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BURNER FOR LIQUID FUEL

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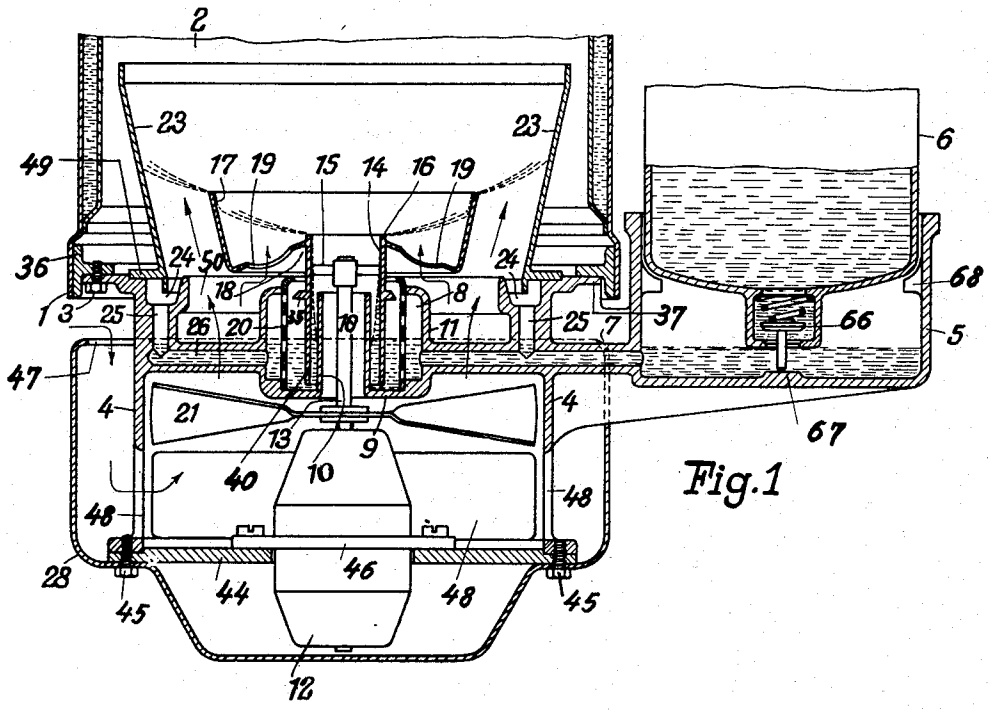
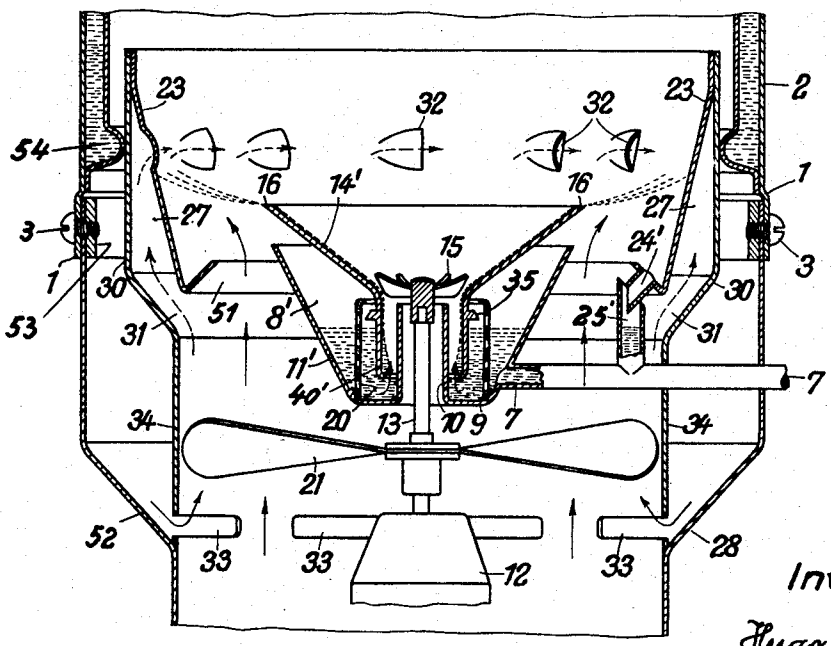


Fig.1

Fig.2



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BURNER FOR LIQUID FUEL

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2 Claims. (Cl. 158—77)

My invention relates to burners for liquid fuel and more particularly to burners having a rotary atomizer from the upper edge of which the fuel is projected by centrifugal action into flowing air so that a suitable mixture of air and fuel is obtained.

