

Oct. 23, 1956

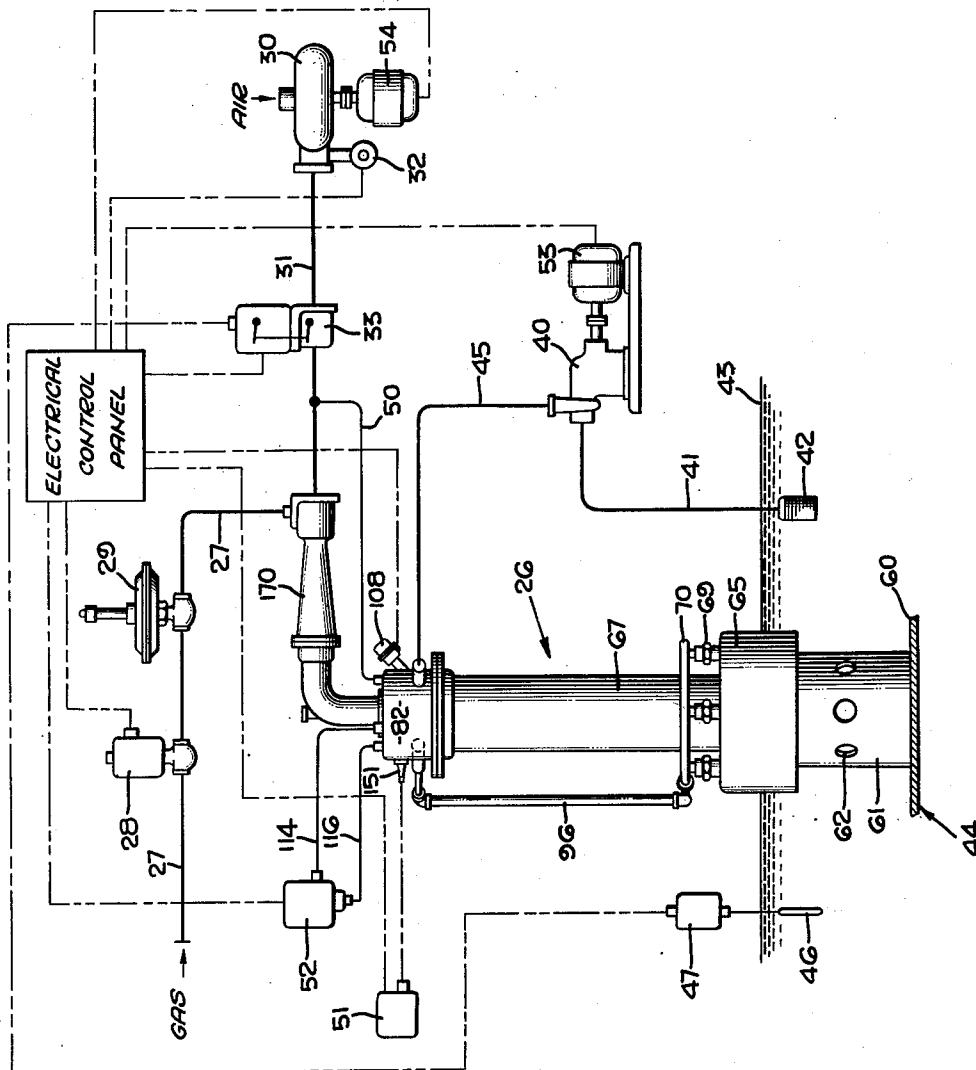
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2,767,784

FUEL BURNER

Filed March 22, 1951

4 Sheets-Sheet 1



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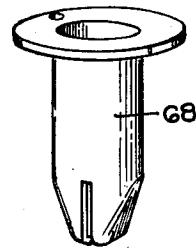
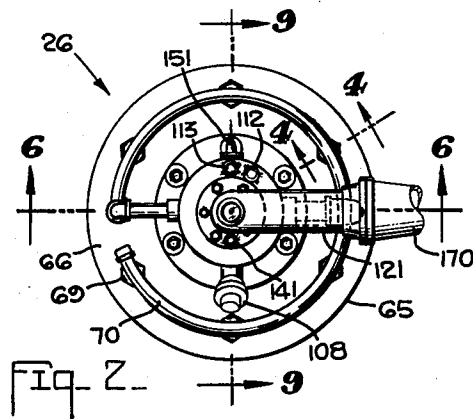


