

Description

The invention relates to a hand, or finger, manipulatable trigger sprayer, as outlined in the preamble of Claim 1.

While trigger sprayers are known in the art in a very broad variety, Claim 1 starts in its preamble from the sprayer disclosed in US—A—4 222 501. This known trigger sprayer has two ball valves as check valves in a linear passageway portion of a passageway between a dip tube connecting the sprayer with a reservoir of fluid to be dispensed, i.e., a container of fluid, and a nozzle for dispensing the fluid. Between the check valves there is a space for taking up fluid to be dispensed and for pressurizing such fluid upon actuation of the trigger. Pressurization of the fluid in the space between the check valves will lead to the ball of the upstream check valve to be pressed upon its seat so as to prevent any reverse flow of fluid to the dip tube, and to lifting the ball of the downstream check valve off its seat so as to allow dispensing flow of the fluid towards the nozzle.

The balls of the check valves, in the rest position of the sprayer, are nested in their seats by gravity, and the balls are confined within a cage to keep them in the vicinity of the seat even when in open valve position. This construction leads to the essential disadvantage that the balls of the check valves will fall off their seats once the sprayer or the bottle with the sprayer is not held upright, but is stored e.g. in horizontal position. This will lead to leakage of fluid from the sprayer in such a horizontal position; it also leads to fluid forwarded for dispensation by slightest increase in pressure insufficient to cause full spraying. This could be avoided by having the balls biased into their seated positions by springs, but any springs within the sprayer housing constitute additional parts adding to price and to assembling difficulties.

Moreover, even if spring-biased, ball valves need, for a tight seal, a seating surface of a rather complex shape, and upon elongation from such seat open up a passage for the fluid with a rather small initial cross section which increases with the increase in distance of the ball from the seat until maximum cross section in passage is reached. Upon closure of the valve, the cross section of the passage is gradually decreased until it is closed off. This leads to a retardation in the formation of a full spray at the nozzle at the beginning of the actuation and possible dripping, or post-throttling, at the end of the trigger activation.

From AT—B—341 362 it is known to use check valves within a sprayer, which, however, is not actuated by a trigger, in the form of umbrella-type valves having an elastic skirt member of flaring configuration, the outer peripheral edge thereof elastically engaging a sealing surface. Upon pressurization of fluid upstream of such check valve, the peripheral edge of the skirt member is elastically deformed to lift off its sealing surface so that fluid may pass, whereas pressure from the

downstream side of check valve leads to added sealing engagement of the peripheral edge of the skirt member at the sealing surface. Since the skirt member maintains a fluid-tight seal regardless of the orientation of the sprayer, the leakage problem of the sprayer in horizontal position is avoided. Also, as some pressure is needed for the initial opening deformation of the peripheral edge of the skirt member, and since the skirt member will return to closing position already at a still elevated fluid pressure, there is a positive valve action excluding pre-activation and post-throttling. Since the skirt member provides a flap-like valving means, full cross section of the passageway for the fluid is attained instantaneously after the first opening movement and full closure is achieved instantaneously after the beginning of the pressure drop at the end of the cycle, and the dispensing spray is fully formed at the beginning of the actuation of the trigger and abruptly stopped at the end of its activation, with any dripping or the like excluded.

The sprayer of AT—B—341 362 includes a valving member having a downstream check valve of the type described in a rectilinear passageway portion and an upstream valve member spanning the opening of the connecting tube to the dip tube, both valving means being connected by a valving stem to form one part. The downstream check valve is slidably reciprocating relative to the rectilinear passageway. In order to secure the position of the valve member against the drag of the flow of dispensing fluid and of fluid coming in from the dip tube, the lower dish-like valve member is pressed by a spring into its sealing position.

While the construction at AT—B—341 362 would avoid the disadvantages of the two ball valves of US—A—4 222 501, adoption of the valve member of AT—B—341 362 in the construction of US—A—4 222 501 would lead to the need of having a spring with corresponding disadvantages as described with respect to springs for biasing the balls onto their seats.

Even more important, for a reliable sealing action in rest position of the downstream valve, for any orientation of the finger pump, the skirt member of a valve construction as shown in AT—B—341 362 needs sealing pressure. As the skirt member is circumferentially closed, it must be assembled under relatively high circumferential compression of its material to exhibit such sealing pressure, also taking account of possible slight imperfections in roundness of the inner wall sealing surface. If a pressure differential is applied so as to open the downstream valve member, such pressure differential must additionally circumferentially compress the material of the skirt member so that a ring-like gap at the outer circumference of the skirt member is opened for fluid flow. Therefore, the pressure differential needed to open a check valve in the form of a skirt valve is very substantial.

An important characteristic of any sprayer is its priming capability. When the pumping chamber

still is filled with air, it must be possible to suck in fluid from the container and to dispense it in a proper spray after only a very few strokes. However, if the air in the pumping chamber must be compressed to a high pressure so as to obtain the pressure differential required for opening the downstream check valve, this high pressure also prevails at the beginning of the suction stroke so that the air must first be allowed to expand again before any vacuum for the sucking action may be created. Therefore, downstream check valves requiring a high pressure differential for opening are considered inappropriate in trigger sprayers with a view to priming. In the environments of the finger pump of AT-B-341 362 this problem may be easily solved by conveniently recessing the passageway portion along which the skirt member is moved during a stroke so that after a full pumping stroke the outer edge of the skirt member will not engage the cooperating passageway wall with any remarkable pressure, or not at all, allowing any pressurized air to quickly escape, but still capable of being pressed onto the cooperating passageway wall as soon as any reverse flow tends to occur. However, in trigger sprayers there is no travel of the downstream check valve within its passageway so that a skirt valve would necessarily be maintained in its partly compressed rest position also after a full pumping stroke. Therefore, with trigger sprayers, use of a skirt valve as downstream check valve has been considered inappropriate.