Burners of this type as designed heretofore present the following drawbacks:

Firstly, it is difficult to supply the fuel to the atomizer. Stuffing boxes or flexible shafts which have been suggested, increase considerably the power input of the burner. It has been suggested to eliminate stuffing boxes by supplying the fuel through the hollow shaft of the motor by which the atomizer is rotated, but this expedient increases the initial cost of the motor. Secondly, the operation of burners as designed heretofore is so difficult as to render them almost unsuitable for household purposes.

It is an object of my invention to eliminate these drawbacks.

To this end I provide a tubular extension on the atomizer which projects below the level of the liquid in the fuel reservoir so that the fuel is fed to the atomizer, preferably to a circular edge, by centrifugal action and without any means for conveying it.

I further provide means, such as a Mariotte flask, for maintaining the fuel in the reservoir substantially at the same level, and by this means, in combination with the centrifugal feeding means, dispense with extra means for conveying the fuel, including a supply pipe. The tubular extension of the atomizer may be cylindrical or tapered. In a cylindrical or slightly tapered extension the fuel rises along the inner wall at a definite and not excessive rate only if the atomizer rotates at normal speed.

I further provide means such as a perforated annular wall in the fuel reservoir for preventing rotation of the fuel in the reservoir by the tubular extension.

I further provide a fixed tube which surrounds the atomizer at some distance from the perimeter of the atomizer which acts as a mixing tube and confines the jet of mixture issuing from the burner. The inside diameter of the mixing tube preferably increases toward the outlet or upper end of the burner. Air-inlet openings may be provided in the mixing tube for admitting secondary air to the mixing tube beyond the atomization zone.

I further provide a motor for imparting rotation to the atomizer, normally an electric motor, having a vertical shaft and arranged below the reservoir so that the reservoir is positioned about the upper end of the shaft but below the circular edge of the atomizer from which the fuel is projected. The atomizer is connected to the motor shaft by any suitable means, such as a spider.

I further so design the reservoir that a stuffing box is dispensed with and so the loss of power it involves is eliminated. Instead of a stuffing box I provide a tube surrounding the shaft and extending beyond the liquid level in the reservoir at its upper end while its lower end is inserted in the bottom of the reservoir.

I further provide a fan or other suitable impellers for effecting a flow of air past the atomizer which is preferably arranged on the motor shaft below the bottom of the reservoir.

I further provide, at some distance from the circular edge from which the fuel is projected by the atomizer, a shell the inside diameter of which preferably increases toward the outlet end of the burner and means, such as holes in the web connecting the shell to the atomizer, may be provided for admitting air to the interior of the shell. The object of the shell is to atomize any unatomized particles which may be present in the veil of liquid projected from the circular edge of the atomizer, so that atomization is effected in two stages and the mixture is finally delivered to the mixing tube in a state of extremely fine subdivision.

Preferably the burner including the atomizer, the motor and other parts, is combined into a self-contained unit adapted to be connected to the element, for instance, a liquid heater, which is operated by the burner.

In order to prevent leakage of unconsumed fuel in atomized or liquid condition, or products of combustion from the burner, into the atmosphere the means for attaching the self-contained burner to the element heated are arranged in the path of the air moving toward the burner at the suction side of the means, for instance a fan, for effecting the flow of air. Any substances which leak from the combustion chamber are intercepted by the flowing air, returned to the burner and discharged into the flue of the element to be heated.

In the drawing affixed to this specification and forming part thereof burners embodying my invention are illustrated diagrammatically by way of example.

In the drawing

Fig. 1 is an axial section of a self-contained

burner attached to the lower end of an element to be heated, and

Fig. 2 is an axial section of a somewhat simplified burner which may also be designed as a self-contained unit.

