Sept. 11, 1956 K. H. LIEDBERG 2,762,901

DEVICES FOR HOT SPRAYING OF MATERIALS

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Fig. 1

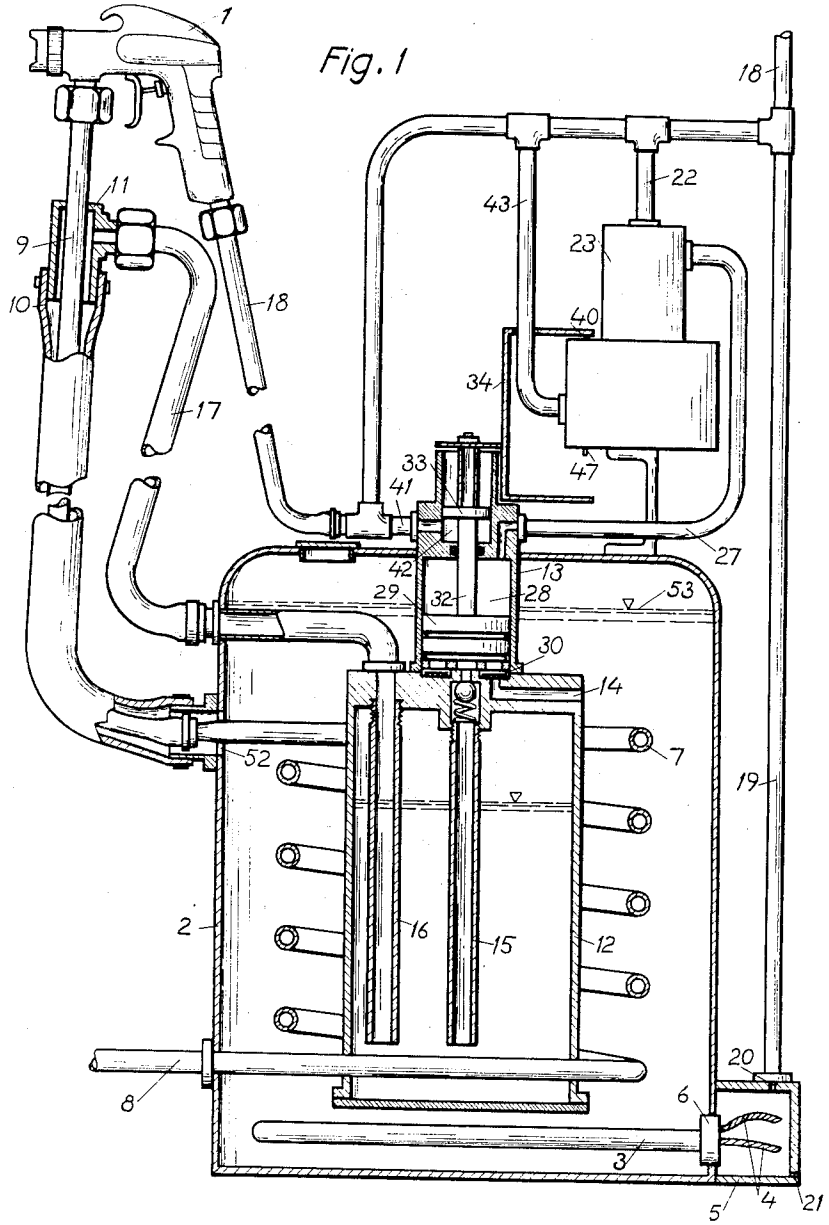

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Fig. 2

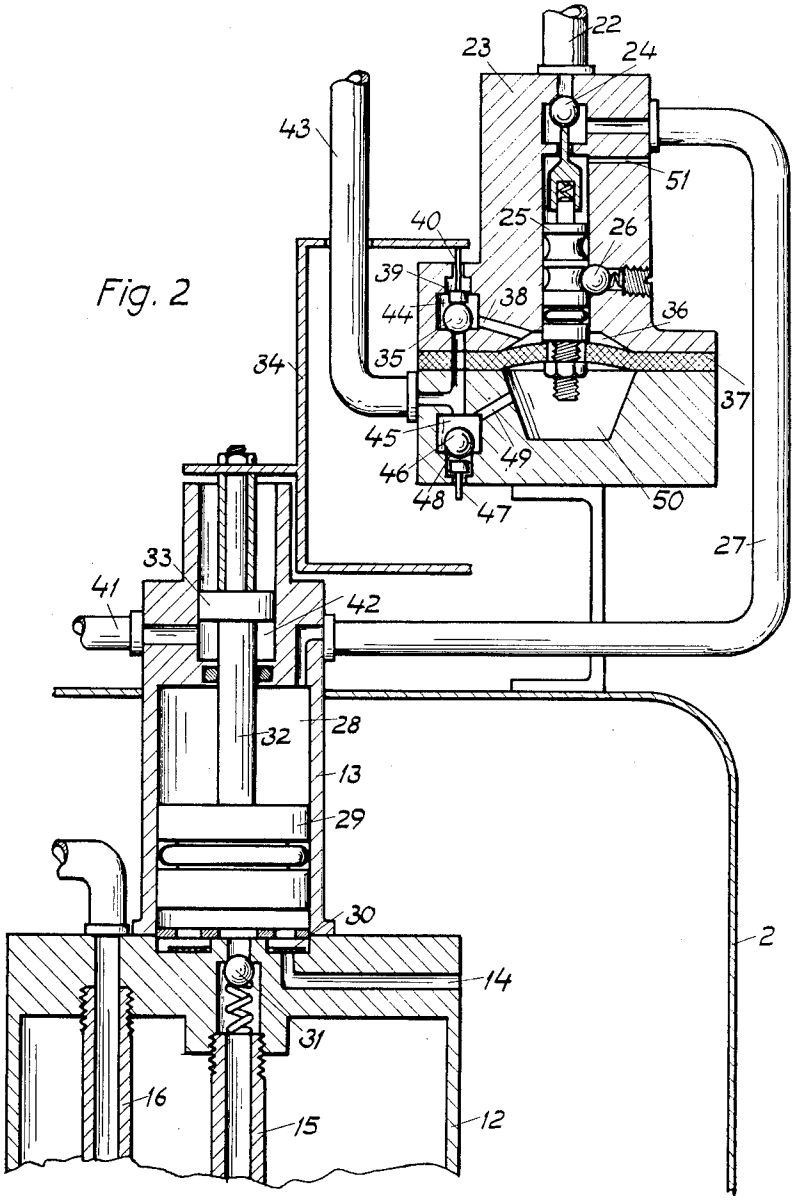

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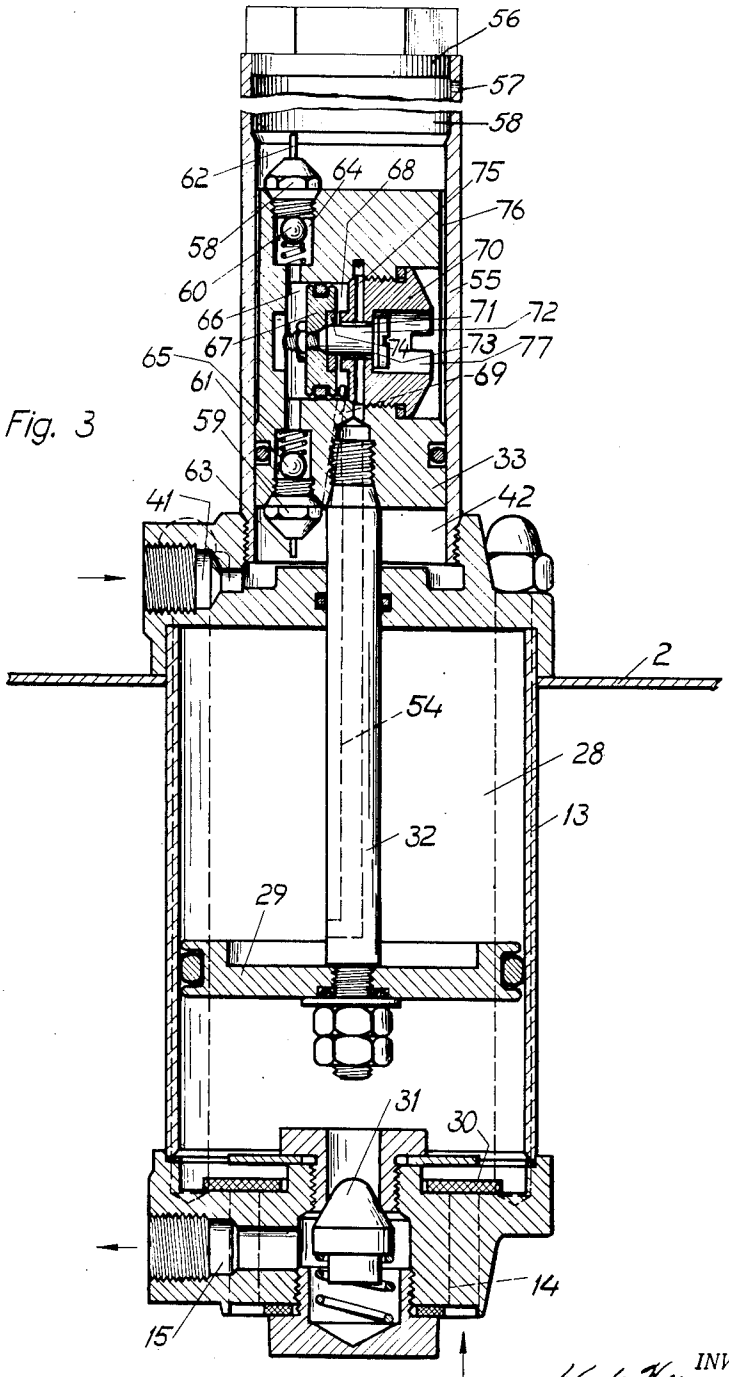
Fig. 3



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DEVICES FOR HOT SPRAYING OF MATERIALS

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Application June 8, 1954, Serial No. 435,223

Claims priority, application Sweden June 29, 1953

4 Claims. (Cl. 219—39)

This invention relates to improvements in devices for hot spraying of materials, such as paint, laquer, plastic or bituminous products, or the like. One object of the invention is to provide a device in which a very good heat transfer is obtained to the spray material and in which a pump for circulating spray material, as usually employed in hot spraying devices, may be dispensed with. A further object of the invention is to provide a device in which a single conduit for spray material may be provided between a spray material receptacle or source and the spray gun, but in which in a simple manner