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LIQUID FUEL BURNER

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2 Sheets-Sheet 1

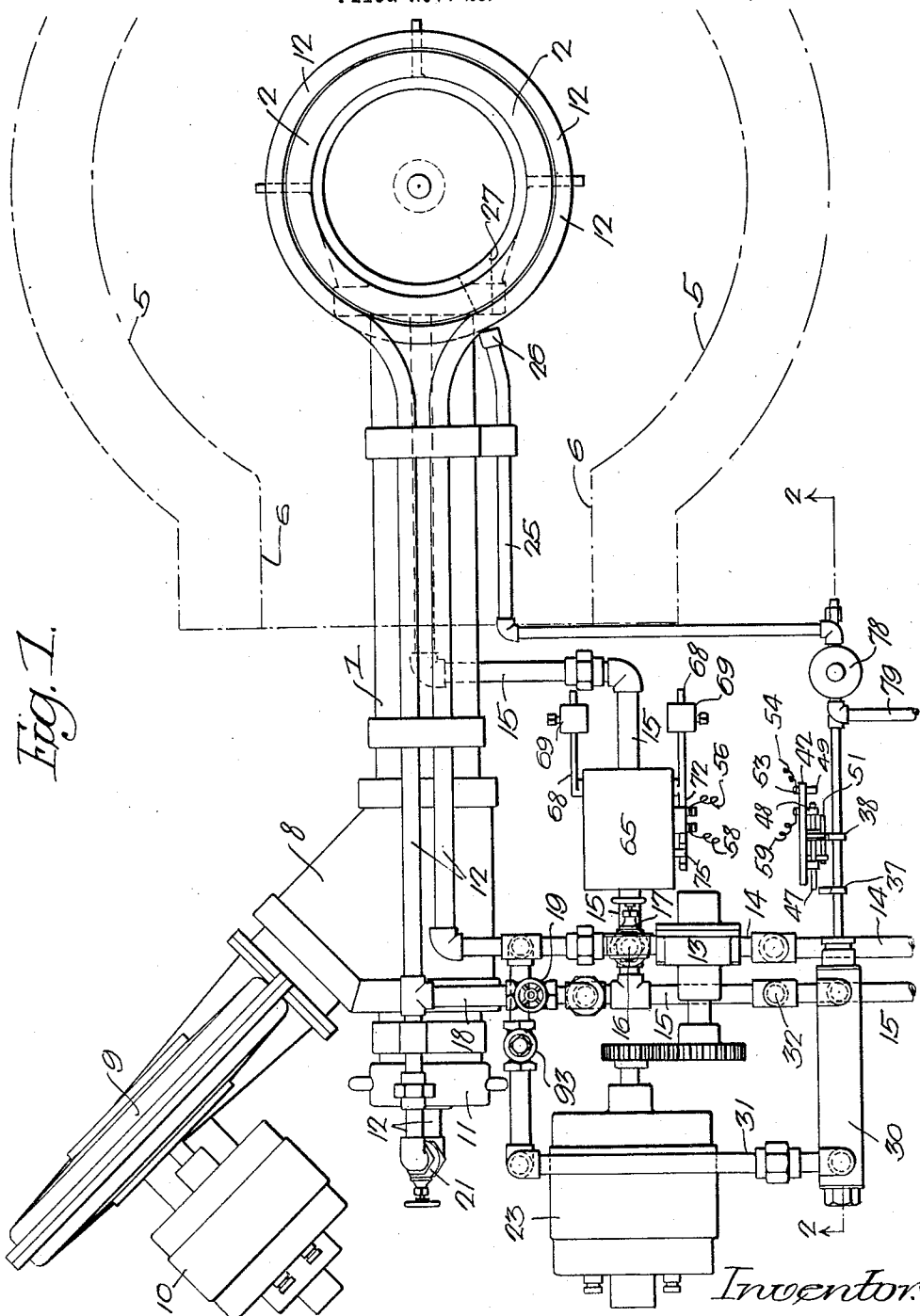


Fig. 1.