Referring now to the drawing, 2 is the furnace element to be heated, here shown as a flue or combustion chamber surrounded by a water space, and 1 is an annular extension at the lower end of the furnace element to which the casing of the burner is attached.

Referring now to Fig. 1, 36 is an annulus which is secured to the extension 1 of the element 2 by any suitable means, not shown, and 4 is the frame of the self-contained burner unit which is secured to the annulus 36 by a flange 37 at its upper end, and screws 3. The frame 4 is a substantially cylindrical member. 44 is a bottom plate at the lower end of the frame 4, 45 are screws by which the bottom plate is attached to the frame, and 46 is a flange on the casing of a motor 12 which is inserted in a hole on the centre of bottom plate 44. 5 is a fuel tank at one side of the frame, 6 is a container for a supply of fuel from which the fuel is discharged uniformly, for instance, a Mariotte flask, and 66 is a check valve at the lower end of the flask which opens automatically by its stem striking a projection 67 on the bottom of the tank 5 when the container 6 is placed in position, lugs 68 being provided for supporting the container at the upper end of the tank 5.

8 is a central fuel reservoir in the frame 4, 7 is a pipe connecting its side wall 11 to the tank 5, and 26 is a pipe connected to the wall 11 at the side of the reservoir which is opposite the pipe 7, for a purpose which will be described. 9 is the bottom of the reservoir 8, and 10 is a tube which extends upwardly from the bottom 9 to a point above the liquid level in the reservoir. 13 is the shaft of the motor 12 which is arranged centrally within the tube 10 so that the tube replaces a stuffing box, and 15 is a spider connecting the upper end of shaft 13 to the atomizer 14. The atomizer 14 comprises a tubular extension 40 the lower end of which is below the liquid level in the reservoir 8 and just above the bottom 9, a circular edge 16, a web 18 which merges into the tubular extension 40 just below the edge 16 and has holes 19, and a shell 17 which is preferably tapered and extends upwardly from the outer edge of the web 18. 35 is a flange on the outer wall of the tubular extension 40.

20 is a baffle here shown as a perforated tube which is arranged co-axially in the reservoir 8 intermediate its side wall 11 and the tubular extension 40 of the atomizer. Baffle 20 is shown perforated throughout its length but may be perforated in its lower portion only, its object being to exert a braking or damping action on the liquid in the reservoir as the liquid must not be entrained by, and rotate with, the extension 40.

The fuel is raised from the reservoir 8 by centrifugal action in the chamber between the tubular extension 40 of the atomizer and the tube 10 but, as mentioned, only if the atomizer rotates at normal speed. It is known that when a hollow cylinder which is partly filled with liquid, is rotated about a vertical axis, the liquid will rise and form a hollow body of parabolic section. The section is determined by the speed at which the hollow cylinder rotates and intersects the wall of the cylinder at a level which is a function of the speed. By suitably determining the speed at which the tubular extension 40 rotates, the liquid is raised beyond the upper edge of the extension where it is atomized under centrifugal action. The extension 40 may be cylindrical as shown or more or less tapered but normally is substantially cylindrical. Any fuel which might creep up on the outside of the extension 40, is stopped by the flange 35.

Arranged below the bottom 9 of the reservoir and secured on the shaft 13 of the motor 12 is a fan impeller 21 which rotates inside the frame 4, and draws in air through an inlet 47 at the upper end of a cowl 28 surrounding the frame 4, and through openings 48 in the frame. It is not necessary to provide the fan 21 if the natural or artificial draught in the element 2 is strong enough for drawing combustion air into the burner. The air flows past the pipes or passages 7 and 26 and is distributed to the space surrounding the shell 17 of the rotary atomizer 14 and to the space within the shell, as indicated by the arrows in Fig. 1.