Therefore, starting from US-A-4 222 501, it is the aim of the present invention to provide a trigger sprayer that makes use of the advantages of a valve member in the form of an elastically deformable skirt member as known per se from AT-B-341 362, but still avoiding any serious priming problems.

The solution to this problem is brought about by the characterizing features of Claim 1.

Having an upstream rod portion serves, in any event, to reduce the effective priming volume of the trigger sprayer, i.e. the volume that has to be initially filled with fluid replacing air before the first spraying cycle may be actuated. Any volume in the space upstream the downstream check valve which needs not be filled by fluid decreases priming problems. Even though the pressure prevailing after the first pumping stroke for priming is high because of the resistance of the skirt valve, the effective volume of residual air may be held extremely small without any constructional problems so that re-expansion of such pressurized air needs only minute movement of the pumping piston before vacuum for suction is created with the piston stroke.

According to Claim 2, such upstream rod portion may further be used to secure location of the valve members in the suction stroke. Also, the frictional engagement by abutment assists in maintaining a strictly coaxial relationship to the axis of the rectilinear passageway portion.

Having the upstream abutment in the form of shoulders according to Claim 3 further assists in

maintaining strictly coaxial relationship to the axis of the rectilinear passageway portion by allowing for a self-adjustment at the abutment surface of the annular shoulder. Furthermore, the extension of the upstream rod portion penetrating through the annular shoulder may further serve to positively locate the end of the valve member opposite the end of the downstream rod portion.

Any problems with easy manufacture of the sprayer body may be avoided by forming the rectilinear passageway portion in an insert member to be inserted into the body according to Claim 4.

According to Claim 5, the skirt member comprises a downstream rod portion which extends into engagement with a stop. Such frictional engagement of the end of the downstream rod portion under the influence of the drag of the fluid to be dispensed contributes to avoid tilting of the skirt member with respect to the axis of the linear passageway portion, and corresponding deterioration of the positive action of the skirt member when opening and closing. Thus, the skirt member is kept in its axial and radial accurate position within the linear passageway portion so as to ensure its proper action with minimum efforts.

With the additional measures of Claim 6, the downstream end of the downstream rod portion is positively positioned to maintain strictly coaxial relationship with the axis of the rectilinear passageway portion under all circumstances as the valve member is securely held in place by two positive positioning means at the ends thereof.

Claims 7 thru 13 contain further advantageous details of construction.

An embodiment of the invention is shown in the drawings, wherein

Figure 1 is a side elevational view of a trigger sprayer, and

Figure 2 is a vertical sectional view of the trigger sprayer shown in Figure 1 and shows a valving system employing a ball valve and a conical skirt/umbrella valve member.

Referring now to Figure 1 in greater detail, there is illustrated therein, a trigger sprayer generally identified by the reference numeral 10. The sprayer 10 includes a body 12, a nozzle 14 coupled to an outlet end 15 of body 12, a trigger 16 pivotally mounted internally of body 12, and a cap 20 coupled to an inlet end 22 of the body 12 and adapted to be connected to a neck 24 of a container 26.

As shown, the body 12 has a generally T-shape with a wide downwardly lower body portion 28 extending to the inlet end 22 connected to cap 20, and a horizontally extending upper body portion 30 having the outlet end 15 at one end thereof and a fairing or shroud 32 at the other end thereof. The body 12 can, of course, have any desired shape and is not limited to a T-shape.

A piston or plunger 34 extends from the lower body portion 28 as shown in Figure 1 and has a rounded yoke 36 (Figure 2) in engagement with a

seat formation 38 formed on back side 40 of the trigger 16. An inner portion 42 (Figure 2) of the piston 34 is received in a sleeve 43 received in a cylindrical cavity 44 (Figure 2) extending from a front side 46 of the lower body portion 28 generally horizontally into the lower body portion 28. A back side 48 of lower body portion 28 is rounded and forms, with the trigger 16, a gripping formation by which a user of the trigger sprayer 10 can grip the sprayer 10 with one hand and squeeze to cause the trigger 16 to push the piston 34 into the sleeve 43 and cavity 44 against the force of a biasing spring 50 (Figure 2) in the sleeve 43 and cavity 44. Although the piston 34 is actually received in the sleeve 43 that is press-fitted into the cavity 44, reference will be made to the piston 34 being received in the cavity 44 only.

As will be described in greater detail hereinafter, squeezing of the trigger 16 will cause liquid to be expressed in a spray from the nozzle 14 and on release of the trigger 16, the spring 50, acting against the piston 34 and urging it outwardly, causes liquid to be drawn into the cavity 44 in the lower body portion 28.

Referring now to Figure 2, the inlet end 22 at the bottom of lower body portion 28 has a generally cylindrical, depending rim 52 which extends into a cylindrical opening 54 in cap 20. The opening 54 extends to and communicates with a larger-in-diameter threaded cylindrical wall surface 56 where a shoulder 58 is formed between opening 54 and the cylindrical cavity defined by wall surface 56. Wall surface 56 is threadably received on the threaded neck 24 of container 26.

The inside wall of the depending rim 52 has an annular groove 60 in which is snap-fittingly received an annular detent 62 on an insert member 64.

The insert member 64 is specially configured, as will be described further below, and is press-fitted into the cylindrical hollow within the depending rim 52 and has an upstanding cylindrical boss 66 which is received in a generally, vertically disposed, cylindrical cavity 68 extending upwardly from the bottom or inlet end 22 of lower body portion 28 into lower body portion 28.

The insert member 64 is generally cylindrical with an outer, radially extending, mounting flange 70 which seats adjacent shoulder 58 and can be held thereagainst by an elastomeric gasket 72 press-fitted into the cap 20 against flange 70 as shown.

The cylindrical boss 66 is eccentric to the central axis of the insert member 64 and extends upwardly from an upper surface 74 thereof which abuts the bottom or inlet end 22 of lower body portion 28.