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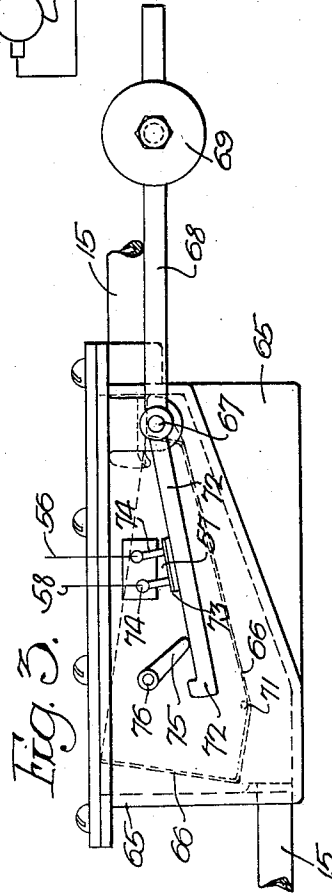
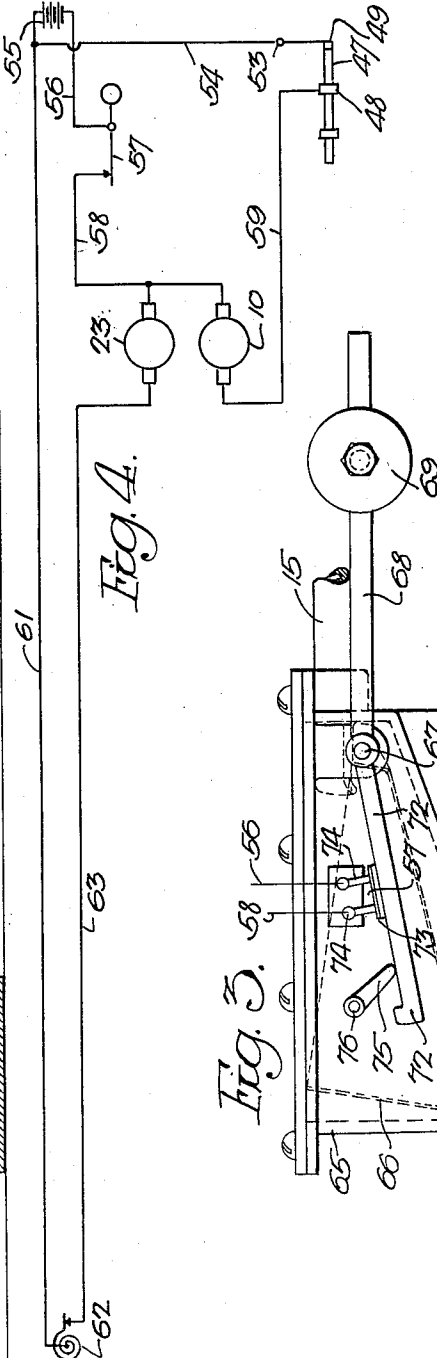
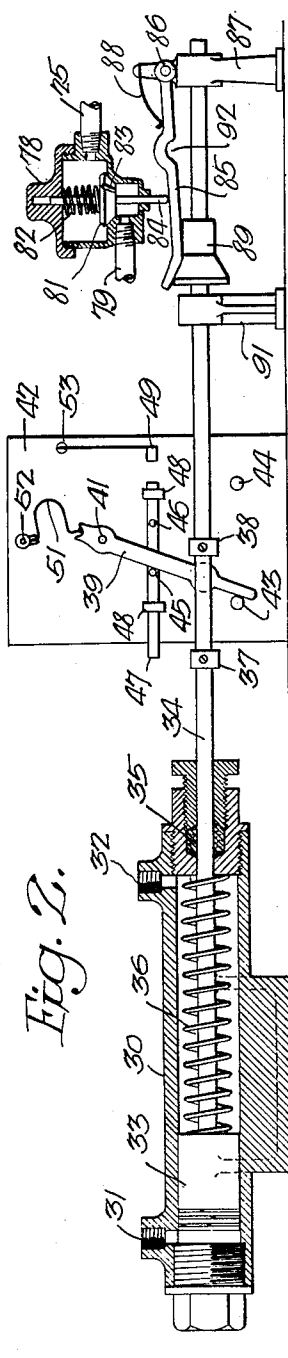
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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LIQUID-FUEL BURNER.

