

1

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AIR OPERATED SPRAY DEVICE HAVING FLEXIBLE PACKING MEANS

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Filed Nov. 14, 1962, Ser. No. 237,616

2 Claims. (Cl. 239-411)

This invention relates to spray guns in which compressed air is employed for atomizing a liquid medium and also for controlling the flow of the sprayed liquid.

The invention relates more particularly to spray guns of the type described which are especially applicable to use in the field of graphic arts, for example, in anti-offset coating installations for printing presses.

The principal object of the invention is the provision, in a spray gun of this class, of novel and improved packing means for the axially movable needle valve which regulates the liquid spray orifice and is in turn controlled by the pressure of the air supply. It is highly important in these fields to prevent the leakage of the high pressure air into the liquid coating supply lines which are under lower pressure, and the effective packing of the valve element has been a problem in this art.

Stuffing boxes of rather complicated construction have been used as well as simpler O-ring packings, but in all cases where the air supply under high pressure has had access to the sliding joint between the needle valve and the bore in the body of the gun through which it passes, danger of leakage of air into the liquid supply and the consequent spitting and erratic operation of the gun has persisted.

The invention in its preferred embodiments contemplates the provision of a static seal between the needle valve and the body of the gun, the sealing device itself being flexible but impervious and having spaced fixed and relatively permanent connections with the needle valve and the gun body respectively.

With this novel arrangement, misalignment of the needle valve or its fluid-motor element, whether diaphragm, bellows, or piston, is of no consequence, either in producing excessive wear or in the deleterious intermingling of the air and liquid supplies.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawings in which one embodiment of the invention is illustrated by way of example.

In the drawings:

FIGURE 1 is a view in side elevation of spray gun embodying the principles of the invention, with certain critical portions shown in vertical longitudinal section;

FIGURE 2 is an enlarged sectional view of the novel needle valve packing arrangement and associated parts; and

FIGURE 3 is a fragmentary view in vertical longitudinal section of the central portion of a spray gun illustrating a prior art packing installation.

In the illustrative example of the practice of the invention disclosed in FIGURE 1 of the drawings, the spray gun as an entirety is given the general designation 10 and comprises a main body portion 11, a nozzle portion 12, and a rearward control portion 13. An elbow for coupling to a compressed air hose is shown at 15 and a similar elbow coupling 16 is in communication with a source of the liquid to be sprayed; in this exemplary case, the liquid being a quick-drying anti-offset liquid in familiar use in printing establishments. Through the nozzle 12 the anti-offset liquid is sprayed in a flat spray pattern upon the sheets as they come from the press, so that the succeeding sheets will not adhere to the prior ones nor smudge the impression.

2

Since those experienced in the art are well aware of the general construction of the nozzle portion of these spray guns, the nozzle 12 will be described only in its broad features.

The nozzle has a central axial orifice 20 which is the forward terminus of the tapering portion 21 of the liquid bore 22 leading from the cross bore 23 communicating with the elbow 16.

The compressed air supplied through the connection 15 passes through controlled passageways (a control valve being diagrammatically suggested at 25) to certain passageways suggested at 26 and 27, the latter being an annular passageway surrounding the liquid orifice 20 and adapted to exert an aspirating and atomizing effect on the liquid discharged by the nozzle. When desired, certain modifying or fanning jets indicated at 30 are supplied with air for flattening the jet pattern, all in a well-known fashion.

The passage of liquid through the tapering passageway 21 and the orifice 20 is controlled by the pointed end of the needle valve member 35 which extends rearwardly through a bore 36 in the body 11 of the gun.

The rearward end of the needle valve 35 is provided with an enlargement 38 which is threaded into a recess 39 in the stud 40. The stud 40 has a broadened flat head 42 against the rearward surface of which the central portion of the flexible diaphragm 45 bears, said diaphragm being exemplary of various forms of motor means for actuating the needle valve. An annular button or clamping plate 46 presses against the rearward face of the diaphragm and serves to clamp the diaphragm centrally when the lock nuts 47 are screwed home.

The outer periphery of the diaphragm 45 is anchored within the rearward motor or control chamber 50 in the gun portion 13 by well-known means as by being clamped between the flange 51 of the body of the gun and the applied housing 52, the clamping being effected as by means of the screws 53. A coil spring 55 is disposed between the clamping button or plate 46 and the rear wall 56 of the control casing and serves to urge the diaphragm 45, the stud 40, and the needle valve 35 forwardly toward orifice closing position.

A tubular screw member 58 not only forms a closure for the chamber 50 but also serves as an abutment gauging the rearward movement of the stud 40 and thus the degree of opening of the orifice 20 afforded by the needle valve 35. A lock nut 59 and an indicator arm 60 are associated with this threaded adjustment of the screw 58.

One of the passageways leading from the compressed air coupling 15 is shown at 62 and this leads to the annular groove 63 which opens into the portion 65 of the control chamber 50 which is located in advance of the diaphragm 45. Thus, when the control valve 25 admits flow of compressed air through the passages 62 and 63 the diaphragm 45 is flexed rearwardly and the needle valve moved toward "on" position, and to the degree permitted by the spring 55 and the screw 58.

The structure as described thus far is more or less conventional and this presentation merely lays the background for the gist of the invention as applied to the operation of the needle valve through the body 11 of the spray gun 10.