Fig. 5-

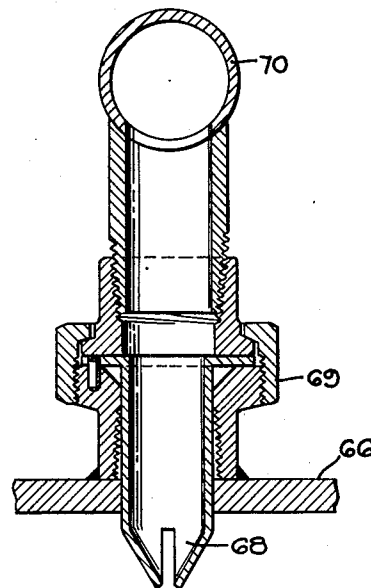
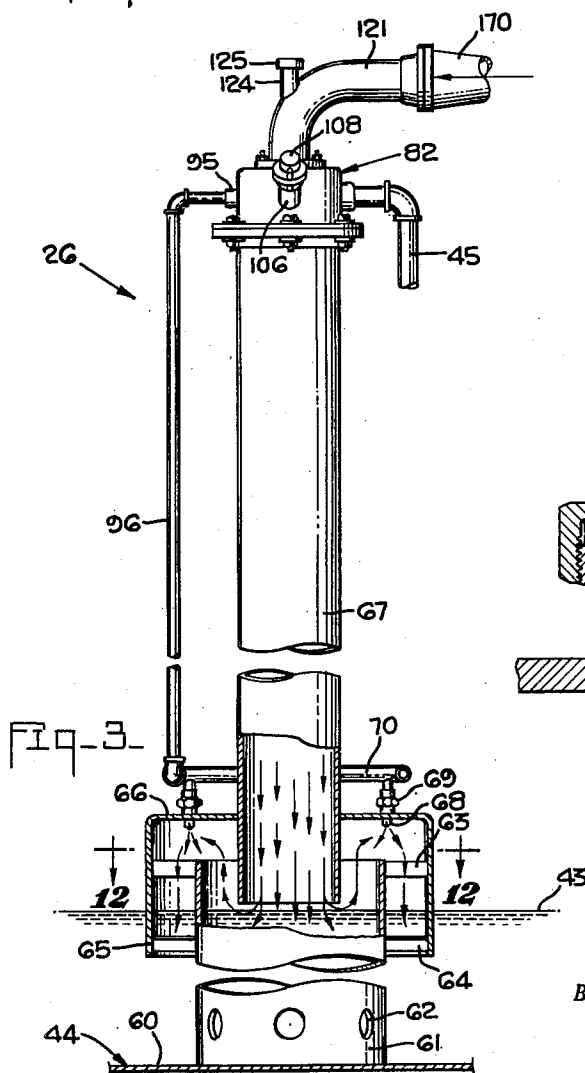


Fig. 4-

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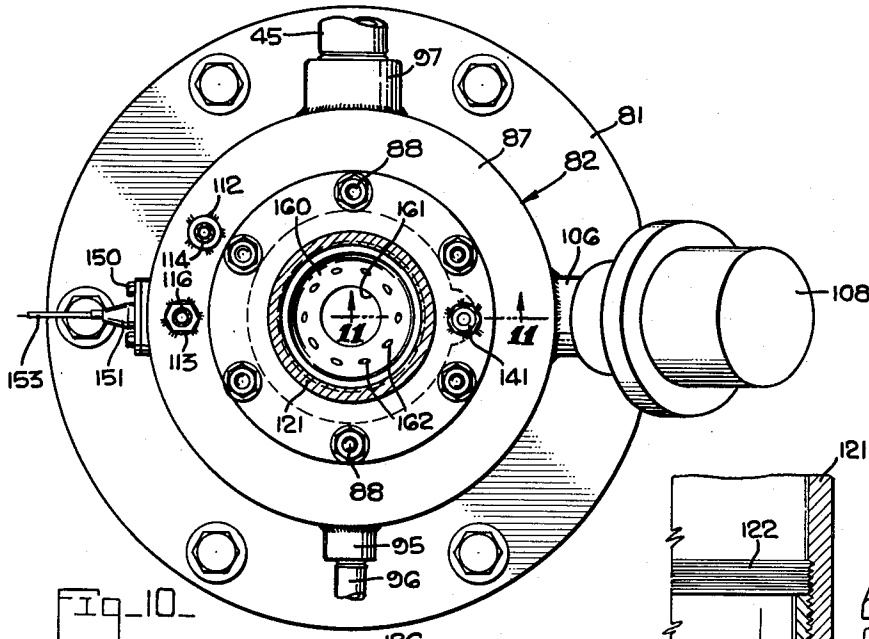


