May 28, 1929. D. DANA 1,714,903

APPARATUS FOR BURNING FLUID FUEL

Filed April 24, 1926

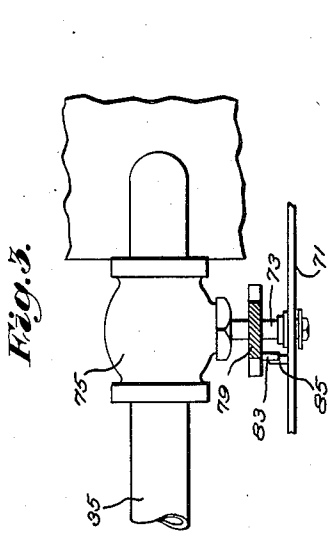

Fig. 3.

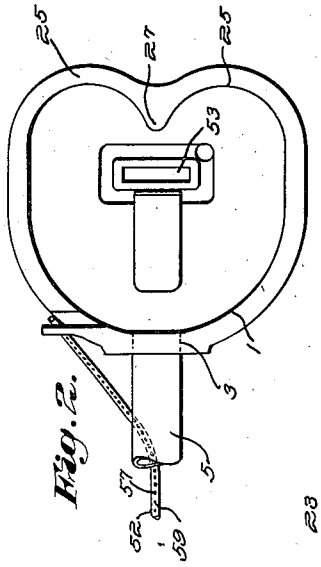

Fig. 2.

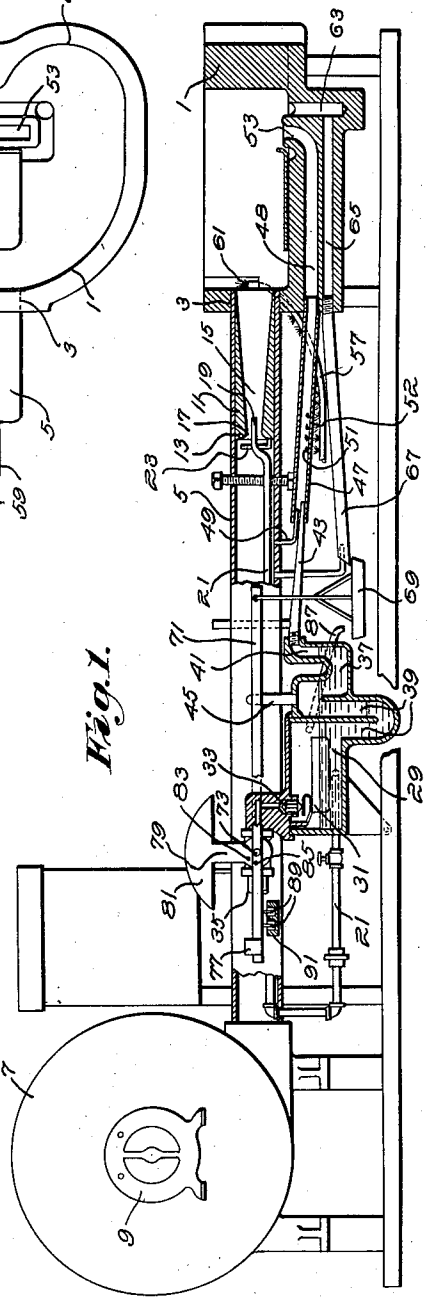

Fig. 1.

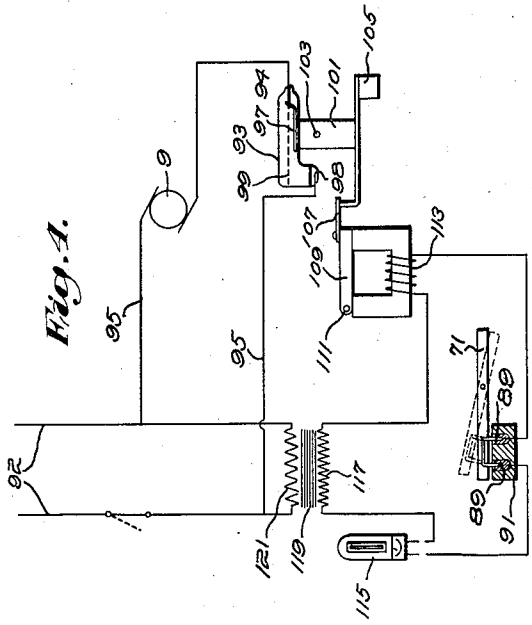

Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR BURNING FLUID FUEL.

