AUTOMATICALLY OPERATED SPRAYING SYSTEM.

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2 Sheets—Sheet 1

Fig. 1

Fig. 5

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The present invention relates to spraying appliances or systems, particularly of the automatic operating type.

Among the objects of the invention is to provide a novel system of spray of the type where the spray gun is automatically operated for any given period of time or in any predetermined time relation with the article to be sprayed, such as with respect to the delivery of printed sheets of paper in a process where the spraying is for the purpose of preventing offset in printing.

The illustrative embodiment of the present invention comprises generally a spray gun having a nozzle structure with material and air nozzle portions and material and air passages leading thereto, together with a means for controlling the discharge of the material and the air from the nozzle structure, and with a novel operating means for actuating the device. Such operation is effected by separate and independent motive fluid in given time relations and under predetermined pressures. The means may be of the piston or diaphragmatic type, the term "piston" being used herein in a generic sense to comprehend a sliding piston and a flexing diaphragm. The piston chamber is separated from the air passage leading to the air control valve and has an independently connected passage for the admission of motive fluid and its release as controlled by a control valve of the three-way type.

The air valve which is normally closed is connected as by a tubular shank passing through the separating wall between the piston chamber and the air valve structure so as to move with the piston when the latter is actuated by the motive fluid or by a spring acting on the piston normally to move the piston forwardly and to close the air valve at the time when the motive fluid is released. The material valve has a portion which extends into the piston chamber also to be actuated upon by the piston in its movements. Such extending portion of the material valve has a means such as a collar normally in spaced relation with respect to the piston whereby before the piston engages this means it has a predetermined amount of movement or lead, at which time the air valve is opened prior to the opening of the material valve. Conversely, the material valve acted on by a spring will be closed before the material valve is closed.

Another object of the invention is to provide a novel control valve for the motive fluid. This valve has a novel auxiliary valve with a main passage controlled by the main valve and connected to the piston chamber, and has an auxiliary passage connected to the main passage and acting as an exhaust passage. This valve is preferably operated by a cam and is so constructed as to first close the normally open auxiliary valve and then to open the main valve whereby the motive fluid passes to the piston chamber to act upon the piston, as above explained. Upon further turning of the cam, suitable springs return the valves to their normal positions, the main valve seating first and then the auxiliary valve opening, whereby the motive fluid returns by way of the exhaust passage for release into the atmosphere. In this way the spraying application is automatically operated intermittently in time relation with the handling of the means being sprayed.

Other objects, advantages, capabilities, features, and the like, are comprehended by the invention as will later appear and as are inherently possessed by the invention.

This is the parent of the copending continuing application of William B. MacMartin, Serial No. 292,167, filed August 28, 1939, for Nozzle structure for spray guns.

Referring to the drawings:

Fig. 1 is a schematic view of a system embodying the invention.

Fig. 2 is a longitudinal sectional view through a novel spray gun of the present invention.

Fig. 3 is a transverse sectional view taken in a plane represented by line 2—2 of Fig. 2 of the drawings.

Fig. 4 is a sectional view of a three-way control valve for the motive fluid.

Fig. 5 is a fragmentary sectional view of an alternate form of spray gun, showing the use of a diaphragm in lieu of a sliding piston.

Referring more in detail to the drawings, the embodiments selected to illustrate the invention are shown as comprising a spray gun having a body 1 provided at its forward end with a forwardly widening socket having a mouth portion 2 provided with a flaring annular seat and with an annular channel 3 within the mouth portion and rearwardly of the seat thereof. The socket also has a base portion 4 opening into the material passage 5 leading from the connection 4′, the base portion 4 having a flared seat and an annular channel 6 forwardly of such flared seat. The base portion 4 is of smaller diameter than the mouth portion 2. The socket also has an intermediate threaded portion 7 of intermediate diameter and is disposed between the channels 3 and 6. The channel 6 is in communication
with the air passage 8 in body 1. In the body 1 is also provided an air passage 9 which is in communication with the air passage 8 and leads to the chamber 2.

