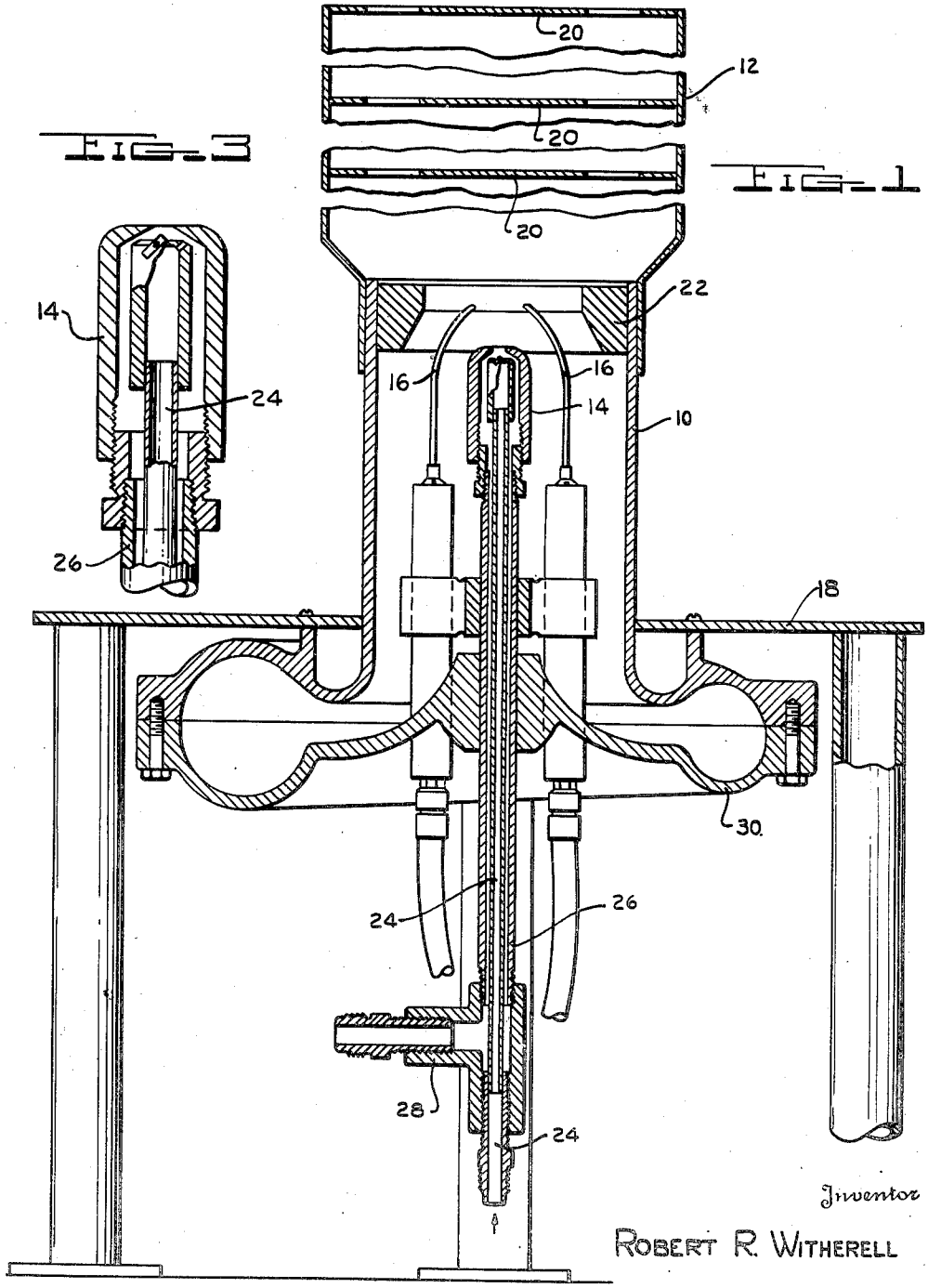
Aug. 12, 1952 R. R. WITHERELL 2,606,604

OIL BURNER OF THE PRESSURE TYPE

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FIG. 3

FIG. 1



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OIL BURNER OF THE PRESSURE TYPE

