

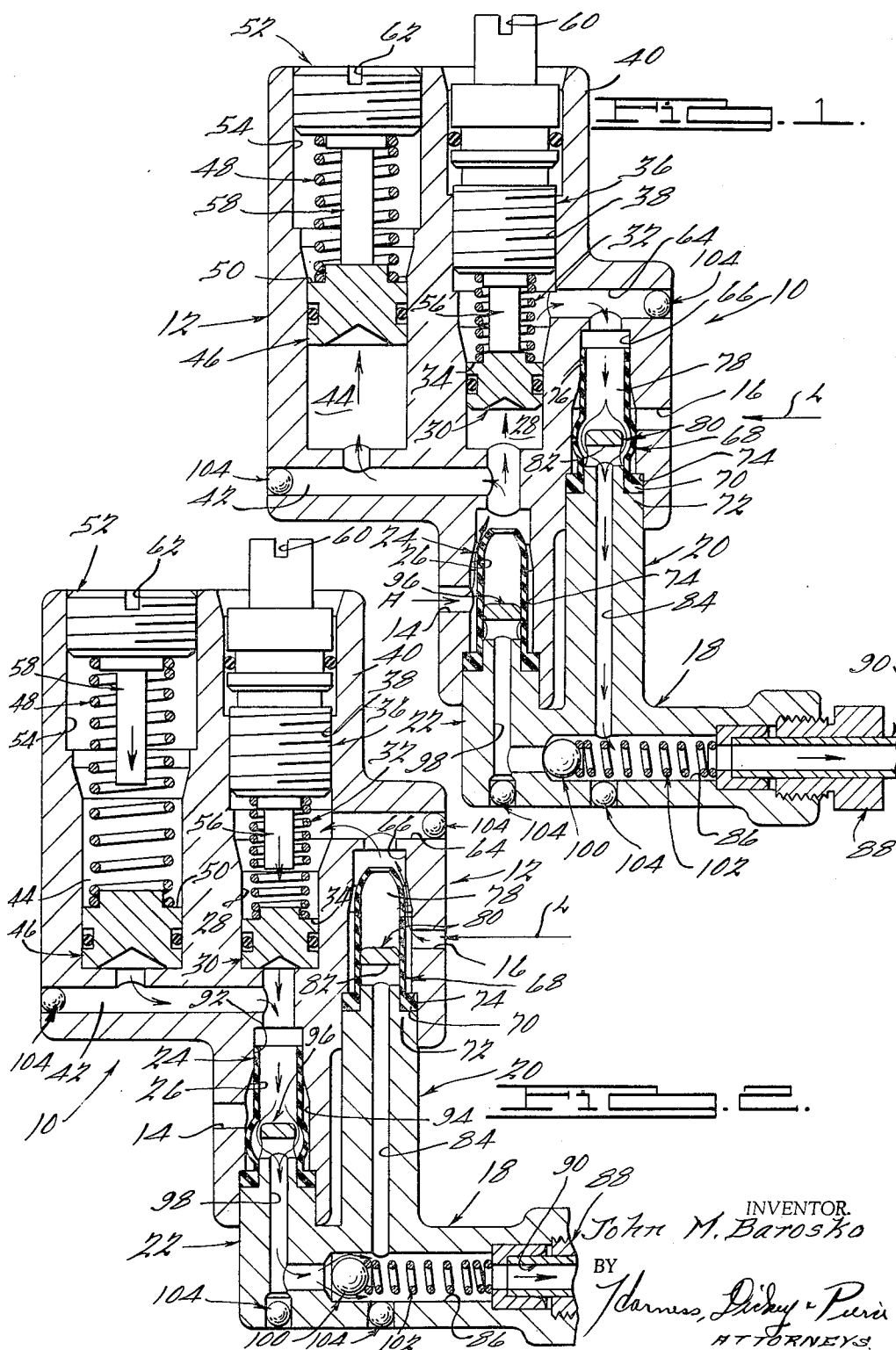
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DEVICE FOR PUMPING AND DISPENSING LIQUID WITH AIR

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DEVICE FOR PUMPING AND DISPENSING LIQUID WITH AIR

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This invention relates generally to liquid feeding devices, and more particularly, to an air pressure actuated liquid spray injector.

The spray injector of the present invention is characterized by an extremely compact and simply designed unit that is provided with suitable means for adjusting both the amount of liquid to be dispensed and the volume of air that is to be used in the liquid dispensing or injecting operation, thus providing an assemblage which is adapted to be operatively installed in a wide variety of applications.

It is therefore a primary object of the present invention to provide an improved liquid spray injector which is characterized by universality of adjustment and installation.

It is another object of the present invention to provide an improved liquid spray injector of an extremely compact construction.

