

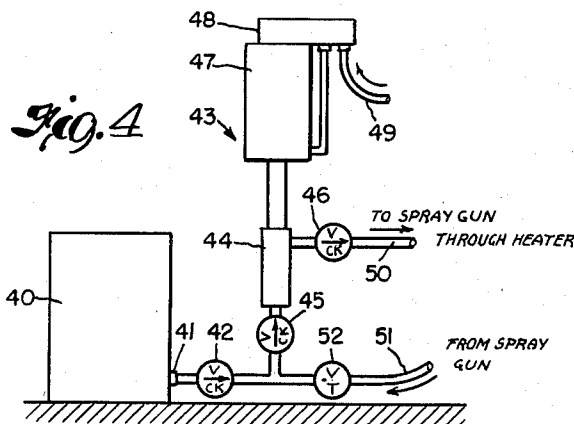
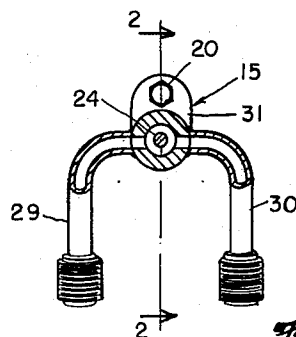
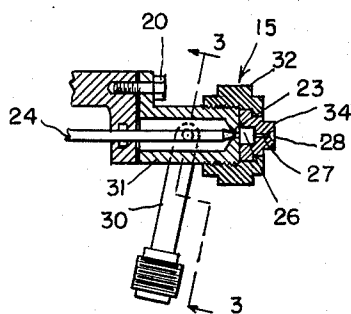
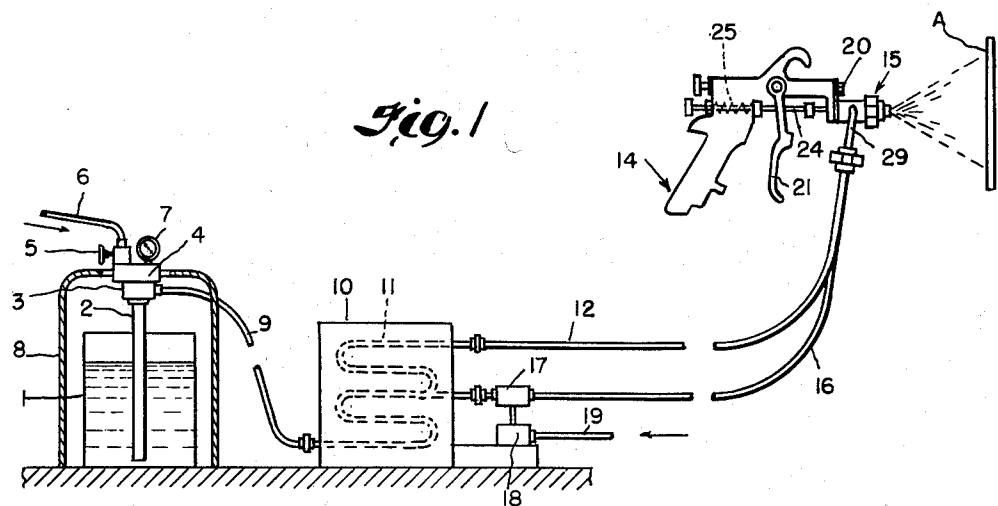
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PAINT HEATING AND CIRCULATING SYSTEM AND SPRAY DEVICE THEREFOR

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PAINT HEATING AND CIRCULATING SYSTEM
AND SPRAY DEVICE THEREFOR

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2 Claims. (Cl. 299—86)

The present invention relates generally as indicated to improvements in paint heating and circulating system and spray device therefor and more particularly to a system in which the paint is continuously circulated irrespective of whether or not the spray device is in use and to a spray device which is adapted to spray the paint without requiring air under pressure for atomization.

It is one object of this invention to provide a paint heating and circulating system which employs one pressure providing means for exerting high pressure on the paint effecting flow thereof from a reservoir and through a heat exchanger to a spray device and another pressure providing means for continuously recirculating the heated paint at least through the spray device and in addition, preferably through the heat exchanger for thereby agitating the paint to prevent settling of any of the ingredients thereof and maintaining the temperature thereof uniform.

It is another object of this invention to provide a paint heating and circulating system which employs a pressure providing means for exerting high pressure on the paint for effecting flow thereof from a reservoir and through a heat exchanger to a spray device and which has means for maintaining circulation of the heated paint without causing heating of the paint contained in the reservoir.

