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OIL BURNER SYSTEM

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Fig. 1

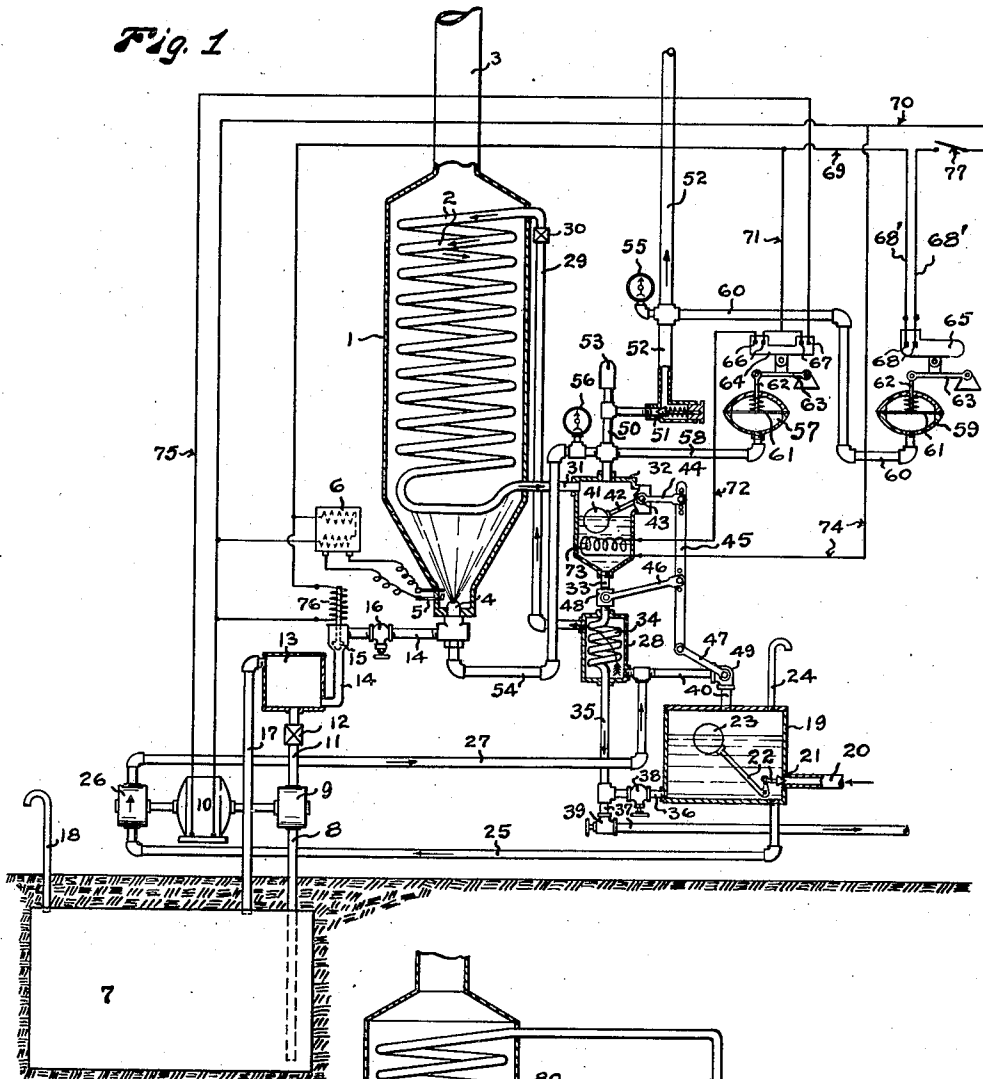
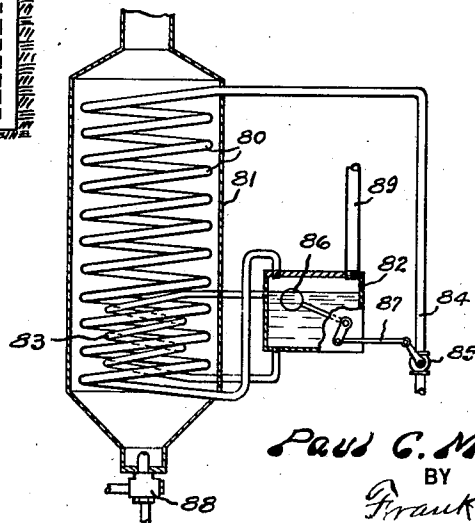