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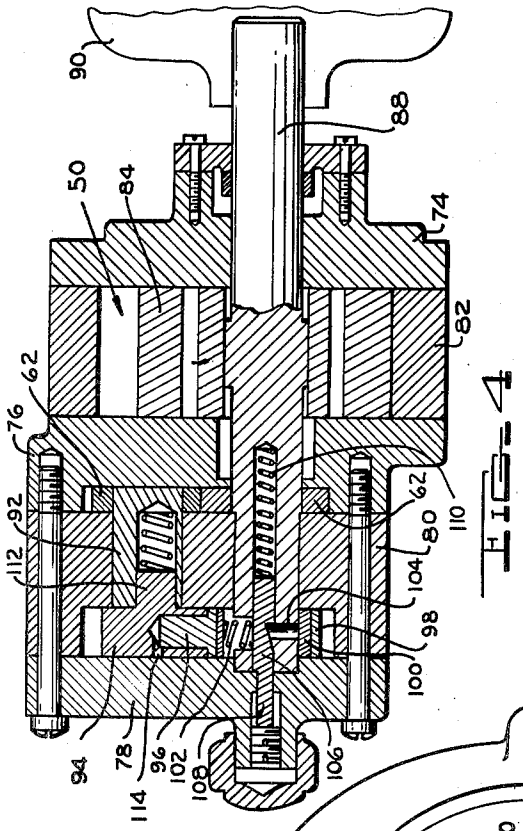
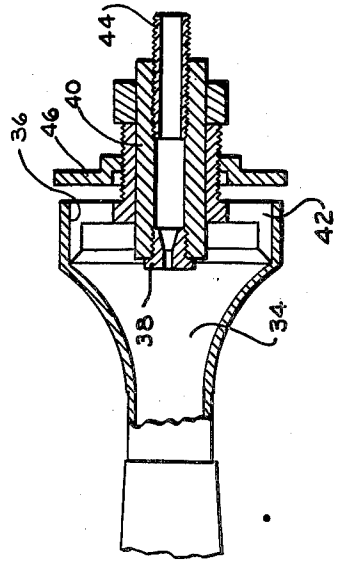


