

Aug. 14, 1962

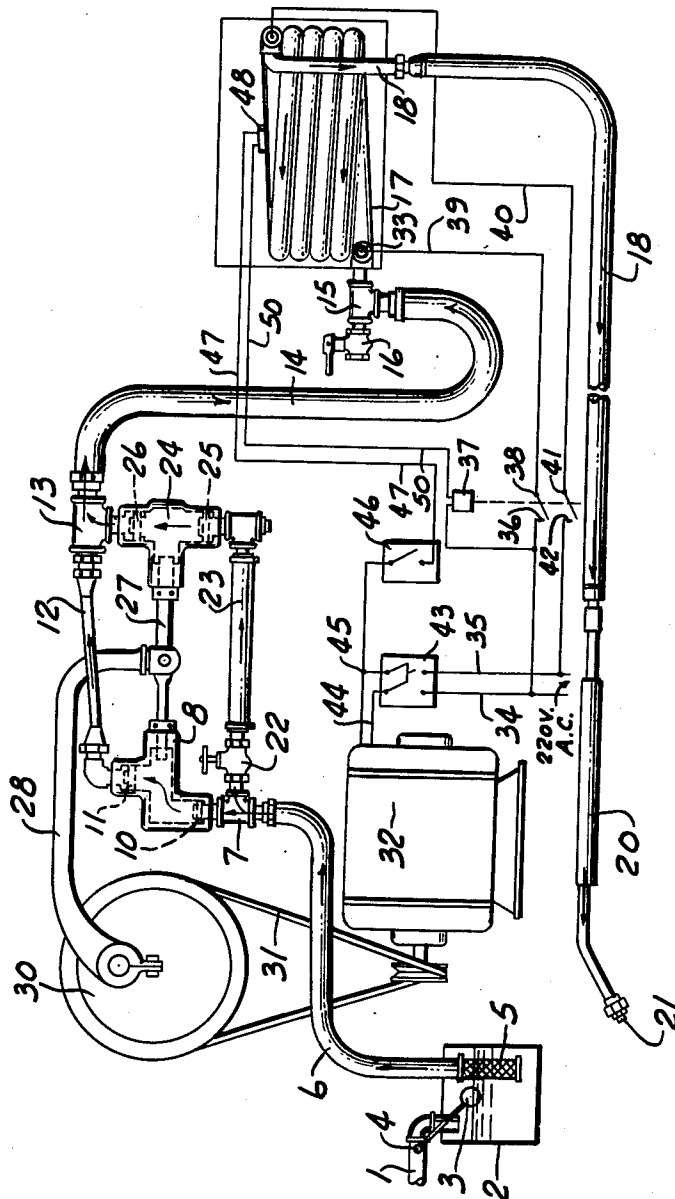
D. M. SIMMONS, JR  
DUAL PHASE SPRAY GENERATOR