Extending downwardly from flange 70 is a cylindrical formation 76 having a cavity 78 therein and a mound portion 80 which is in line with cylindrical boss 66 and eccentric of the center of cylindrical formation 76. A first bore 82 is formed in the mound portion 80 and extends upwardly into the insert member 64. A second bore 84 extends downwardly into the cylindrical boss 66

opposite first bore 82 and in general alignment, preferably coaxial therewith. A third smaller-in-diameter bore 86 extends between and communicates with the first and second bore 82 and 84 within the insert member 64.

Press-fitted within the first bore 82 is a dip tube 88 which extends downwardly into the container 26.

As will be described in detail hereinafter, the second bore 84 comprises part of a one-way check valve assembly 90.

For venting the container 26, a vent passage 92 extends between cavity 78 and upper surface 74 of insert member 64. A relief area 93 is formed in the upper surface 74 and communicates through a vent port 94 in lower body portion 28 and a vent port 95 in sleeve 43 to a forward portion of cavity 44 within the sleeve 43. This communication is normally covered by piston 34 but is open to the ambient environment for allowing air into the container 26 as liquid is dispersed therefrom when the piston 34 is moved into the cavity 44.

The cylindrical boss 66 extends in a cavity 68 to a shoulder 91 and a smaller-in-diameter cavity extension 96 of cylindrical cavity 68 which extension 96 extends upwardly in body 12 into upper body portion 30. Here, in upper body portion 30, a horizontally extending passageway portion 97 communicates the cavity extension 96 with the nozzle 14.

The check valve assembly 90 includes a lower or upstream check valve 98 having ball seated on a conical valve seat 99 at the lower end of second bore 84 in the cylindrical boss 66. A specially configured upper or downstream check valve 100 has a valve body which has a skirt member 112, an inverted umbrella shape, and which has an upper rod portion 102 extending into cavity extension 96 and against a top 103 of the cavity extension 96, and a lower rod portion 104 which extends into the second bore 84 and has a bottom 105 which forms a stop for limiting upwardly movement of the ball of upstream check valve 98. The upper end of the second bore 84 is countersunk, i.e. has a larger-in-diameter cavity portion 106 forming a shoulder 108 into which cavity portion 106 is received an annular formation 110 of the downstream check valve 100 located in between the rod portions 102 and 104. This annular formation 110 has at the upper end thereof the frusto-conical skirt member 112 which extends upwardly and radially outwardly from the annular formation 110 so as to engage a cylindrical wall surface 113 of the cavity portion 106. A lower edge 114 of the annular formation 110 seats on the shoulder 108 and has spaces between ribs of the formation 110 permitting communication between the second bore 84 and the cavity portion 106.

The valve assembly 90 together with trigger 16, piston 34, cavity 44 and spring 50, form a pump 120 which also includes a port 122 in a side wall of cylindrical boss 66 which communicates the second bore 84 with an opening 124 in body 12 between cavity 44 and cavity 68.

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In operation of the pump 120, when trigger 16 is squeezed, piston 34 is pushed into cavity 44 to push fluid in cavity 44 through opening 124 and port 122 and against skirt member 112, moving its outer circular end edge inwardly so that the expressed fluid flows from cavity portion 106 through cavity extension 96 and horizontal passageway portion 97 to nozzle 14; at the same time container 26 is vented.

Then, when trigger 16 is released, spring 50 pushes piston 34 out of cavity 44 creating a vacuum in second bore 84 which draws liquid up through dip tube 88, third bore 86, past ball of upstream check valve 98 and through second bore 84, port 122, opening 124 and into cavity 44 ready to be dispensed, i.e., sprayed, on the next squeezing of trigger 16.

To minimize, if not altogether prevent, malfunction of pump 120, a guide post 130 extends horizontally from the rear end of cavity 44 for receiving and guiding spring 50 at one end thereof. Then, piston 34 has an annular cavity 132 extending into the inner end portion 42 thereof to form a guide pin 134 therein around which the other end of spring 50 is received. The length of post 130 or pin 134 can be varied to provide a metering function, i.e. to increase or decrease the effective stroke of piston 34 and the amount of fluid dispensed on each "trigger squeeze".

The inner end portion 42 of piston 34 has a special configuration which is generally annular in shape and of larger diameter than the body of piston 34. The annular inner end portion 42 has a concave, arcuate in cross-section, annular groove extending between a forward flared annular ridge and a rearward flared annular ridge. Each of the ridges has a diameter slightly greater than the diameter of the cavity 44 to provide a frictional/sealing fit of the annular inner end portion 42 of piston 34 in cavity 44. To facilitate flexing of the annular ridges, the inner end portion 42 has a frusto-conical opening extending outwardly from the annular cavity 132 toward the rearward annular ridge. Then an axially facing annular groove is provided at the forward end of the annular inner end portion 42 radially inwardly of the forward annular ridge. Also, to facilitate insertion of the inner end portion 42, cavity 44 has a chamfer 135 where it opens on the front side 46 of lower body portion 28.

Engagement of pin 134 with post 130 or engagement of the rear edge of inner end portion 42 with the rear end of cavity 44 limits the inward stroke of piston 34 on the squeezing of trigger 16.

On the other hand, engagement of an upper shoulder 136 of trigger 16 with an underside 138 of a nose bushing 140 which forms part of nozzle 14 and which is situated beneath the upper body portion 30, limits the outer stroke of piston 34.

Turning now to nozzle assembly 14, it will be appreciated that the nozzle assembly 14 has an off position, a stream and a spray mist position and includes the nose bushing 140 which has a cylindrical section 141 that is received partly in a part annular, horizontally extending, slot 142 in

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the outlet end 15 of the upper body portion 30 and about a cylindrical body section 143 which is coaxial with passageway portion 97. The nose bushing 140 further includes a forward formation 144 including an annular cavity 145 within an annular nozzle mounting portion 146 and about a center portion 147 which is eccentric to cylindrical section 141. The annular cavity 145 communicates with the passageway portion 97 and the center portion has an axial cavity 148. Ports 149 in the wall of center portion 147 communicate annular cavity 145 with axial cavity 148.