Fig. 2



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OIL BURNER SYSTEM

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My invention relates to improvements in oil or hydrocarbon fuel burning apparatus and the object of my invention is to improve the construction and arrangement of oil burning apparatus used in connection with boilers of the semi-flash type and to render the same more efficient and safer in operation.

Another object is to provide improved automatic feed water controlling means for apparatus of this type, said controlling means embodying devices governed by the moisture content in the discharging steam for regulating the feed of water to the boiler.

A further object is to provide improved, pressure operated, electrical controlling devices for automatically starting and stopping the operation of the oil burning apparatus and to provide improved oil supply means for insuring a readily accessible supply of oil at all times and for preventing an accidental gravity discharge of oil from the oil burner nozzle when the fire is extinguished.

Another object is to provide apparatus of this nature which may be used as a continuously operating non-scaling evaporator for separating liquids, as salt water.

Other and more specific objects will be apparent from the following description taken in connection with the accompanying drawings.

In the drawings Fig. 1 is a somewhat schematic view partly in elevation and partly in section of oil burner apparatus constructed in accordance with my invention.

Fig. 2 is a similar view illustrating a modified form of the invention.

Referring to the drawings, throughout which like reference numerals designate like parts, 1 designates a boiler housing of the flash or semi-flash type and 2 is a water or steam coil which is disposed within said housing 1 in such a manner as to best utilize the heat within the housing for heating the water in the coil. The housing 1 preferably converges at both the top and bottom ends. A smoke pipe 3 is connected with the top end of the housing 1 and an oil burner nozzle 4 of the siphon type is connected with and extends into the bottom end of the

boiler housing in such a manner as to spray liquid hydrocarbon fuel into said housing. Jump spark ignitor means 5 extends within the housing 1 just above the burner nozzle and is connected with a high tension transformer coil 6 as more fully hereinafter explained so that it will deliver a spark into the housing 1 at all times when the burner nozzle is in operation to insure combustion and prevent the burner flame from being extinguished.

The oil supply means, shown at the left in the drawings, comprises a main oil supply tank 7 connected by a pipe 8 with a pump 9 that is driven by a motor 10. Another pipe 11 having a check valve 12 therein connects the pump 9 with a smaller oil tank 13, hereinafter termed a starting chamber. The starting chamber is located just below the level of the burner nozzle 4 and is connected with said burner nozzle by a rim of pipe 14 having an electromagnetically controlled automatic valve 15 and a manually controlled regulator valve 16 interposed therein. This arrangement makes it possible to pump oil into the starting chamber 13 and to easily draw said oil by suction from the starting chamber to the oil burner nozzle 4 but makes it impossible for the oil to flow by gravity from the starting chamber to the burner nozzle and thus flood the combustion chamber of the boiler. An overflow pipe 17 connects the upper portion of the starting chamber 13 with the main supply tank 7 and a vent pipe 18 of the usual form is provided in the supply tank 7.