It is another object of this invention to provide an improved spraying device which includes a valve controlled nozzle to which and through which the heated paint under pressure is circulated, even when the valve is closed, so as to maintain said nozzle in a properly heated condition and to prevent clogging of the fine orifices therein.

Other objects and advantages of my invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings:

Fig. 1 is a diagrammatic view of one form paint heating and circulating system;

Fig. 2 is a cross-section view of the spray nozzle as taken substantially along the line 2—2, Fig. 3;

Fig. 3 is a cross-section view taken substantially along the lines 3—3, Fig. 2; and

Fig. 4 is a diagrammatic view of another form of paint heating and circulating system.

Referring now more particularly to the drawing and first to Fig. 1 thereof, the liquid coating composition such as lacquer, for example, which it is desired to heat and to spray is contained in a suitable reservoir or can 1 in which is immersed the suction pipe 2 of a main pump 3 which is preferably operated by an air motor 4. A suitable regulating valve 5 controls the pressure of the air

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from supply line 6 for operating said motor 4 whereby the composition will be discharged from the pump 3 at desired pressure, for example 300–600 p. s. i. Said pump 3 and air motor 4, including regulating valve 5 and pressure gauge 7 are connected together as a unit and are supported by legs 8 to position the bottom end of suction pipe 2 close to the bottom of reservoir 1.

The discharge port of said pump 3 has a conduit 9 connected thereto leading to the inlet of a heat exchanger 10 which may be of any desired form such as disclosed in my Patent 2,576,558 preferably including thermostat controlled electric heating means (not shown). Thus, as the coating composition flows through the coil 11 or equivalent passage forming means in the heat exchanger 10, the composition will be heated to a predetermined temperature. The heated coating composition then flows through the conduit 12 to a spray gun 14 equipped with a spray nozzle 15 and from said spray nozzle, another conduit 16 leads back to the heat exchanger 10. A circulating air-operated pump 17 is disposed between said heat exchanger 10 and said nozzle 15, said pump 17 being operated by the air motor 18 which has an air pressure supply line 19 connected thereto.

The main pump 3 is designed to exert a pressure of 300 to 600 pounds per square inch pressure on the coating composition; and, obviously, except for the circulating pump 17 when the spray nozzle 15 is closed, the desired discharge pressure as determined by valve 5 will be reached, whereupon said pump 3 will stall and no circulation of the heated composition will be effected. However, by providing the circulating pump 17, the heated coating composition may be continuously circulated even when said spray nozzle 15 is closed.

The spray nozzle 15 may be secured to a conventional spray gun 14 as by bolt 20. Said gun 14 is provided with hand operating lever 21 for opening and closing the discharge orifice 23 of said nozzle. Thus, when said operating lever 21 is moved toward the left as viewed in Fig. 1, the valve stem 24 will be pulled toward the left against the pressure exerted by spring 25 to thus unseat said valve stem so that the pressurized and heated coating composition can flow through the orifice 23 into an expansion chamber 26 and thence through another orifice 27 which terminates in a transverse groove 28 of desired shape so as to effect spraying of the heated composition in a desired pattern against the article A which is to be sprayed. Said nozzle 15 is provided with opposite downwardly curved tubular members 29 and 30 to which the conduits 12 and 16 respectively are connected.

In order to facilitate cleaning of the orifices 23 and 27 and chamber 26, said nozzle 15 is of multi-part construction including a body 31, a nut 32 threaded onto said body, and a spray tip 34 clamped against said body by said nut.

As evident, when the valve stem 24 is in seated position, the circulating pump 17 will continuously circulate the heated coating composition through said nozzle 15 and through said heat exchanger 10; and, if desired, the discharge port of said pump 17 may be connected to the inlet of said heating exchanger. Because the main pump 3 may be stalled but maintains a desired high pressure on the heated composition, the pump 17 will not cause the heated composition to flow back into the reservoir 1. Furthermore, even when the valve stem 24 is unseated, the rate of discharge of the heated composition through said nozzle 15 is usually so slight that it is yet necessary to continue to circulate the composition through said nozzle 15. Thus, the pump 17 continuously circulates the coating composition irrespective of whether the nozzle 15 is open or closed. As evident, said pump 17, while required to withstand the high pressure of the composition, need only create a few pounds per square inch

pressure differential for the desired rate of recirculation.

