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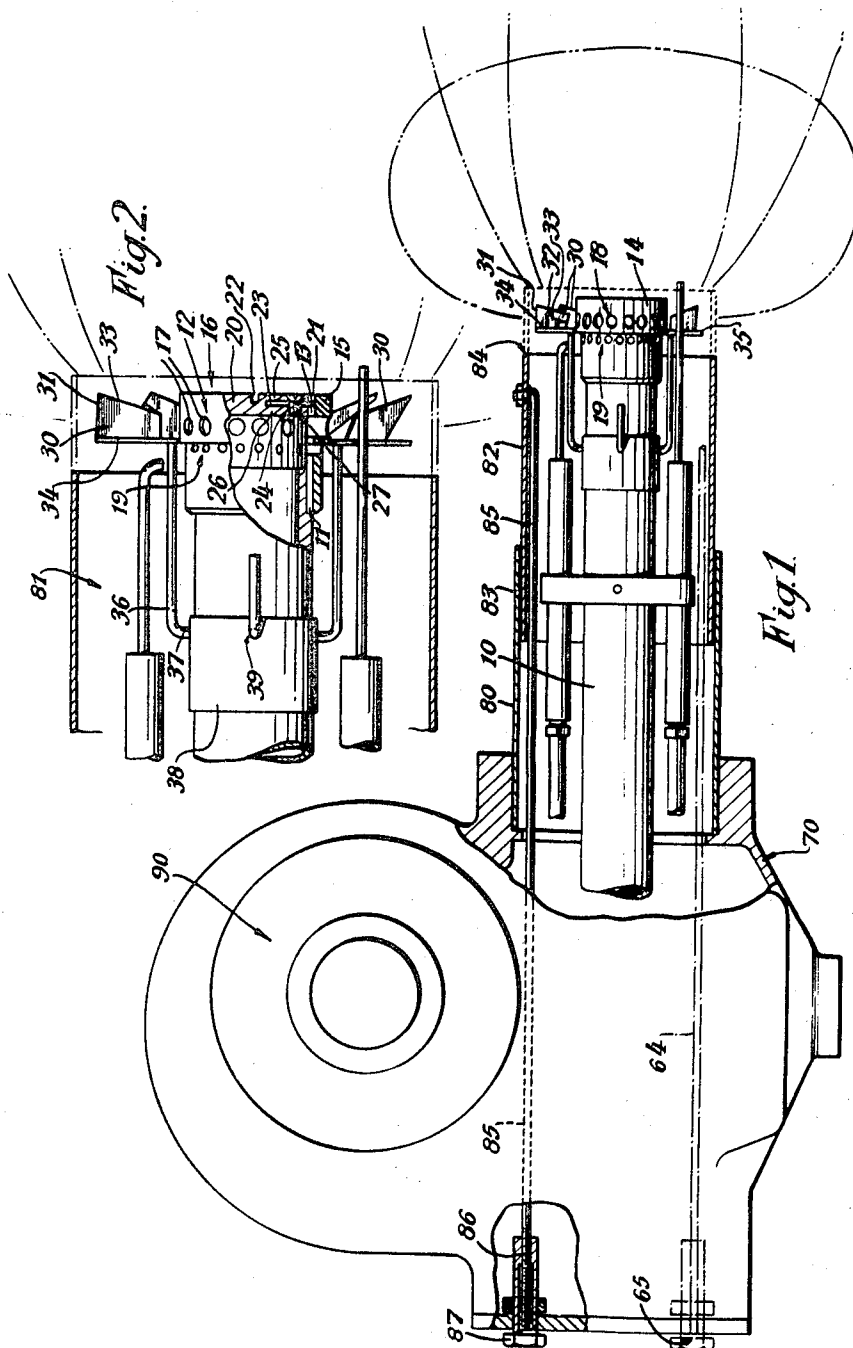
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**3,469,790**