Fig. 10

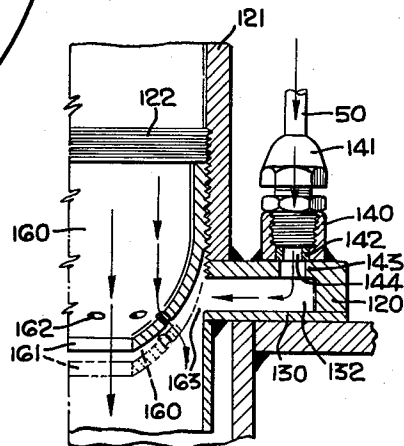


Fig. 11

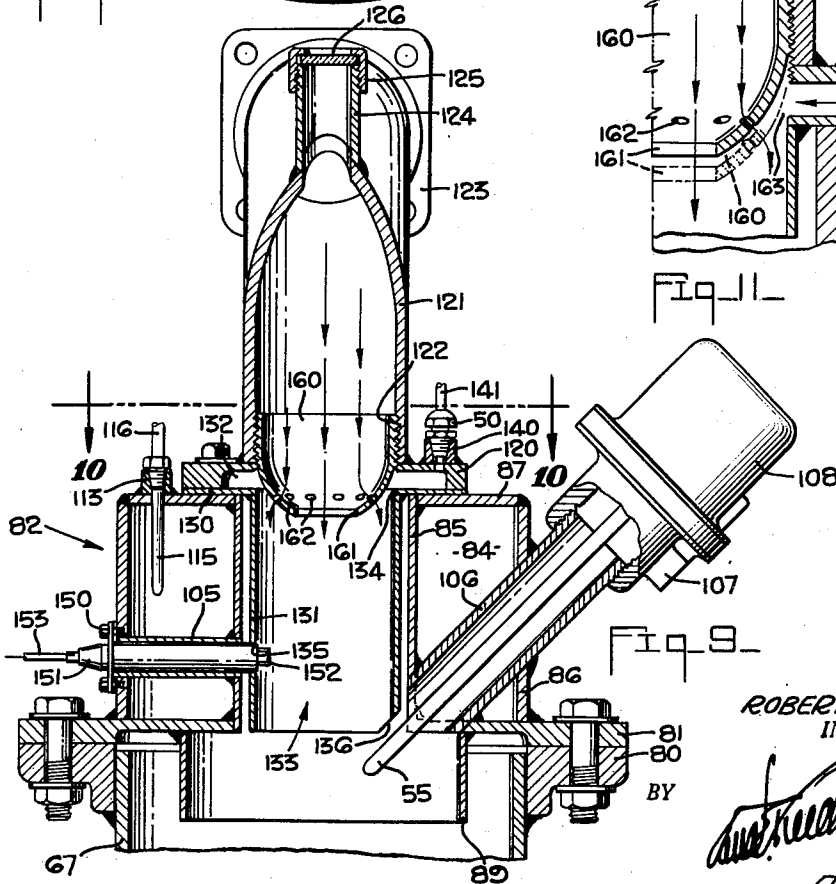


Fig. 9

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2,767,784

FUEL BURNER

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Application March 22, 1951, Serial No. 216,964

2 Claims. (Cl. 158—99)

This invention relates to fuel burners and is particularly useful in the burning of a gaseous fuel mixture in a confined chamber as in an apparatus for heating liquids by direct firing.

In the operation of apparatus of this kind in which the burning fuel is completely confined in a closed chamber difficulty has been experienced in preventing the flame from blowing out as a result of unavoidable fluctuations in the composition and pressure of the fuel mixture delivered to the burner.