It is still another object of the present invention to provide an improved liquid spray injector of a simple design that can be easily assembled and economically manufactured.

Other objects and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a cross-sectional view of a preferred embodiment of the liquid spray injector of the present invention, taken during an initial period of its operational cycle; and

FIGURE 2 is a cross-sectional view of the liquid spray injector illustrated in FIGURE 1, taken during another period of its operational cycle.

Referring now to FIGURE 1 of the drawing, a liquid spray injector 10, in accordance with a preferred embodiment of the present invention, includes an injector or accumulator housing, generally designated by the numeral 12, which is provided with air and liquid inlet passages 14 and 16, respectively, on the opposite sides thereof. A combination mixing chamber and nozzle assembly 18, having a pair of upwardly extending conduits 20 and 22, is rigidly connected to the housing 12 (by machine screws—not shown), and is adapted to operatively inject liquid which has been dispensed from the housing 12, in a manner hereinafter to be described.

Disposed directly in line with the air inlet passage 14 is a flexible sleeve valve 24 which is fabricated of a resilient deformable material, such as molded rubber or the like. The sleeve valve 24 is disposed within a longitudinally extending chamber 26 and is adapted to operatively deform into the configuration illustrated in FIGURE 1 as pressurized air, represented by the arrow A, is introduced through the air inlet passage 14. As the pressurized air bypasses the deformed sleeve valve 24, a portion thereof enters an enlarged annular chamber 28 where it impinges upon and biases a reciprocally mounted piston 30 upwardly into the position it assumes in FIGURE 1. Such upward movement of the piston 30 is resisted by a helical coil spring 32 which extends between an annular face portion 34 of the piston 30 and an adjustment screw 36 which is threadably mounted within an enlarged section bore 38 formed in an upper end portion 40 of the injector housing 12. Both the piston 30 and the adjustment screw 36 are provided with O-ring seals to preclude any leakage

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of air or liquid between these members and their respective chambers or bores.

Disposed directly adjacent the chamber 28, and operatively connected therewith by a transversely extending passageway 42, is a longitudinally extending air accumulator chamber 44. A portion of the air entering the chamber 26 passes through the passageway 42 and into the accumulator chamber 44 where it impinges upon an enlarged cylindrical piston 46 mounted therewithin. As the air pressure within the accumulator chamber 44 increases, the piston 46 is biased upwardly, which movement is resisted by a coil spring 48 extending between an upper end portion 50 of the piston 46 and an adjustment screw 52 which is threadably mounted within an enlarged bore 54 formed in the upper end portion 40 of the injector housing 12. The adjustment screws 36 and 52 are respectively provided with axially extending posts 56 and 58 adapted to engage the rear of face portions of the pistons 36 and 46 respectively, to limit the axial movement thereof. Also, each of the adjustment screws 36 and 52 are provided with diametrically extending, screw driver receiving slots 60 and 62 to facilitate the axial adjustment thereof within their respective bores.

As the piston 30 is biased upwardly by the pressurized air impinging thereon, liquid which is disposed subjacent the piston 30, and which has been communicated to the chamber 28 from the liquid inlet passage 16 by a transversely extending chamber 64 and a longitudinally extending chamber 66, is forced downwardly through the chamber 66, thereby expanding a flexible sleeve valve 68 mounted therewithin. The valve 68 is of an identical construction as the aforesaid valve 24, and is provided with an annular shoulder portion 70 which is operatively mounted between an upper end portion 72 of the conduit 20 and an annular shoulder 74 formed within the chamber 66. Upon expanding, the outer periphery of the sleeve valve 68 engages the inner surface of the chamber 66, as at 76, thereby precluding the ingress of liquid indicated by the arrow L from flowing into the chamber 66 from the passageway 16. Accordingly, the liquid which is being forced out of the chamber 28 by the piston 30 passes through a central passageway 78 in the sleeve valve 68 and around an annular boss 80, which is partially defined by a reduced sectioned recess 82 formed on the upper end portion 72 of the conduit 20. The fluid is then transmitted to a nozzle or outlet passageway 84 in the conduit 20, and thereafter through a transverse discharge passageway 86 in an outlet conduit 87 where it is dispensed through an adaptor fitting 88 to a suitable spray nozzle or conduit 90 adapted to deliver the liquid to the point of application.