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My invention relates to fuel burning apparatus, and particularly but not exclusively to one for burning liquid fuel for use in connection with steam or hot water house heating plants.

The invention which has among its objects a simplified construction for insuring better combustion and safety control features will be best understood from the following description when read in the light of the accompanying drawing of an example of my invention, while the scope of the invention will be more particularly pointed out in the appended claims.

In the drawing Fig. 1 is an elevation of apparatus constructed according to my invention;

Fig. 2 is a plan of a burner according to Fig. 1;

Fig. 3 shows a detail on an enlarged scale; and

Fig. 4 is a schematic wiring diagram.

Referring to the drawing I have shown a burner which comprises a combustion chamber having the vertically disposed walls 1, the chamber being open at the top to afford a discharge for the flame and products of combustion. Through one of the walls is formed an opening 3 through which is admitted a mixture of fuel and air for combustion purposes. As illustrated, the opening 3 has fitted thereinto a conduit in the form of a pipe 5, through which pipe air is forced by means of a blower or fan 7 driven by a suitable motor, for example the electric motor indicated at 9.

The pipe 5 adjacent its discharge end is shown as provided with a bushing 11 forming a nozzle having the converging entrance portion 13 and the diverging discharge portion 15, these two portions at their juncture forming a throat 17. Surrounded by the nozzle just described is a nozzle 19 for the fuel. The end of the nozzle 19 is arranged just forwardly of the throat 17 so that the air passing through the throat will by Venturi effect and fluid friction draw the fuel by suction from the nozzle 19. The arrangement will be recognized as an ejector device which acts further to pulverize the liquid fuel and thoroughly mix it with the air in the combining tube formed by the divergent portion 15 of the bushing.

The fuel nozzle 19 preferably is formed integrally with a fuel connection or pipe 21 which, as illustrated, extends through the pipe 5 to a point adjacent the blower 7, which construction gives sufficient flexibility to the pipe 21 to permit the nozzle 19 to be adjusted in vertical planes so as to discharge the fuel from the nozzle 19 at different angles to the horizontal. As illustrated, a guide 23 is provided for maintaining the nozzle 19 in a vertical plane diametrically of the air nozzle.

I have found that the air and fuel mixture discharging into the combustion chamber assumes in part at least a whirling motion which returns upon itself and plays upon the incoming mixture thereby heating and assisting in the vaporization of the incoming spray. Other parts of said mixture are deflected upward and slightly outward from the combustion chamber. By adjusting the angle of the nozzle 19 as hereinbefore described the proportions of mixture so divided can be varied at will, which permits regulating of the mixture to the extent that only just enough flame remains in the combustion chamber to vaporize the incoming spray, and therefore insures that the fuel is effectively burned. To facilitate the whirling action the walls of the combustion chamber preferably are made vertical and are curvilinear as viewed in plan, the walls opposite the nozzles preferably being formed with reentrant portions 25 separated by a deflecting baffle 27 as shown in Fig. 2.

As illustrated by Fig. 1 the pipe 21 is supplied with fuel from a feed chamber 29, the latter being provided with a float 31 and a valve 33 controlled thereby for maintaining a substantially constant level of fuel in the chamber. As illustrated, the valve 33 is supplied with fuel through a pipe 35 leading from a source of fuel supply not shown.

As illustrated, the feed chamber 29 has in communication therewith an auxiliary chamber 37 connected to the chamber 29 by means of the downwardly extending U-shaped passage 39. Connected to the auxiliary chamber by a conduit 41, which leads from below the level of the fuel in the auxiliary chamber, is a pipe 43, the latter communicating with the conduit above the level of the fuel, while connecting the auxiliary chamber at a point above the level of the fuel with the pipe 5 is a pipe 45. With this arrangement when the flow of air through the pipe 5 is initiated by putting the blower into operation the pressure of air will be communicated to the auxiliary reservoir 37 by the pipe 45 which will

force the limited amount of fuel in the auxiliary reservoir gradually through the pipe 43, the parts being so proportioned with relation to the air pressure that the hydrostatic head of the fuel in the chamber 29 is insufficient to cause more fuel to flow into the chamber 37 while the motor continues in operation.