It is a primary object of the present invention to provide fuel burners which will remain lit in spite of such fluctuations.

It is another object of the present invention to provide such a fuel burner which is readily adjustable to secure the optimum security against the accidental extinguishing of the flame in the burner.

Yet another object of the invention is to provide such a burner in which the adjustment aforesaid may be accomplished from the exterior of the burner.

The manner of accomplishing the foregoing objects as well as further objects and advantages will be made manifest in the following description taken in connection with the accompanying drawings in which

Fig. 1 is a diagrammatic view of a preferred embodiment of the invention in a heater.

Fig. 2 is an enlarged plan view of the heater shown in Fig. 1.

Fig. 3 is a side elevational view of the heater shown in Fig. 2 with certain lower portions of this broken away to illustrate the interior structure.

Fig. 4 is an enlarged detailed sectional view of a spray nozzle of the invention taken on the line 4—4 of Fig. 2.

Fig. 5 is a perspective view of the spray nozzle shown in Fig. 4 removed from its mounting.

Fig. 6 is an enlarged sectional detailed view of the burner head of the invention and is taken on the line 6—6 of Fig. 2.

Fig. 7 is a horizontal sectional view taken on the line 7—7 of Fig. 6.

Fig. 8 is a detailed perspective view of a nozzle employed in the invention.

Fig. 9 is an enlarged sectional detailed view of the burner head of the invention taken on the line 9—9 of Fig. 2.

Fig. 10 is a horizontal sectional view taken on the line 10—10 of Fig. 9.

Fig. 11 is an enlarged detailed sectional view taken on the line 11—11 of Fig. 10 and showing the connection of the auxiliary air line with the auxiliary annular air passage of said burner head.

The invention is embodied in an electrically controlled heating apparatus 25 (Fig. 1) including a heater 26 to which gas is supplied through a pipe 27 having a normally closed solenoid valve 28 and a balanced gas pressure regulator 29 serially mounted therein. Air is delivered to the heater 26 from a motor driven blower 30

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through an air pipe 31 the blower having an air flow indicating switch 32, and the pipe 31 having mounted therein a temperature-responsive motor-operated butterfly valve 33. Water is delivered to the heater 26 by a motor driven pump 40 which draws water through a pipe 41 having a screen 42 submerged in a body of water 43 contained in a tank 44, and delivers said water through a pipe 45 to said heater.

A temperature control bulb or thermometer 46 is submerged in the water 43 in the tank 44 and operates a device 47 which electrically controls the actuation of the butterfly valve 33 so as to vary the amounts of air allowed to pass through said valve in accordance with the temperature of the water 43. A secondary air tube 50 connects with the air pipe 31 between the valve 33 and the heater 26 and constitutes the secondary supply of air to the heater 26. An ignition transformer 51 is provided for use in lighting the fuel delivered to the heater 26. An electrically responsive temperature and pressure unit 52 is also provided for responding to certain temperatures and pressures in the heater 26 in the control of the operation of this heater.

The heater 26 is normally supported by the floor 60 of the tank 44 the lowermost element thereof being a baffle tube 61 which rests directly upon said floor and has ports 62. The upper portion of tube 61 is connected, by two vertically spaced radial sets of gas dispersing baffles 63 and 64, with a spray bell 65, this bell having an upper horizontal wall 66 through a central opening in which a flame tube 67 of the heater extends downwardly said tube being welded therein so as to be rigidly united with the bell 65 and baffle tube 61. Mounted in the wall 66 is a series of nozzles 68 which are connected by couplings 69 with a manifold pipe 70.

While the heater 26 may vary considerably in size, a heater of this type now being used industrially employs a flame tube 67 which is made of a well casing 10 inches in diameter.

The upper end of the flame tube 67 is provided with a flange 80 to which is bolted a mounting flange 81 of a burner head 82. Extending inwardly from the flange 81 is an annular floor 83 of a water jacket 84 the latter also having an inner tubular wall 85, an outer tubular wall 86, and an annular upper wall 87 from the inner edge portion of which threaded studs 88 extend upwardly.

