United States Patent

[11] 3,597,125

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[54] **LIQUID INJECTOR ASSEMBLY FOR PISTON PUMPS**
6 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **417/503,** 417/536
[51] **Int. Cl.** **F04b 21/02,** F04b 41/00
[50] **Field of Search** 417/503, 536; 103/7

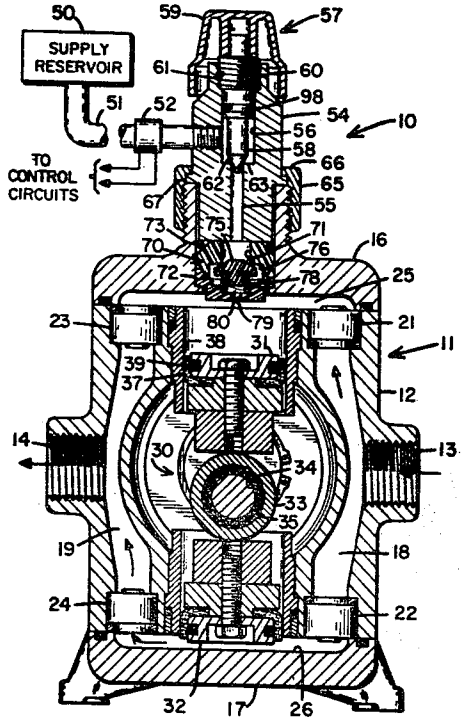
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Attorney—Orrin M. Haugen

ABSTRACT: Induction means for use in combination with a positive displacement pump, the pump having a pumping chamber, a reciprocating piston disposed in a cylinder communicating with the chamber, along with inlet and outlet valves for intermittent isolation of the chamber during the pumping strokes, the induction means being arranged in communication with the pumping chamber and being adapted to induce fluid flow into the pumping chamber for discharge through the positive displacement pump structure, the induction means including induction inlet means for coupling the chamber to a supply reservoir, an adjustable control valve having a first orifice and an adjustable valve element cooperating with the orifice, poppet valve means disposed in a second orifice and in communication with the first orifice and arranged to open upon the suction stroke of the pump, and to close upon the pressure stroke, and an injection chamber means having a third orifice in direct communication with the pumping chamber and having baffle means interposed between the third orifice and the injection chamber.



