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2 Sheets-Sheet 1

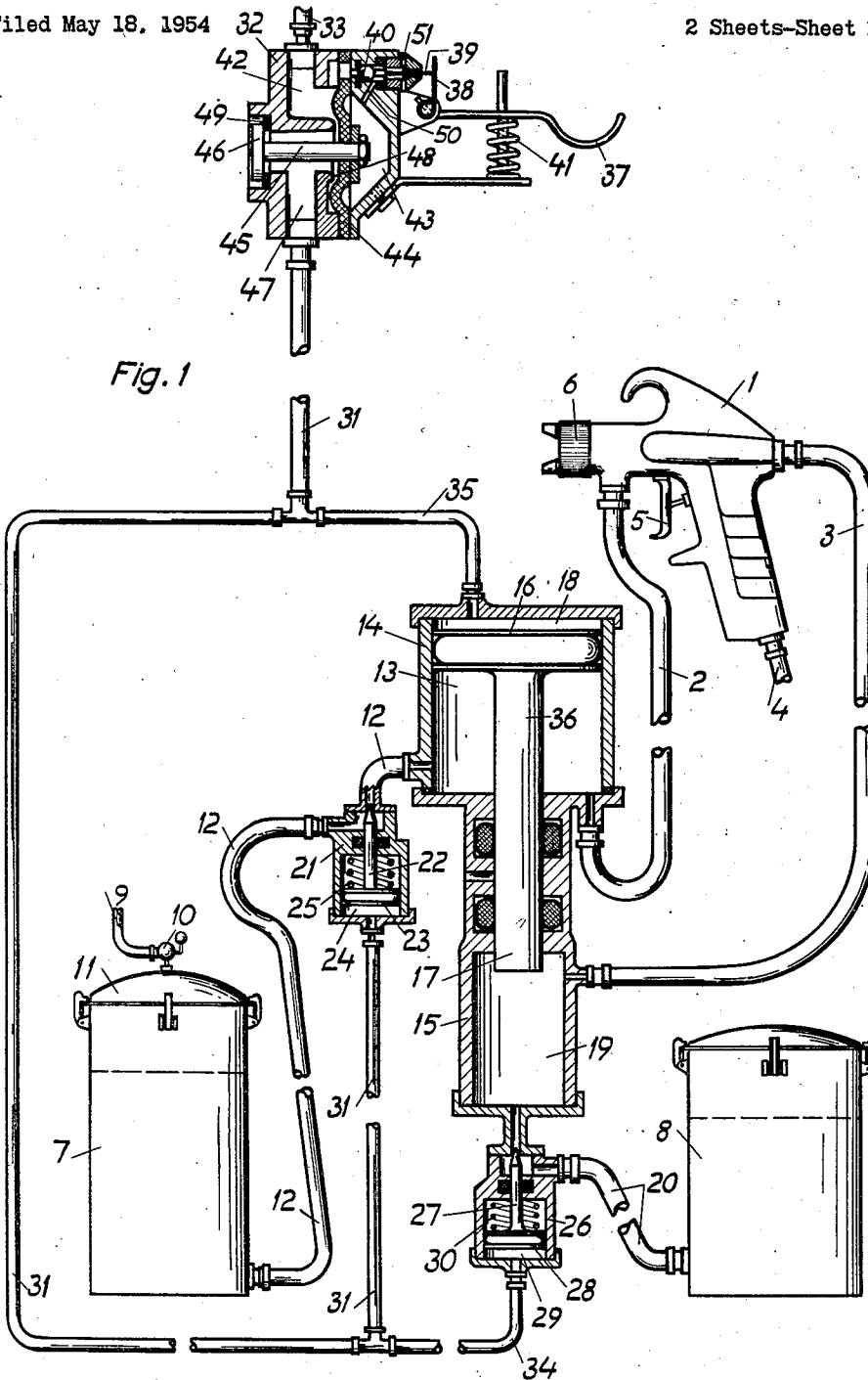


Fig. 1

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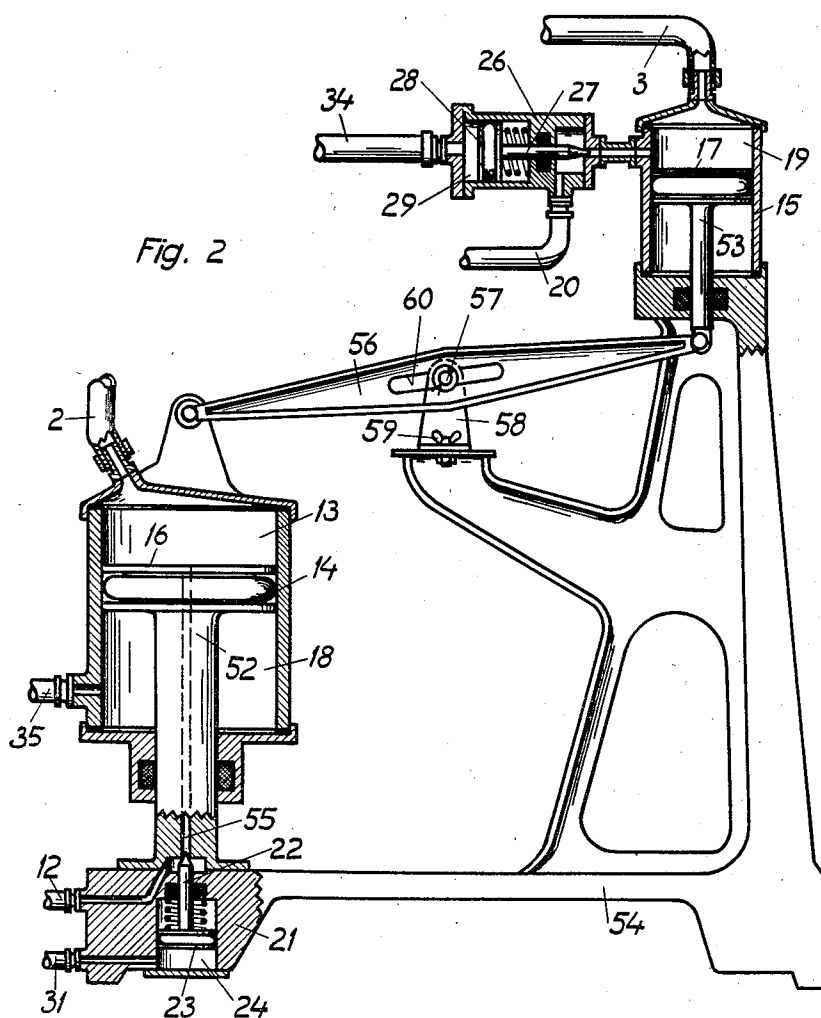
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APPARATUS FOR SIMULTANEOUSLY DISCHARGING MATERIALS

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6 Claims. (Cl. 299—86)

This invention relates to improvements in apparatus for simultaneously discharging materials capable of being handled by positive displacement pumps and for discharging said materials in predetermined relative quantities. One object of the invention is to provide a device which is simple in manufacture and safe in operation. A further object of the invention is to provide a device in which two or more materials may be supplied to and discharged by a discharge device in accurately defined proportions irrespective of the total quantity of materials discharged. A further object of the invention is to provide a device by means of which a paint material or resinous material or other sprayable material may be mixed and discharged by a spray gun together with a second material such as a hardening agent by means of compressed air in accurately defined proportions for providing a coating on an object. Still further objects of the invention will be apparent from the following description, the claims and the drawings.

For the above and other purposes I provide an apparatus comprising a discharge device for the materials, a positive displacement pumping device, a first pump chamber in said pumping device, means for charging said first pump chamber with a first material and for delivering said first material from the first pump chamber to said discharge device, a second pump chamber in the pumping device, means for charging said second pump chamber with a second material and for delivering said second material from the second pump chamber to the discharge device, and means for maintaining a predetermined relation between the delivery capacities of the pump chambers defining the relative quantities of the first and second materials delivered to the discharge device.

In the accompanying drawings two embodiments of apparatus according to the invention are illustrated by way of example. It should be understood, however, that these embodiments are only illustrative of the invention and that various modifications may be made within the scope of the claims without departing from the scope of the invention.

In the drawings Fig. 1 is a diagrammatic view partially in section of an apparatus according to the invention. Fig. 2 illustrates diagrammatically and partially in section a modified form of the pumping device included in the apparatus according to Fig. 1.