FIG-4



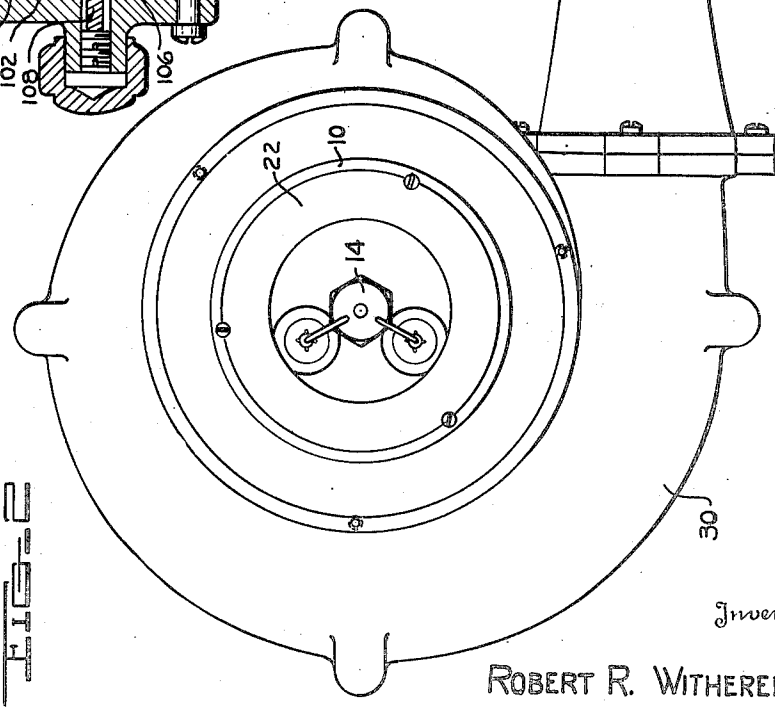


FIG-2

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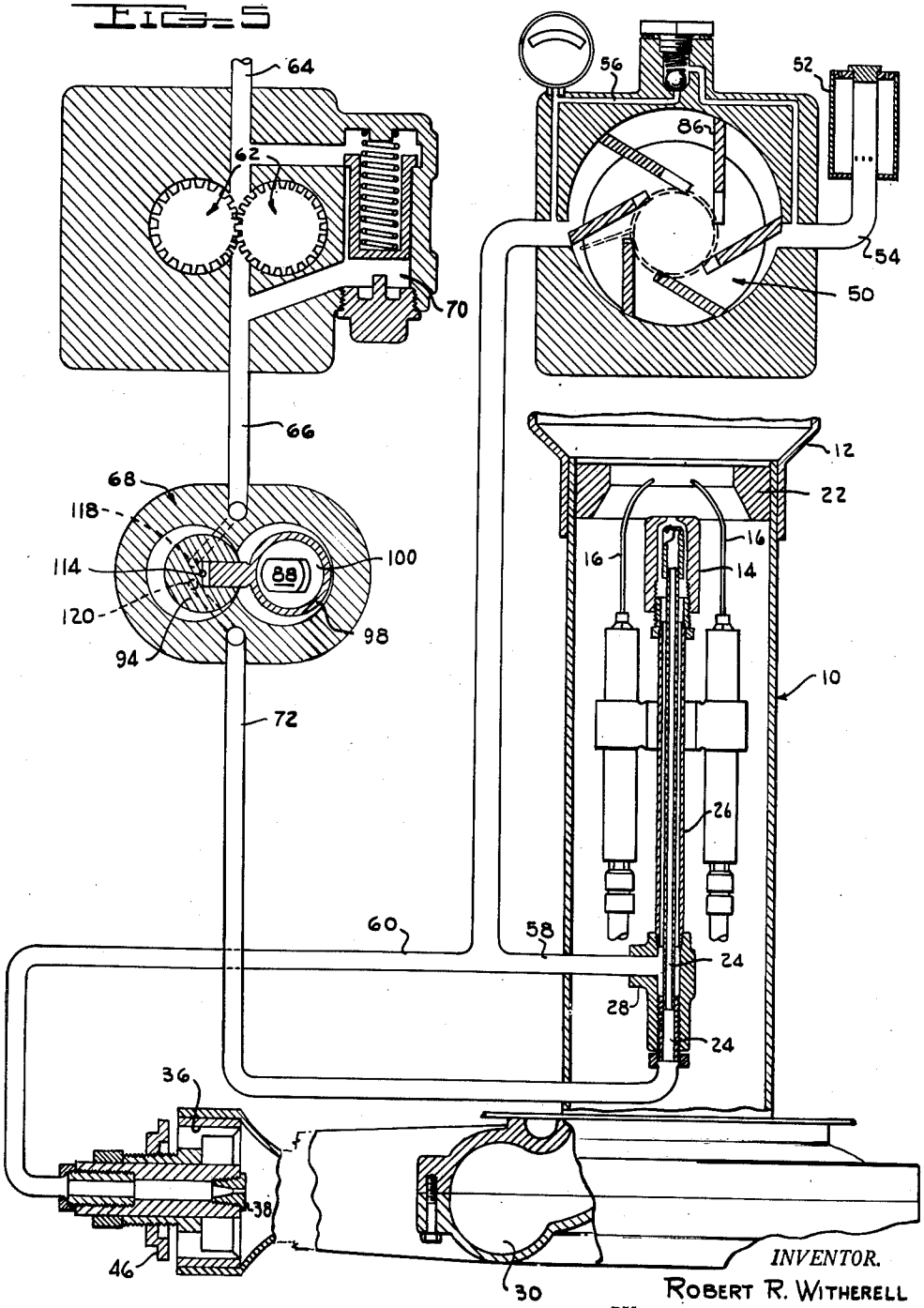
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OIL BURNER OF THE PRESSURE TYPE

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FIG. 5



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OIL BURNER OF THE PRESSURE TYPE

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Application April 27, 1946, Serial No. 665,585

7 Claims. (Cl. 158—76)

1

This invention relates to liquid fuel burners and has particular reference to certain new and useful improvements in the means for supplying air and oil to the burner.

