Sept. 6, 1955 N. F. CORNELIUS 2,717,178

SPRAYERS

Filed Aug. 12, 1953

FIG. 1

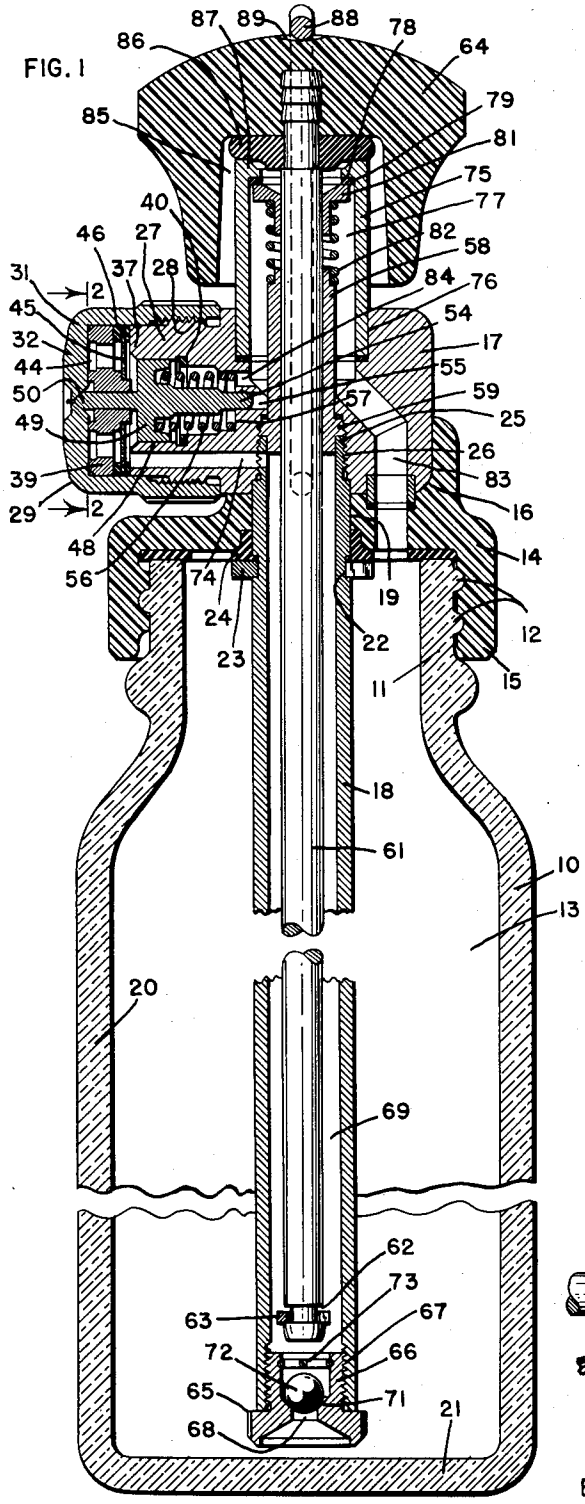


FIG. 3

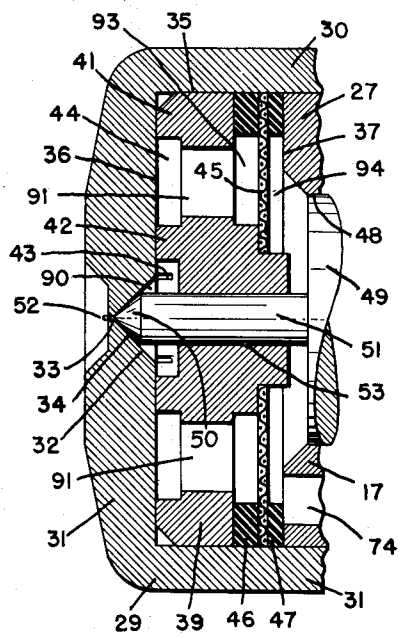
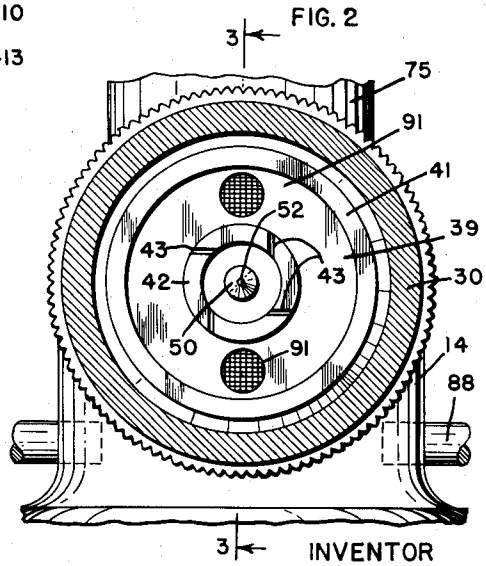