substantially all of the spray material between said spray material receptacle or source and the spray gun may be heated and kept at a desirable temperature. A still further object of the invention is to provide a hot spraying device in which the risks for explosions due to dry boiling in the heating device is avoided as far as possible. A still further object of the invention is to practically eliminate the explosion risks due to electric sparking in the device.

The device according to the invention comprises a liquid receptable, means for heating said liquid, means in said receptacle for transferring heat to spray material from the liquid, a hose for conducting spray material from said heat transferring means to a spray gun, jacket means enclosing said hose and communicating with the receptacle, a conduit for liquid providing a communication between the receptacle and a portion of said jacket means remote from the receptacle, and a pump for mechanically circulating hot liquid from the receptacle through said conduit and the jacket means.

In the preferred form of the invention hot liquid is conducted from the receptacle through the conduit to a portion of the jacket means for the spray material hose disposed adjacent the spray gun and then through said jacket means and from the jacket means at a portion more remote from said spray gun than said first mentioned portion and back to the receptacle.

In the accompanying drawings one embodiment of a hot spraying device according to the invention is illustrated by way of example together with a modification of the pump comprised therein. Fig. 1 is a side view and partial vertical section of a hot spraying device according to the invention. Fig. 2 illustrates on a larger scale a vertical section of a pump acting mechanically on the liquid and forming a part of the device, and Fig. 3 is a vertical section of a pump of a modified design for a hot spraying device according to the invention.

In the drawings 1 designates a spray gun and 2 a hot liquid receptacle which may preferably be partially filled with water, as indicated at 53. At the bottom of the hot liquid receptacle an electrical heating element 3 is provided which is supplied with current over leads 4 connected in a box 5, which contains a thermostatically operated circuit breaker 6 of conventional design for closing and breaking the current to the element 3 so that the temperature of the water or other liquid in the receptacle 2 is kept at a constant and desired value.