To obtain efficient combustion of fuel it is important that a substantially constant air fuel ratio be maintained of the air and fuel supplied to the burner. This invention has particular reference to a means by which this important object may be obtained. In addition the invention makes it possible to build a burner which is adapted to efficiently burn fuel at a much lower rate than pressure oil burners of the type heretofore known.

Principal objects of the invention, therefore, are to provide:

A new and improved oil burner;

An oil burner in which the means for supplying oil and air thereto are constructed and arranged to maintain a substantially constant ratio of the air and fuel supplied to the burner;

An oil burner having a nozzle constructed and arranged to mix the oil and air supplied thereto and to discharge a mixture of oil and air in the form of an oil fog, and in which the means for supplying secondary air to the nozzle includes an air pump which supplies air under pressure to said nozzle and an air jet and venturi with which the air jet is associated to discharge a jet of air into the venturi for inducing the flow of secondary air to said nozzle.

Other and further objects of the invention will be apparent from the following description and claims and will be understood by reference to the accompanying drawings, of which there are three sheets, which, by way of illustration, show a preferred embodiment of the invention and the principles thereof and what I now consider to be the best mode in which I have contemplated applying those principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims. I also contemplate that of the several different features of my invention, certain ones thereof may be advantageously employed in some applications separate and apart from the remainder of the features.

In the drawings:

Fig. 1 is a fragmentary vertical sectional view of part of a burner embodying the invention with parts thereof broken away;

Fig. 2 is a plan view of part of the device illustrated in Fig. 1 removed from its supporting standard and with the muffle thereof removed;

Fig. 3 is an enlarged sectional view of the nozzle;

Fig. 4 is a partly sectional view of the motor and pump unit for supplying oil and air to the burner; and

Fig. 5 is a schematic view of the burner and the means for supplying oil and air thereto.

In Fig. 1 there is disclosed part of an oil burner including a draft pipe 10, a muffle 12, a nozzle 14, and electrodes 16, the foregoing being mounted upon a standard 18 and arranged so that the muffle 12 will project into a combustion chamber.

The nozzle 14 preferably is of the type illustrated in Williams Patent No. 1,934,755, issued November 14, 1933, for "Burner Assembly." The nozzle 14 is adapted to be supplied with oil and air under pressure and is constructed so as to mix such oil and air and to discharge a mixture of oil and air in the form of an oil fog into the muffle 12. The electrodes 16 are provided for igniting the mixture, and the draft pipe is constructed and arranged for supplying secondary air to support combustion, the nozzle discharging the oil fog into the path of the secondary air supplied by the draft pipe 10.

The muffle 12 may comprise a generally cylindrical casing providing with spaced apertured baffles 20. The muffle serves to confine the burning mixture of fuel and to radiate heat back to the mixture in order to help efficiently burn the same, the resulting products of combustion escaping through the apertures in the baffles 20 into the combustion chamber of a furnace. An air cone 22 may be associated with the end of the draft pipe 10 so as to direct the secondary air into the oil fog discharged by the nozzle 14.

Means are provided for feeding metered quantities of oil from an oil metering pump to the nozzle and these means include the fuel pipe 24. Means are also provided for supplying air under pressure to the nozzle, and such means include the air pipe 26 and the T 28, the air pipe 26 surrounding part of the oil pipe 24.

The nozzle 14 as disclosed in such Williams Patent No. 1,934,755 represents a particularly efficient means of producing an oil fog and discharging such fog into the path of the secondary air so as to provide a combustible mixture of fuel. For further details respecting the construction and operation of the nozzle reference may be had to such Williams patent.