Use is made of the fuel discharging from the pipe 43 for initially igniting the mixture of fuel and air discharged into the combustion chamber. As illustrated, the pipe 43 discharges into the end of a pipe 47 which is connected to a conduit 48 formed in the bottom of the combustion chamber and having the vertically arranged discharge orifice 53. Also discharging into the end of the pipe 47 is a pipe 49 connected to the pipe 5 so that air for combustion of the fuel discharged from the pipe 43 will be available. Beneath the pipe 47 is a gas burner 52 the flames whereof heat the pipe to a temperature sufficient to vaporize the fuel and entering through hole 51 in said pipe ignite the vaporized fuel and air forced through the pipe so that the burning fuel will form a flame issuing from the orifice 53 of the conduit 48 for igniting the mixture of air and fuel discharged into the combustion chamber from the end of the pipe 5.

As illustrated, the gas burner 52 is formed by providing a pipe 57 having a series of perforations 59, the pipe extending to the combustion chamber where the gas discharging from the open end of the pipe forms a pilot light 61. Conveniently the row of perforations 59 may extend to the end of the pipe at the combustion chamber so that lighting the pilot light will cause igniting of the burner 52 by reason of the fact that the pilot light will cause successive ignition of all the jets of gas issuing from the several perforations 59. The pilot light affords a convenient means for igniting the burner 52 and also acts to supplement the action of the flame issuing from the orifice 53.

The apparatus conveniently may be provided with means for rendering it inoperative in case the mixture supplied the burner should not be ignited, or combustion should be interrupted. As illustrated, the base of the burner is provided with communicating passages 63 and 65 which discharge into a pipe 67 terminating above a pan or other suitable collecting vessel 69 for unburned fuel. As illustrated, the pan is suspended from the end of a lever 71, which lever is fulcrumed on the valve stem 73 of a valve 75 for closing the fuel supply connection 35. The lever is normally maintained in the position illustrated by Fig. 1 by means of a counter-weight 77, the lever tilting only to permit the pan to descend when sufficient fuel is collected by the latter. Non-rotatably secured to the valve stem 73 is a normally vertical arm 79 the upper end of which carries a weight 81. On the arm 79 is a pin 83 in the path of a pin 85 on the lever 71 so that when the lever tilts the pin 85 will cause the arm 75 to move past the vertical position to cause the weight 81 to fall and rotate the valve stem which closes the valve 75. It will be observed that the weight 81 and associated parts form a relay for closing the valve 75.

Conveniently, if desired, a pipe 87 may be provided for discharging overflow of fuel from the chamber 29 into the pan 69 in case the float valve mechanism should become inoperative, which will act to close the valve 75.

As illustrated, means are provided for rendering the motor 9 inoperative when the pan 69 descends upon a collecting excess of unburned fuel, this means herein taking the form of a mercury switch controlled by the lever 71, the lever as illustrated carrying the pair of contact members 89 cooperating with a cup 91 containing the mercury. As will be understood the mercury switch is indicated diagrammatically, and in practice the contact members 89 will be insulated from the lever.

As indicated by Fig. 4, the motor 9 is connected to a suitable source of electromotive force by means of leads 92, 95. Conveniently a second mercury switch 94 controlled by the temperature of the room or other place heated may be in series with the motor 9 so as to start the motor in operation when the temperature of the room drops to a certain predetermined value, and interrupt the operation of the motor when the temperature rises to a certain predetermined value. This switch is diagrammatically illustrated in Fig. 4 which shows a vessel 93 having contacts 97 and 98 placed in electrical communication by a body of mercury the level of which is indicated at 99. The vessel 93 is mounted on an arm 101 pivoted to a fixed point at 103, the arm being attached to a weight 105 and being normally held in horizontal position by means of a plate 107 carried by an armature 109 pivoted at 111, the parts being so designed that the plate 107 is in contact with the arm in all positions of the armature 109. The coil 113 for energizing the armature 109 is in series with the mercury switch including the contact members 89, also a thermostatic switch 115, which latter is responsive to the temperature of the room, and the secondary 117 of a transformer 119, the primary 121 of which is energized by the motor circuit. It will be observed that if an increase in temperature of the room causes the thermostatic switch 117 to open the energizing circuit of the coil 113, the vessel 93 will tilt and cause interruption of the circuit of the motor, and that when the thermostatic switch again closes, due to a drop in room temperature, the coil 113 again will be energized to draw down the armature 109 and move the vessel 93 back