3,049,302

Filed March 18, 1960

5 Sheets-Sheet 1

Fig. 1



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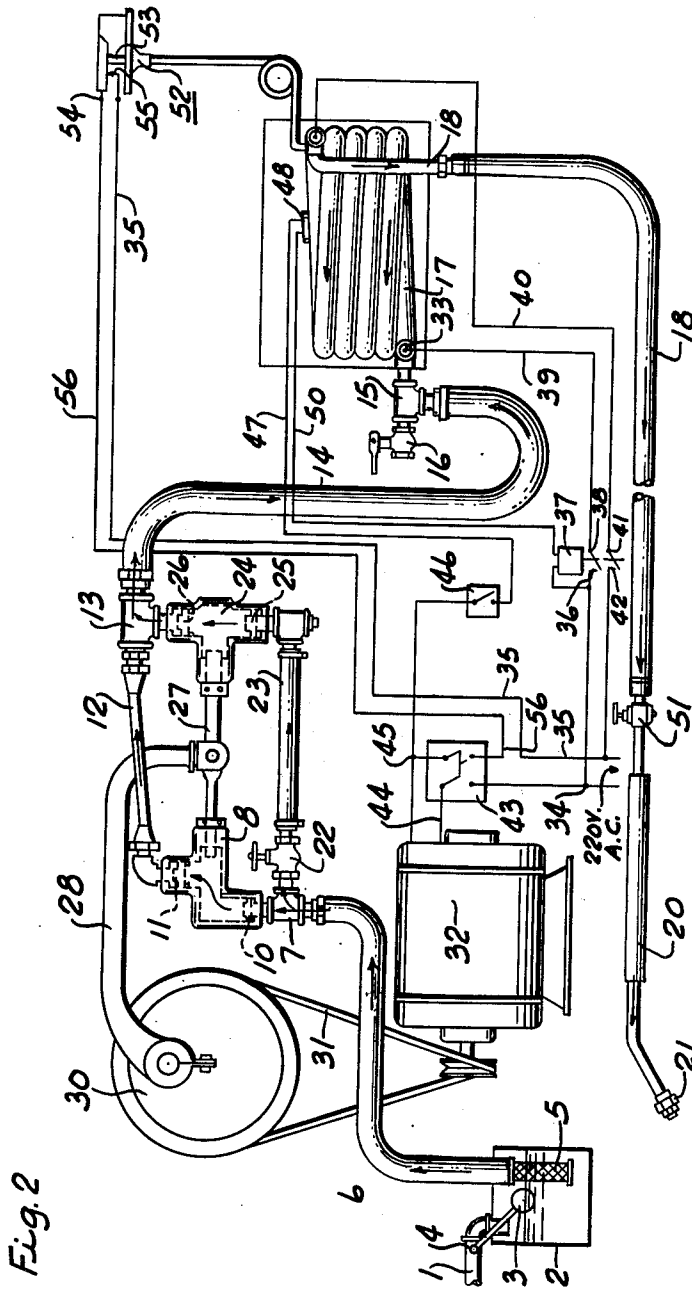
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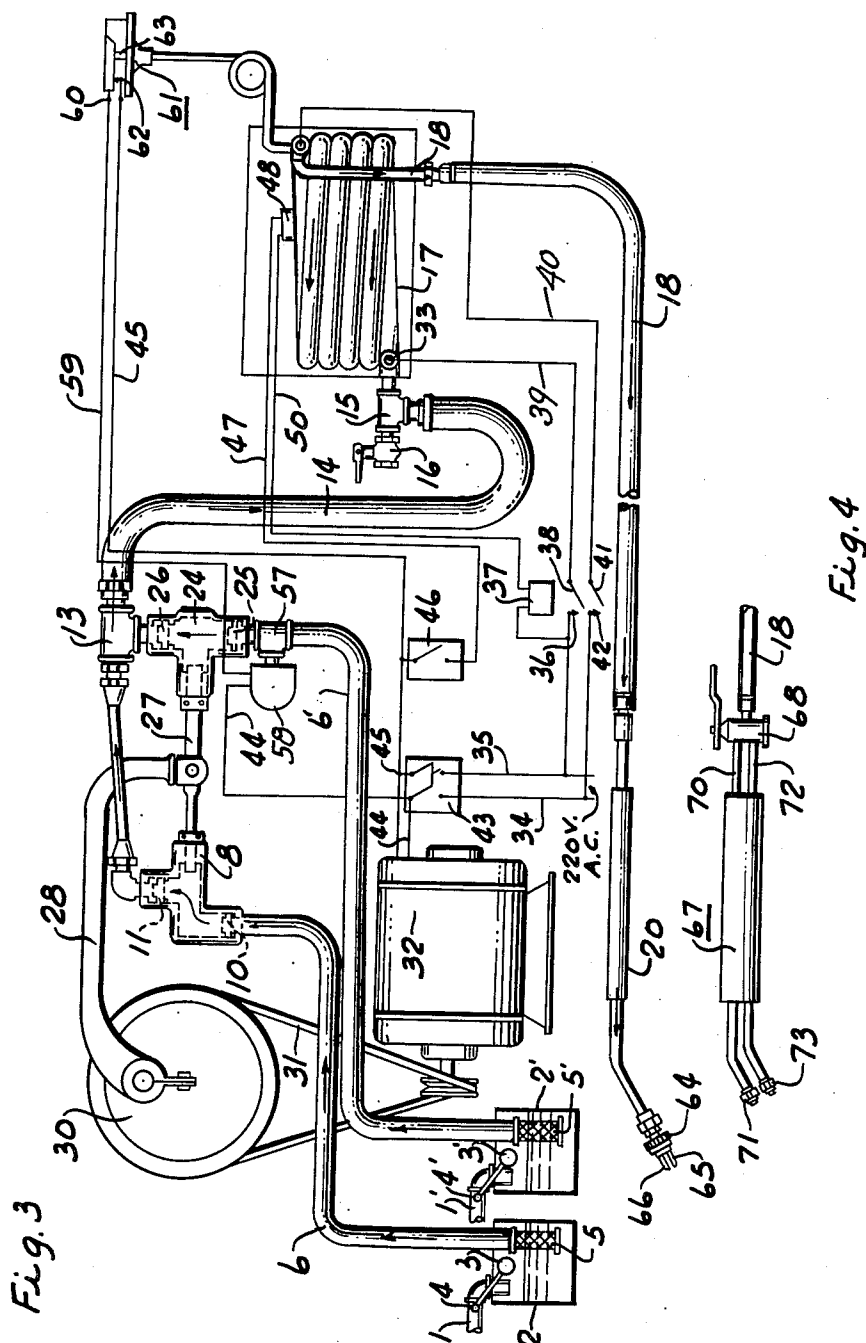
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5 Sheets-Sheet 3