The lower end of the draft pipe communicates with a scroll 30 which is supplied with air by a

pipe 32 a portion of which is formed to provide a venturi 34. In this manner air is tangentially supplied to the interior of one end of the draft pipe 10 so that the air flow through the draft pipe will be in the form of a helix.

One end of the pipe 32 is open to define an air inlet port 36 ahead of the venturi 34. An air jet 38 projects within such port and is arranged to discharge a jet of air into the pipe 32 into the throat of the venturi 34. The jet 38 is formed by a nozzle fixed in one end of a sleeve 40 which is mounted in the hub of a spider 42 arranged in the opening defining the port 36. A pipe fitting 44 mounted in the sleeve 40 forms a part of the means by which the jet 38 is supplied with air under pressure. A valve member 46 threadedly adjustable on the threaded portion of the hub of the spider 42 is cooperable with the port 36 to regulate the flow of air through the port into the pipe 32. The jet of air discharged by the air jet 38 into the throat of the venturi functions to induce a flow of secondary air into the pipe 32 through the port 36 thereof through the scroll 30 and the draft pipe 10 to the nozzle for mixture with the oil fog discharged thereby so as to support combustion of such oil fog.

The system and means for supplying oil and air to the burner is schematically illustrated in Fig. 5 wherein the same reference characters are used to indicate parts corresponding with those shown in the preceding figures.

A rotary vane type air pump 50 is supplied with air through a muffler 52 and an air inlet pipe 54. A valve controlled by-pass 56 may be provided between the intake and discharge of the air pump 50 so that the discharge pressure thereof may be controlled. A conduit 58 connects the outlet from the pump 50 to the T 28 for supplying air under pressure from the pump to the pipe 26 and to the nozzle 14. A pipe 60 is also connected to the discharge outlet of the air pump 50 for supplying air under pressure therefrom to the air jet 38.

Oil from a reservoir is supplied to the intake side of a gear pump 62 by conduit 64, and oil under pressure from such pump is supplied from the outlet thereof by conduit 66 to the intake side of a positive displacement type metering pump 68. A pressure control by-pass indicated generally at 70 may be provided between the intake and discharge sides of the gear pump 62 so that the pressure at which oil is discharged therefrom may be controlled.

Metered quantities of oil are supplied under pressure from the discharge side of the metering pump through conduit 72 to the oil supply pipe 24 and to the nozzle 14. The air pump 50, the gear pump 62 and the oil metering pump 68 preferably are constructed and arranged so that they are driven at the same speed by the same motor as illustrated in Fig. 4. The motor and pumps may be constructed and arranged as disclosed in Witherell Patent No. 2,050,823, issued August 11, 1936, for "Pumping Mechanism," or Williams Patent No. 1,817,051, issued August 4, 1931, for "Electrically Operated and Controlled Oil Burning Mechanism."

The particular gear and metering oil pumps and air pump illustrated, however, are specifically different from those disclosed in such patents, and as shown in Fig. 4 comprise end plates 74, 76 and 78 spaced by cylinder blocks 80 and 82. The cylinder block 82 defines a pump cavity of the air pump 50 and has a slotted rotor 84 therein on which the blades 86 are slidably mounted. A shaft 88 extends through the rotor 84 and is keyed thereto so as to rotate the same, the shaft 88 being journaled in the end plate 74 and the cylinder block 80 and one end of the shaft projecting from the end plate 74 for connection with the shaft of a motor, such as an electric motor 90.

The gear pump 62 comprises two gears, the teeth of which intermesh, and which gears are arranged in a pump cavity defined by and between the end plate 76 and the block 60. One of the gears 62 is fixed to the shaft 88 to rotate therewith, while the other gear 62 is fixed on a shaft 92 journaled in the block 80.