## GAS BURNERS

Filed June 28, 1967

2 Sheets-Sheet 1



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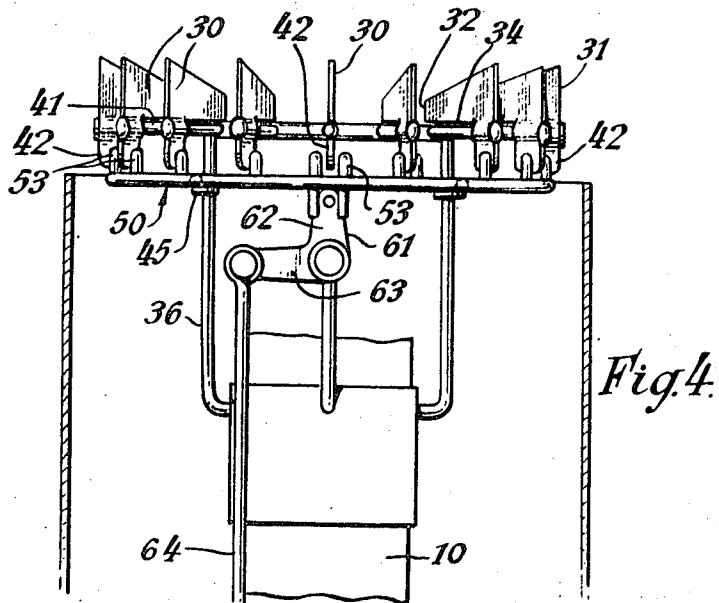
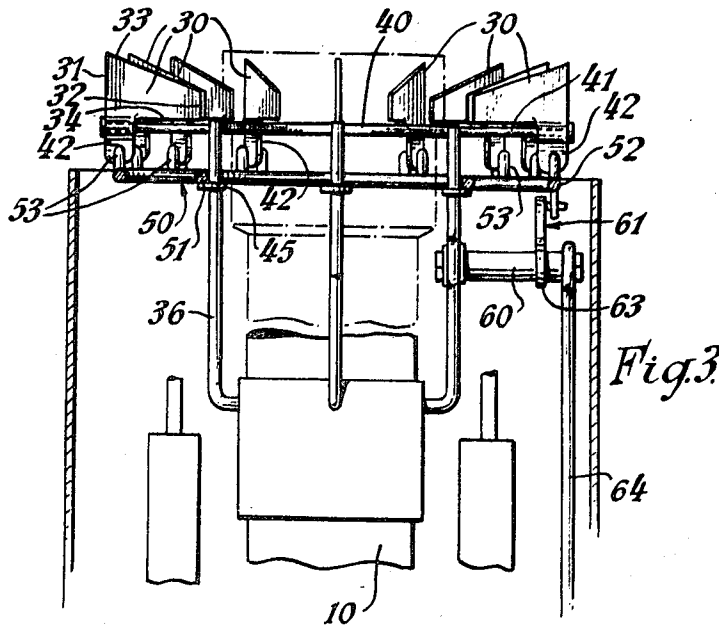
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GAS BURNERS

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24 Claims

## ABSTRACT OF THE DISCLOSURE

The invention relates to a gas burner which consists essentially of gas supply tube and disposed thereabout an outer tube defining an oxygen or air supply conduit, nozzle means for the discharge of gas fuel transverse to a stream of oxygen or air supplied by said conduit and flame control means movable between a first position and a second position with respect to said nozzle or said conduit to permit control of the shape and/or size of the flame. The flame control means may comprise a sleeve mounted at the end of the outer tube and axially slidable between a retracted first position and an extended second position, the former position resulting in a broad flame and the latter position resulting in an elongate flame. The flame control means may also comprise either in combination with the slidable sleeve or separately therefrom, a plurality, of radially directed vanes disposed circumferentially about the fuel nozzle, each of said vanes being rotatable about a radial axis with respect to said nozzle so that the inclination of each of said vanes can be varied with respect to said nozzle to produce control of the burner flame.

The present invention relates to burners and in particular to burners for use with a gaseous fuel where the shape and/or capacity of the flame issuing from the burner can be controlled.

It is well known that in producing burners the shape and form of the flame should be adjusted to the particular combustion chamber in which the burner is to be operated. In general, this requires careful adjustment of each burner and corresponding alteration, if this is possible, of the combustion chamber in which the flame from the burner is to be disposed in order to achieve maximum efficiency. It is, therefore, desirable to provide a gas burner the flame of which is adjustable over a wide range.

According to the present invention there is provided a burner comprising an oxygen supply conduit, a fuel nozzle adjacent an end of said supply conduit for the discharge of fuel transverse to the stream of oxygen or air supplied by said conduit, flame control means movable between a first position and a second position with respect to said nozzle and/or said conduit, the arrangement being such that in operation, progressive movement of said flame control means from said first position towards said second position produces a progressive change in the shape and size of the flame.