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DUAL PHASE SPRAY GENERATOR

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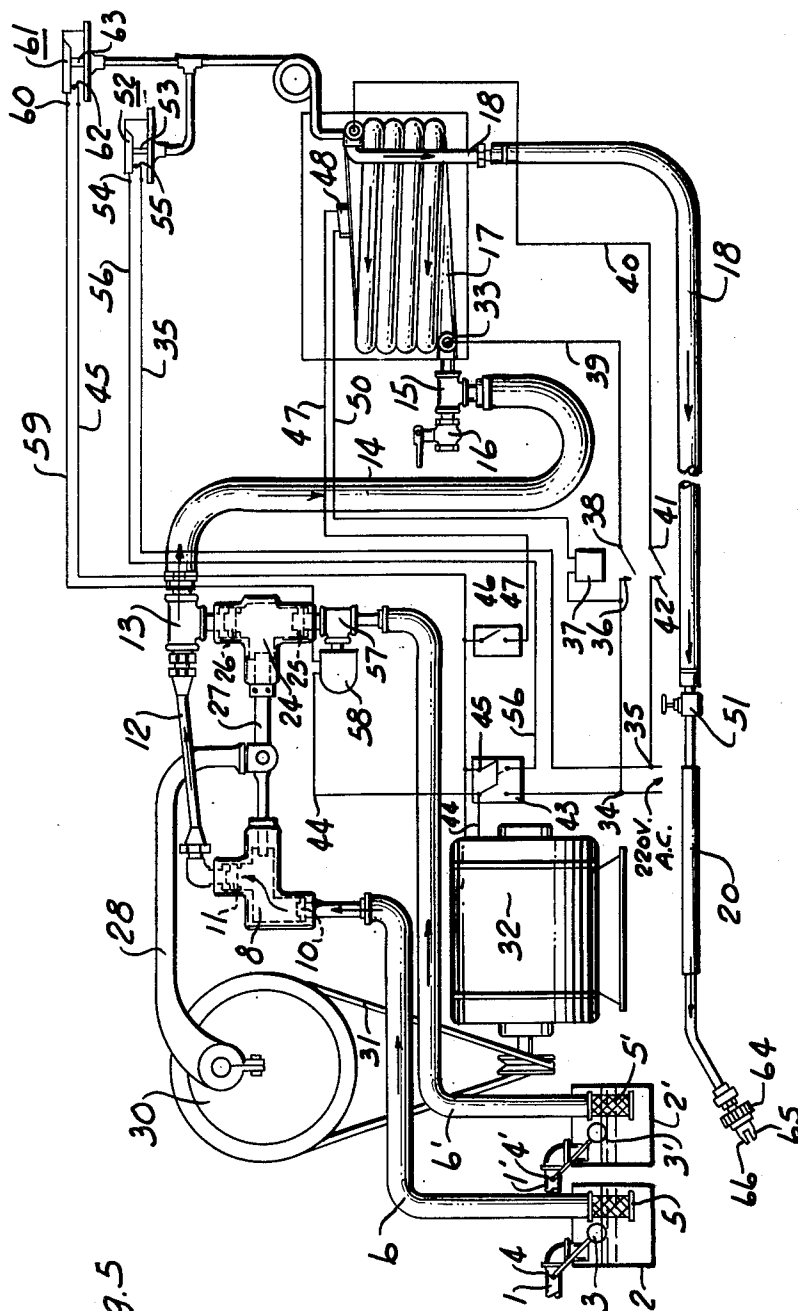