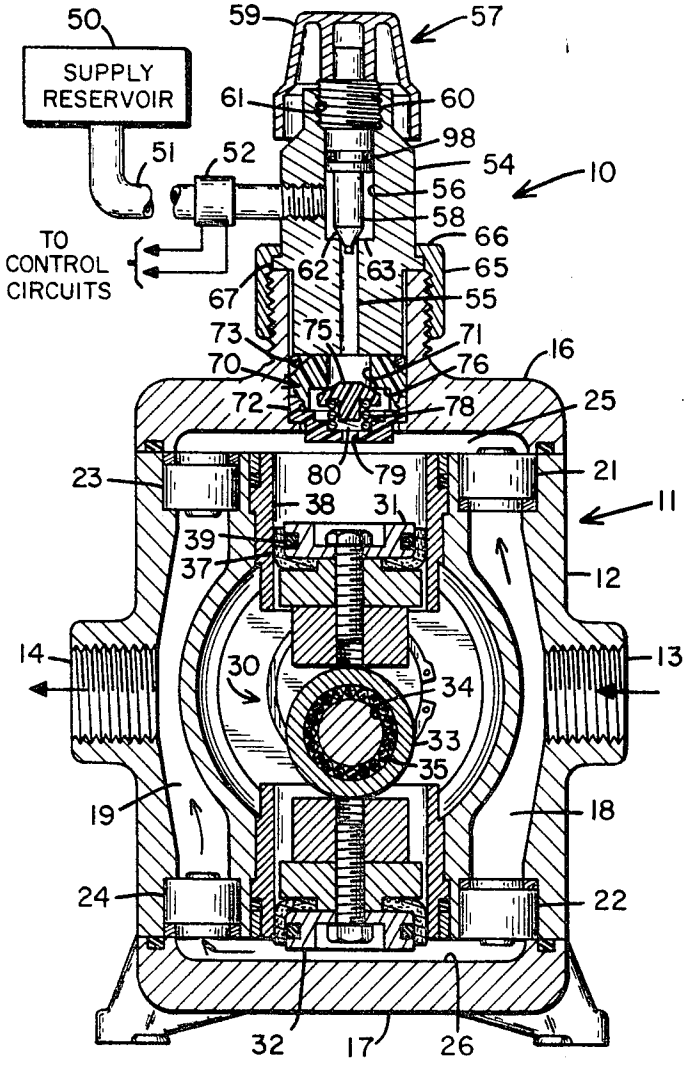


Fig. 1

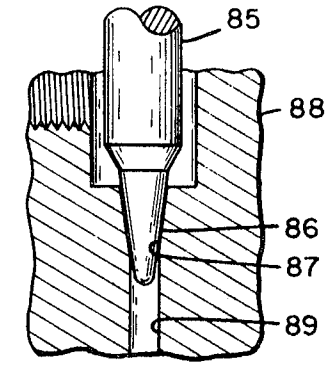


Fig. 2

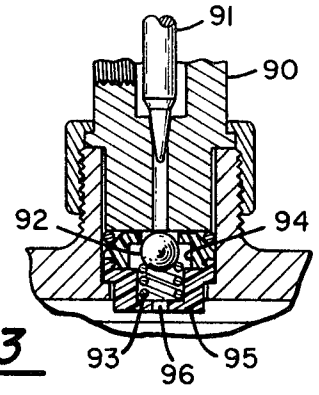


Fig. 3

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LIQUID INJECTOR ASSEMBLY FOR PISTON PUMPS

The present invention relates generally to injection means for positive displacement pumps, and more particularly to injection means arranged for the induction of fluid flow into a pumping chamber. The induction of fluid occurs during the suction stroke of the positive displacement pump, and as such, may be utilized in combination with such pumps even though the inlet is operated under modest pressure. It is a feature of the invention that induction may occur from a reservoir which is not operated under pressure, and thus no unusual steps are required in the induction system.

In the past, various attempts have been made for inducing fluid flow into a pressurized cylinder or chamber. Frequently these devices are used for the purpose of lubrication, and may be utilized in combination with pressurized chambers or reservoirs. In other devices, venturies may be interposed in the pressure line and the venturi, together with its pressure drop, will cause the induction of fluid from a reservoir into the stream. It is requisite, of course, that a venturi operates on the basis of fluid velocity, and accordingly high velocities are required in order to obtain any quantity of injected fluid into the line. The systems may cause considerable back pressure to develop and may be undesirable for interposing in the line for a number of reasons.

Positive displacement pumps such as reciprocating piston pumps are widely utilized. In many applications of these pumps, it is desired to inject a certain quantity of a fluid into the pumped fluid for any of a variety of purposes. One such purpose is the introduction of a controlled quantity of soap, the soap being introduced into the system when it is desired to provide a pressurized washing system such as, for example, in an automobile washing system.

In a conventional system, wherein water is being utilized, it is frequently desirable to couple the system directly to the line source. Such a line source may be at an elevated pressure, such as in the range of 50 p.s.i. up to about 80 p.s.i. In many localities, however, antisiphon ordinances have been established which require a buffer storage chamber to be interposed between the line and the pump. In such installations, therefore, the incoming water would enter the system at substantially atmospheric pressure.

The apparatus of the present invention is highly adapted for use in connection with water supplies at atmospheric pressure, however it has been found that the system is adaptable for use with modest line pressures as well. In instances where coupling directly to the line is permissible, and where the line is at a highly elevated pressure, it may be desirable to utilize a pressure-regulator valve for purposes of consistent operation of the injector.

The system of the present invention is particularly designed for use in combination with positive displacement pumps, the injector system including a pilot or regulator valve which controls the communication between the pumping chamber and the supply reservoir of the injected fluid. Poppet valve means are provided between the injection chamber and the pumping chamber of the pump, in order to isolate the injected fluid during the pressure stroke of the pump. A further feature of the invention is the presence of a baffle means which is interposed between the injection chamber and the pumping chamber this baffle means providing accurate metering between the pumped fluid and the injected fluid.

Therefore, it is an object of the present invention to provide an improved induction means or apparatus for use in combination with a positive displacement pump, the induction means being in communication with the pumping chamber of the pump, and being adapted to induce or inject controlled quantities of fluid into the pumping chamber of the pump.

It is a further object of the present invention to provide an improved induction means for use with positive displacement pumps, the induction means being coupled directly to the pumping chamber and adapted to inject fluid during the section stroke of the positive displacement pump.

It is a further object of the present invention to provide an improved induction means for use in combination with positive displacement pumps, wherein the induction means includes a chamber indirect communication with the pumping chamber of the pump, the two chambers being separated, however, by means of a baffle plate. Other specification, and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specifications, appended claims, and accompanying drawing wherein:

FIG. 1 is a vertical sectional view taken through the center of a positive displacement pump, and illustrating the induction means of the present invention arranged in combination with the positive displacement pump;

FIG. 2 is a fragmentary detail view of a modified pilot valve which may be used in controlling the flow of fluid to be injected or induced into the induction means; and

FIG. 3 is a fragmentary sectional view of a modified induction means utilizing the pilot valve of FIG. 2, and a modified form of poppet control valve.