Application filed November 23, 1923. Serial No. 676,553.

My invention relates to liquid fuel burners of the type forming the subject of my co-pending application, Serial Number 641,433, the object of the present invention being to provide improved automatic means for regulating the operation of the burner to maintain the heated areas at even temperatures.

In the attached drawings:

Figure 1, is a plan view of a burner made in accordance with my invention;

Fig. 2 is a section on the line 2—2, Fig. 1;

Fig. 3, is a side elevation of a part of the control apparatus, and

Fig. 4 is a diagrammatic view illustrating the electrical wiring of the control mechanism.

With reference to the drawings, the device comprises a duct 1 having at one end a substantially bowl-shaped element 2 which constitutes the combustion chamber, said element 2 having an aperture at the side in which the end of the duct 1 is secured. The bowl 2 is adapted to be supported within the fire-box of a furnace or heater, the walls of which are indicated in Fig. 1 by broken lines and designated by the reference numeral 5. The duct 1 extends through a suitable door or opening 6 in the furnace wall, as clearly illustrated in Fig. 1.

At the outer end of the duct 1 in the present instance is a suitable Y-fitting 8, one branch of which is connected with the casing of a suitable blower 9 operated in the present instance by an electric motor 10, the other branch being closed off by a suitable detachable cap 11. Projecting through the cap 11 and into the interior of the duct 1, is a pipe 12 which passes back over the top of the duct, and after making a complete loop around the bowl 2, to a pump 13, which latter is connected by means of a pipe 14 with a reservoir for the liquid fuel (not shown).

Extending from an aperture at the bottom of the bowl 2 is a pipe 15 which after passing through apparatus hereinafter described extends to the fuel reservoir. The pipe 15 is also connected with the discharge side of the pump 13 by a short pipe 16, which latter is controlled by a valve 17 and constitutes a bypass from the pipe 12 to the reservoir. The pipe 15 also communicates with the pipe 12 through a pipe 18 controlled by a valve 19, as illustrated in Fig. 1. It will now be appar-

ent that the liquid fuel drawn from the tank through the pipe 14 by the pump 13, which latter may be operated by an electric motor 23, is normally discharged into the pipe 12, in which it passes around the bowl 2, and thence into the interior of the duct 1. Suitable means in the form of a nozzle is provided in the pipe 12 in the interior of the duct 1 to project the liquid into the base of the bowl 2. The fan 9 operated by the motor 10 provides the necessary draft air through the duct 1 into the bowl 2, while the burning mixture of oil and air may be lighted by means of a flame projected into the bowl 2 from a gas line 25, the nozzle 26 of which lies opposite a suitable opening 27 in the side of the bowl.

With the aforescribed apparatus, I provide means for automatically controlling the operation of the burner to maintain constant temperatures in the heated areas. The control mechanism in the present instance comprises a cylinder 30, one end of which is connected through a pipe 31 with the pipe 12 and the discharge side of the pump 13. The opposite end of the cylinder is connected through a suitable pipe 32 with the pipe 15, and therethrough with the reservoir.

Adapted to operate within the cylinder 30 is a piston 33 having a piston rod 34 projecting through a suitable packing box 35 in one end of the cylinder, and a spring 36 confined between one side of the cylinder and the end closure of the cylinder tends to retain the piston in that end of the cylinder which connects with the pipe 12. The rod 34 carries in the present instance a pair of spaced collars 37 and 38 which are adapted in the movement of the rod 34 to engage the opposite sides of a lever 39 pivoted at 41 to a suitable supporting member 42. The arrangement of parts is such that movement of the piston in the cylinder 30 will effect an oscillation of the lever 39 between a pair of stops 43 and 44 on the support 42 which limit the movement of the lever 39. The opposite sides of the lever 39 are also adapted to engage a pair of pins 45 and 46 on a rod or bar 47 slidably mounted in guides 48, 48, on the support 42. Oscillation of the lever 39 in the aforescribed manner effecting a corresponding reciprocation of the member 47 into and out of contact with an electric contact member 49 on the said support. The member

47 is in the present instance of metal or other suitable electricity-conducting material.