The water supply means embodies a main supply tank 19 connected with a water inlet pipe 20 through which water may be introduced under pressure. A valve 21 connected by suitable link and lever means 22 with a float 23 is provided for shutting off the supply of water through the pipe 20 and maintaining a substantially constant water level in the tank 19, the arrangement being similar to that commonly employed in flush tanks. An air vent pipe 24 is provided in the top of the water supply tank 19 to insure atmospheric pressure in the top of said tank at all times. A water draw off pipe 25 connects the

bottom of the tank 19 with a water pump 26 which is driven by the motor 10. The pump 26 is connected by a pipe 27 with the bottom end of a pre-heating chamber 28. The upper
 5 end of the pre-heating chamber 28 is connected by a pipe 29 with the water coil 2. A check valve 30 is provided in the pipe 29 to permit water to flow from the pipe 29 to the coil 2 but to prevent a flow of water in the
 10 reverse direction. In this way a flow of water is produced in the coil from the upper end downwardly in the opposite direction to the flow usually induced in such coils by heating. This has the advantage of bringing the colder
 15 water into the top of the boiler and causing such water to be heated gradually as it moves downwardly making it possible to form steam at the discharge end of the coil 2.

The lower end of the pre-heater 28 is connected by pipes 40 with the upper end of the water supply pipe 19.

The lower or discharge end of the coil 2 is connected by a pipe 31 with the upper end of a steam receptacle and water trap 32. The
 25 lower end of the steam receptacle and water trap 32 is connected by a pipe 33 with the top end of a coil 34 in the pre-heater 28 and the bottom end of the coil 34 is connected by a pipe 35 with two other pipes 36 and 37 that
 30 are provided with shut off valves 38 and 39 respectively.

It will be noted that the lower portion of the coil 2 is below the point of connection of the pipe 31 with the tank 32 thus forming a
 35 trap in which there will always be retained some water for starting purposes. The pipe 36 is connected with the water storage tank 19 and the pipe 37 may discharge into any suitable sewer or drain. Within the priming
 40 chamber 32 is a float 41 which is connected with a lever arm 42 that is mounted on a pivot 43. Another lever arm 44, external to the chamber 32 is secured to pivot 43 and has its outer end adjustably connected with a vertical
 45 link 45. The link 45 is connected by levers 46 and 47 with valves 48 and 49 respectively in the respective pipes 33 and 40. As the float 41 rises in the chamber 32 the link 45 will be moved downward and will tend
 50 to open the valves 48 and 49 a greater amount thus draining off more water from the chamber 32 and at the same time by-passing more water from the pump 26 back to the supply tank 19 thereby reducing the flow of water
 55 in the coil 2 and causing the steam to come through into the chamber 32 in a drier condition and carrying less water with it. In this way the control afforded by the float 41 automatically regulates or determines the
 60 moisture content of the steam that issues from the coil 2 and the moisture content of the steam, by varying the position of the float 41 regulates the supply of water that is fed to the coil 2, it being necessary for the successful
 65 operation of this control that the steam that

enters the chamber 32 shall carry with it some water which will be deposited in the chamber 32.

The major portion of the steam that enters the chamber 32 passes out through a pipe
 70 50 past a regulating valve 51 and off through a service pipe 52 to any place where said steam may be used. A safety valve 53 may be provided in the pipe 50 between the chamber 32 and the regulator valve 51. The steam
 75 necessary for the operation of the burner nozzle 4 is taken off from the pipe 50, or from the upper end of the chamber 32, through a pipe 54. Suitable pressure gauges 55 and 56 are preferably provided in connection with the respective pipes 52 and 54.
 80 The regulator valve 51 maintains enough pressure on the side of the steam line on which the burner nozzle 4 is located for the successful and efficient operation of said
 85 burner nozzle.

