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PROCESS AND APPARATUS FOR HEAT GENERATION OF SPRAY

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Fig. 1.

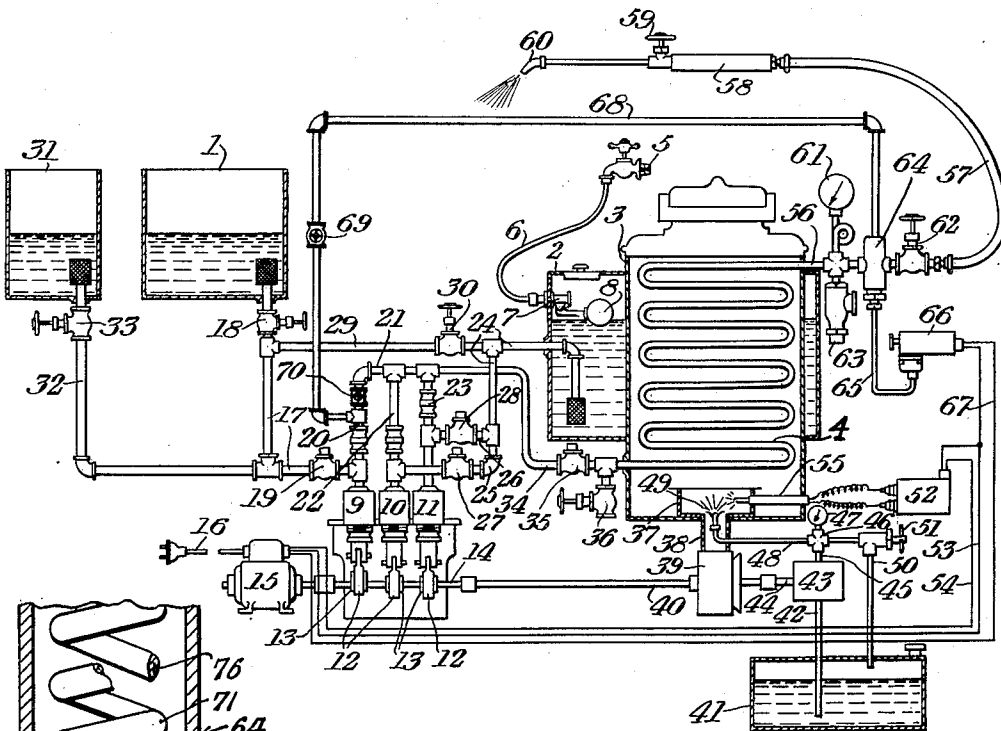
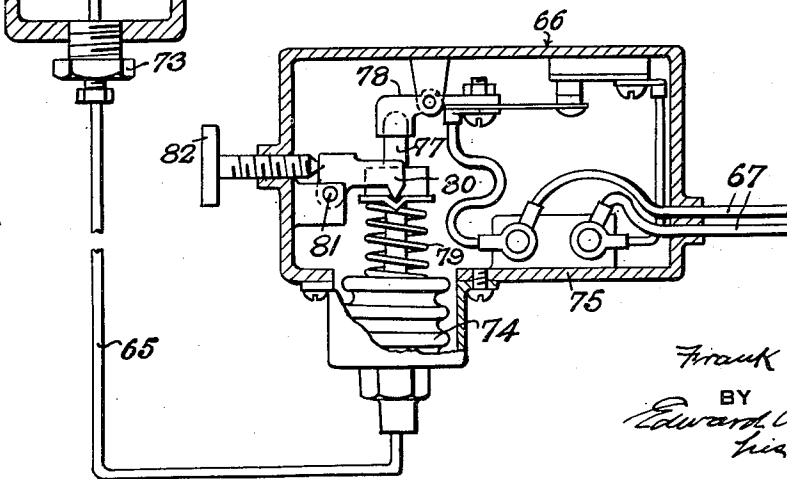


Fig. 2.



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PROCESS AND APPARATUS FOR HEAT GENERATION OF SPRAY

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My invention relates to the generation of spray by heat, such as for instance as a spray of a chemical solution for removing old paint from or cleaning surfaces of accumulated dirt and grime, or a spray of chemicals, oils or other fluids for treating vegetation.

One of the objects which I have in view is the supply of constant proportions of water and another liquid, such for instance as a chemical solution, at a constant rate to the heating zone of the apparatus.

Another object in view is the provision of a more compact and more easily portable and handled mechanism for the purposes described without reducing the effective output capacity of the same.