The oxygen supply conduit may include a tube and the fuel nozzle may be disposed at an end of a fuel supply conduit which is located within the oxygen supply conduit. The flame control means may comprise a sleeve slidably mounted at the end of the oxygen supply conduit and axially movable between a retracted first position and an extended second position. A barrier means may be provided in said oxygen supply conduit adjacent the fuel nozzle to provide a pressure barrier the arrangement being such that with the sleeve in the retracted position, a

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ball-shaped flame is obtained and with the sleeve in the extended position a long flame is obtained.

The fuel nozzle may comprise a plurality of discharge orifices radially disposed in an annulus and adapted to discharge fuel into said stream of oxygen or air within or debouching from said oxygen supply conduit and substantially perpendicular to the direction of movement of said stream.

According to one embodiment of the present invention, the flame control means comprises a plurality of radially directed vanes disposed circumferentially about the fuel nozzle the plane of each of said vanes being inclined at an angle to a plane substantially perpendicular to said oxygen or air stream.

In a preferred embodiment of the present invention the flame control means comprises a sleeve slidably mounted at the end of the oxygen supply conduit and axially movable between a retracted first position and an extended second position in combination with a plurality of radially directed vanes disposed circumferentially about the fuel nozzle the plane of each of said vanes being inclined at an angle to a plane substantially perpendicular to said oxygen or air stream each of said vanes being rotatable about an axis between the first position and the second position.

The invention also includes a nozzle comprising a tubular body member adapted to be connected to a fuel supply means which body member is open at one end and is provided at or towards the open end with a plurality of outlets and a metering element slidably disposed in said tube. In another embodiment of the present invention there is provided a gas burner nozzle which comprises a tubular body member adapted to be connected to a gas supply which body member is open at one end and which is provided at or towards the open end with a plurality of outlets, a metering element slidably disposed in said tube to close the open end thereof so that inward movement of the metering element with respect to the body member results in progressive obstruction of the outlets to meter the gas emerging therefrom, means disposed about said gas outlets in the body to direct a current of air over said outlets and means for controlling the pattern of the air passing said outlets, the arrangement being such that the shape and configuration of the flame obtained on ignition of gas emitted from said outlets can be altered by adjusting the control means for the pattern of the air current passing said outlets.

Following is a description by way of example only and with reference to the accompanying drawings of two embodiments of a gas burner in accordance with the present invention.

In the drawings:

FIGURE 1 is a partial section through a gas nozzle.  
FIGURE 2 is a detail partly in section of FIGURE 1.  
FIGURE 3 is a detail of an alternative embodiment of the nozzle illustrated in FIGURE 1.

FIGURE 4 is another view partly in section of the nozzle forming the subject of FIGURE 3.

The gas burner comprises an elongated cylindrical gas supply tube 10 connected at its rearward end to the gas supply and provided about the external surface of the forward end thereof with a screw thread 11. A burner nozzle 12 comprises a cylindrical sleeve 15 threaded on the internal surface at 13 and adapted to receive at its rearward end the threaded forward portion 11 of the gas supply tube 10. The external surface of the forward portion 14 of the sleeve 15 is stepped to provide an increased diameter in the external surface of the sleeve, the internal diameter of the sleeve 15 remaining substantially constant along its length.

The sleeve 15 is provided towards its open end at 16 with two rings of circumferentially spaced radially directed outlet orifices 17 through which gas supplied by the supply tube 10 passes out of the nozzle 12 for combustion. Said rings of outlet orifices 17 comprises a forward ring indicated generally at 18 and a rearward ring of orifices indicated generally at 19, the forward ring of orifices being located in the expanded portion 14 of the sleeve 15 with each of the forward orifices 18 being of larger diameter than the rearward orifices 19 and the rearward ring of smaller outlet orifices 19 being located in the portion of the nozzle 12 of smaller diameter adjacent the rear of the expanded portion 14.

The forward open end 16 of the sleeve 15 forming the nozzle 12 is closed by a circular disc 20, which is threaded on its circumferential edge 21 and adapted to engage the thread on the inner surface of the sleeve 13. The disc 20 is provided in its outer forward surface with a diametric slot 22 to enable a co-operating instrument having a ridge adapted to engage said slot 22, such as a screw-driver, to engage therewith to enable the disc 20 to be rotated with respect to the sleeve 15 thereby allowing axial movement of the disc 20 with respect to said sleeve 15. The disc 20 is also provided in an edge thereof with a slot 23 extending within the body of the disc 20 to extend through a minor segmental portion thereof defined by a circumferential edge of the disc and a cord spaced from the diameter of the disc 20.