Welded concentrically on the water jacket floor 83 and extending downwardly therefrom is a liquid splash guard 89. Also mounted in two holes in the floor 83 so as to communicate with the water jacket 84 and to extend downwardly within the upper end of the flame tube 67, and between the latter and the splash guard 89, is a pair of nozzles 90. The lower ends of these nozzles are turned so as to discharge water therefrom at an angle slightly less than horizontal and in a clockwise direction within said flame tube 67. The wall 86 is provided with a pipe connection 95 opening outwardly from the water jacket 84 this connection receiving the upper end of a water pipe 96 the lower end of which connects with the water manifold 70 which delivers water to the nozzles 68.

The wall 86 is also provided with a pipe connection 97 with which water pipe 45 connects to deliver water into the water jacket 84.

Referring now to Figs. 9, 10 and 11, it is seen that the walls 85 and 86 are apertured on a horizontal axis to receive an electric spark igniter sleeve 105 opposite ends of which are welded in place to the walls 85 and 86. These walls are also apertured in a radial plane at an angle of 45 degrees to receive a pipe 106 which is also welded in place to make a watertight connection with said walls. Screwed onto the outer end of pipe 106 is a fitting 107 on which is mounted a head 108 this head having provided thereon the flame sensing rod 55 which

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extends inwardly through the pipe 106 and to a point near the central axis of the heater 26. The upper wall 87 is provided with small pipe connections 112 and 113. Screwed into the connection 112 so as to connect with the interior of the water jacket 84 is a small copper pipe 114 which leads to a pressure responsive element in the temperature and pressure unit 52. Screwed into the connection 113 and extending into the water jacket 84 is a thermometer 115 which connects through a tube 116 with the unit 52.

Mounted on the upper wall 87 of the water jacket 84 and secured thereto by the threaded studs 88 which extend through a hollow flange 120 thereof, is a mixture manifold 121 which has the shape of a 90 degree elbow, is provided with internal threads 122 in its discharge mouth at its lower end and has external threads for receiving a flange 123 at its upper end. The manifold 121 is apertured on the axis of the heater 25 to connect with a short tube 124 welded thereto and having a cap 125 to secure in place a sight glass 126 through which the interior of the heater 26 may be viewed. An outward radial flange 130 of a cylindrical flame shield 131 is apertured to fit downwardly over the threaded studs 88 and in the assembly burner head 82 is clamped downwardly against the upper water jacket wall 87 by the hollow flange 120. The hollow character of the latter flange provides an annular air passage 132 which joins the ignition chamber 133 within the flame shield 131 in an annular corner edge or shoulder 134 at the upper end of said shield. Also formed in flame shield 131 is an aperture 135 which is aligned with the sleeve 105 and is of the same size as the interior of said sleeve. The lower edge of flame shield 131 is cut away at 136 to provide a minimum clearance for accommodation of the flame sensing rod 55.

Provided on the hollow flange 120 and connecting with the passage 132 is a pipe connection 140 which receives a suitable fitting 141 connecting the air tube 50 with said passage. A washer 142 is placed in the connection 140 against a shoulder 143, this washer providing a restricting orifice 144 for metering the flow of air admitted into passage 132 from air tube 50.

Secured to the wall 86 by cap screws 150 so as to close the outer end of the sleeve 105 is an electric spark igniter 151 which extends inwardly through the sleeve 105 and the aperture 135 and is provided with spark gap terminals 152 which lie just within the ignition chamber 133 of the flame shield 131. The igniter 151 is connected by a cable 153 to the ignition transformer 51.

Screwed upwardly into the threads 122 of the mixture manifold 121 is an externally threaded round-nosed burner tip 160 with a restricted axial burner port 161 at its lower end, this being surrounded by a series of pilot jet holes 162 disposed upwardly and outwardly from the port 161. It may be noted that the burner tip 160 is free to be screwed in the threads 122 to increase or decrease the air distributing gap 163 between the burner tip 160 and the corner shoulder 134 formed at the upper end of the flame shield 131. Air introduced into the passage 132 from the tube 50 flows downwardly through gap or opening 163 past the pilot jet holes 162 and into the ignition chamber 133. In this way the rate of flow of air from the manifold passage 132 downwardly past the pilot jet holes 162 may be adjustably determined. The burner tip 160 may be rotated to affect this adjustment by removing the cap 125 and sight glass 126 and inserting a tool through the tube 124 which has prongs that fit into a pair of the holes 162.