to the horizontal position for again energizing the motor. Thus the thermostatic switch 115 will cause the motor 9 to be placed in and out of operation except when the lever 71 is tilted out of the position shown by Fig. 1.

Although I have described for purposes of illustration one example of my invention it is to be understood that I am not limited thereto, but that wide deviations may be made therefrom without departing from the spirit of my invention.

Claims:

1. A liquid fuel burning apparatus having, in combination, air and fuel supplies, a nozzle for delivering a mixture of air and fuel for combustion, means for forming a flame for igniting said mixture comprising a perforated conduit means, means directing a flame against said conduit to heat the same and to ignite a mixture of air and fuel when supplied to said conduit means, a connection for supplying air to said nozzle, and means forming a chamber containing a limited amount of fuel communicating with said conduit means and with said connection.

2. A liquid fuel burning apparatus having, in combination, air and fuel supplies, a nozzle for delivering a mixture of air and fuel for combustion, means for forming a flame for igniting said mixture comprising perforated conduit means, means to direct a flame against said conduit to heat the same and to ignite a mixture of air and fuel when supplied to said conduit means, a connection for supplying air to said nozzle, means forming a chamber containing a limited amount of fuel, said chamber having an air intake means supplied from said connection and fuel delivery means, the latter communicating with said conduit means, said conduit means having an intake means communicating with said connection.

3. A liquid fuel burning apparatus having, in combination, a burner provided with a nozzle for delivering a mixture of fuel and air for combustion, an air supply connection for said nozzle, means comprising a conduit for delivering a flame for igniting said mixture, means for heating said conduit, air and fuel supply connections for said conduit, and coordinated means for substantially simultaneously delivering air to said air supply connection for said nozzle and fuel and air to said conduit and thereafter automatically discontinuing the fuel supply to said conduit while containing the supply of air to said connection.

4. A liquid fuel burning apparatus having, in combination, a burner provided with a nozzle for delivering a mixture of fuel and air for combustion, an air supply connection for said nozzle, means comprising a conduit for delivering a flame for igniting said mixture, means for heating said conduit, air and fuel supply connections for said conduit, and coordinated means for supplying a limited amount of fuel to said conduit upon initiation of the supply of air to said air supply connection for said nozzle.

5. A liquid fuel burning apparatus having, in combination, a burner provided with a nozzle for delivering a mixture of fuel and air for combustion, an air supply connection for said nozzle, means comprising a conduit for delivering a flame for igniting said mixture, means for heating said conduit, air and fuel supply connections for said conduit, and coordinated means for supplying a limited amount of fuel to said conduit upon initiation of the supply of air to said air supply connection for said nozzle.

6. A liquid fuel burning apparatus having, in combination, means forming a combustion chamber, an air operated liquid fuel pulverizer for delivering mixed fuel and air to said chamber, means for igniting the mixed fuel and air comprising a tube opening into said chamber independently of said pulverizer, means for heating said tube, and means for supplying mixed air and fuel to said tube upon supplying air to said pulverizer.

7. Apparatus for burning fluid fuel having, in combination, means forming a combustion chamber with a top opening for discharge of flame, means for delivering fuel to said chamber substantially in the form of a jet, means for directing against said jet burning fuel from said jet, means for controlling the amount of burning fuel so directed comprising means for varying the direction of said jet relative to said opening and the walls of said chamber, said apparatus including igniting means for the fuel operative in all positions of adjustment of said jet.

In testimony whereof, I have signed my name to this specification.

DUNCAN DANA.