FIG. 2



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United States Patent Office

2,717,178

Patented Sept. 6, 1955

2,717,178

SPRAYERS

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Application August 12, 1953, Serial No. 373,745

6 Claims. (Cl. 299—97)

The herein disclosed invention relates to sprayers and particularly to the type in which a liquid contained in a receptacle is forced through a nozzle under pressure to atomize the same and has for an object to provide a sprayer which will not leak or drip during spraying or after the spraying has ceased.

Another object of the invention resides in providing a sprayer in which the flow of liquid ceases when the pressure becomes too low to produce atomization.

A still further object of the invention resides in constructing the nozzle with a discharge orifice and in providing a valve at said orifice adapted to close said orifice.

An object of the invention resides in providing a body including means forming a passageway between the liquid in said receptacle and said discharge orifice and in further providing pump means for drawing the liquid from said receptacle and discharging it through said passageway and orifice under pressure.

Another object of the invention resides in providing pressure responsive means subject to the pressure in said passageway for opening said valve when the pressure in said passageway reaches a predetermined value.

A still further object of the invention resides in constructing the valve with a movable valve head and in utilizing as the pressure responsive means a piston connected to the valve head and operable in a cylinder subject to the pressure in said receptacle.

An object of the invention resides in making the piston sufficiently loose in the cylinder to permit the flow of air therebetween and in providing a seal at the end of the cylinder engageable with the piston to terminate flow between the piston and cylinder when the pressure is great enough to cause atomizing of the liquid.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is an elevational sectional view of a sprayer illustrating an embodiment of the invention applied thereto.

Fig. 2 is an elevational cross sectional view taken on line 2—2 of Fig. 1 and drawn to a greater scale.

Fig. 3 is a longitudinal sectional view taken on line 3—3 of Fig. 2.

The construction disclosed in the drawings consists of a receptacle for a liquid to be sprayed and has a neck open at the top and communicating with the interior of the receptacle. A cap secured to the neck supports a barrel leading to the bottom of the receptacle and having an inlet closed by a check valve whereby the liquid in the receptacle may enter the barrel but is prevented from returning into the receptacle through the barrel. A body attached to the cap is provided at its end with a nozzle having a discharge orifice encircled by a conical valve seat. This nozzle has a chamber communicating with said orifice and also communicating with the interior of the barrel whereby liquid entering the barrel may be directed to said orifice. A plunger slidable in a guide attached to said body extends down into said barrel and serves on one stroke to draw liquid into the barrel and on its other stroke to forcibly discharge the liquid under pressure through the orifice in said nozzle. In the body is formed a cylinder in which is slidably mounted a piston connected to said valve head. This piston is subject to the pressure in said chamber and urges the same into the cylinder to withdraw the valve head from engagement with the valve seat when the pressure in the chamber is sufficient to cause spraying of the liquid upon its discharge from the orifice. The piston is loosely mounted in the cylinder to permit air to flow therebetween and back to said receptacle. At the end of the cylinder is a seal engageable with the piston to terminate flow past the piston when the pressure in the nozzle is sufficiently high to produce atomizing of the liquid by the nozzle. A spring acting against said piston and body urges the valve head into closing position. The plunger operating in the barrel is provided with valve means whereby the body may be sealed with reference to the receptacle when the device is not in use. A latching member holds the plunger in its innermost position.

For the purpose of illustrating the invention a receptacle **10** has been shown which may be constructed of glass or any other suitable material. This receptacle has a lateral wall structure **20** with a bottom **21** connected thereto. Issuing upwardly from the wall structure **20** is a neck **11** which is formed with threads **12** on the exterior thereof. The receptacle **10** is formed with a chamber **13** which extends into the neck **11** and which is open to the exterior through the upper end of said neck. A cap **14** closes the receptacle **10** and is provided with a sleeve **15** threaded to screw on the threads **12** of the receptacle **10**.