The disc 20 is also provided towards the periphery thereof, and along a radius which substantially bisects the said cord, with a drilling 24 extending through the disc 20 and the slot 23 therein from the forward to the rearward end so that, with the disc 20 located in the open end of the sleeve 15 the drilling 24 passes through a forward element 25 defined by the slot 23, the periphery of the disc 20, the forward surface of the disc 20 and a rearward element 26 defined by the slot 23, the periphery of the disc 20, and the rearward surface of the disc 20.

The drilling 24 in the rearward element 26 of the disc 20 is provided with a thread which is adapted to receive the threaded shank of a set-screw 27 and the drilling 24 in the forward element 25 of the disc 20 is countersunk to receive the head of the set-screw 27, the arrangement being such that, with the disc 20 located in the forward end of the sleeve 15 forming the nozzle 12, rotation of the set-screw 27 to draw the forward element 25 of the disc 20 towards the rearward element 26 results in a clamping of the forward element 25 and rearward element 26 of the disc 20 about a thread on the inner surface of the sleeve 15, thereby locking the disc 20 with respect to the sleeve 15. On releasing the set-screw 27, the disc 20 is capable of rotational translational movement with respect to the sleeve 15 by virtue of the interengagement between the threads 21 on the periphery of the disc 20 and the threads 13 on the inner surface of the sleeve 15 so that rotation of the disc 20 produces translational movement of the disc 20 within the sleeve 15 in a forward-rearward direction.

The rearward end of the expanded portion 14 of the nozzle 12 has a plurality of circumferentially disposed radially directed trapezoidal vanes 30 adjacent thereto, the plane of each of said vanes 30 being inclined at an angle to the plane containing one of the rings of outlet orifices 17, all the vanes 30 being directed in a similar sense, i.e., in a clockwise or in an anti-clockwise direction, about the nozzle 12. Each of the vanes 30 comprises a pair of substantially parallel side edges 31 and 32, a top edge 33 which is transverse to said sides and slopes from an outer edge 31 to an inner edge 32 of each vane 30 and a bottom edge 34 which is substantially perpendicular to the parallel sides 31 and 32. Each of the vanes 30 is supported at its bottom edge 34 by a vane support ring 35 which defines an annulus about the lower edge of the expanded portion 14 of the nozzle 12.

The vane support ring 35 is supported at its inner edge by four vane support arms 36 disposed symmetrically

about the gas supply tube 10, each of said vane support arms 36 extending rearwardly substantially parallel to the axis of the gas supply tube 10 and being bent radially inwards at the rearward end 37 thereof. The gas supply tube 10 carries spaced rearwardly of said burner nozzle 12 a support sleeve 38 having four radially disposed drillings 39 adapted to receive the inwardly directed portions 37 of the vane support arms 36. The support sleeve 39 is fixed to the gas supply tube 10 and thereby maintains the vane support ring 35 and the vanes 30 attached thereto in constant relation with said burner nozzle 12.

In the embodiment illustrated with respect to FIGURES 3 and 4 of the accompanying drawings control means are provided for varying simultaneously the inclination of each vane 30 to the plane containing one of the rings of outlet orifices 17. In this embodiment, each vane support arm 36 carries at a forward end a vane support ring 40 having a plurality of radially disposed symmetrically spaced spokes 41. Each vane 30 is provided towards its outer edge 31 with a rearwardly disposed projection 42 said projection being expanded just rearwardly of the continuation of the rearward edge 34 of the vane 30 and provided with a bore, the axis of which is substantially parallel with said rearward edge 34. Each vane 30 is adapted to be accommodated on a spoke 41 of the vane support ring 40 for rotation with respect thereto and so that the rearward projection 42 is disposed rearwardly of the vane support ring 40.