Bolted to the flange 123 is a gas and air proportional flow mixer 170 with which the air and gas pipes 31 and 27 connect as shown in Fig. 1 so that a fuel and air mixture of a constantly uniform proportion is delivered through the mixer 170 to the mixture manifold 121 and thus downwardly through the burner port 161 and pilot jet holes 162 into the ignition chamber 133.

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The operation of the heater 26 is accomplished by a gas and air mixture passing downwardly from the burner port 161 into the ignition chamber 133 where this mixture is ignited by a spark between the spark gap terminals 152 causing a continuous combustion of said mixture to take place in a stream of flame extending from a point close to the burner port 161 downwardly through the ignition chamber 133, the liquid splash guard 89 and practically throughout the length of the flame tube 67. Prior to the starting of this flame, water (or any other liquid which is suitable for heating in this manner) is delivered by pump 40 through the pipe 45 into the water jacket 84 in the burner head 82, the major portion of this water flowing downwardly through the nozzles 90 and being discharged therefrom in a helical direction so as to cover the inner surface of the flame tube 67 with a fairly thick swirling layer of water which flows constantly downwardly to cover the interior surface of this tube throughout its length. A portion of the water delivered to the water jacket 84 flows therefrom through a pipe 96 to the spray nozzles 68 which deliver this water in a spray, filling the space in the bell 65 which is above the level of the water 43 therein.

The operation of the heater 26 in this manner accomplishes the heating of the liquid delivered thereto through pipe 45 by the flame formed in the flame tube 67 by the burning of fuel mixture delivered downwardly through the burner head 82. This liquid, of course, escapes from the lower end of the heater 26 into the tank 44.

Fuel mixture escaping downwardly through the pilot jet holes 162 ignites, forming a number of pilot flames equal in number to these holes. The air flowing downwardly through the gap 163 furnishes an auxiliary supply of combustion air which deflects the pilot flames downwardly so that the latter always provide a means of assuring continuing ignition of the main stream of fuel mixture discharged downwardly through the port 161 after this has once been ignited by the igniter 151. This auxiliary air supply flows downwardly about the main stream of fuel mixture in the flame shield 131 and continues down the tube 67 as an envelope surrounding said mixture and assuring an adequate supply of oxygen for complete combustion of the fuel mixture.

The claims are:

1. In combination: a burner head; a fuel and air mixture manifold connecting concentrically with said head to deliver a mixture of fuel thereto; a burner tip in the mouth of said manifold and adjustable axially therein, said burner tip having a restricted central burner port and a plurality of pilot jet ports surrounding said burner port; a cylindrical flame shield embodied in said head, said shield providing an ignition chamber into which fuel leaving said burner port is discharged, there being an annular air passage formed in said head between the mouth of said fuel manifold and the adjacent end of said flame shield, the axial adjustment of said burner tip varying the space between said tip and said end of said shield through which air may pass from said passage into said ignition chamber, said air, in so passing, moving past said pilot jet holes; and means for admitting air to said passage.

2. In a fuel burner, the combination of: a burner head having a cylindrical flame shield forming a fuel and air mixture ignition chamber axially therein, said shield having an outwardly extending radial flange at its upper end, there being an annular shoulder provided on said shield at said upper end of said shield; a fuel and air mixture delivery manifold having a hollow flange for securing said manifold to said radial flange with said manifold coaxially related to said chamber, there being an annular secondary air passage formed between said hollow flange and said radial flange, said passage being disposed outwardly from and adjacent said shoulder, the discharge mouth of said manifold being substantially equal in diameter and co-axial with said cham-

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ber and being internally threaded; means for admitting air to said annular passage; and an externally threaded round nosed burner tip screwed into said manifold mouth with the rounded nose of said tip spaced from said annular shoulder to form an annular air opening of adjustable width leading from said annular passage into said ignition chamber, said tip having an axial main burner port and an annular series of pilot jet holes disposed between said port and said adjustable air opening, the air discharged from said annular opening supplementing the oxygen available to pilot jet flames formed by the ignition of fuel and air mixture discharged through said holes, and sweeping said pilot jet flames inwardly along said rounded tip nose into igniting relation with fuel and air mixture being discharged axially through said port.

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