outer surface 19 and a terminal edge 17. Outer surface 19 is in alignment with outer surface 18, the surface 19 extending outwardly then inwardly in a downstream direction so the fluid passing downstream along and clinging near the outer surface 18 will continue in a downstream flow clinging near the outer surface 19. Annular slit 15 formed by the spacing between the lower surface 26 of the curved body 13 and the upper surface 27 of the curved body 16 is provided to allow a radially outward flow of fuel from opening 10.

FIG. 1 and 4 further illustrate a fuel inlet conduit 2 having an opening 3 provided therein and an air inlet conduit 4 having an opening 5 provided therein. Conduit 2 is in communicative relation with a fuel supply (not shown) and conduit 7. Conduit 4 is in communicative relation with an air supply (not shown) and conduit 8. Conduit 7 is provided with a closure wall 20 and conduit 8 is provided with a closure wall 21.

A bolt having a bolthead 6 is centrally disposed within the housing 9, the upstream curved body 13 and the downstream curved body 16. The bolt is disposed within and it spaced relation to the fuel discharge conduit 7. The threaded end of bolt 12 is received by the downstream curved body 16.

In another preferred embodiment of the instant invention, as shown in FIG. 5, fuel discharge conduit 7 is received by the downstream curved body 16. Conduit 7 is further provided with apertures 28 in the walls in axially aligned relation with the annular slit 15. Further illustrated in FIG. 5 is a heating element 30 and an opening 29 in the downstream curved body 16 to receive the element 30. The heating element 30 is disposed in alignment with the longitudinal extending axis of the nozzle so that uniform heat is distributed along the outer surface 19 and the terminal edge 17 so that uniform heat is distributed along the surfaces which come in contact with the "air-fuel" mixture.

In accordance with the present invention, air is introduced at a high velocity, generally at about sonic velocity, into the nozzle by way of air inlet conduit 4. The air passes through the opening 11 and then spreads in an outwardly radial direction upon hitting the upper surface 25. Annular slit 22 is provided to direct the flow of the air in the outwardly radial direction. Opening of annular slit 22 is small so the air passing through the slit is maintained at a high velocity. As the high-velocity air exits from slit 22 it passes over the lip 23, following the con-

tour of the lip, in lieu of continuing in a radially outward direction. The reason for this change in direction is unknown but is believed to be due to the physical phenomena known as the Coanda effect. This theory is described in many U.S. Patents including U.S. Pat. No. 2,052,869. In any case, the air follows the contour of the lip 23 and then the surfaces 18 and 19 around the outer periphery of the curved bodies 13 and 16, converging at the terminal edge 17.

Fuel, including gaseous and liquid types, is introduced at a low velocity into the nozzle by way of fuel inlet conduit 2. The fuel passes through the opening 10 into plenum 14. As plenum 14 fills, the low-velocity fuel exits from the plenum 14 in a radially outward direction through annular slit 15. Upon exiting from annular slit 15, the low-velocity fuel is pulled into the high-velocity airstream which is flowing past the annular slit 15. The fuel is subsequently mixed with the air and travels as a mixture around the outer periphery of the downstream curved body 16 along the surface 19.

In FIG. 5, a heating element 30 is provided to illustrate that in use of liquid fuels, it is sometimes necessary to vaporize the liquid as it is mixed with the air. If this is not done, droplets of the fuel may be entrained in the fuel-air mixture thereby yielding a heterogeneous mixture with the result being incomplete combustion.

What is claimed is:

1. A nozzle for a fuel-burning device comprising: a first body portion, a second body portion, and a third body portion wherein said second body portion is in axial alignment with and in spaced relation to said first body portion and said third body portion is in axial alignment with and in spaced relation to said second body portion; a first conduit means for passage of a first fluid through said first body portion whereby said first fluid passes from said first body portion and flows in a radially outward direction; a second conduit means for passage of a

second fluid through said first and second body portion whereby said second fluid passes from said second body portion and flows in a radially outward direction; said second body portion and said third body portion providing a configuration whereby said first fluid flows in a downstream direction following the contour of said configuration to join and mix with said second fluid and further follow the contour of said configuration.

2. The nozzle of claim 1 wherein said first conduit is adapted to receive air and said second conduit is adapted to receive fuel.

3. The nozzle of claim 1 wherein said second conduit is of cross-sectional area substantially less than the cross-sectional area of said first conduit.

4. The nozzle of claim 3 wherein said second conduit is disposed concentrically within said first conduit and spaced therefrom providing an annular passage therebetween.

5. The nozzle of claim 1 wherein said second body portion is provided with a lip extending substantially parallel to the longitudinally extending axis of said nozzle.

6. The nozzle of claim 5 wherein said lip extends in a downstream direction communicating with an outer surface that extends outwardly in a downstream direction and said third body portion is provided with an outer surface in alignment with said outer surface in alignment with said outer surface of said second body portion, said outer surface of said third body portion extending outwardly then inwardly in a downstream direction.

7. The nozzle of claim 1 including means for adding heat to said third body portion.

8. The nozzle of claim 7 wherein said means for adding heat is disposed in alignment with the longitudinal extending axis of said nozzle.

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