Each of the vane support arms 36 carries, in a plane substantially parallel to but spaced rearwardly from that containing the vane support ring 40, a ring guide 45. The ring guide 45 on each vane support arm 36 is disposed in the same plane and each guide 45 comprising a flat plate fixed to the vane support arm 36 and projecting radially outwardly thereof and with respect to gas supply tube 10 to provide a bearing surface. Said bearing surface carry and support a vane control ring 50 which comprises an inner ring 51 and an outer ring 52 interconnected by a plurality of radially disposed spokes (not shown). The inner ring 51 is supported on the forward surface of each of said ring guides 45 and the outer ring 52 is concentric with the inner ring 51 so as to be spaced rearwardly from the rearward projections 42 of each of the vanes 30. The outer ring vane control ring 52 is provided with a plurality of pairs of spaced forwardly projecting lugs 53 which are adapted to be disposed on opposed sides of each of the rearward projections 42 of the vanes 30 to locate each vane 30 with respect to the spoke 41 about which each vane 30 is pivoted so that rotation of said vane control ring 50 through a small angle results in movement of said lugs 53 with respect to the spokes 41 on the vane support ring 40 and corresponding movement of the rearward projection 42 engaged therebetween to produce inclination of each vane 30 with respect to the spoke 41, upon which it is mounted thereby producing substantially equivalent inclination of each of said vanes 30 in the same sense about the nozzle 12.

One of said vane support arms 36 is provided intermediate the support sleeve 38 and the ring guide 45 with a radially projecting axle 60 which carries towards an outer end thereof, a bell crank 61. One arm 62 of the bell crank 61 is connected to the vane control ring 50 and the other arm 63 is connected to an elongate rod 64 extending rearwardly of the nozzle 12 and substantially parallel with the axis of the gas supply tube 10 the rearward end of said rod 64 being threaded. The threaded rearward end of said rod 64 engages with a screw-threaded control element 65 mounted for rotation with respect to a housing 70 carrying said gas supply tube 10 so that rotation of said control element 65 produces forward rearward movement of the vane control rod 64 and through the bell crank 61 produces limited rotational movement of the vane control ring 50 to provide control over the inclination of the vanes 30 from a point remote from the nozzle 12.

The nozzle 12 and gas supply tube 10 are surrounded by an external elongate cylindrical tube 80 located substantially concentric with the gas supply tube 10 said external tube 80 defining an annular air supply conduit 81 between the inner surface 80 of said tube and the outer surface of the gas supply tube 10. The forward portion 82 of the external tube 80 is slidable within a rearward portion 83 which rearward portion 83 is secured to a housing 70 fixed with respect to the nozzle 12. The forward portion 82 is arranged to be axially slidable with respect to said rearward portion 83 of the external tube 80 so that in a rearward position the forward end 84 of said external tube is located rearwardly of the rearward ring of gas outlet orifices 19 in the nozzle 12 and in the forward position the whole of the nozzle 12 and associated vanes 30 are located within the tube.

A control rod 85 is disposed adjacent the inner surface of the forward tube portion 82 and is fixed with respect thereto. The rearward portion 86 of the control rod 85 is threaded and is adapted to engage with a threaded element 87 located in a rear part of the housing 70 for rotation with respect thereto so that appropriate rotation of said element 87 causes said control rod 85 to move in a forward rearward direction thereby controlling the movement of the forward tube portion 82 of the air supply conduits 81.

The rearward end of the tube 80 is provided with means 90 such as a centrifugal fan for providing air under pressure so that air passes in the air conduit 81 to provide an air current passing the outlet orifices 17 for the gas in the gas nozzle 12. The pattern of air passing the nozzle 12 is controlled by the vanes 30 disposed externally thereof. The particular air pattern being determined by the location of the forward portion 82 of the outer tube 80 with respect to the nozzle orifices 17 and by the inclination of the vanes 30 with respect to the plane contain one of the rings of outlet orifices 18 or 19.

In use, gas is supplied to the nozzle 12 by means of the gas supply tube 10 under constant pressure, and the capacity of the nozzle 12 can be varied by rotating the metering element 20 in the end thereof so that the disc 20 moves rearwardly with respect to the nozzle 12 and progressively obstructs part of or the whole of one or both of the rings 18 or 19 of orifices 17 in the nozzle 12 to control the area of the openings in the nozzle 12, thereby controlling the capacity of the nozzle 12. When the desired capacity is obtained, the disc is locked in position by turning the set-screw 27 to draw the forward element 25 and rearward elements 26 of the disc 20 into clamping engagement about a thread 13 on the internal surface of the sleeve 15 thereby locking the disc 20 with respect to the sleeve 15.