Fig. 5

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DUAL PHASE SPRAY GENERATOR

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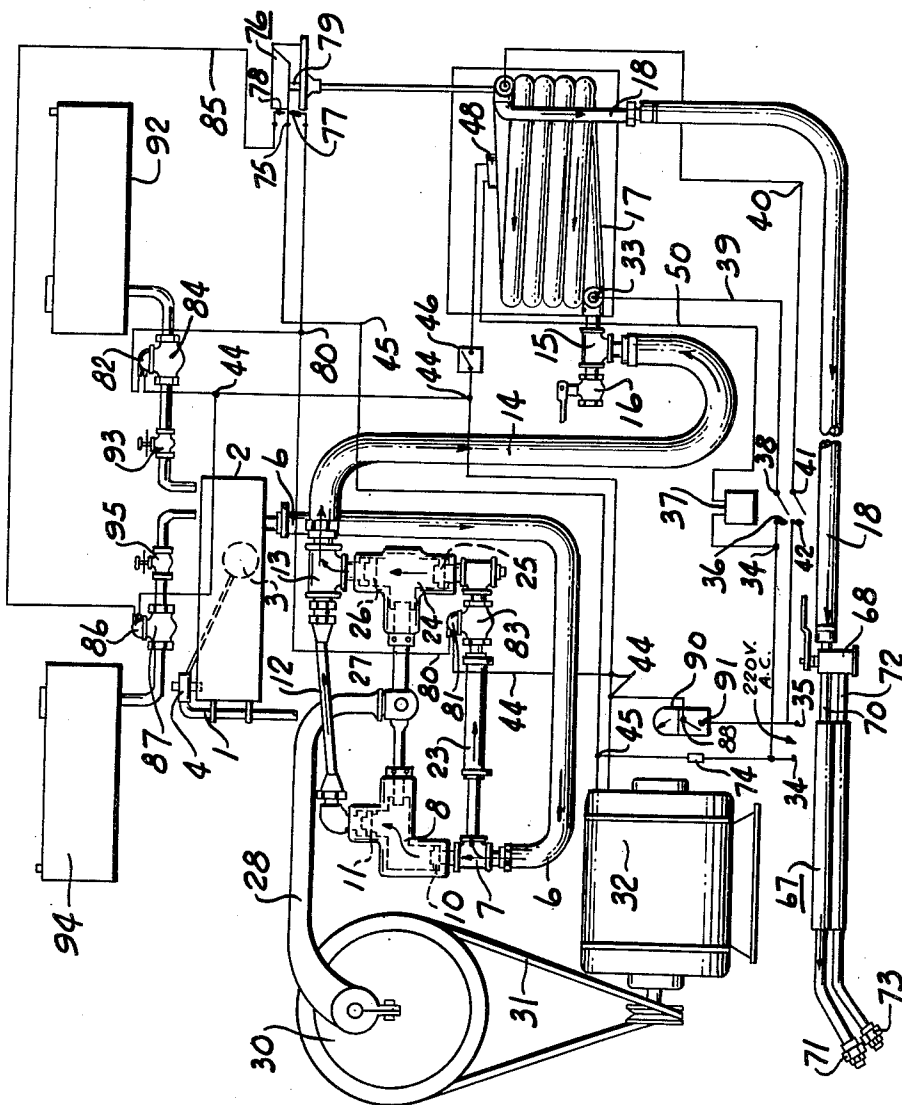


Fig. 6

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1

3,049,302

## DUAL PHASE SPRAY GENERATOR

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10 Claims. (Cl. 239-75)

This invention relates generally to spray apparatus and more particularly to a spray washing unit that is provided with low and high pressure spray phases and the method of utilizing the same.

The present invention provides low and high pressure spray phases, along with regulated supply of liquid and heat to accomplish, economically four ends: (1) car washing with warm water plus special cleaning solution at about two hundred and fifty pounds pressure to remove road dirt without injuring paint, (2) clean foreign matter from engines, chassis, and wheels, with increased pressure, less liquid, greater concentration of cleaning compound, and greater heat under carefully selected proportions to avoid vapor nuisances, (3) back-flushing of cooling systems, (4) miscellaneous cleaning.

This invention provides a heating zone which is constantly supplied with a predetermined amount of heat and the variation between high and low pressure spray generation is obtained by changing the supply of liquid to the heating zone with its fixed supply of heat and controlling the discharge thereof to either produce in the solid phase a high pressure spray with less liquid at higher temperatures and a lower pressure spray with considerably more liquid or let us say, in the liquid phase and at a lower pressure and temperature. In order to perform these controls it is necessary to correlate the amount of liquid supplied in each instance, that is, for high or lower pressure spray production, to a heating zone that is supplied with a constant temperature and the discharge of course is controlled by a different orifice for each phase to obtain the desired pressures.

Another object of this invention is the provision of a control circuit to enable one to automatically transform the spray generator from a high pressure to a lower pressure producing spray by merely controlling either the orifice at the spray discharge or a control valve or the combination of both.

Another object of this invention is the provision of a control for completely interrupting the operation of the spray generator when the pressure or temperature rises to high or beyond a predetermined maximum.

Another object is the provision of a control system which will interrupt the operation of the spray generator by completely shutting off the discharge.

Another object of this invention is the provision of a control for use in the spray generator which will automatically switch the spray generator from a lower to a high pressure phase or vice versa with corresponding temperature changes, by the changing of the discharge orifice.

Another object of this invention is the provision of a control for a combination high and low pressure spray generator wherein a change in the orifice of the discharge will change the supply of liquid and thereby change the pressure and temperature characteristics of the spray or will completely shut down the spray if the discharge is closed.

Another object is the provision of a control for a combination high and low pressure spray generator wherein the change of the orifice of discharge will not only change the amount of liquid supplied to the heating zone but will also change the character of solution supplied to the heating zone and the operation of the same may be controlled by an electrically coin operated timer to pro-

2

vide an automatic do-it-yourself washing spray generator.