Fitted to this socketted forward end portion of the body is a nozzle structure comprising a material nozzle portion and an air nozzle portion. The material nozzle portion comprises a central tubular part 10 in communication with the material passage 9 and having a tapered rear end 11 to seat upon the flared seat of the socket base portion 4. This part 10 has at its forward end a discharge tip 12 controlled by a needle valve 13. The tube part 10 has a concentric portion 14 provided with a threaded portion 15 adapted for securing to the threaded part 1 of the socket and has at its forward end a tapered seat portion 16. Intermediate of said portion 14 is provided a larger dimensioned annular portion 17 with a rearward tapered portion 18 fitting with the flared mouth portion 2 and a forward tapered seat portion 19 so spaced from the seat portion 16 as to provide therebetween an annular air channel 20. A plurality of air passages 21 are provided in the part 14 for connecting the air channel 18 with the air chamber 22 at the front of the material nozzle portion. Also there are a plurality of passages 23 in the intermediate annular portion 17 for connecting the air channel 3 with the air channel 20.

An air nozzle cap 24 has spaced tapered seat portions 25 and 26 which seat upon the seat portions 19 and 16, respectively, with an annular air channel 27 between them and registering with the air channel 20. The cap has horns 28 with passages 29 and side jet orifices 30 communicating with the channel 27. The cap has a central annular air orifice 31.

The cap is connected in place by a coupling ring 32 threaded to the forward or mouth end of the gun body and to the rear end of the cap by way of a spring locking ring. This leaves an annular space 33 between the end or mouth part of the gun body and the rear end of the cap whereby leakage of air might occur if this space were in communication with any of the air passages of the device. But by seating the parts 18 and 19 against the parts 2 and 5 and providing the air bores 23 in the annular part 17, there is no air communication from the air passages to the space 33.

The intermediate portion of the body 1 is provided with an air valve structure having a valve chamber 34, a valve 35 normally closed on the seat 36, a valve outlet 37 leading to an air passage portion 38 which in turn leads to the air passage portion 8. Leading to the valve chamber 34 is an air passage portion 39 in communication with a duct connection or thimble 40.

Rearwardly of the valve chamber 34 is provided a wall or partition 41 in which is screwed a packing or sealing means 42 so bored as slidable to receive the tubular shank 43 of the air valve 35, the rear end of the shank 42 being threaded for securing to a piston 44. Sealing plugs 45 and 46 are fixed in bore portions of the air passage portions 38 and 8, respectively. A hook hole 47 is provided in the upper part of the body 1 for engagement of a hook when the gun is to be suspended, a suitable set screw 48 being provided for securing the hook in place.

In the rearward end portion of the body 1 is provided a piston chamber 49 having a closure cap 50, the piston being slidable in this chamber. To the chamber 49 is connected a motive fluid passage connection 51 leading to the chamber space 52 forwardly of the piston 44 and rearwardly of the wall 41. Rearwardly of the piston 44 is a spring 53 acting to normally force the piston forward.

The needle valve 13 has an elongated shank 54 which extends slidably through packing means 55 secured to the forward portion of the gun body, packing means 56 secured to the intermediate portion of the gun body, then through the air valve 34—43, and the piston 44, with a rear threaded end portion 57 extending rearwardly of such piston. On the threaded part 57 is adjustably secured a collar 58. This collar is normally secured by a lock nut 59 and the piston with a given or predetermined lead. On the threaded end 57 is also secured a stop element 59 which may be of tubular form and having a squared head 60 by which adjustment may be made on the threaded end portion 57 of the needle valve. This element 59 serves the purpose of a locking nut for the collar 58 and the head 64 thereof acts as the contact stop against a head 61 of an adjusting tube 62 threaded in the hub 63 forming a part of the cap 56. A spring 64 is located in the tube 62 between the head 61 and the collar 58 to normally force the needle valve forwardly.

The air to the horns is controlled by a valve device as shown in Fig. 3. Such device comprises a cross bore 65 at the forward end of and in communication with the air passage 8. This bore 65 intersects the air channel 6 and is constantly in communication with the channel. Inwardly is a smaller cross bore 66 which communicates with the cross bore 65 by way of a port controlled by a valve 67. The bore 66 intersects with the air passage 8. This bore also intersects the air channel 5 and is in communication with it. The valve 67 has a smooth stem portion 68, a threaded portion 69, and a knob 70, the threaded portion 69 being operative in a packing nut 71 secured in the outer end of the cross bore 65. At the inside of the nut 71 is a packing 72 backed by a plate 73 against which acts a spring 74 to maintain the packing leak-tight against the smooth portion of the stem 68, the spring reacting against a washer 75 on the stem 66 and backed by a cross pin 76 fast with the head 61. To the plate 73 the valve 67 may be adjusted to control the amount and the pressure of the air to the horn jet orifices, and hence the desired flattening of the material stream projected from the tip 12.