On igniting gas issuing from the nozzle, and supplying air in the manner described above, with the outer tube 82 in the rearward position and the nozzle 12 exposed from the forward end thereof, a steep inclination of the vanes 30 surrounding the nozzle 12 results in the formation of a ball-shaped flame, whereas with small inclination of the vanes 30 and with the outer tube 82 in the forward position, that is to say, the nozzle 12 located within the outer tube 80, a long thin flame is obtained. The flame can be infinitely varied between these two extremes by varying the inclination of the vanes 30 controlling the air pattern passing the nozzle 12 and by varying the position of the outer tube 82 with respect to the nozzle 12 either separately or in combination in order to produce a desired flame shape.

By using the nozzles of the kind described above it is possible to control the configuration of the flame obtained from the nozzle and the capacity of the nozzle without necessitating the removal of one nozzle and the fitting of another.

I claim:

1. A burner comprising an oxygen supply conduit, a fuel nozzle adjacent an end of said supply conduit for

the discharge of fuel transverse to a stream of oxygen or air supplied by said conduit, flame control means movable between a first position and a second position, the arrangement being such that in operation progressive movement of said flame control means from said first position towards said second position produces a progressive change in the shape or size of the flame, said flame control means comprising a plurality of radially directed vanes disposed circumferentially about said fuel nozzle, each of said vanes being supported with respect to its bottom edge by a vane support ring which defines an annulus about said nozzle, said vane support ring being provided with a plurality of radially disposed spokes, each of said vanes being mounted on a spoke for rotation thereabout, the bottom edge of each vane being provided with a projection disposed on the side of said spoke remote from the body of said vane, a vane control ring disposed in space relationship to said vane support ring and adapted for restricted rotation with respect to said vane support ring during said first and second position.

2. A burner as claimed in claim 1 wherein the vane control ring is provided with a plurality of pairs of spaced projecting lugs, each lug of a given pair being disposed on opposite sides of a vane projection to locate the vane with respect to the spoke about which it is pivoted the arrangement being such that rotation of the vane control ring through a small angle results in movement of each pair of lugs with respect to the axis on the vane support ring about which the corresponding vane is capable of restricted rotation to produce corresponding movement of the vane projection and to produce simultaneous inclination of each vane with respect to the axis about which it rotates.

3. A burner as claimed in claim 1 wherein the vane control ring comprises an inner ring and an outer ring interconnected by a plurality of radial spokes, the inner ring being supported on bearing surfaces provided on the nozzle and the outer ring being concentric with the inner ring and carrying the plurality of pairs of spaced projecting lugs.

4. A burner as claimed in claim 1 wherein the fuel supply conduit is a tube having the fuel nozzle at its forward end and wherein the vane support ring is supported at its inner edge by four vane support arms disposed symmetrically about the fuel supply tube, each of said vane support arms extending rearwardly substantially parallel to the axis of the gas supply tube and being radially inward at a rearward end thereof.

5. A burner as claimed in claim 4 wherein the fuel supply tube carries spaced rearwardly of said burner nozzle a support sleeve having four radial drillings adapted to receive the inwardly directed portions of the vane support arms, the said vane support sleeve being fixed to the fuel supply tube.

6. A burner as claimed in claim 5 wherein each of the vane support arms carries in a plane substantially parallel to but spaced rearwardly from that containing the vane support ring, a ring guide, each of said guides being disposed in the same plane and each guide comprising a bearing surface fixed to the vane support arm and projecting radially outwardly thereof.

7. Apparatus as claimed in claim 4 wherein one of said vane support arms is provided intermediate the vane control ring and the support sleeve with a radially projecting axle which carries towards an outer end thereof a bell crank, one arm of the bell crank being connected to the vane control ring and the other arm being connected to a control rod.

8. A burner as claimed in claim 7 wherein the control rod extends rearwardly of the nozzle and substantially parallel with the axis of the fuel supply tube, the rearward end of said rod being threaded.

9. A burner as claimed in claim 8 wherein the threaded end of said control rod engages with a screw threaded

control element mounted for rotation with respect to a housing for said burner, so that rotation of said control member produces forward rearward movement of the control rod and through the bell crank produces limited rotational movement of the vane control ring to provide control over the inclination of the vanes from a point remote from the nozzle.

10. A burner as claimed in claim 4 wherein the oxygen supply conduit comprises an external elongate cylindrical tube and wherein the fuel supply tube is disposed concentrically within said external tube to define an annular oxygen or air supply conduit.