Mounted in a socket **16** in the upper portion of the cap **14** is a body **17**. Screwed into this body is a barrel **18** which extends through an opening **19** in the cap **14** and downwardly toward the bottom **21** of the receptacle **10**. This barrel is formed intermediate its end with a groove **22** in which is received a split spring collar **23**. This collar abuts against a gasket **24** disposed between said collar and the cap **14**. The upper end **25** of the barrel **18** is threaded to screw into threads **26** formed in the body **17**. When the said barrel is properly screwed into said threads the gasket **24** is compressed and the body **17** and barrel **18** held in proper position mounted on the cap **14** and in a manner to prevent leakage between said barrel, body and cap.

The body **17** is constructed with a cylindrical portion **27** which is formed with threads **28**. This cylindrical portion supports a nozzle indicated in its entirety by the reference numeral **29**. Nozzle **29** includes a cap **31** which has an end wall **32** and a sleeve **30** extending outwardly therefrom. This sleeve is threaded to screw upon the threads **28** on the cylindrical portion **27** of the body **17**. Formed at the center of the end wall **32** of cap **31** is a discharge orifice **33** which is surrounded by a conical valve seat **34**. By means of this construction a conical chamber **90** is formed at the locality of the orifice **33** and communicating therewith. Within the interior of the cap **31** is formed a cylindrical surface **35** and an end surface **36**. The surface **36** is spaced from the end **37** of the cylindrical portion **27** of body **17**. Adjacent surface **36** is disposed a disc **39** best shown in detail in Figs. 2 and 3. This disc fits within the cylindrical surface **35** of cap **32** and has a rim **41** which abuts against the end surface **36** of said cap. The disc **39** is further constructed with an annulus **42** spaced from the rim **41** which extends up to the surface **36**. By means of this construction an annular chamber **44** is provided bounded by said rim and annulus. The annulus **42** is formed with a number of spiral grooves **43** which cause the liquid

entering the chamber 44 within said annulus to enter the chamber 90 in the end wall 32 of cap 31. A strainer 45 held between gaskets 46 and 47 is clamped in position between the end 37 of the cylindrical portion 27 of body 17 and the disc 39. This strainer forms one chamber 93 between said strainer and disc 39 and another chamber 94 between said strainer and the cylindrical portion 27 of body 17. Chamber 93 communicates with chamber 44 through holes 91 drilled in the disc 39.

Formed in the cylindrical portion 27 of cap 17 is a cylinder 48 and in which is received a piston 49. This piston is connected to a valve stem 51 issuing from a valve head 50. The valve head 50 is adapted to seat against the valve seat 34 and has a pin 52 extending outwardly therefrom and closing the space in the orifice 33. The valve stem 51 is guided in a bore 53 formed in the disc 39. The piston 49 has a piston rod 54 issuing outwardly therefrom and in alignment with the valve stem 51 and which is guided for sliding movement in a bore 55 formed in the body 17. A compression coil spring 56 encircling the piston rod 54 engages the piston 49 and a shoulder 57 in the body 17 and urges the valve head 50 into engagement with the valve seat 34. At the inner end of the bore 48 is disposed an annular compressible seal 40. This seal is adapted to be engaged by the end of the piston 49 when the valve head 50 is in open position. The piston 49 is made sufficiently loose in the bore 48 so that air may flow past said piston and into the space in back of the piston. This forms a bypass around the piston. When the end of the piston reaches the seal 40 flow of air past the same terminates.

Mounted in the body 17 is a guide 58 which is constructed with a threaded flange 59 screwed into the threads 26 of said body and extending in alignment with the barrel 18. In this guide is slidably mounted a plunger 61 which extends downwardly toward the bottom of the barrel 18. This plunger at its lower end is formed with a groove 62 in which is received a split spring collar 63. This collar prevents the plunger from being withdrawn from the guide 58 upon engagement with the lowermost end of the same. The plunger 61 is provided with a knob 64 attached to the protruding end of the same and by means of which said plunger may be reciprocated.

At the lower end of the barrel 18 is provided a check valve 65 which comprises a bushing 66 screwed into threads 67 formed upon the interior of the barrel 18. This bushing has a passageway 68 communicating with the bore 69 of the barrel 18. This passageway is surrounded by a valve seat 71 on which a ball valve member 72 may seat. A retainer 73 holds the said ball member in operative position. In the body 17 is formed a hole 74 which communicates with the bore 69 of barrel 18 and with the chamber 94 in cap 31. This hole, the bore 69 and the chambers 94, 93 and 44 form a passageway for bringing the nozzle 29 into communication with chamber 13 in receptacle 10.