The upper end of the lever 39 is notched, as clearly illustrated in Fig. 2, and said notch is engaged by the lower end of a spring 51 whose upper end is secured to the support 42. This spring has the effect of tending to retain the lever in each of the extreme positions. The contact element 49 is connected with a binding post 53, and the bar 47 when in contact with the member 49 electrically connects this binding post 53 with the guide 48, which may constitute a second binding post.

The post 53 constitutes an element of an electric circuit including a conductor 54, a suitable source of current 55, a conductor 56, a switch 57 whose operation will be described hereinafter, a conductor 58, the blower motor 10, a conductor 59, the binding post 48, the bar 47, and the contact element 49. This circuit is controlled both by the position of the bar 47, and the switch 57. A second circuit related to the first comprises the source of current 55, a conductor 61, a thermostatic switch 62, a conductor 63, the pump motor 23, the conductor 58, the switch 57, and the conductor 56. This circuit is controlled both by the switch 57 and by the thermostatic switch 62.

The operation of the switch 57 is controlled by apparatus aforementioned, which occupies a position in the pipe line 15, this apparatus being shown in detail in Fig. 3. The apparatus comprises a casing 65, into the upper part of which that portion of the pipe 15 which attaches to the bowl 2 projects, the pipe 15 continuing from the lower part of the opposite end of the casing, as clearly illustrated. That portion of the pipe 15 extending from the bowl 2 is adapted to discharge into a container 66 pivotally mounted within the casing 65 upon a shaft 67 which is journaled in and projects through the side of the casing 65 and which has fixed to its outwardly projecting end an arm 68 having adjustably secured thereto a weight 69. This weight tends to maintain the container 66 in the elevated position, in which it is shown in Fig. 3. The container 66 is provided at the bottom with one or more discharge apertures 71 from which the liquid fuel which may pass through the pipe 15 to the container may discharge into the bottom of the casing 65, from whence it passes off through that portion of the pipe 15 which connects with the reservoir.

The shaft 67 is also provided on the outside of the casing with a second arm 72 which carries a contact element 73, which when in contact with elements 74, 74, connects the conductors 56 and 58, the contact elements 73 and 74 constituting the aforementioned switch 57.

The weight 69 is such and so positioned

upon the arms 68 that it will maintain the container 66 in the elevated position until a predetermined quantity of the liquid fuel has collected in the latter. When the amount of fuel reaches this point, the container will be depressed, and the consequent rocking of the shaft 67 will carry the arm 72 downwardly and open the switch 57 by breaking the contact between the elements 73 and 74, 74. A latch 75 pivoted at 76 to the outside of the casing 65 is normally supported in an inclined position by the arm 72, and is adapted when the arm 72 is carried downward in the manner described to fall by gravity into a substantially vertical position, so that its lower end will abut the end of the arm 72 and prevent return of the container to the elevated position.

The aperture 71 while sufficiently large to permit any normal return flow of oil from the bowl 2 to the reservoir to pass therethrough without accumulating in the container, is not sufficiently large to handle a large flow of oil such as might occur upon the starting of the pump motor at some time when the pilot light from the gas line 25 has been extinguished, or in the absence of other provision for igniting the burning mixture.

Normally, provision for the lighting of the oil and air mixture in the bowl is provided by means of a flame projected into the bowl from the gas line 25. In this line 25 is provided a valve 78 which in its normal closed position permits only sufficient gas to pass into the pipe 25 from the source, (which latter is not illustrated) to afford a pilot flame at the nozzle 26. This valve 78 is illustrated in detail in Fig. 2, in which it is shown in the normal position. Gas enters the valve casing through the pipe 79, and is for the most part blocked by the valve 81, which normally is held to its seat by a spring 82 in the valve casing. The valve 81, however, is provided with one or more recesses 83 which permit a limited amount of gas to pass the valve even when seated, and this small amount of gas passing to the nozzle 26 through the pipe 25 provides for maintaining a small pilot light at the nozzle.