11. A burner as claimed in claim 10 wherein a forward portion of the said external tube is axially slidable within the rearward portion which rearward portion is secured to a housing fixed with respect to the nozzle.

12. A burner as claimed in claim 11 wherein the forward portion is arranged to be axially slidable with respect to said rearward portion of the external tube so that in a rearward position the forward end of said external tube is located rearwardly of a rearward ring of fuel outlet orifices in the nozzle and in a forward position the whole of the nozzle is located within the tube.

13. A burner as claimed in claim 11 wherein a control rod is disposed adjacent the inner surface of the external tube, the forward portion of said control rod being secured to the forward tube portion and movable in a forward rearward direction therewith, the rear of the control rod being threaded and adapted to engage with a threaded control member carried in the rearward portion of the housing for rotation with respect thereto so that appropriate rotation of said control member causes said control rod and the forward portion of the external tube to move in a forward rearward direction.

14. A burner as claimed in claim 4 wherein the nozzle comprises a tubular body member adapted to be connected to a fuel supply means which body member is open at one end and is provided at or towards the open end with a plurality of outlets and a metering element slidably disposed in said tube to close the open end thereof, the arrangement being such that movement of the metering element inwardly of the tubular body member results in a progressive obstruction of the outlets to meter the flow of fuel emerging therefrom.

15. A burner as claimed in claim 14 wherein the body of said nozzle is substantially cylindrical and wherein said nozzle comprises a plurality of radially directed outlet orifices.

16. A burner as claimed in claim 15 wherein the burner nozzle comprises a cylindrical sleeve threaded on the internal surface thereof and adapted to receive at its rearward end a threaded forward portion of a fuel supply tube and wherein the external surface of the forward portion of the nozzle is stepped to provide an increased diameter in the external surface of the sleeve, the internal diameter of the sleeve remaining substantially constant along its length.

17. A burner as claimed in claim 16 wherein the nozzle is provided towards its open end with two rings of circumferentially spaced radially directed outlet orifices through which gas or fuel supplied by the supply conduit may pass out of the nozzle for combustion.

18. A burner as claimed in claim 17 wherein said rings of orifices comprise a forward ring and a rearward ring of orifices, the forward ring of orifices being located in

the expanded portion of the sleeve with each of the forward orifices being of larger diameter than the rearward orifices, and the rearward ring of smaller outlet orifices being located in the portion of the nozzle adjacent the rear of the expanded portion.

19. A burner as claimed in claim 14 wherein the metering element comprises a circular disc which is threaded on its circumferential edge and adapted to engage the thread on the inner surface of the sleeve.

20. A burner as claimed in claim 18 wherein the disc is provided in its outer forward surface with a diametric slot to enable a co-operating instrument having a ridge adapted to engage said slot such as a screw-driver to engage therewith to enable the disc to be rotated with respect to the nozzle body thereby allowing axial movement of the disc with respect to the body.

21. A burner as claimed in claim 20 wherein the disc is provided in an edge thereof with a slot extending within the body of the disc through a minor segmental portion thereof defined by circumferential edge of the disc and a chord spaced from a diameter of the disc.

22. A burner as claimed in claim 21 wherein the disc is also provided towards the periphery thereof and along a radius which substantially bisects the chord with a drilling extending through the disc and the slot therein from the forward to the rearward ends so that with the disc located in the open end of the nozzle the drilling passes through a forward element defined by the slot, the periphery of the disc, and the forward surface of the disc, and a rearward element defined by said slot, the periphery of the disc and the rearward surface of the disc.

23. A burner as claimed in claim 22 wherein the drilling in the rearward element of the disc is provided with a thread which is adapted to receive a threaded shank of a set screw and the drilling in the forward element of the disc is countersunk to receive the head of the set screw the arrangement being such that with the disc located in the forward end of the sleeve forming the nozzle, the rotation of the set screw to draw the rearward element of the disc towards the forward element of the disc results in a clamping of the forward and rearward elements about a thread, on the inner surface of the sleeve thereby locking the disc with respect to said sleeve.

24. A burner as claimed in claim 4 wherein the rearward end of the oxygen supply conduit is provided with means for providing air or oxygen under pressure so that air or oxygen passes into the annular space between the fuel supply tube and the inner wall of the external tube to provide an air or oxygen stream passing the exit orifices in the fuel nozzle.

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