Referring now to FIGURE 2, when the pressurized air within the passageway 14 reaches a certain preselected pressure level (approximately that level at which the pistons 30 and 46 are biased upwardly within their respective chambers), the flow of air entering the housing 12 is automatically stopped by appropriate valve means at the pressurized air source, and at which time the pistons 30 and 46 are urged downwardly by their associated coil springs 32 and 48. As the pistons 30 and 46 move downward, the pressurized air within the chambers 28 and 44 is forced into the chamber 26 thereby expanding the flexible sleeve valve 24 such that the outer periphery thereof engages the inner surface of the chamber 26, as at 92, to prevent air from within the chamber 26 from flowing outwardly through the air inlet passage 14. The lower end portion of the chamber 26 is provided with an enlarged section 94 which permits the sleeve valve 24 to expand and permits the air being forced into the chamber 26 by the downwardly moving pistons 30 and 46 to flow around an annular boss 96 and through a cen-

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tral passageway 98 in the conduit 22. A conventional ball check valve, having a check ball 100 which is resiliently mounted in the passageway 86 by a coil spring 102, then opens as the pressure within the passageway 98 increases, thus permitting the flow of air to pass into the discharge passageway 86 and force the liquid there-within outwardly through the nozzle of conduit 90 to the point of application.

During normal operation, as the piston 30 moves downward within the chamber 28, it creates a vacuum within the chambers 64 and 66, thereby collapsing or deforming the sleeve valve 68 and drawing liquid through the liquid inlet passage 16 into chambers 64 and 66. When the sleeve valve 68 is thus deformed, its inner periphery engages the annular boss 80 to prevent the liquid being drawn into the chambers 64 and 66 from flowing through the passageway 84 in the conduit 20. When the pistons 30 and 46 have reached their lowermost position, as illustrated in FIGURE 2, the chambers 28, 64 and 66 will have been replenished with the liquid drawn by the aforementioned vacuum and the complete unit is conditioned for its next successive cycle, whereby air is again permitted to flow through the inlet passage 14 into the housing 12.

The accumulator housing 12, together with the mixing chamber 18, may be suitably constructed by die casting aluminum or a similar strong, light-weight and economical material. A plurality of spherical plugs, generally designated 104, may then be rigidly secured, as by press fitting, within the ends of the passages 42, 64, 84 and 98 to provide end closure means for these passages and further enhance the economies of weight and expense of the unit.

It will be noted that by axially positioning the adjustment screw 36 within the bore 28, the amount of liquid drawn into and dispensed from the injector 10 may be widely varied. Similarly, by adjusting the screw 52, the volume of air, and consequently the force with which the liquid is dispensed, may be varied considerably. Moreover, since the injector is adapted to operate effectively with substantially any relatively viscous liquid, its range of useful applications is substantially unlimited.

While it will be apparent that the preferred embodiment herein illustrated is well calculated to fulfill the objects stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a device for dispensing a liquid with pressurized air, the combination which includes,
 - means for combining said liquid and pressurized air,
 - means for selectively metering said pressurized air to said combining means,
 - piston means for pumping said liquid to said combining means for adjusting said flow of said liquid and said pressurized air to said combining means, and
 - means for selectively controlling the flow of said liquid and said pressurized air to said dispensing chamber.
2. The combination as set forth in claim 1 including an air accumulator means.
3. The combination as set forth in claim 2 wherein said means for selectively metering said pressurized air includes piston means operatively mounted within said air accumulator chamber.
4. In a pressurized air actuated liquid pumping device, a dispensing chamber adapted to operatively combine the liquid with the pressurized air,
 - piston means for pumping said liquid to said dispensing chamber,
 - an air accumulator chamber,
 - piston means within said air accumulator chamber operable to selectively meter said pressurized air to said dispensing chamber,

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valve means adapted to selectively control the flow of said pressurized air and liquid to said dispensing chamber, and

means for adjusting said flow of said liquid and said pressurized air to said dispensing chamber.

5. In a pump,
 - a pump housing which includes a dispensing chamber and an air accumulator chamber,
 - means in said housing for pumping liquid to said dispensing chamber,
 - means within said air accumulator chamber for selectively metering pressurized air to said dispensing chamber,
 - valve means adapted to selectively control the flow of said pressurized air and said liquid to said dispensing chamber,
 - means for adjusting the flow of said liquid and said pressurized air to said dispensing chamber, and
 - means on said pump housing operable to communicate said liquid and said pressurized air from said housing to the point of application.

6. In a liquid dispenser, the combination which includes,
 - a dispenser housing having an air and liquid dispensing chamber and an air accumulator chamber,
 - piston means for pumping liquid to said dispensing chamber,
 - piston means within said air accumulator chamber operable to selectively meter pressurized air to said dispensing chamber,
 - valve means adapted to selectively control the flow of said pressurized air to and from said accumulator chamber and the flow of said liquid to said dispensing chamber,
 - means for adjusting the flowing of said liquid and said pressurized air to said dispensing chamber, and
 - nozzle means operable to communicate said liquid and said pressurized air from said housing to the point of application.