Then, nozzle 14 further includes a stream nozzle element 150 that has an off position, a stream position and a spray mist position which has an outer cap formation 152 which is snap-fittingly received over the annular nozzle mounting formation 146 and an inner cap formation 154 which is received over the outer end of center formation 147. A stream forming orifice 156 coaxial with an extending through cap formations 152 and 154 communicates with axial cavity 148.

The umbrella shaped skirt member 112 of check valve 100 has a number of advantages. For example, it provides a positive, one-way shutoff valve which, because of the internal resistance of the seal provided between the skirt member 112 and cavity portion 106, lends itself to controlling flow of viscous materials as well as other liquids.

Additionally, the umbrella skirt member 112 works as a hydraulic valve which is only activated by pressure exerted on same by fluid or viscous material.

Further, the conical shape of the skirt member 112 allows the fluid to collapse the seal between the skirt member 112 and the wall of the cavity portion 106 inwardly of the axis of the valve body such that there is no back pressure or loss of functionality of the check valve 100. Furthermore, the check valve 100 operates solely as a valve mechanism with metering of the output fluid being achieved by another mechanism.

Other advantages of the umbrella skirt member 112 of downstream check valve 100 are as follows:

1. In the trigger sprayer 10 the pump 120 and valve assembly 90 can be primed with a minimum amount of strokes and once primed it will not lose the fluid; on squeezing of the trigger 16, the valve assembly 90 is immediately reprimed.

2. External forces such as squeezing the container 26 will not activate the valve assembly 90.

3. There is no post-activation that will allow fluid to be expelled through the orifice 156 in the nozzle 14 when the trigger 16 is released and the valve assembly 90 will not allow post throttling of fluid through the bore 84.

4. The simplicity of design of the body of the downstream check valve 100 facilitates plastic mold design and plastic cavitation design of the valve body.

5. The flexibility of the outer sealing surface of the frusto-conical skirt member 112 allows for some imperfection in the outer sealing surface since the flexibility of the skirt member 112 will

force the surface against the wall of the passageway.

Preferably, the valve body is made of low-density polyethylene or equivalent material, the material composition being based upon the compatibility of the particular material with fluids to be dispensed.

Although the trigger sprayer 10 shown in Figure 2 shows a lower valve 98 including a ball and an upper valve comprising the umbrella valve body, both the upper and lower valves can be defined by umbrella valve body 244.

Claims

1. A hand-manipulatable trigger sprayer (10) comprising:

a body (12) having a passageway therein including a rectilinear passageway portion (84, 106), said passageway extending between an inlet adapted to be coupled to a container (26) of fluid to be dispensed and an outlet adapted to be connected to a nozzle (14) through which the fluid is dispensed, said rectilinear passageway portion (84, 106) having a cylindrical wall surface (113),

an upstream check valve (98) and a downstream check valve (100) in said passageway defining therebetween a space in said passageway adapted to take up fluid to be dispensed, said upstream check valve (98) preventing reverse flow of fluid to the container (26) upon pressurization in said space and said downstream check valve (100) preventing reverse flow in the suction phase into said space,

said downstream check valve (100) being situated in said rectilinear passageway portion (84, 106), and a pump (120) comprising a trigger (16) reciprocally connected to the body (12) and manipulable to pump fluid from the container through the rectilinear passageway and valves to the nozzle (14), characterized in that

said downstream check valve (100) comprises an annular formation (110) and a flexible, frusto-conical shaped skirt member (112) which is fixed to and flares outwardly from said annular formation (110) in a downstream direction to an outer circular end edge and which has an outer marginal area adjacent said end edge that normally is in engagement with said cylindrical wall surface (113) of said rectilinear passageway portion (84, 106), said skirt member (112) being deformable radially inwardly under fluid pressure to allow fluid to flow downstream past said skirt member (112),

said annular formation (110) has an upstream rod portion (104) which extends axially upstream from said skirt member (112) into vicinity with said upstream check valve (98) and effectively reduces the volume of the portion of the passageway between the check valves and therefore the residual effective volume of the pumping chamber, and said pump (120) including a generally cylindrical cavity (44) in said body (12) communicating with said passageway, a piston

(34) received in said cylindrical cavity (44), a spring (50) in said cylindrical cavity (44) between the inner end thereof and an inner end portion (42) of said piston (34) for biasing said piston (34) outwardly of said cylindrical cavity (44), said trigger (16) is engageable with the outer end of said piston (34) and is manipulatable for pushing said piston (34) into said cylindrical cavity (44) against the action of said spring (50), thereby to force fluid in said cylindrical cavity (44) on an inner stroke of said piston (34) from said cylindrical cavity (44) into said passageway and past said downstream check valve (100) so as to be dispensed through said nozzle (14), and on an outer stroke of said piston (34) to draw fluid into said cylindrical cavity (44) from the container (26) through said upstream check valve (98).

2. The sprayer of Claim 1, characterized in that said upstream rod portion (104) is in engagement with an upstream abutment (108) preventing excessive movement of said annular formation (110) in counter-direction to said direction of flow of fluid to be dispensed.

3. The sprayer of Claim 2, characterized in that said upstream abutment is formed by an annular shoulder (108) in said rectilinear passageway portion (84, 106) engaged by a shoulder (114) on said upstream rod portion (104).

4. The sprayer of Claim 3, characterized in that said rectilinear passageway portion (84, 106) is formed in an insert member (64) in said body (12).

5. The sprayer of Claim 1, characterized in that said annular formation (110) has a downstream rod portion (102) which extends axially downstream from said skirt member (112) into engagement with a stop (103) for the downstream end thereof to bear against said stop (103) against the dragging force of fluid flowing at the circumference of said skirt member (112) and annular formation (110) upon actuation of said trigger (16).

