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FUEL MIXER

Filed Nov. 26, 1928

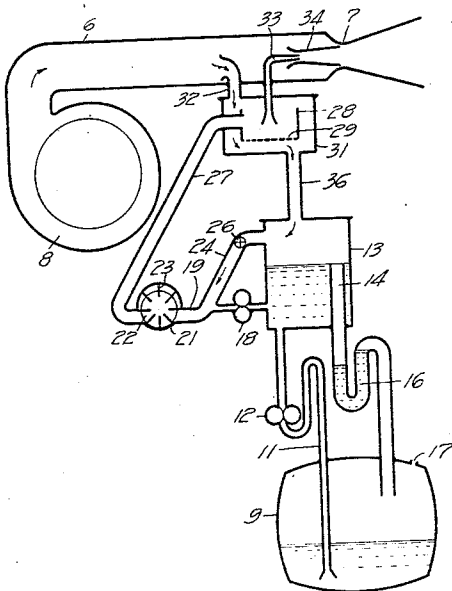


FIG. 1

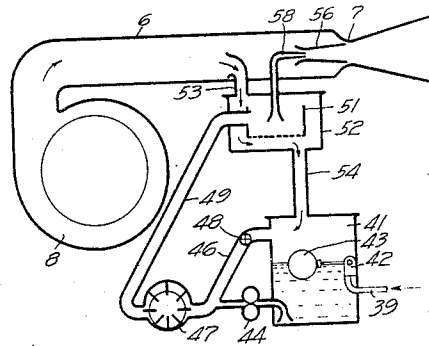


FIG. 2

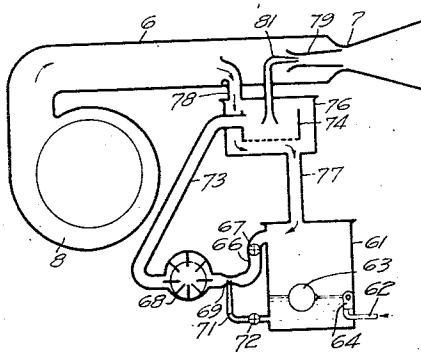


FIG. 3

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FUEL MIXER

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My invention relates to means for burning liquid fuels, such as distillate, fuel oil and kerosene, and especially is concerned with mechanism for mixing the liquid fuel with a combustible proportion of air. The efficiency of any means for consuming fuel oil or liquid fuels in general depends largely upon the thoroughness with which the fuel is intermixed with the air for combustion. That is, the more homogeneous the fuel and air mixture, the better the combustion and the greater the economy effected.

It is therefore one of the objects of the present invention to insure a very thorough intermixture of the fuel and the air for combustion.

Another object of the invention is to provide means for breaking up and disseminating a heavy fuel oil in an air stream, so that perfect combustion of the heavy oil is obtained.

A further object of the invention is to provide means for converting the liquid fuel into a fuel foam and regulating the rate of production of the foam in proportion to the fuel demands of the burner.

The foregoing and other objects are attained in the embodiment of the invention shown in the drawing, in which

Fig. 1 is a diagrammatic showing of one modification of my invention.

Fig. 2 is a diagrammatic representation of another modification of my invention.

Fig. 3 is a diagram showing an additional modification in accordance with my invention.

In its preferred form, my invention includes a conduit thru which a current of air is induced to flow and into which a combustible proportion of fuel foam is introduced.

In the modification disclosed in Fig. 1, there is provided a conduit 6 which terminates usually in a venturi 7 and thru which a current of air is induced to flow by a blower 8 preferably driven by an electric motor. The conduit 6 is adapted especially for use with furnaces or other heaters, but the invention is applicable to other environments as well. For supplying a liquid fuel to the current of

air flowing thru the conduit, I preferably provide a fuel storage tank 9 and withdraw the liquid fuel through a pipe 11 and force it by means of a pump 12 into a reservoir 13. To regulate the height of fuel in the reservoir there is afforded an overflow tube 14 having a reverse bend 16 therein acting as a fuel trap. The tube 14 terminates within the tank 9 and returns thereto any fuel which overflows the upper end of the tube 14. To accommodate the changing fuel volume within the tank 9, an atmospheric vent 17 is provided thereon.