The spray generator disclosed herein is particularly advantageous for use in washing cars wherein it is desired to have a large quantity spray supply with a soap or detergent to wash the painted parts and windows and wheels of the automobile and wherein by merely closing the valves manually or automatically a lower volume and higher temperature and pressure spray is produced which is adapted for cleaning greasy and heavily encrusted parts of the automobile such as parts of the chassis and the engine block.

Another object is the provision of a method of utilizing this spray generator for the washing of automobile bodies, wheels and underparts of the chassis and engine block without spoiling the paint finish or removing the wax surface on the paint. This is accomplished by correlating the supply of liquid and heat to produce a liquid spray under sufficient pressure and containing a soap or detergent that will flow the dirt off the surface of wax finish without removing the wax and without the aid of a brush or scrubbing action which action usually scratches the finish. Brushing a dirty wax surface mechanically scours the wax away. This spray with compounds, when held close to the surface flows the dirt from the surface by the pressure of the controlled warm water. After the dirt is floated off the car is rinsed with water then dried. This complete process is accomplished by using a large volume of water such as eighty to ninety gallons per hour at two hundred and forty pounds pressure per square inch gauge and from twenty to thirty degrees F. temperature rise. To clean the engine block or chassis the water supply is reduced to approximately twenty-five gallons per hour at three hundred pounds pressure per square inch gauge and at a temperature rise of approximately one hundred degrees F. To change the correlated amount of liquid with the heat supplied one can change the speed of the pump or the throw of the piston to increase or decrease the supply of liquid and thus the temperature rise thereof. To change heat of the spray without changing the heat supplied to the heating zone one may recirculate the liquid to increase the heat rise.

Other objects and advantages of this invention appear hereinafter in the following description and claims.

The accompanying drawings show for the purpose of exemplification without limiting this invention or the claims thereto, certain practical embodiments illustrating the principles of this invention wherein:

FIG. 1 is a schematic view of the dual phase spray generator having a temperature control.

FIG. 2 is a schematic view of the dual phase spray generator having a temperature and pressure control with a valved discharge.

FIG. 3 is a schematic view of the dual phase spray generator having a temperature and pressure phase control together with a variable orifice.

FIG. 4 is a view of a substitute variable orifice discharge cleaning gun that may be substituted in the structure of FIG. 3.

FIG. 5 is a schematic view of the dual phase spray generator having a temperature and pressure control with a valved discharge together with a variable orifice and pressure phase control.

FIG. 6 is a schematic view of the dual phase spray generator having a temperature and pressure phase control together with a variable orifice and an automatic control of cleaning solution for each of the generator phases.

Referring to FIG. 1 the spray generator comprising this invention is provided with a liquid supply such as water as indicated at 1 which liquid is emptied into the tank 2, the level of which is controlled by the float 3 actuating the valve 4. A strainer 5 on the end of the suction line

6 is connected to the T 7 one branch of which is directly supplied to the pump 8 through its inlet valve 10 and its outlet valve 11 and through the discharge 12 from thence it travels through the T 13, the flexible connection 14, to the T 15 one side of which has a relief valve 16 connected thereto and the other side of the T is connected to the bottom of the heating coil 17. The discharge 18 is directed through the hose to the cleaning gun 20 from whence the spray emits from the orifice 21.

The other end of the T 7 is connected to the valve 22 and the line 23 to the pump 24 passing through its inlet valve 25 and its outlet valve 26 to the T 13 and thence travels through the flexible connection 14 with the output of the pump 8.

If the valve 22 is closed only the discharge of the pump 8 is supplied to the heater coil and thence to the cleaning gun 20 to discharge or if the valve is partially closed a regulation in the pressure and temperature may be made through the adjustment of this valve.

The pumps 8 and 24 are actuated by the same piston 27 which extends into both of the chambers of the pumps 8 and 24 and is driven by the reciprocating arm 28 connected to the crank 30 driven by the belt 31 from the motor 32.

The heating coil or heating zone 17 has a coaxial electric heater passing therethrough which heater is indicated at 33. The supply current which is indicated by the lines 34 and 35 is preferably 220 volts AC, the line 34 being connected to the first contact 36 of the relay 37, the heel 38 of which is connected by the line 39 to one end of the heater 33. The other end of the heater 33 is connected by the line 40 to the heel 41 of the relay 37 and thence through the front contact 42 to the line 35. Thus when the relay 37 is energized the heating zone 33 is connected across the line to supply a constant temperature to the heating zone 33. The lines 34 and 35 are also connected to the double pole switch 43, one side of which is connected by the line 44 to one side of the motor 32. The line 35 is connected through the switch 43 to the line 45 which supplies current to the opposite side of the motor 32. Thus when the switch 43 is closed the motor is supplied with energy and operates the pump to supply liquid to the heating zone 17.