6. The sprayer of Claim 5, characterized in that said stop comprises axially extending wall elements providing radial stop surfaces at the circumference of the downstream end of said downstream rod portion (102).

7. The sprayer of any one of Claims 1 to 6, characterized in that said passageway (88, 84, 106, 96, 97) has a stepped chamber (84, 108, 106) therein, said chamber (84, 108, 106) forming said rectilinear passageway portion (84, 106) and an annular shoulder (108) being defined at the junction between a larger diameter downstream portion (106) and a smaller-in-cross-section upstream portion (84) of said passageway (88, 84, 106, 96, 97) and in that said annular formation (110) is received in said larger diameter downstream portion (106) for seating on said annular shoulder (108) and said upstream rod portion (104) extends into said smaller-in-cross-section upstream portion (84) of said passageway (88, 84, 106, 96, 97).

8. The sprayer of Claim 7, characterized in that said formation (110) is defined by at least two

force the surface against the wall of the passageway.

Preferably, the valve body is made of low-density polyethylene or equivalent material, the material composition being based upon the compatibility of the particular material with fluids to be dispensed.

Although the trigger sprayer 10 shown in Figure 2 shows a lower valve 98 including a ball and an upper valve comprising the umbrella valve body, both the upper and lower valves can be defined by umbrella valve body 244.

Claims

1. A hand-manipulatable trigger sprayer (10) comprising:

a body (12) having a passageway therein including a rectilinear passageway portion (84, 106), said passageway extending between an inlet adapted to be coupled to a container (26) of fluid to be dispensed and an outlet adapted to be connected to a nozzle (14) through which the fluid is dispensed, said rectilinear passageway portion (84, 106) having a cylindrical wall surface (113),

an upstream check valve (98) and a downstream check valve (100) in said passageway defining therebetween a space in said passageway adapted to take up fluid to be dispensed, said upstream check valve (98) preventing reverse flow of fluid to the container (26) upon pressurization in said space and said downstream check valve (100) preventing reverse flow in the suction phase into said space,

said downstream check valve (100) being situated in said rectilinear passageway portion (84, 106), and a pump (120) comprising a trigger (16) reciprocally connected to the body (12) and manipulable to pump fluid from the container through the rectilinear passageway and valves to the nozzle (14), characterized in that

said downstream check valve (100) comprises an annular formation (110) and a flexible, frusto-conical shaped skirt member (112) which is fixed to and flares outwardly from said annular formation (110) in a downstream direction to an outer circular end edge and which has an outer marginal area adjacent said end edge that normally is in engagement with said cylindrical wall surface (113) of said rectilinear passageway portion (84, 106), said skirt member (112) being deformable radially inwardly under fluid pressure to allow fluid to flow downstream past said skirt member (112),

said annular formation (110) has an upstream rod portion (104) which extends axially upstream from said skirt member (112) into vicinity with said upstream check valve (98) and effectively reduces the volume of the portion of the passageway between the check valves and therefore the residual effective volume of the pumping chamber, and said pump (120) including a generally cylindrical cavity (44) in said body (12) communicating with said passageway, a piston

(34) received in said cylindrical cavity (44), a spring (50) in said cylindrical cavity (44) between the inner end thereof and an inner end portion (42) of said piston (34) for biasing said piston (34) outwardly of said cylindrical cavity (44), said trigger (16) is engageable with the outer end of said piston (34) and is manipulatable for pushing said piston (34) into said cylindrical cavity (44) against the action of said spring (50), thereby to force fluid in said cylindrical cavity (44) on an inner stroke of said piston (34) from said cylindrical cavity (44) into said passageway and past said downstream check valve (100) so as to be dispensed through said nozzle (14), and on an outer stroke of said piston (34) to draw fluid into said cylindrical cavity (44) from the container (26) through said upstream check valve (98).

2. The sprayer of Claim 1, characterized in that said upstream rod portion (104) is in engagement with an upstream abutment (108) preventing excessive movement of said annular formation (110) in counter-direction to said direction of flow of fluid to be dispensed.

3. The sprayer of Claim 2, characterized in that said upstream abutment is formed by an annular shoulder (108) in said rectilinear passageway portion (84, 106) engaged by a shoulder (114) on said upstream rod portion (104).

4. The sprayer of Claim 3, characterized in that said rectilinear passageway portion (84, 106) is formed in an insert member (64) in said body (12).

5. The sprayer of Claim 1, characterized in that said annular formation (110) has a downstream rod portion (102) which extends axially downstream from said skirt member (112) into engagement with a stop (103) for the downstream end thereof to bear against said stop (103) against the dragging force of fluid flowing at the circumference of said skirt member (112) and annular formation (110) upon actuation of said trigger (16).

6. The sprayer of Claim 5, characterized in that said stop comprises axially extending wall elements providing radial stop surfaces at the circumference of the downstream end of said downstream rod portion (102).

7. The sprayer of any one of Claims 1 to 6, characterized in that said passageway (88, 84, 106, 96, 97) has a stepped chamber (84, 108, 106) therein, said chamber (84, 108, 106) forming said rectilinear passageway portion (84, 106) and an annular shoulder (108) being defined at the junction between a larger diameter downstream portion (106) and a smaller-in-cross-section upstream portion (84) of said passageway (88, 84, 106, 96, 97) and in that said annular formation (110) is received in said larger diameter downstream portion (106) for seating on said annular shoulder (108) and said upstream rod portion (104) extends into said smaller-in-cross-section upstream portion (84) of said passageway (88, 84, 106, 96, 97).

8. The sprayer of Claim 7, characterized in that said formation (110) is defined by at least two



ribs extending radially outwardly and axially of the body of said downstream valve (100) and integral therewith.