In accordance with the preferred modification of the present invention, and with particular attention being directed to FIG. 1 of the drawing, the injection system generally designated **10** is shown coupled to and in combination with the positive displacement pump generally designated **11**. The pump includes the conventional housing **12** incorporating a supplyor inlet orifice **13** along with a discharge orifice or the like **14**. The inlet **13** and outlet **14** are appropriately threaded so as to permit convenient coupling to supply conduits and discharge conduits. The basic operation of the pump illustrated in FIG. **1** is described in detail in U.S. Pat. No. 3,238,890 to H. J. Sadler, et al., entitled "Piston Type Pump" and assigned to the same assignee as the present invention, and while the structure will be explained in some detail here, reference is made to the Sadler, et al. patent for a thorough description of the pump structure. The pump body **12** is provided with a pair of heads, such as the heads **16** and **17**, these heads being arranged at opposed ends of the inlet channel **18** and the outlet channel **19**. Appropriate inlet valves are provided at **21** and **22**, and appropriate outlet valves are provided at **23** and **24**. In order to provide the variable volume pumping chambers **25** and **26**, reciprocating piston assembly generally designated **30** is provided, this system including pistons **31** and **32**. An eccentric drive means is shown as at **33**, the drive means including an eccentric pin member **34** spaced from the drive cam or race **33** by means of a plurality of roller bearings such as are shown at **35**. A suitable connecting yoke, not shown, is utilized to draw the individual pistons inwardly of the system during the pumping strokes. Also, as is conventional, an expandable piston cup is utilized as at **37**, the cup being held against the walls of the cylinders, such as the cylinders **38** by means of an O-ring as at **39**.

It will be appreciated that the induction or injection means illustrated herein may be utilized in combination with a variety of positive displacement pumps, and the system is shown in combination with the pump herein for purposes of a better understanding of the overall concept. For example, the system can function in a variety of pump structures, including positive displacement pump structures having one piston, two pistons, or even a greater number of pistons. The pistons may be axially opposed, or may be arranged along parallel axes. It is preferable, how that each reciprocating piston be provided with a separate pumping chamber, such as the pumping chambers **25** and **26** which are each provided with individual reciprocating pistons **31** and **32** in conjunction therewith.

Particular attention is now directed to the induction means **10** which is illustrated in knurled **1**, the induction means being coupled to supplyreservoir **50** by conduit **51**. In order to provide appropriate control of the flow of fluid to be induced, a solenoid valve or the like may be utilized, such as is shown at **52**, with appropriate control lines, as necessary, being utilized. The induction means **10** comprises a body member **54** which has a bore **55** extending therethrough, bore **55** having a counterbore portion as at **56** for accommodating the control valve

or pilot valve means generally designated **57**. Valve **57** includes a pin member **58** which is coupled to the knurled knob portion **59**. Knurled knob **59** has a threaded member **60** which is threadably engaged with the bore extension **61**, thus controlling the relative dispositions of the tapered tip portion **62** of the pin member **58** relative to the seat area **63**. This provides a controllable orifice for the flow of material from the supply reservoir to the pumping chamber **25**.

It will be appreciated that a variety of means can be utilized to couple the induction means to the pump body. In the device shown herein, a threaded collar nut **65** having a flanged portion as at **66**, is utilized to engage the collar **67** of the body **54**, and thereby retain it in appropriate disposition on the head member **16**. A threaded attachment is generally preferred, thus making it possible for the induction means to be coupled to the supply reservoir at any angular disposition.

Attention is now directed to the end portion of the injection means shown generally at **70**, this member including a body with two segments, including segment **71** and segment **72**, O-ring **73** being utilized to seal the induction means within the head **16**. Poppet valve **75** is shown operating against the seat or orifice area as at **76**, valve **75** being resiliently biased by means of the spring **78**, and accordingly being adapted to open upon the suction stroke of piston **31**, and close upon the pressure stroke of that piston.

The arrangement is provided with a baffling orifice as at **79**, this orifice isolating the chamber area **80** from the pumping chamber **25**. Thus, turbulent flow or the like within the pumping chamber **25** will not present any adverse affects upon the induction flow into chamber **25** from the induction means **10**. Furthermore, it has been found possible that with the use of the baffle member, induction of fluid may occur even though the inlet to the pump is under modest or moderate pressure.