A pressure operated, automatic switch embodying a housing 57 is connected by a pipe 58 with the pipe 50 that communicates with the chamber 32 and another pressure operated
 90 automatic switch embodying a housing 59 is connected by a pipe 60 with the steam conduit pipe 52. The housings 57 and 59 each have a diaphragm 61 connected by a stem 62 with a lever arm 63 that is external
 95 the housing. Mercury switches 64 and 65 respectively are mounted on the lever arms 63 in well known manner so that tilting of said lever arms in one direction or another by movement of the diaphragm will open
 100 or close certain electric circuits as hereinafter described. The switch 64 is provided with two sets of switch terminals 66 and 67, one set of which will always be electrically connected and the other set electrically dis-
 105 connected. The switch 65 has only one set of terminals 68 which may be in either the open or closed position, depending on the position of the arm 63. The terminals 68 are connected by wires 68' with one wire 69 of
 110 a power circuit, the other wire of said power circuit being designated by the numeral 70. One of the terminals of each of the sets 66 and 67 is connected by a wire 71 with the main circuit wire 69, the other of the ter-
 115 minals 66 is connected by a wire 72 with a heating element 73 in a chamber 32, the circuit from heating element 73 to wire 70 being completed by wire 74. The other terminal of set 67 is connected by wire 75 with
 120 the motor 10. The two terminals 66 thus control the flow of current to the heating element 73 by which the necessary steam for initially starting the heating system is generated.
 125

The spark coil 6 is connected directly between the two main circuit wires 69 and 70 so that, at any time current is allowed to flow through said main circuit wires, the coil 6
 130 will be energized and caused to produce a

spark between ignitor terminals 5. An electromagnet coil 76 that controls the opening of the fuel supply valve 15 between the small fuel tank 13 and the burner nozzle 4 is electrically connected between main circuit wires 69 and 70 so that whenever these circuit wires are energized the valve 15 will be open. The valve 15 will preferably be closed with a spring when coil 76 is de-energized. A switch 77 may be provided in the main circuit wires 69 and 70 for manually opening and closing the main circuit.

The operation of this apparatus is as follows:

When the burner is not in operation the pressure against the lower sides of the diaphragms 61 in the pressure actuated switches 57 and 59 will be relieved and the circuits through the terminal set 66 and the terminal set 68 will be closed. If, when this condition exists, the switch 77 is closed, a circuit will be established between the main circuit wires through wire 71, terminals 66, wire 72, heating element 73 and wire 74 thereby heating the element 73 and producing steam in the chamber 32. This steam will not have pressure enough to open the valve 51 but will pass through the pipe 54 to the burner nozzle 4 drawing oil by induced suction from the starting oil chamber 13 and spraying the oil and steam into the combustion chamber of the boiler 1 where it will be ignited by the spark from the ignitor terminals 5, it being apparent that the closing of the switch 77 when the switch 68 is closed will instantly energize the spark coil 6 and the valve control solenoid coil 76. The combustion, thus produced within the boiler 1 will heat the water in the trap formed at the bottom of the coil 2 thus quickly producing steam, which steam will be delivered into the chamber 32, raising the steam pressure therein a sufficient amount to lift the diaphragm 61 of the pressure operated circuit controller 57 enough to break the circuit between terminals 66 and close the circuit between terminals 67. This cuts out the starting coil or element 73 and cuts in the motor 10, pumping oil into the chamber 13 and establishing a circulation of water through pipe 25, pump 26, pipe 27, preheating chamber 28, and pipe 29 to coil 2. This puts the apparatus into normal operation causing wet steam to be delivered at normal pressure into the chamber 32. The major portion of this steam will pass outwardly through the service pipe 52 and the apparatus will continue to function in the manner described as long as only the required amount of steam is delivered to the service pipe 52. If an excess amount of steam is delivered to the service pipe 52 the pressure in said pipe will rise and the excess pressure communicated through pipe 60 to the chamber below the diaphragm 61 in the housing 59 will raise said diaphragm and break the circuit through

the terminals 68 thus automatically shutting off the electric current and causing the entire apparatus to cease operation until the steam pressure in the service pipe drops, whereupon the lowering of pressure against the diaphragm 61 in housing 59 will cause the circuit between terminals 68 to again be closed putting the apparatus back into operation. If the steam pressure in the chamber 32 has been lowered enough to break the circuit through terminals 66 then the heating element 73 will again be energized and the apparatus will go through the cycle hereinbefore described in coming back to a fully operative condition, the trap at the bottom of coil 2 always retaining enough water to generate the necessary steam pressure for closing switch 67, but if the circuit through the terminals 67 has not been broken then the apparatus will resume normal operation without the use of the heating element 73. Obviously the switch 59—65 may be arranged so as to permit any desired fall in pressure between the time of the opening and subsequent closing of the circuit through terminals 68.