In the drawings 1 designates a spray gun of conventional design for mixing and discharging a mixture of two materials and compressed air, for instance a paint or lacquer of resinous type and a hardening agent. The spray gun 1 is provided with a delivery conduit 2 for supplying a first material, for instance paint, and with a delivery conduit 3 for supplying a second spray material, for instance a hardening agent, and with a conduit 4 for supplying compressed air for atomizing the materials and for propelling the materials to a surface to be coated. The spray gun is provided with a trigger 5 for controlling conventional material and air valves in the spray gun and with a spray head 6 in which the spray materials are

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mixed and atomized by the compressed air, and from which the mixture is discharged. The spray gun may, for instance, be carried out according to Swedish Patent Number 134,867 or in other ways. Spray material, such as paint, may be provided in a receptacle 7 and a second spray material such as a hardening agent in a receptacle 8. The receptacle 7 may be a pressure tank which for this purpose is connected through a hose 9 with a source of compressed air (not illustrated), a valve 10 being provided on the cover 11 of the receptacle for admitting compressed air to the interior of the receptacle. The receptacle 7 communicates through a supply conduit 12 with a spray material chamber 13 in a pumping device comprising a first pump cylinder 14 and a second pump cylinder 15. A first piston 16 is reciprocable in the cylinder 14 and a second piston 17 in the cylinder 15. A compressed air working chamber 18 is formed in the cylinder 14 at the opposite side to the chamber 13 of the piston 16. A second spray material chamber 19 is formed in the cylinder 15. The chamber 19 communicates with the receptacle 8, which may be an open tank, through a supply conduit 20. The spray material chambers 13 and 19 are connected to the spray gun 1 through delivery conduits 2 and 3 respectively. In the conduit 12 a first supply shut-off valve 21 is provided which contains a valve member 22 having a head 23 actuated by air pressure in a chamber 24 in closing direction and in opposite direction by a spring 25. A second supply shutoff valve 26 is provided in the conduit 20 and contains a valve member 27 with a head 28 actuated in closing direction by compressed air admitted to a chamber 29 and in the opposite direction by a spring 30. The chamber 24 is connected through a conduit 31 to a regulating valve device 32 which is supplied with compressed air through a conduit 33 from a source of compressed air (not illustrated). The shut-off valve 26 has the chamber 29 connected with the conduit 31 through a conduit 34 and the working chamber 18 is connected through a conduit 35 to the conduit 31.

The first piston 16 is connected to the second piston 17 by a shank 36 thereby maintaining a predetermined relationship between the travel of piston 16 and the travel of piston 17 which results in providing a predetermined relationship between the delivery capacities of pump chambers 13 and 19. Obviously, the delivery capacities of the pump chambers 13 and 19 within the limits of the volume of such chambers and the cross sectional areas of the pistons 16 and 17 are determined by a length of travel of such pistons in the chambers. The regulating valve device 32 is controlled by a bell crank lever 37 forming a hook and having an arm 38, which controls a guide pin 39 of a ball valve member 40. The lever 37 rests on a spring 41 which is compressed if the spray gun 1 is hung up on the lever 37. The ball valve 40 controls a passage from an intake chamber 42 in the valve device 32 to a regulating space 43 confined by a membrane bellows 44 which carries a stem 45 with a valve member 46. The valve device 32 is provided with an outlet 47 and seats 48 and 49.

The apparatus according to Fig. 1 operates in the following manner: In the illustrated position of the various elements of the apparatus the spray gun 1 has been removed from the hook formed by the lever 37 and the chambers 13 and 19 are filled with spray materials. The levers 37 and 38 are in the illustrated positions and the ball valve 40 is pressed against its seat and the space 43 is then vented to the atmosphere through passages 50, 51. The membrane bellows 44 is lifted from the seat 48 and compressed air flows from the inlet 42 to the outlet 47 and through the conduits 31, 34 and 35 to the chambers 24, 29 and 18 thereby causing the shut-off valve members 22 and 27 to close the conduits 12, 20 leading to the spray

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material chambers 13 and 19, respectively. Compressed air acting in the chamber 18 acts to depress the pistons 16, 17. As soon as the trigger 5 is pressed the air discharge openings and spray material openings in the spray gun 1 are opened and the compressed air acting in the chamber 18 moves the pistons 16 and 17 downwardly so that material is delivered from the chambers 13 and 19, respectively, through the delivery conduits 2, 3 to the spray gun. It is obvious that since the pistons 16 and 17 have different cross sectional areas and are connected rigidly by means of the shank 36 the quantities of spray material discharged through the delivery conduit 2 always is in a certain relation to the quantity of spray material discharged through the delivery conduit 3, said quantities being in the described embodiment directly proportional to the effective cross sectional areas of the pistons 16 and 17.