7. In a liquid dispenser, the combination which includes,
 - a dispenser housing having an air and liquid dispensing chamber and an air accumulator chamber,
 - piston means in said housing for pumping liquid to said dispensing chamber,
 - piston means within said air accumulator chamber operable to selectively meter pressurized air to said dispensing chamber,
 - valve means adapted to selectively control the flow of said pressurized air to and from said accumulator chamber and the flow of said liquid to said dispensing chamber,
 - means including means in said accumulator chamber operable to control the movement of each of said pistons, and
 - nozzle means operable to communicate said liquid and such pressurized air from said housing to the point of application.

8. In combination with a liquid dispensing nozzle, an injector housing having liquid inlet and outlet chambers,
 - means for pumping liquid from said inlet chamber to said outlet chamber, means for adjusting said flow of said liquid from said inlet chamber to said outlet chamber, and

means within said housing operable to force liquid within said outlet chamber to flow to the dispensing nozzle.

9. In combination with a liquid dispensing nozzle, a dispenser housing having air and liquid inlet passages, an air accumulator chamber and a liquid and air mixing chamber in said housing,
 - piston means for pumping said liquid from said inlet passage to said mixing chamber,

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piston means for forcing air within said air accumulator chamber to said mixing chamber,
 means for individually adjusting the movement of each of said piston means to adjust the flow of said liquid and said air to said mixing chamber, and
 valve means adapted to selectively control the flow of said liquid and said air between said inlet passages and said mixing chamber.

10. In a liquid injector,
 an injector housing having liquid and air inlet passages and defining a liquid and air mixing chamber, a liquid pumping chamber and an air accumulator chamber,
 piston means within said pumping chamber for pumping liquid from said liquid inlet passage to said mixing chamber,
 nozzle means for communicating liquid and air to the point of application,
 piston means in said air accumulator chamber for forcing liquid in said mixing chamber to flow to said nozzle means,
 means for individually adjusting the size of said liquid pumping and said air accumulator chambers, and
 valve means adapted to selectively control the flow of said liquid and said air between said inlet passages and said nozzle means.

11. A liquid injector as set forth in claim 10 wherein said valve means consist of a plurality of resilient cylindrical sleeves which are deformable to selectively preclude the flow of said air from said air accumulator chamber to said mixing chamber and the flow of said liquid from said inlet passage to said mixing chamber.

12. A liquid injector as set forth in claim 10 wherein said liquid pumping chamber and said air accumulator chamber are each provided with threadably mounted adjustment screws operable to effect the movement of said piston means within said pumping and air accumulator chambers.

13. A fluid spray, which includes,
 a housing having liquid and air inlet passages and defining a liquid and air mixing chamber, an air accumulator chamber and a liquid pumping chamber,
 a reciprocally mounted piston in said pumping chamber for pumping liquid from said liquid inlet passage to said mixing chamber,
 a dispensing nozzle for communicating liquid and air from said mixing chamber to the point of application,
 a reciprocally mounted piston in said air accumulator chamber operable to force liquid in said mixing chamber to flow into said dispensing nozzle,
 means for individually adjusting each of said pistons to control the flow of said liquid and air from said mixing chamber to said dispensing nozzle, and

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a pair of resilient cylindrical sleeve valves disposed one adjacent each of said liquid and air inlet passages and being deformable to selectively preclude said flow of liquid and air from said liquid and air passages to said mixing chamber.

14. A fluid spray comprising,
 a housing having air and liquid inlet passages and defining a liquid and air mixing chamber, an air accumulator chamber and a liquid pumping chamber,
 a reciprocally mounted piston in said liquid pumping chamber,
 a dispensing nozzle operable to communicate liquid and air from said mixing chamber to the point of application,
 a reciprocally mounted piston in said air accumulator chamber operable to force liquid in said mixing chamber to flow into said dispensing nozzle,
 a pair of resilient deformable sleeve valves disposed one adjacent each of said air and liquid inlet passages and one of which is movable to and from a position communicating pressurized air to and from said air accumulator chamber and the other of which is movable to and from a position communicating liquid from said liquid inlet passage to said mixing chamber, and
 a pair of adjustment screws disposed one in said air accumulator chamber and the other in said liquid pumping chamber,
 said adjustment screws being movable within said air accumulator and liquid pumping chambers to effect the volume of said air and said liquid displaced by said pistons within said air accumulator and liquid pumping chambers.

15. In combination with a liquid dispensing nozzle, an injector housing having liquid inlet and outlet chambers, air accumulator means within said housing, means for pumping liquid from said inlet chamber to said outlet chamber, means for adjusting the flow of said liquid from said inlet chamber to said outlet chamber, and means within said air accumulator means operable to force said liquid within said outlet chamber to flow to the dispensing nozzle.

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