The use of the chamber 32 is essential to the successful operation of the system and it is essential to the operation of the chamber 32 that the steam be wet and carry over enough moisture to keep the water up to the required level in the chamber 32. The float control connected with the valves 48 and 49 keeps a substantially constant water level in the chamber 32 during normal operation of the apparatus and also serves to regulate the amount of water that is fed through the coil 2. It is thus seen that the wetness or amount of water that is carried over by the steam into chamber 32 is used to regulate the supply of water to the coil 2, the water supply being reduced as the steam becomes wetter and being increased as the steam becomes drier.

The starting oil chamber 13 is below the level of the oil burner nozzle 4 thereby making it impossible for oil to flow by gravity out of the burner nozzle. The return pipe 17 and vent pipe 18 insure atmospheric pressure within the chamber 13 at all times. The starting chamber 13 will always carry sufficient oil to put the burner apparatus into normal operation when starting the same, it being necessary, in starting to generate enough steam pressure to throw the pressure operated switch 57—64 and start the motor 10 before the oil and water pumps will be put into operation. The starting chamber 13 being only a short distance below the level of the burner nozzle overcomes the danger of flooding incident to a gravity flow of oil and yet permits the oil to be very readily drawn, by suction, to the nozzle 4.

In the ordinary operation of this apparatus the overflow water from the chamber 32 will be returned to the tank 19 through pipe

33, coil 34, and pipes 35 and 36. The heat in the overflow water is thus practically all conserved and used to warm the feed water in the preheating chamber 28 and tank 19. If the overflow water is impure or undesirable for any reason it may be discharged through the pipe 37. If, for instance salt water, as ocean water, is introduced into the heating coils, the steam taken off through the pipe 52 may be condensed as fresh, distilled water and the brine water discharged through the pipe 37. The device thus serves as a continuously operating condenser that will not scale or become clogged by the residue from the condensation processes.

In Fig. 2 I have shown a modification of the invention in which the feed of water to a steam coil 80 in a boiler housing 81 is controlled by the moisture content in the steam delivered by said steam coil into a separator tank 82 and in which the excess moisture from the separator tank 82 is disposed of by evaporation in a small coil 83 disposed within the boiler housing 81. In this form of apparatus the water supply tank may be eliminated and water under pressure introduced to the top of the coil 80 directly through a pipe 84 in which is provided a valve 85 that is operated by a float 86 in the tank 82 through the intermediacy of suitable links and levers 87. An oil burner 88 is provided at the bottom of the boiler housing 81 and a steam delivery pipe 89 is connected with the tank 82. The controls described in connection with Fig. 1 may be used in connection with this form of apparatus. It will be noted that the lower portion of the coil 80 is below the point of connection of said coil with the tank 82 whereby a water trap will be formed to insure sufficient water for starting purposes.

The operation of the device shown in Fig. 2 is similar to the operation of the device hereinbefore described in connection with Fig. 1.

What I claim is:

1. In apparatus of the class described, a boiler, a steam coil in said boiler, an oil burner nozzle for spraying fuel into said boiler, a receptacle forming a water trap in the discharge line from said steam coil, conduit means connecting said nozzle with the upper portion of said receptacle, an electric heating element in said receptacle for generating steam therein for starting the burner and automatic means for cutting out said electric heating element in response to a rise in the steam pressure within said receptacle.

2. In apparatus of the class described, a boiler, a steam coil in said boiler, means for supplying water to said steam coil, a receptacle forming a water trap in the discharge line from said steam coil, an oil burner nozzle extending into said boiler, a steam conduit connecting the upper end of said receptacle

with said burner nozzle, a service outlet conduit connected with the upper end of said receptacle, a pressure regulator valve in said service outlet conduit, means for generating steam in said receptacle for starting the operation of said burner nozzle, and devices for rendering said steam generating starter means inoperative as the steam pressure in said receptacle increases.

