Jan. 24, 1950 W. L. RIEHL 2,495,481

GAS PILOT BURNER WITH ANNULAR FLAME PORT

Original Filed July 12, 1944

FIG. 1.

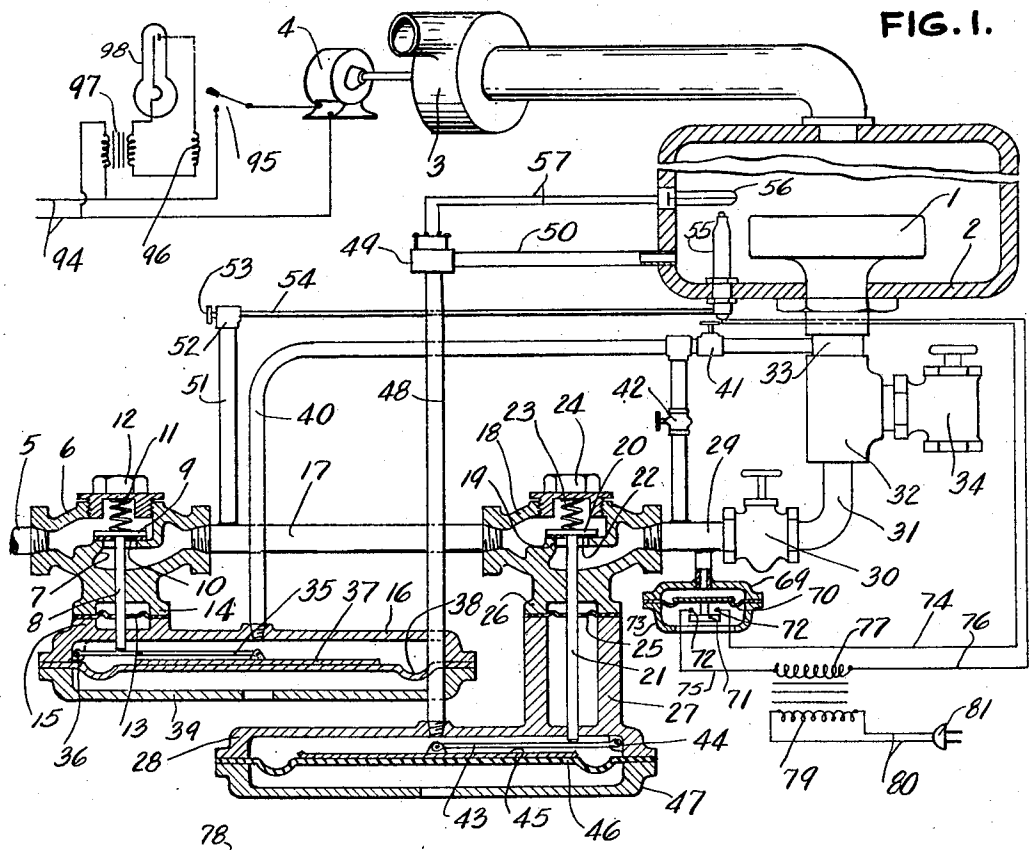
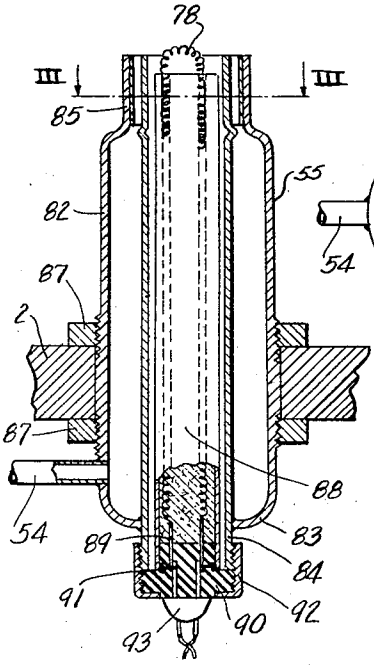


FIG. 2.



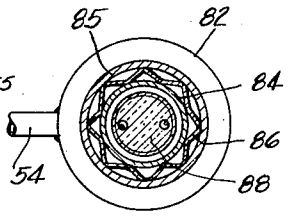


FIG. 3.

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GAS PILOT BURNER WITH ANNULAR FLAME PORT

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Original application July 12, 1944, Serial No. 544,529. Divided and this application October 5, 1945, Serial No. 620,515

2 Claims. (Cl. 158—115)

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This invention relates to combustion systems and is particularly useful in those systems in which fluid fuel is burned under subatmospheric pressures.