9. The sprayer of Claim 8, characterized in that said ribs are situated in pairs diametrically opposite each other.

10. The sprayer of Claim 9, characterized in that said formation (110) comprises two additional ribs which are situated diametrically opposite each other in a plane normal to the plane of said two first ribs.

11. The sprayer of Claim 9, characterized in that each of said ribs has a stepped outer edge with an outer portion extending generally in the same direction as the elongate axis of said body of said downstream valve (100), an inner portion which is received in said smaller-in-cross-section chamber portion (84), and a rib shoulder (114) which is situated between said outer and inner portions and which rests on said annular shoulder (108).

12. The sprayer of Claim 11, characterized in that said body of said downstream valve (100) in the area between said ribs, has a conical surface which ends at the plane of said rib shoulders (114), the cross-section of said conical body at the location of said rib shoulders being less than the diameter of said smaller-in-cross-section upstream portion (84) of said passageway such that flow through passages are defined between said ribs and between said upstream portion (84) of said passageway (88, 84, 106, 96, 97).

13. The sprayer of any one of Claims 1 to 12, characterized in that said body of said downstream valve (100) is made of a flexible elastomeric material such as polyethylene.

Patentansprüche

1. Von Hand abzugshebelbetätigter Sprühzerstäuber

mit einem Gehäusekörper (12) mit einem darin angeordneten Kanal, der einen geradlinigen Kanalabschnitt (84, 106) aufweist und sich zwischen einem einen Behälter (26) für ausstragendes Fluid anzuschließenden Einlaß und einem Auslaß erstreckt, der mit einer Düsenanordnung (14) verbindbar ist, durch welche hindurch Fluid austragbar ist, wobei der geradlinige Kanalabschnitt (84, 106) eine zylindrische Wandoberfläche (113) aufweist,

mit einem stromaufseitigen Rückschlagventil (98) und einem stromabseitigen Rückschlagventil (100) in dem Kanal, die zwischen sich in dem Kanal einen Raum zur Aufnahme von auszutragendem Fluid begrenzen, wobei das stromaufseitige Rückschlagventil (98) bei Druckbeaufschlagung in dem Raum einen Rückfluß des Fluids zum Behälter (26) und das stromabseitige Ventil (100) im Saughub einen Rückfluß des Fluids in den Raum vermeidet,

wobei das stromabseitige Rückschlagventil (100) in dem geradlinigen Kanalabschnitt (84, 106) angeordnet ist, und

mit einer Pumpe (120), welche einen mit dem Gehäusekörper (12) hin- und herbeweglich ver-

bundenen Abzugshebel (16) aufweist, der für eine Pumpförderung des Fluids vom Behälter durch den geradlinigen Kanalabschnitt und die Ventile zur Düsenanordnung (14) betätigbar ist, dadurch gekennzeichnet

daß das stromabseitige Rückschlagventil (100) einen Ringkörper (110) und ein flexibles, kegeltumpfförmig ausgebildetes Randabspernteil (112) aufweist, welches am Ringkörper (110) befestigt ist und sich von diesem nach außen in Stromabrichtung zu einem äußeren kreisförmigen Rand erstreckt, und welches in der Nachbarschaft des äußeren Randes einen äußeren Randbereich aufweist, der normalerweise an der zylinerischen Wandoberfläche (113) des geradlinigen Kanalabschnittes (84, 106) anliegt, wobei das Randabspernteil (112) unter Fluiddruck radial nach innen verformbar ist und Fluid in Stromabwärtsrichtung am Randabspernteil (112) vorbeistreichen läßt,

daß der Ringkörper (110) einen stromaufseitigen Stangenabschnitt (104) aufweist, der sich vom Randabspernteil (112) in axialer Richtung stromauf in die Nachbarschaft des stromaufseitigen Rückschlagventils (98) erstreckt und dabei das effektive Volumen des Abschnitts des Kanals zwischen den Rückschlagventilen und somit das effektive Restvolumen der Pumpenkammer vermindert, und

daß die Pumpe (120) eine im wesentliche zylindrische Ausnehmung (44) in dem Gehäusekörper (12) aufweist, die mit dem Kanal in Verbindung steht, weiter einen Kolben (34) in der zylindrischen Ausnehmung (44) aufweist, sowie eine Feder (50) in der zylindrischen Ausnehmung (44) zwischen deren innerem Ende und

einem inneren Endabschnitt (42) des Kolbens (34) aufweist, die den Kolben (34) in Richtung aus der zylindrischen Ausnehmung (44) hinaus belastet, wobei der Abzugshebel (16) mit dem äußeren Ende des Kolbens (34) in Anlage bringbar und im Sinne eines Hineindrückens des Kolbens (34) in die zylindrische Ausnehmung (44) gegen die Kraft der Feder (50) betätigbar ist und so Fluid in der zylindrischen Ausnehmung (44) beim Einwärtshub des Kolbens (34) aus der zylindrischen Ausnehmung (44) in den Kanal und am stromabseitigen Rückschlagventil (100) vorbei zum Ausstrag aus der Düsenanordnung (14) preßt sowie beim Auswärtshub des Kolbens (34) Fluid aus dem Behälter (26) durch das stromaufseitige Rückschlagventil (98) in die zylindrische Ausnehmung (44) einsaugt.

2. Sprühzerstäuber gemäß Anspruch 1, dadurch gekennzeichnet, daß der stromaufseitige Stangenabschnitt (104) zur Vermeidung einer übermäßigen Bewegung des Ringkörpers (110) in Gegenrichtung zur Strömungsrichtung der ausstragenden Flüssigkeit an einem stromaufseitigen Anschlag (108) anliegt.

3. Sprühzerstäuber nach Anspruch 2, dadurch gekennzeichnet, daß der stromaufseitige Anschlag durch eine Ringschulter (108) in dem geradlinigen Kanalabschnitt (84, 106) gebildet ist, an der eine Schulter (114) des stromaufseitigen Stangenabschnittes (104) anliegt.