3. In apparatus of the class described, a boiler, a steam coil in said boiler, means for supplying water to said steam coil, a receptacle forming a water trap in the discharge line from said steam coil, an oil burner nozzle extending into said boiler, a steam conduit connecting the upper end of said receptacle with said burner nozzle, a service outlet conduit connected with the upper end of said receptacle, a pressure regulator valve in said service outlet conduit, a heating element in said receptacle, electric circuits connected with said heating elements, and pressure operated switch means for opening the circuits to said heating element in response to a rise of steam pressure in said receptacle.

4. In apparatus of the class described, a boiler, a steam coil in said boiler, means for supplying water to said steam coil, a receptacle forming a water trap in the discharge line from said steam coil, an oil burner nozzle extending into said boiler, a steam conduit connecting the upper end of said receptacle with said burner nozzle, a service outlet conduit connected with the upper end of said receptacle, a pressure regulator valve in said service outlet conduit, an electric heating element in said receptacle, an electric circuit connected with said heating element, means operated by excess steam pressure beyond said regulator valve for breaking the circuit to said heating element, and means for closing the circuit to said heating elements in response to low pressure in said receptacle and for breaking the circuit to said heating element in response to higher pressure in said receptacle.

5. In oil burner apparatus, a boiler, a steam coil in said boiler, means for supplying water to said steam coil, a pump in said water supply means, a motor for driving said pump, a receptacle connected with the steam discharge end of said steam coil and forming a water trap, an electric heating coil in said receptacle for generating steam for starting purposes, an oil burner nozzle in the furnace, a conduit connecting the upper end of said receptacle with said oil burner nozzle, electric circuits connected with said motor and said heating element and pressure operated means for closing the circuit to said heating element when the pressure in said receptacle is lowered and for breaking the circuit to said heating element and closing the circuit to said motor when the pressure

in said receptacle exceeds a predetermined amount.

5 6. In oil burner apparatus, a boiler, a steam coil in said boiler, means for supplying water to said steam coil, a pump in said
10 water supply means, a motor for driving said pump, a receptacle connected with the steam discharge end of said steam coil and forming a water trap, an electric heating coil in said
15 receptacle for generating steam for starting purposes an oil burner nozzle, oil supply means connected with said oil burner nozzle, a conduit connecting the upper end of said receptacle with said oil burner nozzle, a
20 steam service pipe connected with said receptacle and having a pressure regulating valve therein, electric circuits connected with said motor and said heating element and pressure operated means for closing the circuit to said heating element when the steam pressure in said receptacle is lowered below a
25 predetermined amount and for breaking the circuit to said heating element and closing the circuit to said motor when the pressure in said receptacle exceeds a predetermined amount.

7. In apparatus of the class described, a boiler, a steam coil in said boiler, a separator tank, means for supplying water to the upper end of said steam coil, the other end of said steam coil communicating with said separator tank, another coil in said boiler, the ends of which communicate with said separator tank, a steam delivery outlet in
35 said separator tank, water actuated control means operative by the amount of water delivered into said separator tank, devices operatively connected with said control means and governing the supply of water to said first named steam coil and means for heating said two coils.

8. Apparatus of the class described, embodying a heating surface element formed as a continuous conduit, means for admitting water into one end of said continuous
45 conduit, a separator tank adapted to receive steam and water from the other end of said continuous conduit, another heating surface element connected below the top of said separator tank and arranged to evaporate the water delivered into said tank, and means for controlling the water admitted into said first heating surface element by said evaporation of said water delivered into said tank,
50 and means for heating said two heating surface elements.

In witness whereof I hereunto subscribe my name this 28th day of February, A. D. 1928.

60 PAUL C. MULLIGAN.