Another object which I have in view is the provision of a constant water supply and the use of the same as a jacket for the heating coil, thus rendering unnecessary the provision of insulation for the heating zone and insuring a constant temperature for the latter.

Another object in view is the provision of means for supplying exactly the required quantities and proportions of water and the other liquid to the heating zone of the apparatus regardless of the static head of liquids in the tanks.

Other objects will appear from the following description.

In the accompanying drawing, wherein I have illustrated a practical embodiment of the principles of my invention, Fig. 1 shows diagrammatically a spray apparatus in which a metered amount of liquid is supplied to the heating zone and a metered amount of fuel is supplied to the heating zone, and the same so proportioned that a mixture of the liquid and the vapor of said liquid is the product of the apparatus.

Fig. 2 is a view in elevation of the control means shown in Fig. 1 wherein parts are shown in section, and parts are broken away.

Referring to the drawing, 1 represents a tank to contain the chemical solution or other liquid to be mixed with the water, and 2 represents the water tank which, in the embodiment illustrated, is of annular form and serves as a water jacket for the casing 3 of the heating-coil 4.

The solution is poured into the tank 1 while the water tank 2 is of the constant level type being supplied from a water-service valve 5 or other convenient source through a flexible tube or hose 6 which connects to a valve connection 7 extending through the wall of the tank 2 adjacent its top and which is controlled by the float

mechanism 8. Thus the water in tank 2 is kept at constant level.

9, 10 and 11 represent three pumps of the piston type assembled in parallelism into a unit and having their pistons coupled to straps 12 which ride on the cam disks 13 carried by the drive shaft 14 of an electric motor or other source of rotative power 15. The motor is supplied with electric current by means of the cable 16 which may be plugged into a suitable supply of electricity.

The bottom of the tank 1 is connected to the pump 9 by the pipe 17 provided with a stop valve 18 adjacent to the tank. The pipe 17 is provided with a check valve 19 arranged to open toward the pump, thus preventing return of the solution to the tank during the discharge strokes of the pump 9.

The discharge of the pump 9 is connected by the pipe 20 to the header pipe 21 to which the discharge of the pumps 10 and 11 are also connected by the pipes 22 and 23, respectively. The pumps 10 and 11 are supplied with water from the tank 2 by means of the pipe 24 whose branches 25 and 26 are connected to the pipes 22 and 23, respectively. 27 and 28 represent check valves in the pipes 25 and 26, respectively, which prevent the return of water to the tank 2 during the discharge strokes of the pumps 10 and 11. The contents of the tanks are at atmospheric pressure.

The pipe 24 is also connected by the pipe 29 to the pipe 17 below the valve 18, said pipe 29 being provided with a stop valve 30.

Thus by closing the valve 18 and opening the valve 30 the pump 9 may be used to pump water. By closing the valve 30 and opening the valve 18, the pump 9 will pump solution from the tank 1.

It is sometimes necessary to substitute one solution for the other and even possibly to furnish two solutions simultaneously to the pump 9. Thus I provide a second solution tank 31 connected by a pipe 32 to the pipe 17, and I provide the pipe 32 with a stop valve 33 so that the solution from tank 31 may be supplied to the pump or cut off therefrom as may be desired.

The header 21 is connected by a pipe 34 to the lower end of the heating-coil 4 in the casing 3, a check valve 35, arranged to open toward the coil being interposed in pipe 34. The pipe 34 is also provided with a drain valve 36 to drain the coil when desired.

The coil 4 is enclosed in the tubular casing 3 whose top and bottom are closed.

In the center bottom of the casing 3 is mounted the burner assembly. Thus 37 is a circular open top fire pot into the center of which leads the air-duct 38 whose lower end is connected to the rotary blower 39 whose driving shaft 40 is coupled to the shaft 14.

41 represents a fuel oil tank mounted below the casing 3 into which extends the intake pipe 42 of the rotary fuel pump 43 whose shaft 44 is coupled to the shaft 40. The pump 43 is of the positive displacement type and meters the quantity of fuel delivered thereby.

The discharge pipe 45 of the fuel pump 43 extends upwardly to a four-way connection 46 to which is connected the gauge 47. The burner pipe 48 leads from the connection 46 through the wall of the duct 38 and is provided within the latter with an inwardly directed pressure atomizing spray nozzle 49. 50 represents a return drain for excess oil from the burner pipe 48 to the tank 41 and is provided with a manual set oil pressure control valve 51.