A coiled tube 7 is disposed in the hot liquid receptacle 2 and forms a means for transferring heat from the liquid to the spray material which is connected by means of a conduit 8 to a not illustrated spray material source and through a conduit 9 to the spray gun 1. The conduit 9 which consists of a rubber hose is along the main part of its length enclosed by jacket means 10 which adjacent the spray gun is fitted to a header 11 and which communicates with the receptacle 2 at a portion 52 more remote from the spray gun and below the lowest permissible water level in the receptacle. The jacket means 10 and conduit 9 may be carried out as a rubber hose with double walls. Within the tube coils 7 in the hot liquid receptacle 2 a dash pot 12 is arranged to which hot liquid is pumped from the receptacle 2 by a pump 13. The pump 13 is provided with an intake passage 14 which opens in the hot liquid receptacle 2 at a level so much above the level of the heating element 3 that supply of hot liquid to the pump ceases if the level of the liquid in the receptacle 2 should happen to sink below a level which is chosen with regard to the desired safety against dry boiling. A delivery conduit 15 of the pump opens into the dash pot 12 from which a conduit 16 and a hose 17 lead the hot liquid to the header 11.

Compressed air is supplied to the spray gun from a conduit 18. A conduit 19 branched from the conduit 18 conveys compressed air to the box 5 which has an inlet opening 20 and a small outlet opening 21 of such dimensions that a faint stream of air continually flows through the box 5 and thereby prevents explosive gas mixtures from building up in said box. A conduit 22 is furthermore branched from the conduit 18 and conducts compressed air to a valve housing 23, Fig. 2, which contains a ball valve 24 controlling the pump 13. The pump 13 is carried out as a compressed air driven piston pump. Compressed air from the conduit 22, however, opens the ball valve 24 in the valve housing 23 only when a sleeve 25 provided in the housing has been shifted by a membrane 37 from the illustrated position to a lower position defined by a ball lock 26. Compressed air then flows over the ball valve 24 through a conduit 27 to a chamber 28 in the pump cylinder 13 at the upper side of a pump piston 29. The pump is provided with a suction valve formed as a disc 30 and a delivery valve formed as a spring loaded ball valve 31. The pump piston is secured to a rod 32 which carries an auxiliary piston 33 and a valve throwing means 34. When the pump piston 29 has reached bottom position, as illustrated in Fig. 2, the valve throwing means 34 opens the valve 35 in the valve housing 23 causing a space 36 at the upper side of the membrane 37 to be vented to the atmosphere through a passage 38 and a passage 39 along a guide pin 40 of the valve member 35. Compressed air is constantly supplied to a chamber 42 in an auxiliary cylinder provided at the upper end of the cylinder 13. The compressed air to the chamber 42 is supplied through a conduit 41 and acts on the lower face of the auxiliary piston 33, the upper face of which is turned towards the atmosphere. Compressed air is furthermore constantly supplied through a conduit 43 to the valve housing 23. The conduit 43 is branched to a space 44 containing the valve member 35 and a space 45 containing a valve member 46 provided with a guide pin 47 extending through a passage 48 in the valve housing 23, as obvious from Fig. 2. The space 45 communicates through a passage 49 with a space 50 at the lower side of the membrane 37.

When the piston 29 has reached bottom position, as illustrated in Fig. 2, and the valve throwing member 34 has opened the connection from the space 36 to the atmosphere then compressed air in the space 50 moves the membrane 37 upwards so that said membrane takes the position illustrated in Fig. 2. In this position the

valve 24 shuts off the compressed air supply to the chamber 28 and instead opens a vent passage 51. When the chamber 28 is vented the air pressure in the chamber 42 lifts the pump piston 29 causing hot liquid to be drawn through the intake passage 14 into the lower chamber of the pump cylinder 13. Adjacent the upper end position of the piston 29 the valve throwing member 34 opens the valve 46 by engaging the guide pin 47. This causes the space 50 at the lower side of the membrane 37 to be vented to the atmosphere, and, since compressed air acts in the space 36 at the upper side of the membrane 37 as soon as the valve throwing member 34 has left the guide pin 40, the sleeve 25 is moved downwards upon venting of the space 50.