From the reservoir 13, the liquid fuel is withdrawn by a pump 18 and is introduced into a pipe 19 leading to a fuel foam pump 21. This fuel foam pump can be of any of the recognized kinds but preferably includes an eccentrically mounted rotor 22 equipped with radially extending blades 23 which contact with the pump casing and afford a pumping action. The upper portion of the reservoir 13 is supplied with air, as will later be described, and this air is withdrawn by the pump 21 through a pipe 24 provided with a valve 26 for regulating the flow therethrough. By regulating the action of pump 18 and by regulating valve 26, the relative proportions of liquid fuel and of air which merge just prior to entering the foam pump 21 are easily varied. The foam pump is effective not only to withdraw air and fuel from the reservoir 13, but is also effective to churn or whip the air and fuel together to provide a foam-like mixture. Sometimes such a pump is termed a "nebulizer".

From the foam pump the fuel foam is discharged through a tube 27 into a cup 28 open at the top and having a perforate bottom 29. This cup is situated within a receiver 31 conveniently disposed adjacent the conduit 6. For inducing the flow of fuel foam from the cup 28 into the conduit 6, I preferably afford a duct 32 extending into the conduit 6 and communicating with the interior of the receiver 31. The current of air flowing through the conduit 6 enters through duct 32 into the receiver and affords an increased air pressure therein, which assists the educing action of the stream of air passing

through the conduit 6 to raise the fuel foam upward through a nozzle into the conduit 6. The air which is subsequently mixed with the liquid fuel to form a foam is preferably

- 5 drawn from the receiver 31 and the air entering this receiver may be taken from the conduit 6 when an elevated air pressure is desired, or it may be taken directly from the atmosphere.
- 10 An outlet for the fuel foam to the air conduit is provided through a nozzle 33 leading from the interior of and encompassed by the cup 28 into the throat of an auxiliary venturi 34 situated adjacent the venturi 7. The
- 15 eduction of the venturi, with or without the additional pressure afforded by the air passing through duct 32, depending upon the operating conditions, is ample to aspirate the fuel foam from the cup 28 and mix it with
- 20 the current of air flowing through the conduit 6 and through the venturi 7. The stream of air passing through the conduit 6 ordinarily does not possess sufficient energy to raise and disseminate a heavy fuel in liquid
- 25 form, but by foaming the fuel, its weight per unit of volume is greatly decreased, so that it is readily lifted and aspirated by the air stream.

- To afford a return for any surplus fuel
- 30 foam which is not aspirated and which passes through the perforate bottom 29 of the cup 28 or overflows the upper edge thereof, there is afforded a tube 36 extending into the reservoir 13. The surplus fuel foam collects in
- 35 the reservoir 13, whence it again passes through the foaming pump, preventing or minimizing the flow of air through the pump and thus reducing the amount of foam produced. The formation of the foam is thus
- 40 automatically regulated, so that a sufficient or a slight excess of foam is continually produced, the amount of foam produced depending upon the fuel demands of the burner.

- With the system described, there is introduced into a current of air from which a
- 45 proportion has been by-passed, an amount of fuel foam which, when reintroduced into the main current of air, provides a readily combustible and thoroughly homogeneous mixture.

- 50 In Fig. 2, substantially the same scheme is disclosed with the exception of the mechanism for handling the liquid fuel. Here, likewise, there is shown a conduit 6 having
- 55 a venturi 7 through which a current of air is induced by a blower 8. The fuel, however, is introduced through a pipe 39 into a reservoir 41. Communication between the pipe and the reservoir is controlled by a valve 42
- 60 operated by a float 43, dependent upon the level of liquid fuel within the reservoir, and effective to maintain the level at approximately any predetermined amount.

- From the reservoir the liquid is withdrawn
- 65 by a pump 44 which discharges it into a pipe

46 leading to a foam pump 47. The pipe 46 communicates with the upper portion of the reservoir 41, in which air is contained, and the passage of air through the pipe 46 is controllable by a valve 48. The fuel and air are mixed together to provide a foam by the pump 47, and are discharged thru a tube 49 into a cup 51 situate in a receiver 52. The receiver is in communication thru a duct 53 with the current of air passing thru conduit 6 so that an added pressure is present within the receiver. To accommodate the overflow from the cup 51 and also to provide an amount of air within the reservoir 41, a tube 54 connects the reservoir with the receiver. Projecting into the cup 51 and terminating within an auxiliary venturi 56 adjacent the venturi 7, is a nozzle 58.