Another object of the invention is to provide an improved combustion apparatus which will be extremely efficient in operation.

Another object of the invention is to provide an improved combustion apparatus in which the fuel will automatically be ignited.

Another object of the invention is to provide an improved combustion apparatus in which the ignition device will be well-protected.

Another object is to provide an improved combustion apparatus in which the ignition device will be in position to insure quick and effective ignition of fuel when it is admitted.

Another object is to provide an improved combustion apparatus having a pilot burner which will prevent accumulations of dirt at its outlet and at the ignition device.

Another object is to provide an improved combustion apparatus having a pilot burner which may be easily and accurately assembled.

Another object is to provide an improved combustion apparatus having a pilot burner which will produce a hollow cylindrical flame.

Other objects will hereinafter appear.

This application is a division of my co-pending application, Serial No. 544,529, filed July 12, 1944, now abandoned.

The invention will be better understood from the description of one practical embodiment thereof, illustrated in the accompanying drawings, in which:

Figure 1 is a fragmentary elevational view, parts being broken away and shown in section, of a combustion control system, together with parts of a combustion chamber and burners;

Figure 2 is a central, vertical, sectional view of the pilot and ignition mechanism of Figure 1, shown to an enlarged scale; and,

Figure 3 is a transverse sectional view taken on the line III—III of Figure 2.

The combustion system of this application is especially useful for burning fuels at subatmospheric pressures, and will be described in conjunction with an apparatus for this purpose. It will be understood, however, that features of it may readily be adapted to combustion at higher pressures, up to and even above atmospheric.

In Figure 1 the combustion apparatus is shown as including a burner 1, positioned within a hermetically sealed combustion chamber 2, from which products of combustion are exhausted by

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means of a fan or blower 3, driven by an electric motor 4.

Fuel and air are drawn into the burner by means of the subatmospheric pressure or partial vacuum thus induced in the combustion chamber, the fuel being supplied by a conduit 5 from any suitable source, such, for instance, as a main delivering gas under pressure, while the air is admitted to the system as will be more fully hereinafter described.

The pipe 5 is threaded into the end of a valve body 6, in general of the shape of an ordinary globe valve, having a seat 7 which may be engaged by a valve consisting of a stem 8, a head 9, and a gasket or washer 10 of soft leather or the like, the valve head being urged toward its seat by a compression spring 11 interposed between it and a plug 12 threaded in the valve body.

The valve stem projects through an aperture in the lower side of the body, being sealed to the body by means of a flexible diaphragm 13, the margin of which is clamped between a flange 14 formed on the body and a similar flange 15 of a diaphragm housing 16.

From the valve body 6 a pipe or conduit 17 extends to a second fuel valve body 18, in all essential respects similar to that just above described, and having a valve seat 19, a valve comprising a head 20, a stem 21, and a washer 22, there being also a valve seating compression spring 23 and a closure plug 24.

The valve stem is sealed by a flexible diaphragm 25 with its margin clamped between a flange 26 on the valve body 18 and a tubular extension 27 of a diaphragm housing 28.

From the valve body 18 a pipe or conduit extends to an orifice member 30, shown as an adjustable valve or stopcock, which in turn communicates with an angle 31 secured to one arm of a T fitting 32, the other arm of which is connected by a pipe 33 to the burner 1.

The stem or third branch of the T has secured to it an air inlet control device, shown as an angle valve 34.

The diaphragm housing 16 carries on its interior a lever 35 pivoted to the housing as indicated at 36 and contacting the lower end of the valve stem 8. The free end of the lever is pivoted near the center of a plate 37 secured to the upper surface of a diaphragm 38, the edge of which is clamped against the housing 16 by a cover 39.

A pipe 40 leads from the interior of the diaphragm housing 16, this pipe being provided with two branches, one of which communicates

through an orifice controlling member shown as a valve or stopcock 41 with the interior of the conduit 33 and the other of which communicates through an orifice controlling member illustrated as a valve or stopcock 42 with the interior of conduit 29.

The second diaphragm housing 28 is provided with a lever 43, pivoted at one end 44 to the housing, and adjacent this end engaging the lower end of the valve stem 21 and having its free end in pivoted engagement with the center of a plate 45 carried by a flexible diaphragm 46 clamped between the margin of the housing 28 and that of a cover 47.

The space above the diaphragm 46 within its housing is in communication with a tube 48 which extends to a magnetically controlled valve 49 and thence, as indicated at 50, to the interior of the combustion chamber 2.