The line 45 is also connected to the switch 46 the other side of which is connected by the line 47 to the thermostat control 48, the other side of which is connected by the line 50 to one side of the operating coil of the relay 37, the other side being connected directly to the line 34.

Thus when the switch 43 is closed the motor 32 is first energized to supply liquid to the heating zone and this switch must be closed before energy can be supplied through the switch 46 and the normally closed thermostat 48 in series with the operating coil of the relay 37. Thus the motor is in operation to supply liquid before the switch 36 is supplied with energy to energize the relay 37. When the relay 37 is energized, the front contacts 36 and 42 are closed to complete the electric circuit to the heater 33. In this way, the coil is supplied with liquid a short time before it is supplied with heat but if for any reason the temperature reaches a predetermined degree the normally closed bi-metal thermostat 48 will interrupt the circuit of the heater 33 by interrupting the energization of the operating coil of the relay 37 to open the front contacts 36 and 42.

The nozzle 21 of the gun 20 is selected so that it will operate efficiently regardless of whether the spray is a high pressure spray or a low pressure spray. If the valve 22 remains open allowing both the pumps 8 and 24 to operate the spray emitted from the nozzle 21 is of the low pressure and low temperature. If, however, the valve 22 is closed the pump 24 is taken out of service and only the pump 8 supplies a liquid to the heating zone 7. Thus a less amount of water is supplied to the same amount of heat which correlated proportions produce a spray of much higher pressure than within the latent heating zone

to properly clean the heavy parts of the car or other objects or to remove paint and the like. Thus by manually operating the valve 22 one is provided with a variation in the control of both phases that is the high temperature spray discharge in the latent heat zone or the low pressure and low temperature with increased volume of spray when the valve 22 is opened. By carefully watching the degree of the opening of the valve 22 one can make this apparatus very sensitive to the dual phases of high and low temperature or operation within the latent heat zone or solid phase zone respectively.

Referring to the structure shown in FIG. 2 the spray generator is just the same and functions in the same manner but in addition is provided with the control valve 51 between the discharge 18 and the gun 20. With this valve the operator can completely shut off the system. Under these conditions it is necessary to provide for the pressure switch 52 which has an actuator 53 that operates the heel contactor 54 to open the back contact 55 when the pressure reaches a predetermined amount such as 350 p.s.i.g. The back contact 55 is connected directly to the line 35 and the heel 54 is connected to the line 56 which is connected to the switch 43 which when closed connects the line 35 through the pressure switch through the line 45 as before. Thus upon the closing of the valve 51 the pump still operating and the heater still heating the liquid within the coil quickly builds up the pressure causing the pressure switch 52 to open thereby stopping the motor and interrupting the energy to the relay 37 to open the circuit to the heater 33. It is quite possible that the thermostat 48 might interrupt the heater circuit 33 before the pressure switch 52 depending upon the relative seating of these two instruments, namely the bi-metal thermostat 48 and the pressure switch 52.

Referring to FIG. 3 the structure and circuit are similar to that shown in FIG. 1 with the exception that an additional supply of liquid 1' is fed to the tank 2' in which a float control 3' actuates the valve 4' to control the level of the liquid in the tank 2' which supplies the strainer 5' and the suction hose 6' for supplying the liquid from the second tank directly to the solenoid control valve 57. From thence it flows into the pump 24 as previously described. The supply line 6 supplying liquid to the pump 8 as before. The solenoid valve 57 is a normally closed valve being opened by the solenoid indicated at 58 which is energized from the line 44 and the other side of which is connected by the line 59 to the heel 60 of the pressure switch 61 which is normally closed with its contact 62 and which may be open when the heating zone 17 reaches a predetermined pressure which in turn operates the actuator 63 to open the contact between 60 and 62 and thereby interrupt the operation of the solenoid 58. The back contact 62 is connected to the line 45.

This structure is also provided with an adjustable nozzle 64 which has two orifices 65 and 66 and by rotating the nozzle either orifice can be selected. It would be assumed that the orifice 65 is larger and that the switches 43 are closed to energize the solenoid 58 through the normally closed pressure control switch 61 so that liquid is drawn by pumps 8 and 24 from both tanks 2 and 2' and flows through the heating zone 17 which is maintained at a constant temperature and the discharge through the line 18, the gun 20 with the nozzle orifice 65. This provides the solid water phase of the spray at a lower temperature wherein either water or different solutions may be supplied in the tanks 2 and 2' and this spray would be normally used for cleaning painted surfaces and the like such as washing the exterior of a car. When the operator switches the nozzle 64 from the large nozzle 65 to the smaller orifice nozzle 66 a higher pressure developed in the heating zone 17 and the pressure switch 61 is caused to open the back contact 62 at a pressure substantially around 250 p.s.i.g. The opening of this contact interrupts the energy flowing through the solenoid 58 and thus closes the valve 57 that takes the pump 24 out of operation. The

5

spray then continues to operate through the pump 8 which is a lower volume of water at a higher temperature within the latent heat zone and produces a higher pressure through the smaller orifice nozzle 66 for the purpose of cleaning the engine block and other very hardened crusty surfaces or for removing paint. If the operator wishes to re-phase the generator he need only switch the orifices of the nozzle 64 to place the large orifice nozzle 65 in service and thus re-energize the solenoid 58 opening the valve 57 to restore the operation of the pump 24.