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4. Sprühzerstäuber nach Anspruch 3, dadurch gekennzeichnet, daß der geradlinige Kanalabschnitt (84, 106) in einem Einsatzstück (64) des Gehäusekörpers (12) gebildet ist.

5. Sprühzerstäuber nach Anspruch 1, dadurch gekennzeichnet, daß der Ringkörper (110) einen stromabseitigen Stangenabschnitt (102) aufweist, der sich in axialer Richtung stromab vom Randabspernteil (112) in Anlage an einen Anschlag (103) zur Abstützung seines stromabseitigen Endes gegen die Schleppkraft des bei Betätigung des Abzughebels (16) am Umfang des Randabspernteils (112) und des Ringkörper (110) strömenden Fluids erstreckt.

6. Sprühzerstäuber nach Anspruch 5, dadurch gekennzeichnet, daß der Anschlag (103) sich in axialer Richtung erstreckende Wandelemente aufweist, die radiale Anschlagflächen am Außenumfang des stromabseitigen Endes des stromabseitigen Stangenabschnitts (102) bilden.

7. Sprühzerstäuber nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der Kanal (88, 84, 106, 96, 97) eine abgestufte Kammer (84, 108, 106) aufweist, welche den geradlinigen Kanalabschnitt (84, 106) und eine ringförmige Schulter (108) bildet, die am Übergang zwischen einem stromabseitigen Abschnitt (106) größeren Durchmessers und einem stromaufseitigen Abschnitt (84) kleineren Querschnitts des Kanals (88, 84, 106, 96, 97) gebildet ist, und daß der Ringkörper (110) in dem stromabseitigen Abschnitt (106) größeren Durchmessers für einen Sitz auf der ringförmigen Schulter (108) aufgenommen ist und der stromaufseitige Stangenabschnitt (104) sich in den stromaufseitigen Abschnitt (84) kleineren Querschnitts des Kanals (88, 84, 106, 96, 97) erstreckt.

8. Sprühzerstäuber nach Anspruch 7, dadurch gekennzeichnet, daß der Ringkörper (110) durch wenigstens zwei Rippen begrenzt ist, die sich radial nach außen und axial von dem Körper des stromabseitigen Ventils (100) erstrecken und einstückig damit ausgebildet sind.

9. Sprühzerstäuber nach Anspruch 8, dadurch gekennzeichnet, daß die Rippen paarweise einander gegenüberliegend angeordnet sind.

10. Sprühzerstäuber nach Anspruch 9, dadurch gekennzeichnet, daß der Ringkörper (110) zwei weitere Rippen aufweist, die einander diametral gegenüberliegend in einer Ebene angeordnet sind, die senkrecht auf der Ebene der ersten beiden Rippen steht.

11. Sprühzerstäuber nach Anspruch 9, dadurch gekennzeichnet, daß jede der Rippen einen gestuften Außenrand mit einem äußeren Abschnitt aufweist, der sich im wesentlichen in derselben Richtung wie die Längsachse des Körpers des stromabseitigen Ventils (100) erstreckt, und mit einem inneren Abschnitt, der in dem Kammerabschnitt (84) kleineren Querschnitts aufgenommen ist, sowie mit einer Rippenschulter (114), die zwischen dem äußeren und dem inneren Abschnitt angeordnet ist und auf der Ringschulter (108) aufliegt.

12. Sprühzerstäuber nach Anspruch 11,

dadurch gekennzeichnet, daß der Körper des stromabseitigen Ventils (100) in dem Bereich zwischen den Rippen eine konische Oberfläche aufweist, welche in der Ebene der Rippenschultern (114) endet, wobei der Querschnitt des konischen Körpers an der Stelle der Rippenschultern geringer ist als der Durchmesser des stromaufseitigen Abschnitts (84) kleineren Querschnitts des Kanals und so die Strömung durch Durchlässe hindurch erfolgt, die zwischen den Rippen und dem stromaufseitigen Abschnitt (84) des Kanals (88, 84, 106, 96, 97) begrenzt ist.

13. Sprühzerstäuber nach einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß der Körper des stromabseitigen Ventils (100) aus einem flexiblen elastomeren Material wie Polyethylen besteht.

Revendications

1. Pulvérisateur à gâchette manoeuvrable à la main (10) comprenant:

un corps (12) à passage intérieur comprenant une partie de passage rectiligne (84, 106), ledit passage s'étendant entre une entrée prévue pour être raccordée à un récipient (26) de fluide à distribuer et une sortie prévue pour être raccordée à une buse (14) à travers laquelle le fluide est distribué, ladite partie de passage rectiligne (84, 106) présentant une surface de paroi cylindrique (113),

un clapet anti-retour amont (98) et un clapet anti-retour aval (100) placés dans ledit passage et définissant entre eux un espace dans ledit passage, prévu pour la reprise de fluide à distribuer, ledit clapet amont (98) empêchant une circulation inverse de fluide vers le récipient (26) lors de la mise en pression dans ledit espace et ledit clapet aval (100) empêchant une circulation inverse lors de la phase d'aspiration dans ledit espace;

ledit clapet aval (100) étant situé dans ladite partie de passage rectiligne (84, 106), et une pompe (120) comprenant une gâchette (16) reliée pour un mouvement de va-et-vient au corps (12) et manipulable pour pomper le fluide à partir du récipient, à travers le passage rectiligne et les clapets, vers la buse (14), caractérisé en ce que

ledit clapet aval (100) comprend une partie annulaire (110) et une jupe tronconique flexible (112) qui est fixée à ladite partie annulaire (110) et s'évase vers l'extérieur à partir de celle-ci, vers l'aval, jusqu'à un bord d'extrémité circulaire extérieur, et qui présente une région marginale extérieure adjacente audit bord d'extrémité qui est normalement en contact avec ladite surface de paroi cylindrique (113) de ladite partie de passage rectiligne (84, 106), ladite jupe (112) étant déformable radialement vers l'intérieur sous une pression de fluide pour permettre au fluide de s'écouler vers l'aval au-delà de ladite jupe (112),