In the above described device the main part of the spray material contained between a source of spray material, such as a pressure tank (not illustrated), and the spray gun may be heated effectively. Due to the positive displacement circulating pump the hot liquid in the receptacle 2 is always circulated through the jacket means 10 and a constant or substantially constant temperature of the spray material, for instance paint, is maintained which is important for obtaining a satisfactory working result.

The hot spraying device above described should only be considered as an example and the details of the invention may be modified in several different ways within the scope of the claims. For instance, other pumps such as gear pumps may be used to circulate the hot liquid. Such a pump may be driven by a rotary air motor.

A modified reciprocating pump is illustrated in Fig. 3. Said pump differs from the pump according to Figs. 1 and 2 substantially in the arrangement of the valve device 23 which according to Fig. 3 has been built into the auxiliary piston 33. The elements of the pump according to Fig. 3 which are substantially the same as in the pump of Figs. 1 and 2 have been designated with the same reference numerals and are not described again.

The pump piston 29 which is reciprocable in the cylinder 13 is in the embodiment of Fig. 3 provided with a piston rod 32 having a longitudinal passage 54 which opens into the chamber 28 in the pump cylinder near the pump piston. The piston rod 32 is secured to the auxiliary piston 33 which forms a seal in an auxiliary cylinder 55 and contains the valve device for controlling the operation of the pump piston corresponding to the valve device 23 in Fig. 2. The cylinder 55 is closed at its upper end by a press fitted plug 56 and is furthermore provided with a vent passage 57. The chamber 42 in the cylinder 55 is similar to the embodiment in Fig. 2 connected to a compressed air source at 41. Two valve housings 58 and 59 are screw threaded into the upper and lower face of the auxiliary piston 33 and contain valve seats for ball valve members 60 and 61, respectively, opening against spring pressure and provided with guide pins 62 and 63, respectively, corresponding to the guide pins 40 and 47 in Figs. 1 and 2. The ball valve members are disposed in spaces 64, 65 communicating with a transverse cylinder chamber 66 in the auxiliary piston 33 in which a valve piston 67 is movable under the action of air pressure in the chamber 66 and a further cylinder chamber 68 which is constantly supplied with compressed air from the chamber 42 through a passage 69 in the auxiliary piston 33. A plug 70 is screw threaded into the auxiliary piston 33 and forms a passage 71 through which a piston rod 72 secured to the piston 67 extends with considerable play. The piston rod 72 carries a vent valve member 73 and the valve piston 67 a packing 74. Passages 75 in the plug 70 connect the passage 71 with the passage 54 in the pump piston rod. The auxiliary piston 33 has reduced diameter along the portion where the plug 70 is disposed so that a passage 76 is formed which connects a space 77 in the plug 70 with a chamber 78 in the cylinder 55 on top of the auxiliary piston 33.

The pump according to Fig. 3 operates in the following manner: In the illustrated position with the passage 41 open to compressed air source full line pressure prevails in the chamber 42 and compressed air flows through the passage 69, the passage 71, the passages 75 and 54 to the cylinder chamber 28. The pump piston 29 is consequently moved downwards and forces hot liquid through the conduit 15. When the pump piston 29 during said movement has reached so far that the guide pin 63 is pressed against the bottom of the cylinder chamber 42 then the valve 61 is opened and compressed air flows into the chamber 66. The piston 67 is then displaced to the right in Fig. 3, since the compressed air in the chamber 68 acts on a reduced surface of the piston and the piston 67 is consequently pressed with the packing 74 against the inner end of the plug 70 and simultaneously lifts the vent valve member 73 thereby venting the cylinder chamber 28 to the atmosphere through the passage 54, the passages 75, the passage 71, the space 77, the passage 76, the chamber 78 and the opening 57. Compressed air in the chamber 42 then moves the auxiliary piston 33 upwards carrying the pump piston 29 along so that liquid is drawn through the intake 14 into the pump cylinder. When the auxiliary piston 33 has moved a small distance upwards the valve member 61 is closed and when the auxiliary piston 33 has moved so far that the guide pin 62 is pressed towards the plug 56 then the valve member 60 is opened. The chamber 66 is then vented to the atmosphere through the space 64, the chamber 78 and the opening 57. The air pressure in the chamber 68 then moves the piston 67 to the left in Fig. 3 and closes the vent valve member 73 so that venting of the cylinder chamber 28 is interrupted and compressed air is again supplied to the chamber 28 from the chamber 42 through the passage 69, the passage 71, the passages 75, and the passage 54. The pump piston 29 is pressed downwards, the valve 60 closes and a new liquid quantity is forced through the delivery conduit 15 of the pump. The above described working cycle is then repeated as long as compressed air is supplied to the conduit 41. When the compressed air supplied to said conduit is interrupted by closure of a valve (not illustrated) in the conduit 41 the pump stops.