Encircling the guide 58 and plunger 61 exteriorly of the body 10 is a sleeve 75 which is received in a socket 76 formed in the body 17. This sleeve is pressed into position and forms an annular chamber 77 encircling the guide 58. The sleeve 75 is constructed with a shoulder 78 extending inwardly therefrom and against which a gasket 79 is disposed. A follower 81 slidably mounted on the plunger 61 is moved upwardly by means of a compression coil spring 82 to urge said follower against the gasket 79 and form a tight connection between the plunger 61 and the body 17. The plunger 61 fits sufficiently loosely in the follower 81 so that air may flow past the same from the exterior and into the chamber 77. This construction also permits of slight variations in alignment between the sleeve 75 and the barrel 18 so as to reduce friction between the plunger 61 and follower 81. The chamber 77 communicates with the chamber 13 in receptacle 10 through a passageway 83 which extends through the body 17 and cap 14. Another

passageway 84 at the end of the bore 48 in the portion 27 of body 17 communicates with the chamber 77. In this manner any leakage past the piston 49 is discharged back into the receptacle 10. Likewise the follower 81 scrapes off any liquid collected on the plunger 61 and discharges the same back into the chamber 77 from which it flows through passageway 83 into the chamber in receptacle 10.

Mounted on the plunger 61 and located within a cavity 85 in the knob 64 is a valve head 86. This valve head is adapted to seat against the upper end 87 of the sleeve 75 and to completely close the mechanism carried by the cap 14 from communication with the exterior. A resilient U-shaped wire keeper 88 is pivoted to the cap 14 and is adapted to swing into a depression 89 on the knob 64 to hold the valve member 86 in engagement with the end 87 of sleeve 75 when the device is not in use.

The use of the invention is obvious. Cap 14 is first removed and the chamber 13 in the receptacle 10 filled with the liquid to be sprayed. The cap is then reapplied. Upon swinging the keeper 88 clear of knob 64 the same drops downwardly and rests upon the receptacle 10. Knob 64 may now be manipulated to draw the plunger 61 upwardly. This draws liquid through the passageway 68 and into the bore 69 of barrel 18, the ball valve member 72 raising to allow the passage of the liquid to said bore. At first small portions of liquid are drawn into bore 69 with each stroke. The air in passageway 74 and chamber 94 is compressed upon each stroke of the plunger and flows between the piston 49 and cylinder 48 into the space in said cylinder in back of the piston. As the bore 69 fills with liquid the pressure in the chamber 94 increases until the piston seats against seat 40 and obstructs flow past said piston. When the various chambers in the nozzle are filled with liquid downward movement of the plunger 61 causes the liquid to be forced through the hole 74 and into chamber 44 through chamber 94, the strainer 45, chamber 93 and the holes 91 in disc 39. When the pressure in chamber 94 is sufficient, piston 49 is forced inwardly and into engagement with seat 40 and the valve head 50 unseated from the seat 34 and the pin 52 withdrawn from the orifice 33. The liquid is then free to pass into chamber 90 and in passing through the grooves 43 is given a swirling motion causing it to be atomized and discharged from the orifice 43 in a fine mist or spray. When the plunger 61 reaches its lowermost position the pressure in the chamber 44 decreases and as soon as the pressure is insufficient to atomize the liquid, spring 56 urges the valve head 50 into closing position and shuts off the flow of liquid through orifice 43. At the same time the pin 52 clears the said orifice of any dirt which might have lodged in the same thus cleaning the orifice for the next stroke of the plunger 61. At each stroke of the plunger a mist of atomized liquid is sprayed from the nozzle 29 and at the end of the spraying the flow of liquid is rapidly shut off. This prevents dripping or leakage of the liquid from the nozzle when the spraying ceases. As the liquid is removed from the receptacle 10, the same is replaced by air entering the chamber 77 through the space between the follower 81 and piston 61. This inward flow of air sucks back any liquid which may have leaked past said follower and discharges it into chamber 77 where it may flow back into chamber 13 of receptacle 10 through passageway 83. Upon completion of the spraying the knob 64 is pressed downwardly until the valve head 86 engages the end 87 of sleeve 75 and closes communication between the chamber 77 and the exterior.

The advantages of the invention are manifest. An extremely fine mist can be procured at each stroke of the plunger and between strokes, and during the spraying no leakage or dripping from the nozzle occurs. The pin on the end of the valve member which closes communica-

tion between the nozzle orifice and the receptacle clears the orifice so that the same is fully open for the next discharge of fluid liquid therefrom. Any liquid which may leak past the piston is drained by gravity back into the receptacle. With my invention it becomes unnecessary to place the receptacle under pressure, the pressure being confined to the barrel and nozzle which may be sufficiently rigidly constructed to withstand the strain produced thereby. When the plunger is in its lowermost position and locked in place leakage or evaporation of the liquid is completely prevented.