The bore 36 through which the central portion of the needle valve 35 slides would be subject to leakage in either direction, either seepage of the liquid from the passageway 23 rearwardly when the gun is idle, or leakage of compressed air forwardly when the control valve 25 is open. It is not well to permit the leakage of liquid to foul up the control diaphragm, and it is disastrous to permit the compressed air to bypass the needle valve stem and force the liquid to back up into the liquid line, thus causing spitting and erratic operation of the spray gun in its coating function.

Now referring to FIGURE 3 of the drawings, here there is shown a packing arrangement aimed at preventing leakage of these fluids but which has not been completely successful. The basic parts of the gun will be recognized as the same as those described in FIGURE 1 of the drawings, the body of the gun indicated at 11, the needle valve at 35, the bore through which it passes shown at 36, the stud 40 with its head 42 shown in association with the diaphragm 45, and the headed rear portion 38 of the needle valve. The compressed air passageway 63 is indicated as well as the annular channel 63 which communicates with the forward control chamber portion 65.

The bore 36 widens out as at 68 to form a sort of pocket and this in turn widens into a rather large recess 70, the greater portion of which is provided with internal screw threads 71. A washer 72 is seated at the bottom of the recess 70 and a plug 75 which may be considered as an O-ring housing is threaded into the pocket or recess 70 and bears against the washer 72. The housing 75 is provided with a central bore 77 through which the needle valve 35 passes and a recess 78 is formed in the forward surface of the member 75 to contain the O-ring 80.

It has been the experience that in the operation of the spray gun with this type of O-ring packing means, numerous failures have occurred. When the gun is in operation, the control diaphragm 45 does not lift or flex evenly. This causes the needle valve stem as it slides through the O-ring to exert lateral pressure on the packing, this resulting in excessive wear or elongation of the internal diameter of the O-ring. When this condition occurs, as it does frequently, the compressed air bypasses the needle valve stem and force the liquid which is at a lower pressure than the air to back up into the liquid line and spoil the operation of the gun.

Now referring back to FIGURE 1, and also more particularly to the enlarged view of FIGURE 2, it will be seen that instead of the washer 72 and the O-ring and its housing 75, the recess 70 is occupied by a flexible collapsible bellows-like packing member 85 which has a forwardly disposed radially outwardly extending flange 86 pressed tightly against the shoulder 87 at the bottom of the recess 70 by means of the threaded tubular clamping bushing or sleeve 88 as it is screwed into the threaded walls of the recess 70. The greater portion of the length of the packing member 85 is comprised of the bellows convolutions 90 and these terminate in the base structure 92 which is recessed at its rearward end as at 93 to receive the O-ring 95. A cap 96 clamps the O-ring 95 in position where it serves as a packing between the base structure 92 of the packing device or gland 85 and the needle valve 35.

The bellows device 85 is made of a durable non-corroding resilient plastic material such as Teflon and the retainer cap 96 may be made of metal. The O-ring may of course be made of rubber or an equivalent elastomeric plastic.

Thus it will be readily seen that in the applicant's novel structure a permanent seal is effected between fixed elements of the gun at 86, 87 by the clamping action of the bushing or sleeve 88; and a similar fixed permanent seal is effected between the rear portion of the packing member 85 and the walls of the needle valve 35 by means of the O-ring 95. The collapsible or resilient nature of the packing member 85 accommodates any anticipated amount of movement of the needle valve without the possibility of leakage past relatively sliding surfaces.

The recess 68 and the interior of the bellows-like packing element of course may contain a certain amount of liquid leakage through the bore 36, but this is of little

or no consequence since it cannot pass through any further sliding joints to the supply chamber. Similarly, the compressed air in the control chamber 65 cannot leak through a sliding joint into the liquid supply as in the case of prior art constructions.

It is understood that various changes and modifications may be made in the embodiment illustrated and described herein without departing from the scope of the invention as determined by the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a spray device of the class described, a spray gun body having a spray nozzle at the forward end thereof, a liquid chamber in the forward portion of said gun body in communication with said nozzle, a compressed air chamber in said body also in communication with said nozzle but having a rearwardly disposed portion, a liquid discharge orifice and air discharge orifices in said nozzle, an elongated cylindrical needle valve having a forward end controlling flow through said liquid orifice, a bore in the body of said gun between said liquid chamber and the rearward portion of said air chamber through which an intermediate portion of said needle valve snugly passes, a motor chamber within said gun body communicating with the compressed air supply, and a motor element in said motor chamber adapted to be subjected to the pressure of the compressed air, means connecting the rear end portion of said needle valve with said motor element whereby movement of said motor element under the pressure of the compressed air effects longitudinal movement of said needle valve to open the liquid orifice of said nozzle, and packing means for the needle valve supplementing the close fit of the valve in said bore which comprises a tubular flexible member surrounding said valve and having one portion thereof fixedly sealed to the interior of said gun body adjacent said bore through which the needle valve extends and another portion fixedly sealed to a portion of the needle valve longitudinally spaced from the point of securement of the first named portion to said body, a cylindrical cavity formed in the body of the gun rearwardly of said bore and with which said bore communicates, the joint between the first named end of the tubular flexible member and the body of the gun comprising a flange on the tubular flexible member and a clamping sleeve threaded into a portion of said cavity and adapted to press said flange into intimate contact with the end wall of said cavity adjacent said bore, and the joint between the second named end of the tubular flexible member and the needle valve comprising an O-ring seated within a cylindrical recess in the outer end of said packing means and bearing radially inwardly firmly against the periphery of the needle valve.

2. The packing device as set forth in claim 1 in which the cylindrical recess in the last named end of the packing means is closed at its outer end by the flange of a cap element, a tubular portion of the latter element surrounding the second named end portion of the packing means.

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