The valve stem 84 of the valve 81 projects downwardly through the bottom of the valve casing and overlies an arm 85 pivotally mounted at 86 on a suitable support or standard 87, said arm being held by means of a spring 88 against a cam member 89 fixed to the piston rod 34, this rod being supported in the guide 87 and in a second guide 91. The arm 85 and the cam 89 are so formed that when the rod 34 is advanced under the action of the piston in the cylinder, the arm 85 is elevated, which in turn lifts the valve 81 from its seat and permits the full flow of gas from the pipe 79 into the pipe 25, this full flow resulting in a

flame being projected from the nozzle 26 into the interior of the bowl 2. The arm 85 is also provided with a notch 92 which when the rod 34 advances to the end of the cylinder receives the edge of the cam 89 and permits the arm 85 to sink under the pressure of the spring 88 to an extent again seating the valve 81. Return movement of the rod 34 temporarily elevates the arm 85 and the valve 81 a second time, the arm moving downward and the valve closing when the rod 34 and the associated elements resume their normal positions illustrated in Fig. 2.

The operation of the device is as follows: Assuming that the temperature in the heated areas has fallen below that desired, there results a closing of the thermostatic switch 62. At the moment of the closing of this thermostatic switch, the parts are as illustrated in Fig. 2, the switch 47—48—49 being open and the switch 57 being closed by reason of the normal, elevated position of the container 66. The closing of the thermostatic switch 62 has the effect of closing the circuit of the pump motor, which latter actuates the pump 13 to force the liquid fuel from the reservoir through the pipe 12 and into the burner. The pressure in the pipe 12 due to the flow of oil has the effect through the pipe 31 of exerting a pressure against the piston 33, which moves the latter in the cylinder against the spring 36, and in such movement both closes the switch 47—48—49 and elevates the valve 81 from its seat. Closure of the switch 47—48—49 connects the blower motor with the source of current, and thereby effects a draft of air through the blower, while the elevation of the valve 81 projects a flame into the bowl 2 which ignites the mixture. Continued forward movement of the piston 33 brings the cam 89 under the recess 92 and thereby closes the valve 81. The burner is now in full operation, and this operation continues until such time as the thermostatic switch again operates to open the circuit of the pump motor. The shutting down of the pump effects an immediate decrease in pressure in the pipe line 12, and consequently relieves the pressure in that end of the cylinder which communicates with this pipe, and permits the spring 36 to force the piston back towards its normal position.

It is desirable that the return movement of the piston 33 be comparatively slow, and for this purpose I prefer to provide in the pipe 31 a suitable valve which while permitting free movement of the fluid through the pipe into the cylinder 30 acts as a partial check retarding the flow of the liquid from the container. This valve is designated by the reference numeral 93.

Return movement of the piston 33 under the action of the spring 36 has the effect, first, of re-opening the valve 81 and pro-

jecting a scavenging flame into the bowl 2, which has a tendency to burn up any oil or dregs that may have accumulated.

The collars 37 and 38 which engage the lever 39 are also so positioned and spaced as to provide for a partial movement of the piston in each direction before the switch 47—48—49 is operated. Accordingly, the blower continues to operate for a predetermined time after the pump has ceased to operate, and this continued blowing also assists in the scavenging operation. The switch 47—48—49, however, is eventually opened, with the result that the blower is shut down, and also the arm 85 by returning to its normal depressed position permits the seating of the valve 81.