The motive fluid is controlled by a three-way valve shown in Fig. 4. This valve comprises a body 71 having an inlet 76, a chamber 79, a main valve having a valve seat 80, a chamber 81 and an outlet 82. The main valve seat is normally closed by a main valve element 83. The valve 83 has a shank 84 about which is a spring 85 which acts between the valve 83 and a cap 86 at the end of the chamber 79. The valve 83 has a stem 87 with an auxiliary valve element 88 at its end. In an extended portion of the chamber 81 is a slidable tube 89 which has at its inner end a valve seat 90 for seating against the auxiliary valve 88. The tube 88 has a bore 91 and exhaust outlets 92. The inner end of the tube has a packing 93 backed by a plate 94 against which acts a spring 95. The latter, besides tending to close the auxiliary valve 88, also acts normally to hold the auxiliary valve seat 90 away from the valve element 88. To the end portion 96 is adjustably secured, as by a lock nut 98, a guide 97. This guide has side ele-
ments 99 between which an extension 100 of the tube 89 slides. This extension 100 is of smaller diameter than the tube 89 so as to present shoulders 98 which contact with shoulders 99 provided on the cylinder 88, the latter shoulders 98 acting as a limit stop for the outward movement of the tube 89. Also, the extension 100 is slotted and carries a bearing pin 101 upon which is rotatably mounted a roller 102 which roller is located in the slot of the extension. A cam 103 having a cam lobe 104 is so positioned as to operate against this roller.

As the cam 103 rotates and the lobe 104 is brought in contact with the roller 102, the tube 89 is forced inwardly against the force of the spring 85. First there is a closing of the valve seat 80 against the auxiliary valve 88 and then there is an opening of the main valve 83, whereby motive fluid passes through the device by way of the outlet 82 to the passage 81 and the piston chamber 82 forwardly of the piston 44. This causes the piston to be moved rearwardly at which time the air valve immediately opens. After the piston 44 has moved through the lead distance for the needle valve it engages the collar on the needle valve shank and the needle valve is then opened. Hence the auxiliary valve under the force of the spring 85 may hereby be protected through the tip 12. As the cam lobe 104 turns away from the roller 102, the spring 85 immediately acts to move the tube 89 outwardly. The first effect is a closing of the main valve 83 under the force of the spring 85, and then an opening of the auxiliary valve under the force of the spring 85 whereby the motive fluid is permitted to exhaust by way of the passage 81 and outlets 82.

Fig. 5 shows a diaphragmatic type of operating means in lieu of a piston type. The piston chamber is of the same general construction as shown in Fig. 2, with the exception that the diaphragm 105 is clamped at its margin or periphery between outwardly extending flange portions 106 and 107 of the chamber structure. In all other respects the device is the same as shown in Fig. 2.

Referring to Fig. 1, there is shown a tank or container 108 in which the material to be sprayed is contained under pressure. The material is fed to the spray gun by a pipe or hose 109 connected to the thimble 5. The air supplied to the air nozzle portion and controlled by the air valve is contained under pressure in a container 110. It is fed from this container through a suitable reducing valve and by way of a pipe 111 connected to the thimble 48. Air under pressure is always present at the air valve 35, so that upon opening of the air valve there is an immediate supply of the air at the air nozzle portion.

The motive fluid is supplied from any suitable source 95 connected to the three-way valve 77. The outlet 82 of this three-way valve is connected by way of a pipe to the thimble 51.

While we have herein described and upon the drawings shown preferred embodiments of the invention, it is to be understood that the invention is not limited thereto, but comprehends other constructions, details, arrangements of parts, features, and the like, without departing from the spirit of the invention.