The oil metering pump comprises an oscillating cylinder 94 and a piston 96 reciprocable in the bore thereof, the piston being secured to a ring 98 which is journaled on an adjustable rotary cam 100. The cam ring 100 is slotted and fitted on the flattened end of the shaft 88. A spring 102 biases the ring 100 to one extreme of its position relative to the shaft 88. A pin 104 and a slide 106 having a cam surface thereon cooperate to position the ring 100 relative to the shaft 88. One end of the pin 104 bears against the cam surface on the slide 106, while the other end of the pin 104 bears against the inside surface of the slot in the cam ring 100. By adjusting the slide 106 lengthwise of the shaft 88, an adjustment of the cam 100 relative to the shaft 88 may be obtained. A screw 108 has its head threadedly engaged in a socket in the end plate 78 and is engageable with one end of the slide 106 for moving the same in opposition to a spring 110.

The setting of the cam ring 100 relative to the shaft 88 determines the stroke of the piston 96 in the bore of the cylinder 94. The cylinder 94 oscillates in the chamber in which it is arranged, such oscillation being due to the fact that the cylinder is pivotally mounted by means of a stub shaft 112 in the shaft 92 which rotates with the shaft 88 due to the intermeshing of the gears 62. The end of the cylinder bore is provided with a port 114 which upon oscillation of the cylinder 94 is brought into alignment with the port 118 at the end of the oil supply duct so that oil may be supplied to the bore of the cylinder 94 on the intake stroke of the piston, and with the port 120 so that oil may be discharged from the bore of the cylinder on the discharge stroke of the piston 96. The ducts which terminate in the ports 118 and 120 may be formed in the end plates 78.

With the construction disclosed I have found that it is possible to supply secondary air efficiently and at a pressure which is substantially unaffected by back pressure and other variable factors in the combustion chamber, and also I have been able to maintain the air-fuel ratio substantially constant. In addition, with the construction illustrated it is possible to provide a burner which will efficiently burn fuel at a relatively low rate of consumption as compared with conventional burners due to the fact that secondary air at adequate pressure is supplied to the nozzle in order to support combustion.

The following specifications were taken from actual test data of an oil burner embodying the invention disclosed in this application:

Venturi throat diameter .734 in.
Venturi jet diameter .070 in.
Air pressure at Venturi jet 7.5 in. of mercury.
Fuel firing rate .626 gallon per hour.
CO_2 in flue gas 10.2%.
Pressure in combustion chamber .02 in. water gauge.

Displacement of air pump 2.8 cubic feet per minute.

The oil metering pump was adjustable from .24 gallon to .75 gallon per hour.

While I have illustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a liquid fuel burner the combination with an air pressure pump, an oil metering pump, a motor operable for driving said pumps simultaneously, a burner nozzle, conduit means for feeding oil and air from said pumps directly to said burner nozzle, said nozzle being constructed to mix the oil and air delivered thereto by said pumps and to deliver a mixture of oil and air, and a draft pipe for supplying secondary air adjacent to said burner nozzle and into which secondary air said nozzle delivers said mixture, said draft pipe having an air inlet, of an air jet arranged to discharge a jet of air into said pipe in a direction toward said nozzle, and means for supplying air under pressure from said air pump to said air jet so as to discharge a jet of air into said pipe to induce the flow of secondary air through said draft pipe to said burner nozzle, the arrangement for supplying oil from said oil metering pump to said nozzle being such that all of the oil discharged by the oil metering pump is delivered to said nozzle and discharged therefrom as a part of said mixture.

2. In a liquid fuel burner the combination with an air pressure pump, an oil metering pump, a burner nozzle, conduit means for feeding oil and air from said pumps directly to said burner nozzle, a motor for driving said air pressure pump and said oil metering pump, and a draft pipe for supplying secondary air adjacent to said burner nozzle and into which secondary air said nozzle delivers a mixture of oil and air, of a Venturi tube associated with said draft pipe for supplying air thereto, an air jet disposed at the entrance to said Venturi tube and arranged to discharge a jet of air into said pipe through said tube, and means for supplying air under pressure to said air jet from said air pump so as to discharge a jet of air into said pipe to induce the flow of secondary air through said draft pipe to said burner nozzle, the arrangement for supplying oil from said oil metering pump to said nozzle being such that all of the oil discharged by the oil metering pump is delivered to said nozzle and discharged therefrom as a part of said mixture.