ladite partie annulaire (110) comporte une partie de tige amont (104) qui s'étend axialement en amont à partir de ladite jupe (112) jusqu'au voisinage dudit clapet amont (98) et réduit effecti-



ment le volume de la partie du passage entre clapets et par conséquent le volume résiduel effectif de la chambre de pompage, et ladite pompe (120) comprend une cavité sensiblement cylindrique (44) dans ledit corps (12) en communication avec ledit passage, un piston (34) disposé dans ladite cavité cylindrique (44), un ressort (50) placé dans ladite cavité cylindrique (44) entre l'extrémité intérieure de celle-ci et une partie d'extrémité intérieure (42) dudit piston (34) pour rappeler ledit piston (34) vers l'extérieur de ladite cavité cylindrique (44), ladite gâchette (16) pouvant venir en contact avec l'extrémité extérieure dudit piston (34) et étant manœuvrable pour pousser ledit piston (34) dans ladite cavité cylindrique (44) contre l'action dudit ressort (50), de manière à refouler le fluide contenu dans ladite cavité cylindrique (44) lors d'une course intérieure dudit piston (34), à partir de ladite cavité cylindrique (44), dans ledit passage et au-delà dudit clapet aval (100) afin de le distribuer par l'intermédiaire de ladite buse (14), et de manière à aspirer le fluide dans ladite cavité cylindrique (44), lors d'une course extérieure dudit piston (34), à partir du récipient (26) et à travers ledit clapet amont (98).

2. Pulvérisateur suivant la revendication 1, caractérisé en ce que ladite partie de tige amont (104) est en contact avec une butée amont (108) empêchant un mouvement excessif de ladite partie annulaire (110) en direction opposée à ladite direction d'écoulement du fluide à distribuer.

3. Pulvérisateur suivant la revendication 2, caractérisé en ce que ladite butée amont est formée par un épaulement annulaire (108), prévu dans ladite partie de passage rectiligne (84, 106), et coopérant avec un épaulement (114) ménagé sur ladite partie de tige amont (104).

4. Pulvérisateur suivant la revendication 3, caractérisé en ce que ladite partie de passage rectiligne (84, 106) est formée dans un insert (64) placé dans ledit corps (12).

5. Pulvérisateur suivant la revendication 1, caractérisé en ce que ladite partie annulaire (110) comprend une partie de tige aval (102) qui s'étend axialement en aval de ladite jupe (112), en contact avec une butée (103) de sorte que son extrémité aval s'appuie contre ladite butée (103) pour résister à la force d'entraînement exercée par le fluide en circulation à la circonférence de ladite jupe (112) et de ladite partie annulaire (110) lors de la manœuvre de ladite gâchette (16).

6. Pulvérisateur suivant la revendication 5, caractérisé en ce que ladite butée comprend des éléments de paroi s'étendant axialement qui présentent des surfaces de butée radiales à la circonférence de l'extrémité aval de ladite partie de tige aval (102).

7. Pulvérisateur suivant l'une quelconque des

revendications 1 à 6, caractérisé en ce que ledit passage (88, 84, 106, 96, 97) comprend un chambre à gradins (84, 108, 106), ladite chambre (84, 108, 106) constituant ladite partie de passage rectiligne (84, 106), et un épaulement annulaire (108) étant défini à la jonction entre une partie aval de plus grand diamètre (106) et une partie amont de plus petite section (84) dudit passage (88, 84, 106, 96, 97), et en ce que ladite partie annulaire (110) est reçue dans ladite partie aval de plus grand diamètre (106) pour s'appliquer sur ledit épaulement annulaire (108), et ladite partie de tige amont (104) s'étendant dans ladite partie amont de plus petite section (84) dudit passage (88, 84, 106, 96, 97).

8. Pulvérisateur suivant la revendication 7, caractérisé en ce que ladite partie annulaire (110) est définie par au moins deux nervures s'étendant radialement vers l'extérieur et dans la direction axiale du corps dudit clapet aval (100), solidairement de celui-ci.

9. Pulvérisateur suivant la revendication 8, caractérisé en ce que lesdites nervures sont disposées par paires, diamétralement opposées l'une à l'autre.

10. Pulvérisateur suivant la revendication 9, caractérisé en ce que ladite partie annulaire (110) comprend deux nervures supplémentaires qui sont placées en opposition diamétrale l'une à l'autre, dans un plan perpendiculaire au plan desdites deux premières nervures.

11. Pulvérisateur suivant la revendication 9, caractérisé en ce que chacune desdites nervures comporte un bord extérieur épaulé, avec une partie extérieure s'étendant sensiblement dans la même direction que le grand axe dudit corps dudit clapet aval (100), une partie intérieure qui est reçue dans ladite partie de chambre de section plus petite (84), et un épaulement de nervure (114) qui est situé entre lesdites parties extérieure et intérieure et qui repose sur ledit épaulement annulaire (108).

12. Pulvérisateur suivant la revendication 11, caractérisé en ce que ledit corps dudit clapet aval (100), dans la région entre lesdites nervures, présente une surface conique qui se termine dans le plan desdits épaulement de nervure (114), la section transversale dudit corps conique à l'endroit desdits épaulements de nervure étant inférieure au diamètre de ladite partie amont de section plus petite (84) dudit passage de sorte que des passages traversants d'écoulement sont définis entre lesdites nervures et entre ladite partie amont (84) dudit passage (88, 84, 106, 96, 97).

13. Pulvérisateur suivant l'une quelconque des revendications 1 à 12, caractérisé en ce que ledit corps dudit plateau aval (100) est fabriqué en une matière élastomère flexible, telle que du polyéthylène.



* C L M S *