What I claim is:

1. A device for hot spraying of materials, such as paint, lacquer, plastic or bituminous products, or the like, comprising a liquid receptacle, means for maintaining a desired raised liquid temperature in said receptacle, means in said receptacle for transferring heat to spray material from the liquid, a hose for conducting spray material from said heat transferring means to a spray gun, liquid jacket means substantially completely enclosing said hose and communicating with the receptacle whereby said liquid is in direct contact with said hose, a conduit for the liquid leading from the receptacle to a portion of said jacket means remote from the receptacle, and a pump for mechanically pumping the hot liquid from the receptacle through said conduit to the jacket means and back to the receptacle through the jacket means thereby surrounding said hose with a continuous stream of hot liquid of said desired temperature.

2. A device for hot spraying of materials, such as paint, lacquer, plastic or bituminous products, or the like, comprising a liquid receptacle, means for maintaining a desired raised liquid temperature in said receptacle, means in said receptacle for transferring heat to spray material from the liquid, a hose for conducting spray material from said heat transferring means to a spray gun, liquid jacket means substantially completely enclosing said hose and communicating with the receptacle whereby said liquid is in direct contact with said hose, a conduit for the liquid leading from the receptacle to a portion of said jacket means remote from the receptacle, and a compressed air driven reciprocating pump for circulating the hot liquid from the receptacle through said conduit and the jacket means.

3. A device for hot spraying of materials, such as

paint, lacquer, plastic or bituminous products, or the like, comprising a liquid receptacle, an electrical thermostatically controlled heating element at a low level in said receptacle for maintaining a liquid in the receptacle at a substantially constant temperature, a heat exchanging device extending through a portion of the receptacle provided with means for connection to a source of spray material under pressure and forming a passage for conducting spray material therethrough, a hose for conducting spray material from said heat exchanging device to a spray gun, jacket means enclosing said hose and communicating with the receptacle, a conduit for liquid providing communication between the receptacle and a portion of said jacket means remote from the receptacle, a compressed air driven reciprocating liquid pump for circulating hot liquid from the receptacle through said conduit and the jacket means, a pump cylinder in said pump having a liquid intake disposed in the receptacle at a substantially higher level than the heating element, a reciprocating air motor in driving connection with said pump and a valve device for supplying compressed air to said motor to produce pressure and suction strokes of the pump.

4. A device for hot spraying of materials, such as paint, lacquer, plastic or bituminous products, or the like, comprising a liquid receptacle, means for maintaining

a desired raised liquid temperature in said receptacle, means in said receptacle for transferring heat to spray material from the liquid, means for supplying spray material from a source of spray material to said heat transferring means, means for discharging spray material from the heat transferring means to a spray gun, a compressed air driven reciprocating pump for circulating the liquid, a pump cylinder in said pump submerged in the receptacle, a single acting pump piston in said cylinder, an auxiliary cylinder in the pump, an auxiliary piston in said auxiliary cylinder connected to said pump piston, a compressed air working chamber in the pump cylinder, a compressed air working chamber in the auxiliary cylinder in which compressed air may be admitted to act on the auxiliary piston, and valve means for alternately admitting compressed air to said compressed air working chamber in the pump cylinder to produce a pump stroke of the pump piston and venting said last mentioned working chamber to the atmosphere to permit the compressed air in said working chamber in the auxiliary cylinder to move the auxiliary piston and the pump piston to produce a suction stroke of the pump piston.

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