When the coating composition is lacquer or the like, the heating thereof in the heat exchanger 10 is such that the boiling point of the solvent is exceeded and the pressure exerted thereon well exceeds that which is required to maintain the solvent in liquid state. Thus, the composition is divided into fine particles as it passes through the nozzle 15 and when discharged from the nozzle, the particles are further sub-divided to form a fog-like atmosphere by the immediate transformation of a portion of the solvent to gaseous state. The sub-divided solvent containing particles are then directed against the article A to form a smooth, continuous film thereon and because of the absence of atomizing air and consequent turbulence, there is no necessity of providing a spray booth and there is no overspray. This "airless" atomization process for atomizing compositions having one or more solvents and involving heating of the composition to a temperature exceeding the boiling point of the solvent or of the lower boiling point solvent and forcing of the heated composition through a spray nozzle is fully described in my co-pending application Serial No. 184,092, filed September 9, 1950. The present system and nozzle may also be used to spray other types of coating compositions such as those containing pigments, vehicles, and driers and those containing vegetable oils, resins, driers, and thinners as well as coating compositions composed essentially of thermoplastic materials or of rubber, synthetic rubber, etc.

In my co-pending applications Serial Nos. 184,093 and 184,094, filed September 9, 1950, are disclosed processes for coating articles with organic coating compositions and with heat plasticizable materials respectively and in such processes, the present system and nozzle may be employed for the heating, circulation, and spraying of the coating materials.

With further reference to said nozzle 15, the heated coating composition in passing through orifice 23 into chamber 26 is broken up into fine particles which expand and sub-divide in such chamber and built up pressure therein for passage through orifice 27 and again there is an expansion and a still further sub-dividing of the particles. Accordingly, the particles deposited on article A are extremely small and actually the spray resembles a fog or mist which is directed at the article A without the usual impact and splattering encountered in spray painting with an air pressure atomizing system.

Referring now to the paint heating and circulating system illustrated in Fig. 4, there is included a paint container 40 having an outlet port 41 to which port the check valve 42 is connected. The air operated pumping unit which is operative to draw coating composition from the container 40 and through the check valve 42, is represented by the numeral 43, said unit comprising a reciprocating piston pump 44 provided with inlet and outlet check valves 45 and 46, an air motor 47 for operating said pump 44, and a four-way reversing valve 48 operated by the piston in said air motor to alternately direct air under pressure into opposite ends of said motor from the air pressure supply line 49. The piston pump 44 is of conventional form so arranged that during each stroke of the piston therein as reciprocated by the motor 47, coating composition is discharged through the check valve 46 and through the discharge hose 50. The discharge hose 50 corresponds with the hose 9 in Fig. 1 and is connected to a heat exchanger 10 and from said heat exchanger a hose is connected to the spray gun as illustrated in Fig. 1.

The return line for coating composition is denoted by the reference numeral 51, said return line having therein a needle valve 52 or the like which causes a pressure drop

in the system so as to maintain a circulation of the heated composition through the spray nozzle when the spray gun is not in use. Therefore, the coating composition in the container 40 is heated only as it is used so as to maintain the system filled and the heated composition is continuously circulated through the pump, both when the spray gun is in use and when the spray gun is not in use.

In the type of pump 44 shown herein, the delivery pressure is proportional to the pressure of the air supply, and without the needle valve 52 in the return line of an equivalent restriction or pressure drop device, the air motor 47 will stall and no circulation of the composition will be effected when the spray gun is closed. The needle valve 52, therefore, is a simple expedient for the establishment of a continuous circulation of the heated coating composition whether the spray gun be open or closed, since, in either case, there will be a sufficient pressure drop by the flow of the heated composition through the needle valve to enable operation of the pump 44 by the air motor 47.

In summary it will therefore be apparent that in both of the systems as illustrated in Figs. 1 and 4, there is maintained a continuous circulation of the heated coating composition through the spray nozzle without causing unnecessary heating and premature polymerization of the coating composition in the containers 1 and 40, and such circulation of the heated composition is maintained even when the spray gun is closed.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a heating and circulating system for coating composition, the combination of a reservoir for coating composition; a heat exchanger designed to heat the composition as it flows therethrough; a spray nozzle and means for opening and closing the same; an air motor operated-high pressure pump having intake and delivery ports, the former of which is in fluid communication with the composition in said reservoir; a power-operated recirculating pump having intake and delivery ports, and conduit means for conducting coating composition under high pressure from the delivery port of said high pressure pump through said heat exchanger to said spray nozzle for spraying when the latter is open, and for recirculating the coating composition through said recirculating pump, through said heat exchanger and through said spray nozzle when the latter is closed; said high pressure pump, when said spray nozzle is closed, maintaining the coating composition under high pressure on the delivery port side thereof without power consumption, while recirculation of the composition is effected by said recirculating pump with a power consumption only sufficient to overcome line losses of the composition as it is recirculated.

2. The system of claim 1 wherein said recirculating pump is operative to so recirculate the coating composition also when said spray nozzle is open.

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