Having thus disclosed the invention, we claim:

1. A spraying system comprising a spray gun provided with a nozzle structure having material and air nozzle portions and separate material and air passages leading thereto, normally closed material and air valves respectively in said passages for controlling discharge of material and air from said nozzle portions, said air passages including an air valve chamber, said gun having a piston chamber and a piston movable therein, a wall for separating said piston chamber and said air valve chamber, and a third passage leading to said piston chamber between said wall and said piston for passage of motive fluid independently thereto and therefrom, resilient means in said piston chamber and acting on said piston for normally forcing said piston forwardly, said air valve being so connected to said piston as to move therewith to open position by action of motive fluid on said piston when admitted into said piston chamber and to closed position by action of said resilient means when the motive fluid is released from said piston chamber, said material valve having a portion extending into said piston chamber rearwardly of said piston, a spring acting on said material valve for normally forcing said valve to closed position, and means on said extending portion of said material valve so located in normally spaced relation to said piston to be engaged by said piston when rearwardly moved to open said material valve subsequently to the opening of said air valve, and when forwardly moved to permit the closing of said material valve prior to the closing of said air valve.

2. A spraying system comprising a spray gun provided with a nozzle structure having material and air nozzle portions and separate material and air passages leading thereto, normally closed material and air valves respectively in said passages for controlling discharge of material and air from said nozzle portions, said air passages including an air valve chamber, said gun having a piston chamber and a piston movable therein, a third passage leading to said piston chamber rearwardly of said piston for passage of motive fluid independently thereto and therefrom, resilient means in said piston chamber and acting on said piston for normally forcing said piston forwardly, said air valve having a partition between said piston chamber and said air valve chamber for separating said chambers, said air valve having a rearward extension slidably through said partition and being so connected to said piston as to move therewith to open position by action of motive fluid on said piston when admitted into said piston chamber and to closed position by action of said resilient means when the motive fluid is released from said piston chamber, said material valve having a portion extending into said piston chamber rearwardly of said piston, a spring acting on said material valve for normally forcing said valve to closed position, and means on said extending portion of said material valve so located in normally spaced relation to said piston to be engaged by said piston when rearwardly moved to open said material valve subsequently to the opening of said air valve, and when forwardly moved to permit the closing of said material valve prior to the closing of said air valve.

3. A spraying system comprising a spray gun provided with a nozzle structure having material and air nozzle portions and separate material and air passages leading thereto, normally closed material and air valves respectively in said passages for controlling discharge of material and air from said nozzle portions, said air passages including an air valve chamber, said gun having a piston chamber and a piston mov-
able therein, and a third passage leading to said piston chamber forwardly of said piston for passage of motive fluid independently thereto and therefrom, resilient means in said piston chamber and acting on said piston for normally forcing said piston forwardly, said gun having a partition between said piston chamber and said air valve chamber for separating said chambers, said air valve being of tubular form with a seat at its forward end and with means at its rear end for connection to said piston, said air valve being slidable through said partition and movable with said piston to open position by action of motive fluid on said piston when admitted into said piston chamber and to closed position by action of said resilient means when the motive fluid is released from said piston chamber, said material valve having a portion extending slidably through said air valve and into said piston chamber rearwardly of said piston, a spring acting on said material valve for normally forcing said valve to closed position, and means on said extending portion of said material valve so located in normally spaced relation to said piston as to be engaged by said piston when rearwardly moved to open said material valve subsequently to the opening of said air valve, and when forwardly moved to permit the closing of said material valve prior to the closing of said air valve.

4. A spray gun comprising a body having a forward portion provided with a nozzle structure comprising material and air nozzle portions, and provided with a material passage leading to the material nozzle portion, said body having an intermediate portion provided with an air valve structure, and with an air passage leading to said valve structure and from said valve structure to said nozzle structure, said body having a rear portion provided with a piston chamber having a forward wall closing off said chamber from said valve structure, a piston movable in said chamber, and provided with a motive fluid passage leading to said chamber rearwardly of said wall and forwardly of said piston, a spring acting on said piston to force it forward, means for connecting the valve of the valve structure to the piston to open and close with the movements of the piston, a spring pressed needle valve for controlling the flow of material through said material nozzle portion, and means on said needle valve so located as to be engaged by the piston for opening the needle valve.

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