When spraying is interrupted by the operator who for this purpose releases the trigger 5 delivery through the spray gun nozzle 6 stops. By hanging the spray gun on the hook of the lever 37 the pressure of the arm 38 on the guide pin 39 of the ball valve member 40 is released. The air pressure in the inlet 42 then lifts the valve member 40 to close the vent passage 51 and to admit compressed air through the passage 50 to the space 43. The membrane bellows 44 are consequently pressed against the seat 48 and the valve 46 is lifted from its seat 49 so that the outlet 47 is vented to the atmosphere and consequently the conduits 31, 34, 35 and the chambers 24, 29 and 18 are vented to the atmosphere. This results in opening of the shut-off valve member 22 due to the pressure of the spring 25 and of the material in the receptacle 7 which acts directly on the valve stem 22 so that the shut-off valve member 22 is moved to open position and admits the first spray material from the receptacle 7 to the chamber 13. Simultaneously, the spring 30 opens the shut-off valve member 27 so that a communication is opened from the receptacle 8 through the conduit 20 to the chamber 19. The material which is forced into the chamber 13 moves the piston 16 upwardly in the cylinder 14 and the piston 17 in the chamber 19 also moves upwardly and draws material from the receptacle 8 through the conduit 20 into the chamber 19. Depression of the lever 37 consequently causes charging of the chambers 13 and 19 with their respective spray materials. When the spray gun is unhooked spraying of material may again take place.

Fig. 2 shows a modification of the pumping device according to Fig. 1 and the elements of Fig. 2 which are identical in function with the elements in Fig. 1 are designated with the same reference numerals as in Fig. 1 and are not described again. The cylinders 14 and 15 are provided with delivery conduits 2 and 3, respectively, and with pistons 16 and 17 having piston rods 52 and 53, respectively. The piston rod 52 is fixed to a frame 54 and provided with a passage 55 forming a communication between the conduit 12 and the space 13 controlled by the valve member 22. The cylinder 14 is journaled to one end of a double armed lever 56 the opposite end of which is connected to the piston rod 53. The lever 56 is swingable on a pivot 57 carried by a bracket 58 which may be fixed in various positions on the frame 54 by means of a wing bolt 59 secured in a slot extending longitudinally of the lever 56 in the frame 54. The lever 56 is provided with a slot 60 through which the pivot 57 extends. Suitable play may be provided in the journals of the lever 56 and the cylinder 14 and rod 53 to prevent sticking. By moving the bracket 58 in the direction of the slot 60 and fixing it in a new position the leverage of the lever 56 may be changed and thereby relative length of travel of the pistons 16 and 17 which determine the delivery capacities of the chambers 13 and 19 one relative to the other. The apparatus according to Fig. 2 provides means whereby the relative quantities of spray material delivered by the pumping device to a spray discharge

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device, such as a spray gun 1, may be set at various values according to prevailing conditions. The operation of the pumping device illustrated in Fig. 2 is the same as the pumping device illustrated in Fig. 1 with the exception that in Fig. 2 the cylinder 14 moves on the piston 16 and is connected to the piston 17 through the lever 56 instead of the pistons being coupled directly one to the other as in Fig. 1.

The apparatus above described should only be considered as examples and for instance other pumping devices may be used within the scope of the claims. One such other pumping device may comprise two gear type pumps the driving gears of which are interconnected so that the pumps operate with relative deliveries as desired. Naturally, a device according to the invention may be carried out for discharging more than two spray materials, for instance three materials in which case the pumping device is provided with a three step piston or three pistons coupled together in such a way that the desired quantities of material are delivered to the discharge device.

What I claim is:

1. Apparatus for simultaneously discharging materials capable of being handled by positive displacement pumps and for discharging said materials in predetermined relative quantities, comprising a spray gun having two spray material supply conduits and a compressed air supply conduit and means for discharging a mixture of spray materials and compressed air supplied to said spray gun, a compressed air operated positive displacement pumping device comprising a first and a second pump cylinder, a first piston reciprocable in said first pump cylinder, a first spray material chamber in the first pump cylinder, a compressed air working chamber in the first pump cylinder at the opposite side of said first piston to said first spray material chamber, a second piston reciprocable in said second pump cylinder, a second spray material chamber in the second pump cylinder, said first and second spray material chambers communicating each with one of said spray material supply conduits, a receptacle for the first spray material, means for applying pressure to the first spray material in said receptacle, a conduit for leading the first spray material from said receptacle to the first spray material chamber, a first shut off valve in said conduit from the receptacle actuated in opening direction by the pressure in the receptacle and in closing direction by compressed air, an air conduit for supplying compressed air to said first shut off valve for closing the first shut off valve, a regulating valve in said air conduit capable in one position to admit compressed air through the air conduit and in a second position to vent the air conduit to the atmosphere, a second receptacle for the second spray material, a second material conveying conduit leading from said second receptacle to the second spray material chamber, a second shut off valve in said second material conveying conduit actuated in closing direction by compressed air pressure, a compressed air conduit communicating with said second shut off valve and said air conduit for supplying compressed air to the first shut off valve, a conduit communicating with said compressed air working chamber in the first pump cylinder and the air conduit for supplying compressed air to the first shut off valve, and means for operating the regulating valve to supply compressed air to the shut off valves and the compressed air working chamber for closing the shut off valves and for moving the pistons to supply the spray materials to the spray gun and in another position to vent the working chamber and the conduits to the shut off valves to cause the spray material chambers to be charged with spray materials.

2. Apparatus for simultaneously spraying two or more materials capable of being handled by positive displacement pumps and for discharging said materials in predetermined relative quantities, comprising a positive displacement pumping device, a first pump chamber in said pumping device, a first supply conduit leading from a first

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material source to said first pump chamber, a pressure fluid operated supply shut-off valve in said first supply conduit, a first pump piston movable in the first pump chamber to displace a volume of the first pump chamber, a second pump chamber in the device, a second supply conduit leading from a second material source to said second pump chamber, a pressure fluid operated supply shut-off valve in said second supply conduit, a second pump piston movable in the second pump chamber to displace a volume of the second pump chamber, means for maintaining a predetermined relation between the delivery capacities of the pump chambers, delivery conduits leading from the pump chambers to a spraying device, delivery valve means for the pump chambers in said delivery conduits operable independently of said supply shut-off valves to discharge the materials simultaneously from the pump chambers in said predetermined relative quantities, a pressure fluid control conduit to each supply shut-off valve, and means for controlling the pressure fluid in said control conduits to shut and open the supply shut-off valves, respectively.

3. Apparatus for simultaneously spraying two or more materials capable of being handled by positive displacement pumps and for discharging said materials in predetermined relative quantities, comprising a positive displacement pumping device, a first pump chamber in said pumping device, a first supply conduit leading from a first material source under pressure to said first pump chamber, a compressed air operated supply shut-off valve in said first supply conduit, a first pump piston movable in the first pump chamber upon actuation by compressed air to displace a volume of the first pump chamber, a second pump chamber in the device, a second supply conduit leading from a second material source to said second pump chamber, a compressed air operated supply shut-off valve in said second supply conduit, a second pump piston movable in the second pump chamber to displace a volume of the second pump chamber, means for maintaining a predetermined relation between the delivery capacities of the pump chambers, valve means controlling the supply of compressed air for actuation of the supply shut-off valves to shut their pertaining conduits and the first pump piston to apply pressure on the material in the first pump chamber, delivery conduits leading from the pump chambers to a spraying device, and delivery valve means for the pump chambers in said spraying device operable independently of said supply

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shut-off valves to discharge the material simultaneously from the pump chambers in said predetermined relative quantities.

4. Apparatus according to claim 3, in which said first and second pistons are formed as parts of a differential piston connected by a shank or piston rod.

5. Apparatus according to claim 3, in which said first and second pistons are formed separately, and adjustable leverage being provided to positively maintain the desired relation between the movements of said pistons.

6. Apparatus for simultaneously spraying a liquid surface coating material and a solidifying agent for said coating material and for discharging said material and agent in predetermined relative quantities, said apparatus comprising a positive displacement pumping device having a first pump chamber for the coating material and a second pump chamber for the solidifying agent separated from said first pump chamber so as to prevent material admitted to the first chamber from contacting the agent admitted to said second chamber within said pumping device, a first supply conduit leading from a coating material source to the first chamber, a second supply conduit leading from a source of solidifying agent to the second chamber, power operated pistons reciprocable in the pump chambers for applying pressure on the material and agent in the chambers, valves in said conduits operable to close said conduits when said pistons apply pressure on said material and agent, delivery conduits leading from said pump chambers, means for producing and maintaining a predetermined relation between the displacement movements of the pistons, a spraying device connected to said delivery conduits and means for controlling the discharge of material and agent simultaneously from the pump chambers in said predetermined relative quantities.

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