Attention is now directed to FIG. **2** of the drawing wherein a modified form of control valve or pilot valve **85** is illustrated, this member having a tapered tip portion **86** which is received within tapered bore **87** of the body **88**. With this arrangement, enhanced control may be accomplished. In the structure illustrated in FIG. **1**, the included angle across the tip of the pin **58** is in the area of about 60°, and the relative taper existing between the tip **86** and the bore **89** of body **88** is in the area of about 8°. It will be appreciated, of course, that various other techniques may be utilized in order to provide control for the flow of fluids from the supply reservoir to the pumping chamber.

Attention is now directed to FIG. **3** of the drawing where a somewhat modified form of injection chamber means is illustrated. In this structure, the body member **90** is provided with control valve or pilot valve member **91**, such as is illustrated in FIG. **2**, with the poppet valve being in the form of a ball check **92** resiliently biased by spring member **93**, and operating within the confines of the injection chamber **94**. A baffle is provided as at **95**, along with a central orifice as at **96**. The operational features of this arrangement are substantially the same as those described in connection with the modification shown in FIG. **1**.

The individual pilot valves are preferably isolated from the atmosphere by means of an O-ring **98**, the O-ring **98** also functioning to provide some resistance to a wondering axial disposition for the member **58**. As an alternative, it is possible to utilize a resilient spring member in lieu of the O-ring **98**.

The system has been shown with baffles as at **79** and **95**. For two piston pumps of the type illustrated in FIG. **1** operating at about 500 p.s.i. and 3 g.p.m., a **150**-inch bore has been deemed appropriate and useful. Pumps of the style shown in FIG. **1** are capable of operating at 1,800 r.p.m. Such pumps are commercially available from Hypro, Inc., of St. Paul, Minnesota, under their identification of Series 5300.

FOr materials of construction, any of a variety may be employed. For example, the seat area **76** may be fabricated from a metal such as brass, although a plastic material may be preferred for some operations. The poppet **75** is preferably metallic, and the tension on spring **78** is controlled so as to provide a force which substantially counterbalances the gravitational force on poppet **75**.

It will be appreciated that the structures shown here may be utilized in a variety of combinations, and with a variety of pumping structures, and that the examples given herein are for purposes of illustration only.

What we claim is:

1. In combination with a positive displacement pump having a pumping chamber, a reciprocating piston disposed in a cylinder communicating with said chamber, and inlet and outlet valve means for intermittent isolation of said chamber from a supply conduit and a discharge conduit respectively;

a. induction means communicating with said pumping chamber for inducing fluid flow into said pumping chamber for discharge through said discharge conduit and including:

1. induction inlet means for coupling said induction means to a supply reservoir of fluid to be introduced into said pumping chamber;
2. adjustable control valve means including a first orifice and an adjustable valve element cooperating with said first orifice;
3. valve means disposed in a second orifice and in communication with said first orifice and arranged to open upon the suction stroke and to close upon the pressure stroke of said reciprocating piston;
4. injection chamber means consisting of an induction chamber having a wall with a third orifice formed therein, the third orifice establishing direct communication between said pumping chamber and said induction chamber and having baffle means interposed in the communication between said third orifice and said induction chamber for substantially isolating said induction chamber and restricting communication from said pressure chamber to said induction chamber.

2. The combination as defined in claim **1** being particularly characterized in that the lateral surface of the valve means disposed in said second orifice prevents direct fluid flow between said second and third orifices.

3. The combination as defined in claim **1** being particularly characterized in that said control valve means is a needle valve tapered along its elongated axis and adapted to operatively extend into said second orifice.

4. The combination as set forth in claim **1** being particularly characterized in that the valve means disposed in the second orifice is a spring-biased poppet valve having a sealing surface at one end thereof and a stem extending away from said sealing surface in opposed disposition therefrom.

5. The combination as defined in claim **4** being particularly characterized in that spring means are provided for spring biasing said poppet, said spring means being helically wound about said stem, and having a support surface adjacent said baffle area.

6. The combination as defined in claim **5** being particularly characterized in that said spring, stem, poppet, injection chamber means, and second and third orifices are all arranged concentrically, one with another.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,597,125 Dated August 3, 1971

Inventor(s) Harry J. Sadler; Ramon Pareja; John Leschisin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 4, "indirect" should read -- in direct --. Line 6, "specification" should be deleted. Line 63, "how" should read -- however --. Line 68, "knurled" should read -- Figure --.

Column 3, line 65, "150-inch" should read -- 1/8-inch --.

Signed and sealed this 18th day of January 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents

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