The structure of FIG. 4 is merely a different type of gun 67 to be used in conjunction with the gun 20 of FIG. 3 wherein the discharge line 18 is supplied to a valve 68 that has two positions. One delivering the discharge to the line 70 and the orifice 71 which is similar to the orifice 65 and the other position of the valve 68 delivering the discharge to the line 72 and thence to the nozzle 73 which is similar to the nozzle 66. Thus the structure of FIG. 4 is merely a substitute cleaning gun that employs a valve to switch nozzles rather than the nozzles themselves. When this gun is employed with the structure of FIG. 3 the same operation and control is realized by turning the valve 68 to select the different orifices. The valve 68 itself does not control the discharge.

Referring to FIG. 5 it will be seen that the structure of the circuit shown therein is merely a combination of the structure illustrated in FIGS. 2 and 3. Thus by employing the structure shown in FIG. 5 one is provided with two sources of liquid supply as indicated by the containers 2 and 2' and the pump 24 is controlled by the normally closed solenoid valve 57 which is opened when the solenoid 58 is energized and the pressure subjected to the pressure control switch 61 is no greater than let us say 250 p.s.i.g. Thus when the large orifice opening 65 is employed or the valve 55 is maintained open or sufficiently open to prevent the generation of a pressure higher than 250 p.s.i.g. in the heating zone 17 then the pump 24 continues to operate to maintain the spray generator in its solid phase operation.

If, however, the orifice 66 is placed in service its restriction will increase the pressure in the heating zone 17 to an amount greater than 250 p.s.i.g. which will open the back contact 62 deenergizing the solenoid 58 to close the valve 57 and thus interrupt the supply of liquid to the pump 24. Thus the pump 8 is the sole supply of liquid to the heating zone 17 which heats the same within the latent heat zone to develop a pressure higher than 250 p.s.i.g. and will properly operate through the nozzle 66 without increasing the pressure greater than 350 p.s.i.g. which let us assume is the operating pressure of the pressure control switch 52.

If the valve 51 is closed then the pressure in the heating zone 17 is increased greater than that of the setting of the pressure switch 52 which opens the back contact 55 and interrupts the operation of the motor 32 as well as the relay 37, the latter opening the electric circuit to the electric heater 33.

Thus with the variable orifice discharge nozzle 64 or with the spray gun 67 as shown in FIG. 4 in the circuit of FIG. 5 together with the valve 51 a complete control is provided for the spray generator.

Referring to FIG. 6 the motor 32 is supplied with current from the line 34 through the fuse 74 to the line 45. The line 45 is also connected to the heel 75 of the pressure switch 76 which has the normally closed back contact 77 and the open front contact 78 as actuated by the expanding member 79. The line 45 being connected to the heel 75 will supply current through the back contact 77 to the line 80 which supplies current to one side of the two solenoids 81 and 82. The solenoid 81 operates the valve 83 which is normally open when the solenoid is energized and the other side of the same is connected to the line 44.

The solenoid 82 actuates the valve 84 which is also normally open when the solenoid 82 is energized. The opposite side of the solenoid 82 is connected to the line 44.

6

The front contact 78 of the pressure control switch 76 connects the line 85 with one side of the solenoid 86 which operates the valve 87 which valve is also normally open when the solenoid 86 is energized. The opposite side of the solenoid 86 is likewise connected to the line 44. The line 34 is likewise connected to one side of the relay 37 which controls the supply of electric current to the heater 33 in the heating zone 17, and the other side of the relay 37 is connected by the line 50 to one side of the thermostat 48, the other side of which is connected to the line 44. Thus the line 44 might be considered as a return line for all of the control apparatus and the motor 32 which line is connected to the heel 88 of the coin meter timer 90, the front contact 91 of which is connected to the line 35. Thus when one places a coin in the coin meter timer 90 and sets the meter according to the coin deposited the contact 91 is closed with the heel 88 to operate the apparatus through the cycle of the timer and the operator has the same control through the valve 68 of the cleaning spray gun 67.