3. In a liquid fuel burner the combination with an air pressure pump, an oil metering pump, a burner nozzle, means for feeding oil and air from said pumps to said burner nozzle, said nozzle being constructed to deliver a mixture of oil and air, a motor for driving said air pressure pump and said oil metering pump, and a draft pipe for supplying secondary air adjacent to said burner nozzle and into which secondary air said nozzle delivers a mixture of oil and air, of a Venturi tube connected to said draft pipe for supplying air thereto, an air jet disposed at the entrance to said Venturi tube, a connection between said air pressure pump and said air jet to deliver air under pressure thereto for the purpose of inducing the flow of secondary air through said draft pipe to said nozzle, the arrangement for supplying oil from said oil metering pump to said nozzle being such that all of the oil discharged by the oil metering pump is delivered to said nozzle and discharged therefrom as a part of said mixture.

4. Liquid fuel burning apparatus comprising an air pressure pump, an oil metering device, a burner nozzle, means for feeding air from said air pump to said nozzle, means for feeding all of the oil delivered by said oil metering device to said nozzle, said nozzle being constructed so as to mix all of the oil and air fed thereto and to discharge said mixture of oil and air in the form of an oil fog, a draft pipe in and at one end of which said nozzle is arranged, said draft pipe having an air inlet and forming a means for supplying secondary air to said nozzle, said nozzle discharging said oil fog in the path of the air supplied by said draft pipe, an air jet in said draft pipe and arranged to discharge a jet of air into said pipe, and means for supplying air under pressure to said air jet so as to discharge a jet of air into said pipe for inducing a flow of secondary air through said draft pipe to said nozzle, said last mentioned means being supplied with air from said air pump.

5. Liquid fuel burning apparatus comprising an air pressure pump, an oil metering pump, a motor for driving said pumps, a burner nozzle, means for feeding air under pressure from said air pump to said nozzle, means for feeding oil under pressure from said oil pump to said nozzle, said nozzle being constructed so as to mix said oil and air and to discharge a mixture of oil and air in the form of an oil fog, a draft pipe having an air inlet and forming a means for supplying secondary air to said nozzle, said nozzle being arranged to discharge said oil fog into the path of the air supplied by said draft pipe, an air jet in said draft pipe and arranged to discharge a jet of air into said pipe, and means for supplying air under pressure to said air jet so as to discharge a jet of air into said pipe for inducing a flow of secondary air through said draft pipe to said nozzle, said last mentioned means being supplied with air from said air pump, the arrangement for supplying oil from said oil metering pump to said nozzle being such that all of the oil discharged by the oil metering pump is delivered to said nozzle and discharged therefrom as a part of said mixture.

6. Liquid fuel burning apparatus according to claim 5 wherein said draft pipe is provided with a venturi positioned relative to said air jet so that the jet of air discharged thereby is discharged into the throat of said venturi.

7. A liquid fuel burner comprising an air pressure pump of the positive displacement type, an oil pump, an electric motor for operating said pumps, a burner nozzle connected to said pumps so as to be supplied with regulated amounts of oil and air therefrom, said nozzle being constructed to mix the oil and air delivered thereto and to discharge such mixture in the form of an oil fog, a draft pipe in whose discharge end said nozzle is arranged and through which draft pipe a stream of secondary air is supplied for flow past said nozzle and through the discharge end of said pipe, the air intake end of said draft pipe being provided with an atmospheric air inlet through which air is free to flow into said draft pipe, an air jet operative by air delivered under pressure from said air pressure pump and associated with said atmospheric air inlet of said draft pipe for

inducing a flow of secondary air from atmosphere through said atmospheric air inlet into the intake end of and through said draft pipe, the arrangement for supplying oil from said oil pump to said nozzle being such that all of the oil discharged by the oil pump during firing of the burner is delivered to said nozzle and discharged therefrom as a part of said mixture into said secondary stream of air, said air pump and jet and the flow of secondary air induced thereby providing the entire supply of air for said nozzle and the mixture discharged thereby.

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(Addition to No. 687.675)