Changes in the specific form of the invention, as herein described, may be made within the scope of what is claimed without departing from the spirit of the invention.

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

1. In combination, a receptacle for a liquid to be sprayed, a cap attached to said receptacle, a nozzle carried by said cap, means forming a liquid conducting passageway between said receptacle and said nozzle, pump means communicating with said passageway and alternately drawing liquid from said receptacle through said passageway and forcing it through said nozzle, a shut-off valve at said nozzle including a valve head engageable with a valve seat, a valve stem issuing from said valve head, a cylinder communicating at one end with said passageway, a piston in said cylinder connected to said valve stem and operating said valve head, a spring held from movement at one end relative to said cap and engaging said piston at its other end and urging said valve head into closing position, means forming a by-pass around said piston and sealing means engageable with said piston to close said by-pass when the piston reaches a position in which passage through the orifice in the nozzle is effected.

2. In combination, a receptacle for a liquid to be sprayed, a cap attached to said receptacle, a nozzle carried by said cap, means forming a liquid conducting passageway between said receptacle and said nozzle, pump means communicating with said passageway and alternately drawing liquid from said receptacle through said passageway and forcing it through said nozzle, a shut-off valve at said nozzle including a valve head engageable with a valve seat, a valve stem issuing from said valve head, a cylinder communicating at one end with said passageway, a piston in said cylinder connected to said valve stem and operating said valve head, a spring held from movement at one end relative to said cap and engaging said piston at its other end and urging said valve head into closing position, means forming a by-pass around said piston and an annular resilient seal at the end of said cylinder engageable with said piston to close said by-pass when the piston reaches a position in which passage through the orifice in the nozzle is effected.

3. In combination, a receptacle for a liquid to be sprayed, a cap attached to said receptacle, a nozzle carried by said cap, means forming a liquid conducting passageway between said receptacle and said nozzle, pump means communicating with said passageway and alternately drawing liquid from said receptacle through said passageway and forcing it through said nozzle, a shut-off valve at said nozzle including a valve head engageable with a valve seat, a valve stem issuing from said valve head, a cylinder communicating at one end with said passageway, a piston in said cylinder connected to said valve stem and operating said valve head, a spring held from movement at one end relative to said cap and engaging said piston at its other end and urging said valve head into closing position, said piston fitting sufficiently loosely in said cylinder to form a by-pass around said piston and sealing means engageable with said piston to close said by-pass when the piston reaches a position in which passage through the orifice in the nozzle is effected.

4. In combination, a receptacle for a liquid to be sprayed, a cap attached to said receptacle, a socket in said cap, a body received in said socket, a nozzle formed on said body, a barrel screwed into said body and extending into said receptacle, means forming a shoulder on said barrel engaging said cap and holding the body attached to said cap and pump means carried by said body and drawing liquid from said receptacle and into said barrel and discharging it through said nozzle.

5. In combination a receptacle having a chamber for a liquid to be sprayed, a body carried by said receptacle, a nozzle formed on said body, a barrel attached to said body and extending into said receptacle and communicating with said nozzle, a guide carried by said body and having a bore, a plunger slidable along said bore and entering said barrel, means on said body encircling said plunger and forming an annular chamber about said plunger, said means having an annular surface concentric with said plunger, means forming a passageway communicating with said annular chamber and the chamber in said receptacle, a knob on the end of said plunger and having a cavity therein, a gasket disposed in said cavity in contact with said knob and engageable with said annular surface when the plunger is in its innermost position, and means acting between said receptacle and knob for holding said gasket in fluid-tight engagement with said knob and surface.

6. In combination a receptacle having a chamber for a liquid to be sprayed, a body carried by said receptacle, a nozzle formed on said body, a barrel attached to said body and extending into said receptacle and communicating with said nozzle, a guide carried by said body and having a bore, a plunger slidable along said bore and entering said barrel, a sleeve issuing outwardly from said body and encircling said plunger, said sleeve being spaced from said plunger to form an annular chamber about the same, said bore communicating with said chamber, said sleeve having an annular surface at the end of the same, a knob on the end of said plunger and having a cavity therein, a gasket disposed in said cavity in contact with said knob and engageable with said annular surface when the plunger is in its innermost position, and means acting between said receptacle and knob for holding said gasket in fluid-tight engagement with said knob and surface.

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