The aforescribed switch 57 and the associated apparatus constitutes means for shutting down the pump motor if, in starting, the pilot light has been extinguished. Under these circumstances, the oil pumped into the bowl 2 will accumulate and will discharge through the pipe 15 into the container 66. The excessive flow of oil into the container gradually fills the latter in spite of the provision for the discharge made by the aperture 71, and when the container has accumulated a sufficient quantity of the oil, it moves downwardly, thereby opening the switch 57 in the manner previously described. At the same time, the arm 75 swings to a position preventing the return or upward movement of the container 66, thereby preventing re-closing of the pump motor circuit until such time as the member 75 is manually displaced, the pilot light being, of course, first re-lighted.

The connection of one end of the cylinder 30 with the drain pipe 15 provides for the discharge from the cylinder of any oil which may leak past the piston 33.

I claim:

1. In a liquid fuel burner, the combination with a combustion chamber, of a pump for forcing liquid fuel into said chamber, means for actuating the pump, a blower for creating a draft of air through the combustion chamber, motor means for operating the blower, a cylinder connected with the pump, a piston adapted to be advanced in the cylinder by pressure developed by the pump, control means for the blower motor operatively connected with the piston and adapted when the piston advances in the cylinder to actuate the motor, a gas line comprising a nozzle adapted to project a flame into the combustion chamber, and a valve adapted when seated to permit a limited amount of gas to pass to the nozzle for a pilot light, said valve being operatively connected with the said piston whereby when the piston advances in the cylinder the valve is opened to permit a full flow of gas to the nozzle.

2. In a liquid fuel burner, the combination with a combustion chamber, of a pump for feeding fuel to the said chamber, a blower adapted to create a draft of air through the combustion chamber, motor means for operating the blower, a cylinder connected with the pump, a piston adapted to be advanced in the cylinder under pressure developed by said pump, means for returning the piston to the normal retracted position when the said pressure is relieved, a control device for the blower motor operatively connected with the piston and adapted when the piston is advanced to actuate the motor and when the piston is retracted to interrupt the operation of said motor, a gas line comprising a nozzle adapted to project a flame into the combustion chamber, a valve in said gas line adapted when seated to permit a limited amount of gas to pass to the nozzle for a pilot light, and means interconnecting the valve and said piston whereby when the piston advances and returns in the cylinder the valve is unseated, and means for effecting a re-seating of the valve when the piston reaches the extreme advanced position in the cylinder.

3. In a liquid fuel burner, the combination with a combustion chamber, of a pump for forcing liquid fuel into said chamber, an electric motor for actuating the pump, a blower for creating a draft of air through the combustion chamber, an electric motor for operating the blower, a cylinder connected with the pump, a piston adapted to be advanced in the cylinder by pressure developed during the operation of the pump, a gas line comprising a nozzle adapted to project a flame into the combustion chamber, a valve adapted when seated to permit a limited amount of gas to pass to the nozzle for a pilot light, a switch controlling the flow of current to the blower motor operatively associated with the piston and

adapted to be closed when the piston advances in the cylinder and to be opened by a return movement of the piston, a spring for returning the piston to its normal position when the pressure in the cylinder is relieved by interruption in the operation of the pump, and a mechanical connection between the said plunger and the said nozzle controlling valve including a cam whereby the opening of the valve to permit a full flow of gas to the nozzle is accurately controlled when respect to the starting and stopping of said blower motor.

4. In a liquid fuel burner, the combination with a combustion chamber, of a pump for forcing liquid fuel into said chamber, an electric motor for actuating the pump, a blower for creating a draft of air through the combustion chamber, an electric motor for operating the blower, a cylinder connected with the pump, a piston adapted to be advanced in the cylinder by pressure developed when the pump is operated, a switch controlling the blower motor adapted for actuation by movement of the said piston, a gas line including a nozzle adapted to project a flame into the combustion chamber, a valve adapted when seated to permit a limited amount of gas to pass to the nozzle for a pilot light, and means operatively connecting the piston with the said valve whereby the valve is opened to permit a full flow of gas to the nozzle during both the advance and return movement of the piston, means whereby when the piston is fully advanced and retracted the said valve is permitted to close, and means for delaying the closing of the switch controlling the blower motor during a substantial portion of the return movement of the piston during which time the said valve is in the open position permitting a scavenging flame to enter the combustion chamber.

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