A tube 51 extends from conduit 17 to a fitting such as a T, 52, having a stopcock 53 by which air may be admitted to the tube 54 leading to the pilot burner, this being indicated generally at 55 in Figure 1 and shown to an enlarged scale and in greater detail in Figure 2.

A thermocouple 56 is positioned within the combustion chamber adjacent the outlets of the burner and of the pilot burner 55 and from the thermocouple leads 57 extend to the magnetic valve 49.

It has been found in practice that a single thermocouple furnishes adequate current for the actuation of this magnetic valve.

Connected to the conduit 29 is a pressure operated switch consisting of a housing 69 having a flexible diaphragm 70 which carries a conductor 71 arranged to bridge two stationary electrical contacts 72 carried by and insulated from the housing cover or bottom 73, these contacts being in a circuit including wires 74, 75 and 76, a secondary 77 of a transformer, and the electrical resistance coil 78 of the igniter coil in the pilot.

The primary 79 of the transformer is connected by conductors 80 through a plug 81 to an ordinary 110 volt A. C. lighting circuit or the like.

The igniter and pilot burner, as best seen in Figure 2, consists of a hollow shell made of two telescopically arranged tubular members, the outer one of which 82 is reduced in size at its lower end 83 and sealed to the inner end 84 as by welding or brazing.

The upper end of the outer tubular member is also reduced in diameter at 85 and the space between this and the inner member contains a corrugated metal strip 86 which divides the space between the tubular members into a number of relatively small axially extending portions which preclude the passage of flame to the interior of the pilot burner.

The outer surface of the outer tubular member 82 is threaded and provided with nuts 87 by which it is clamped tightly through the wall of the combustion chamber 2.

Within the inner tubular member is a cylindrical insulator 88 of such material as porcelain having two parallel axially extending apertures which receive the ends of the helically coiled resistance wire 78, these ends being connected to leads 89 which pass through the bottom of the insulator into an insulating block 90 where they are secured as by set screws 91, the block 90 being held to the tubular members by a threaded centrally perforated cap 92 which leaves the end of the block exposed.

A conventional electrical plug 93 having two contact prongs may be connected with the block 90 at the end of the pilot for supplying current to the coil 78 of resistance wire.

It will be obvious that one side of the resistance coil 78 could be grounded if desired, so that only a single conductor need be connected with the other end thereof.

It will be noted that the coil of resistance wire 78 is looped around so that it projects beyond the upper end of the porcelain insulator 88, and that this end is retracted below the upper ends of the telescopic tubular members 82 and 84, so that a part of the coil extends slightly above these ends only.

This insures the heated loop of the coil being in close proximity to the mixture of air and gas which emerges from the tubular members, and guarantees ignition of the same.

However, once the pilot flame is ignited, it is drawn upwardly generally in an axial direction, in the form of a hollow cylinder, the space within this cylinder having a reducing atmosphere which surrounds the coil of ignition wire 78 and protects it from oxidation.

Gas is supplied to the pilot burner at full line pressure as long as the valve 6 is open and valve 18 is closed, as is the case at the start of the cycle of operation, but as soon as the second valve 18 opens and gas is admitted to the main burner, the pressure supplied to the pilot drops.

The motor 4 actuating the blower or exhausting means is supplied with current by conductors 94, connected with a suitable source of current supply, in one of which is interposed a pair of relay contacts 95. The coil 96 of the relay is supplied with current through a transformer 97, the primary of which is connected across lines 94, and the secondary circuit of which includes both coil 96 and a thermostat 98 positioned in the room or space which it is desired to be heated, so that the motor is actuated whenever heat is required, and is stopped whenever the need for further heat ceases.

It will be apparent that atmospheric air pressure is exerted upon the underside of each of the diaphragms and when a sufficient degree of suction exists on the upper side of the diaphragms, this air pressure will move them, respectively, upwardly, the motion being controlled by and in accordance with the reduced pressure which obtains on their upper sides.

The apparatus above described operates as follows:

Assuming that the apparatus is out of operation, and that the temperature of the space which is to be heated then drops sufficiently to require an additional supply of heat, the contacts of thermostat 98 close, supplying current to the motor 4 which drives the blower 3, exhausting the contents of the combustion chamber and producing a partial vacuum therein.

This partial vacuum withdraws the contents from conduit sections 29, 30, 31, 32 and 33, also removing any traces of fuel, products of combustion, or the like, which may have remained within the combustion chamber 2. Fresh air is drawn in through valves 34 and 53 and thoroughly scavenges the interior of the apparatus, making it certain that there is no fuel left in such concentrated or undiluted quantities as to be either combustible or explosive.