In this instance the controlled selection by the valve 68 does not merely control the operation of the pump 24 but also controls the character of solution emitted to the tank 2 for the selection of the nozzle 71 or 73 through the valve 68. Thus when a low pressure solid phase water spray is desired the nozzle 71 is selected which pressure control permits the energization of the solenoids 81 and 82 to permit the operation of the pump 84 by opening the valve 83 and admit a light solution from the tank 92 through the valve 84 upon the energization of the solenoid 82, the solution flowing through the metering valve 93 to the tank 2.

When the valve 68 of the gun 67 is turned to switch to the nozzle 73 the increased pressure in the heating zone 17 actuates the pressure control switch 76 to open the back contact 77 and close the front contact 78. The opening of the back contact 77 deenergizes the solenoids 81 and 82 thus closing the valve 83 and removing the pump 24 from service. The pump 3 continues to operate and the front contact 78 energizes the solenoid 86 to open the valve 87 and thus admit a strong solution from the tank 94 through the valve 87 and the metering valve 95 to the float valve tank 2. Thus the operator upon using the nozzle 73 to produce a high pressure spray generation within the latent heat zone employs a strong solution to remove the heavily encrusted dirt and grease from the machinery or to remove paint, the operation of the device being controlled by the timer 90. In this way, one may lease out the operation of the machine to those who wish to clean their own cars or apparatus by coin control without supervision of an operator which is a material advantage in this construction. The pressure control switch 52 could also be supplied to this circuit and placed between the line 44 and the contact 80 of the coin meter timer 90 as a factor of safety to prevent the disruption of the apparatus by overheating in case the liquid supply gave out or for some other unforeseen reason.

I claim:

1. A spray generator comprising a spray gun, a heating zone connected to feed fluid to said spray gun, a liquid supply, a motor and pump to feed liquid from said liquid supply to said heating zone, heater means to supply heat to said heating zone correlated with the supply of liquid, a control switch connected to supply current to said motor to operate said pump, a relay having front contacts connected to supply current to said heater when said relay is energized, a thermal switch responsive to the temperature of the liquid in the heating zone, a circuit connecting said relay and said thermal switch in series to the motor side of said control switch, a second pump operated by said motor to feed additional liquid to said heating zone, and a valve to control the flow of liquid to said second pump and thus to said heating zone.
2. The spray generator of claim 1 characterized by a

valve to control said spray gun, and a pressure control switch actuated by the pressure within said heating zone and having normally closed contacts connected between the current supply and said control switch to open the latter upon increased pressure in said heating zone.

3. The spray generator of claim 1 characterized in that said valve to control the flow of liquid to said second pump is electrically actuated, flow change means for said spray gun, and a pressure control switch actuated by said heating zone and having normally closed contacts connected between said electrically actuated valve and the motor side of said control switch to close said valve when said flow change means restricts the fluid flow to said gun.

4. The spray generator of claim 3 characterized in that said flow change means is an adjustable nozzle for low and high pressure flows.

5. The spray generator of claim 3 characterized in that said flow change means is a switch valve to alternately supply nozzles of different sized orifices.

6. The spray generator of claim 2 characterized in that said valve to control the flow of liquid to said second pump is electrically operated, and a second pressure control switch actuated by said heating zone and having normally closed contacts connected between said electrically actuated valve and the motor side of said control switch to close said electrically operated valve when the fluid flow through said gun is restricted by said control valve.

7. The spray generator of claim 6 characterized by an adjustable nozzle for said spray gun for low and high pressures.

8. The spray generator of claim 1 characterized in that said control switch is a timer switch and said valve to control the flow of liquid to said second pump is electrically operated and normally closed when deenergized, a second electrically operated normally closed valve to control the supply of weak solution to said liquid supply, a third electrically operated normally closed valve to control the supply of strong solution to said liquid supply, a pressure control switch actuated by the pressure within

said heating zone and having a normally closed back contact carried between the current supply and said first and second electrically operated valves and said timer switch to energize and open said electrically operated valves when the timer is closed, and a normally open front contact in said pressure control switch connected between the current supply and said third electrically actuated valve and said timer switch to energize and open said electrically operated valve when the timer is closed and high pressure conditions prevail in said heating zone.

9. The spray generator of claim 8 characterized by flow control means for said spray gun to change the pressure in said heating zone and temper the solutions accordingly.

10. A spray generator comprising a spray gun, a heating zone connected to feed fluid to said spray gun, a liquid supply, a motor and pump to feed liquid from said liquid supply to said heating zone, heating means to supply heat to said heating zone correlated with the supply of liquid to said heating zone, a control switch connected to supply current to said motor to operate said pump, electric control means for supplying current to said heating zone, a circuit connected from the motor side of said control switch to operate said electric control means, a second pump operated by said motor to feed additional liquid from said liquid supply to said heating zone, and a valve to control the flow of liquid from said liquid supply to said second pump.

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