23 is a non-rotary mixing tube which surrounds the shell 17 at some distance and is supported on the upper face of the frame 4 by a flange 49. Preferably the mixing tube 23 is tapered in conformity with the shell 17, i. e., with its inside diameter increasing toward its upper or outlet end. The mixing tube, in addition to its principal function of effecting an intimate mixture of the veils of fuel projected from the edge 16 and from the upper edge of the shell 17 with the air which breaks through the veils, also confines the issuing jet of mixture so that it flows in the proper direction and is not hurled against the flue of the element 2 by centrifugal action. Any non-atomized particles which strike the wall of the mixing tube 23, flow down the wall and are returned to the fuel reservoir 8 through a circular slot 24 formed between the lower end of the mixing tube 23 and an annulus 50 projecting upwardly from the frame 4, and thence through passages 25. In this manner the non-atomized fuel is not entrained by the mixture, to the deterioration of combustion, but returned to the reservoir.

The air inlet 47 at the upper end of the cowl 28 is so positioned with respect to the point where the self-contained burner is connected to the element 2 that the air which is drawn into the burner through the inlet 47, flows past the connection and any fuel, gas or other leakage from the combustion chamber is entrained by the air and returned to the flue 2.

Referring to Fig. 2, the general arrangement of the burner is similar to that described with reference to Fig. 1 but the burner is simplified. The atomizer 14 is here replaced by a plain dish 14', with the edge 16 at its perimeter, and without the shell 17. The tubular extension 40' with the flange 35, the baffle 20, the tube 10 surrounding the motor shaft 13, and its spider 15, are provided substantially as in Fig. 1, but slightly modified. The mixing tube 23 has an annular flange 51 at its lower end forming a trough from which a pipe 24' extends to a pipe 25' extending vertically from the supply pipe 7. The pipe 26 is dispensed with, and the reservoir 8 is replaced by a bowl 8', with a tapered side wall 11'.

The frame 4 in Fig. 1 is replaced by a suction pipe 34 which is open at its lower end and in which the motor 12 is arranged. The major portion of the air delivered by the fan 21, or drawn into the burner by the natural or artificial draught in the flue of the element 2, flows through

the annular passage between the wall 11' of the reservoir 9' and the inner edge of the flange 51, but a smaller portion is by-passed as secondary air through a tapered passage 31, between 23 and an extension 30 of the suction pipe 34 which is secured to the outer wall of the mixing tube 23 at its upper end, and openings 32 in the mixing tube above the atomization zone. The cowl 28 is here replaced by a pipe 52 which is attached at its upper end to the extension 1 at the bottom of the element 2 by screws 3 and an annular member 53, and connected to slots 33 in the pipe 34 at its lower end. By these means any leakage from the combustion chamber is returned to the reservoir but in order to prevent interference with the upward draught in the flue, an annular extension 54 is arranged which projects inwardly from the water jacket of the element 2 and is in contact with the outer wall of the extension 30. It will be understood that the connection at 1 is held permanently under reduced pressure by these means and escape of gas or other undesirable matter into the atmosphere is absolutely prevented.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:—

1. In combination with a furnace to be heated, oil burning apparatus comprising a frame which is adapted to be connected to, and to make a tight fit on said furnace, and is in open communication with the combustion chamber of said furnace, a central annular fuel reservoir in said frame whose upper end is also in open communication with said combustion chamber, a fuel-supply tank at one side of said frame, means in said fuel-supply tank for maintaining the fuel level therein, a pipe connecting said reservoir and said tank, and supporting said tank on said frame, a motor in said frame, a shaft extending from said motor upwardly through said reservoir, an atomizer mounted on said shaft above said reservoir, a tube extending downwardly from said atomizer and into said reservoir, and a fan on said shaft below said reservoir.

2. In combination with a furnace to be heated, oil burning apparatus comprising a frame which is adapted to be connected to, and to make a tight fit on said furnace, and is in open communication with the combustion chamber of said furnace, a central annular fuel reservoir in said frame whose upper end is also in open communication with said combustion chamber, a fuel-supply tank at one side of said frame, means in said fuel-supply tank for maintaining the fuel level therein, a pipe connecting said reservoir and said tank and supporting said tank on said frame, a motor in said frame, a shaft extending from said motor upwardly through said reservoir, an atomizer mounted on said shaft above said reservoir, a tube extending downwardly from said atomizer and into said reservoir, a fan on said shaft below said reservoir, and a collector for unconsumed fuel arranged at the top of said frame and connected to said pipe.

HUGO JUNKERS.