The motor is operated at constant speed and fuel is fed to the burner at constant pressure, and it is evident that while the motor is operating the quantity and rate at which the solution and also the water are supplied to the coil 4, and the quantity and rate of air and fuel supplied to the burner assembly remain unchanged. Thus the amount of liquid pumped to the heating coil is proportioned to the amount of fuel fed to the burner.

52 represents an induction coil which is supplied with current by the conductors 53 and 54, and 55 is a spark plug connected to the coil and extending through the side of the casing 3 and the wall of the fire pot 37 adjacent the nozzle 49, thus maintaining ignition of the fuel mixture.

The upper end of the coil 4 is connected to a lead off pipe 56 which is in turn connected, as by the flexible hose 57 to the spray gun 58 provided with a valve 59 and a discharge nozzle 60.

The pipe 56 is provided with a gauge 61, a stop valve 62 and a pressure relief valve 63.

A thermostatic element is enclosed in a manifold 64 which is interposed in the pipe 56. Thermostatic elements of this type are well known in the art and the same per se is not the subject matter of this invention. In this thermostatic element, shown in detail in Fig. 2, 71 represents a tube which is closed at one end thereof and may be conveniently shaped in a spiral as illustrated in the drawing. The other end of the tube is connected, as shown at 72, to the pipe 65 which passes through the stuffing box 73 in the bottom wall of the manifold 64 and is connected at its other end to the bellows 74 in the lower end of the casing 75 of the manually adjustable control switch 66.

The tube 71 is flattened as indicated at 76 which provides a Bourdon tube that expands and contracts with pressure.

The tube 71, the pipe 65 and the bellows 74 are filled with a fluid that expands and contracts in response to temperature variations.

The tube 71 is exposed to the mixture in the manifold 64 and the walls of this tube may be compressed inwardly with increased pressure, thereby forcing the fluid to expand the bellows 74 regardless of the temperature of the mixture.

The liquid in the tube 71, being affected by the temperature of the mixture in the manifold 64, will also expand upon the increase in tempera-

ture causing the bellows 74 to expand regardless of the pressure within the manifold 64.

The expansion of the bellows 74 moves the link 77 upwardly, operating the contact arm 78 which opens the motor circuit represented by the wires 67 thereby stopping the motor 15. The spring 79 is held between the bellows 74 and the block 80 which is pivoted as shown at 81. The thumb screw 82 is arranged to bear against the block 80 to provide an adjustment of the effective pressure of the spring 79 on the bellows 74. This adjustment obviously provides variations in the operation of the device in response to different temperatures or pressures that may be selected as the operating conditions of the spraying machine.

The arrangement is such that when the temperature in the manifold 64 exceeds the maximum to which the thermostatic element is adjusted, the motor circuit is interrupted and the solution and water pumps, the blower and the fuel pump are stopped. This results in a fall in temperature in the manifold 64 causing the thermostatic element to again contract, closing the control switch and starting the solution and water pumps, the blower and the fuel pumps. The fuel mixture is then ignited in the burner by the constantly operating spark plug.

It is evident that the closing of the valve 59 at the gun 58 will, owing to the stoppage of the outflow of hot liquids from the coil 4, result in a rise in temperature in the manifold 64, thus causing the control switch 66 to open and stop the motor. Again the opening of the valve 59 will result in the flow of the hot fluids from the coil, thus reducing the temperature in the manifold, causing the thermostatic element to contract and closing the control valve, thus starting the motor, the solution and water pumps, the blower and the fuel pump, and thus again supplying the hot fluids to the nozzle.

In the drawing I have shown the pump 9, the intake of which is connected to the solution tank 1, having its discharge connected up in such a manner that the solution may be shunted around the heating zone of the apparatus and may be discharged into the outlet conduit of the apparatus, thus, as for instance, into the pipe 56.

Thus I show a pipe 68 connected to the pipe 20 and extending across to be connected with the pipe 56 at the discharge end of the heating coil. Thus I have shown the pipe 68 connected to the manifold 64.

The pipe 68 is provided with a shut-off valve 69 and the pipe 20 is provided with a valve 70 between its connection with the pipe 68 and its connection with the header 21.

Thus the discharge of the solution pump 9 may be shunted around the heating zone or fed to the heating zone, as may be desired, without altering the proportion of the several liquids in the apparatus, and the result at the nozzle would be the same in either case.

Although for the sake of clearness in disclosing the principles of my process, I have described the apparatus illustrated in the drawing, it will be understood that various other means and instrumentalities may be employed in connection with my process without departing from the scope of my present invention.