This mechanism is effective to maintain a substantially constant level of liquid fuel within the reservoir 41 and to provide a fuel foam which when mixed with the current of air flowing in conduit 6 is readily combustible, largely due to its homogeneity.

In Fig. 3 there is a similar arrangement in which a conduit 6 having a venturi 7 thru which a current of air is induced by a blower 8 is provided with a fuel foam supplying means. This consists of a reservoir 61 supplied with fuel thru a pipe 62. A float 63 controlling a valve 64 regulates the height of liquid fuel within the reservoir and keeps it at any predetermined level. The upper portion of the reservoir contains air which is educted thru a pipe 66 controlled by a valve 67 to a foam pump 68. Within the pipe 66 is a constriction 69 into which projects a fuel nozzle 71 communicating with the liquid fuel within the reservoir 61 and controlled by a suitable valve 72. By proper manipulation of the valves 67 and 72, the relative proportions of air and fuel entering the foaming pump 68 are regulated. The foam pump discharges into a pipe 73 leading into a cup 74 situate within a receiver 76, so that fuel foam overflowing from the cup can pass into the receiver 76 and thru a pipe 77 into the reservoir 61.

To increase the pressure within the receiver, I provide a duct 78 intersecting the conduit 6 and affording a passage for a proportion of the current of air flowing there-thru into the receiver. Air may also flow thru the pipe 77 into the upper portion of the reservoir 61 from which it can be withdrawn by the foam pump as described. Projecting into the cup 74 and terminating in the throat of an auxiliary venturi 79 is a fuel nozzle 81.

This scheme like the two just described, is effective in introducing into a current of air, a combustible proportion of a fuel foam which, when united with the remainder of the air current, is combustible. Furthermore, the result of all of the devices described is

to afford an extremely homogeneous and combustible mixture of fuel and air, employing an intermediate stage of mixture termed "fuel foam" herein. This thorough intermixture and fine division of the fuel and air is effective to increase the efficiency of a fuel burning system, and while it has been described herein as especially applicable to furnaces, the mechanisms shown as well as other modifications of them are well adapted to use in any environment in which it is desired to mix a liquid fuel with air in combustible proportion.

It is to be understood that I do not limit myself to the form of the fuel burner shown and described herein, as the invention, as set forth in the following claims may be embodied in a plurality of forms.

I claim:

1. A fuel mixer including a conduit having a venturi therein, means for causing a current of air to flow thru said conduit, a source of liquid fuel, a pump for mixing said fuel with air to form a fuel foam, a container to receive said fuel foam from said pump, and a duct connecting said container and said conduit thru which said fuel foam is aspirated by said current of air.

2. A fuel mixer including a conduit, means for causing a current of air to flow through said conduit, a container open to said conduit, means for whipping liquid fuel with air to form a fuel foam, means for supply-

ing said fuel foam to said container, and a fuel foam duct joining said container to said conduit.

3. A fuel mixer including a conduit having a venturi therein, means for causing a current of air to flow thru said conduit, a fuel foam container, an air pipe joining said container to said conduit, a fuel foam duct joining said container and said conduit, a cup in said container encompassing said duct, and means for supplying fuel foam to said cup.

4. A fuel mixer including a conduit having a venturi therein, means for causing a current of air to flow thru said conduit, a fuel foam container, an air pipe joining said container to said conduit, a fuel foam duct joining said container to said conduit adjacent said venturi, a fuel and air tank, an air tube joining said container to said tank, and a fuel foam pump adapted to withdraw fuel and air from said tank and deliver fuel foam to said container.

5. A fuel mixer including a conduit, a container, means for producing and supplying fuel foam to said container, means for aspirating fuel foam from said container into said conduit, and means for regulating the amount of fuel foam produced in accordance with the amount of fuel foam aspirated.

In testimony whereof, I have hereunto set my hand.

WILLIAM A. DOBLE, Jr.

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