The suction is precluded from exhausting the space within diaphragm housing 28 as this space is vented through the electromagnetic valve 49. The suction, therefore, may only raise dia-

phragm 38 and diaphragm 70, the first of which opens valve 6, permitting gas at the pressure existing in the main to pass to valve 18 and also to pass through pipe 51 to the pilot.

The raising of diaphragm 70 bridges the stationary contacts 72 supplying igniting current to the coil of resistance wire 78 which becomes incandescent and ignites the gas which is now drawn through the pilot by the suction of the blower.

After the pilot has been ignited, the heat from its flame generates a current in thermocouple 56 which energizes the magnetic valve 49 permitting the suction to exhaust through pipe 48, the space within the diaphragm housing 28, and thus to raise the diaphragm 46, opening valve 18.

The raising of this valve, of course, permits gas to pass into conduit 29, through orifice member 30, and thence through conduit ports 31, 32, and 33 to the burner 1, the fuel being mixed after passing through the T 32, with air entering the valve 34.

The gas is admitted to conduits 29 and 33, the pressure within these conduits rises and permits a slight backflow through orifice members 41 and 42 into pipe 40, reducing the suction on the upper surface of diaphragm 38 and permitting valve 6 to partially or completely close, depending on the modulated pressure supplied to its diaphragm.

This increase in pressure also permits diaphragm 70 to drop, breaking the circuit between the contacts 72 and so discontinuing the supply of current to the igniting coil 78 of the pilot.

When sufficient heat has been generated to actuate the thermostat 98, the motor 4 is stopped, the pressure in the combustion chamber and conduits rises, and all three diaphragms drop to their lowermost positions, closing both valves and interrupting the circuit through the electric contacts.

Gas which has already passed through valve 6 rises through the pipe 51 to the pilot burner and is consumed at this point as long as a sufficient concentration to support combustion is delivered.

Should the thermostat be operated, as by a sudden drop in temperature, while the pilot light is still burning, the pilot will, of course, re-ignite the fuel supplied to the main burner.

However, ordinarily the temperature will not drop until after the pilot as well as the main burner has been extinguished, and the parts will then go through the cycle above described to render coil 78 incandescent before any gas is admitted to the main burner, and simultaneously a small amount of gas will be delivered through pipe 51 to the pilot, to be ignited and maintain combustion at this point.

It will be noted that pipe 51 is threaded into pipe 17, so that this pipe receives fuel under the pressure which obtains between the two fuel valves.

It will be understood that pipe 29 is connected to pipes 40 and to orifice controlling member 30.

In the embodiment above described, the control is such as would be suitable for a single combustion device operated independently of any others, and having its own individual pressure exhausting blower and room thermostat 98

However, this system of combustion can be used to considerable advantage in places where a plurality of units are necessary, and several of these units may be connected to a single common pump or blower 3, which may be caused to operate continuously as long as there is any requirement for heat from any of the units.

Those units which are not required to furnish heat at any given time may be turned off and may be ignited either automatically or manually when the temperature of the spaces with which they are associated fall to any predetermined point.

While the embodiment illustrated is shown as operating in a single unit, at pressures below that of the atmosphere, the atmospheric pressure itself on the exposed surfaces of the diaphragms being utilized as the force for opening the valves or closing the electrical contacts, as the case may be, it will be apparent that the apparatus may be one of a series of units, as described in the above mentioned parent application or that it may be used advantageously in operating with pressures higher than that of the atmosphere. This would only require connecting the source of higher pressures to one side of the diaphragm.

While I have described the illustrated embodiment of my invention in some particularity, obviously many others will readily occur to those skilled in this art, and I do not, therefore, limit myself to the precise details shown and described herein, but claim as my invention all embodiments, variations, and modifications coming within the scope of the appended claims.

I claim:

1. A pilot burner comprising two generally coaxial tubular members having their ends lying substantially in a given plane to form a generally tubular outlet opening, means supplying fuel and air to the space between said tubular members, an igniter positioned within the inner of said tubular members and projecting slightly beyond the plane of their end surfaces, and a corrugated sheet metal spacer between the outlet ends of said tubular members dividing the space between them into a plurality of small outlets.

2. A pilot burner comprising two generally coaxial tubular members having their ends lying substantially in a given plane to form a generally tubular outlet opening, means supplying fuel and air to the space between said tubular members, an igniter positioned within the inner of said tubular members and projecting slightly beyond the plane of their end surfaces, a refractory insulator within the inner tubular member, a resistance wire projecting from the end of the insulator beyond the plane of the ends of the tubular member, and having conductors extending through the insulator and connected to a source of electricity.

WILLIAM L. RIEHL.

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