I claim:—

1. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of a plurality of tanks for storing liquids, a heating coil, positive dis-

placement means for supplying a plurality of liquids to the coil from said tanks in predetermined amounts, and other positive displacement means for supplying fuel to said coil for heating said liquids, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying said liquids as to produce a predetermined ratio between the elements of the mixture.

2. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of a plurality of tanks for storing liquids, a heating coil, positive displacement means for supplying a plurality of liquids to the coil from said tanks in predetermined amounts, other positive displacement means for supplying fuel to said coil for heating said liquids, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying said liquids as to produce a predetermined ratio between the elements of the mixture, and means actuated by the mixture prior to its discharge as a spray for controlling the operation of all of said supply means.

3. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of a positive displacement pump for supplying a predetermined amount of one liquid to said apparatus, a second positive displacement pump for supplying a predetermined amount of another liquid to said apparatus, and a third positive displacement pump for supplying fuel to said apparatus for heating said liquids, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying said liquids as to produce a predetermined ratio between the elements of the mixture.

4. In apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of a plurality of liquid reservoirs, a positive displacement pump for supplying a predetermined amount of liquid from one reservoir to said apparatus, a second positive displacement pump for supplying a predetermined amount of liquid from a second reservoir to said apparatus, and a third positive displacement pump for supplying fuel from a third reservoir to said apparatus for heating said liquids, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying said liquids as to produce a predetermined ratio between the elements of the mixture.

5. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating said liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, and heat responsive means controlled by the temperature of the mixture prior to its discharge as a spray for controlling the operation of both the liquid supply means and the heating means.

6. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of a heating means, positive displacement means for supplying a predetermined amount of liquid to the inlet of said heating means, a second positive displacement

means for supplying a predetermined amount of liquid to the outlet of said heating means, and a third positive displacement means for supplying fuel to said apparatus for heating the liquid in said heating means, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying said liquids as to produce a predetermined ratio between the elements of the mixture prior to its discharge as a spray.

7. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, and means actuated by the temperature of the mixture prior to its discharge as a spray for simultaneously controlling the stopping and starting of said liquid and fuel supplying means.

8. In an apparatus for producing a spray composed of a mixture of a liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, and means actuated by the temperature and pressure of the mixture prior to its discharge as a spray for simultaneously controlling the stopping and starting of said liquid and fuel supplying means.

9. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, and means actuated by the temperature of the mixture prior to its discharge as a spray for controlling the pressure of said mixture.

10. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, and means actuated by the temperature of the mixture prior to its discharge as a spray for controlling the pressure of said mixture by simultaneously controlling the stopping and the starting of the supply of said liquid and said fuel to said apparatus.

11. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other posi-

tive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, valvular means for controlling the discharge of said spray, and means actuated by rise in the temperature of the mixture, due to the closing of said valvular means, prior to the discharge of the mixture as a spray for controlling the stopping of the supply of said liquid and fuel simultaneously to said apparatus.

12. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, valvular means for controlling the discharge of said spray, and means actuated by rise in the temperature of the mixture, due to the regulation of the discharge by said valvular means, prior to the discharge of the mixture as a spray to shut off the supply of the liquid and fuel for controlling the pressure of the heated mixture.

13. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, valvular means for controlling the discharge of said spray, and means actuated by rise in the temperature of the mixture, due to the closing of said valvular means, prior to the discharge of the mixture as a spray for controlling the stopping of the supply of said liquid and fuel simultaneously to said apparatus, said last mentioned means restoring the supply of the liquid and the fuel simultaneously to the apparatus in response to the opening of said valvular means.

14. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, valvular means for controlling the discharge of said spray, and means actuated by rise in the temperature of the mixture, due to the regulation of the discharge by said valvular means, prior to the discharge of the mixture as a spray to shut off the supply of the liquid and fuel for controlling the pressure of the mixture, said last mentioned means restoring the supply of the liquid and the fuel to the apparatus when the temperature drops below a predetermined degree.

15. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, electrical means for operating both of said above mentioned means, and means actuated by the temperature of the mixture prior to its discharge as a spray for controlling the operation of said electrical means.

16. In an apparatus for producing a spray composed of a mixture of liquid, and a vapor of a liquid, the combination of positive displacement means for supplying a predetermined amount of liquid to said apparatus, other positive displacement means for supplying fuel to said apparatus for heating the liquid, said fuel supply means being constructed to supply fuel at a rate so correlated with the rate of supplying liquid as to produce a predetermined ratio between the elements of the mixture, electrical means for operating both of said above mentioned means, and means actuated by the pressure of the mixture prior to its discharge as a spray for controlling the operation of said electrical means.

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