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2,903,008

PROPORTION FLOW PUMP

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Application April 23, 1956, Serial No. 580,109

2 Claims. (Cl. 137—99)

This invention relates to new and useful improvements in fluid injection pumps for feeding fluid from a reservoir supply, as a container vessel, into the main flow stream of another fluid.

More particularly, it relates to a fluorine injection pump adapted for home use for feeding liquid fluorine from a fluorine container into the flow stream of a metered water conduit having a faucet outlet, such pump being of the type shown in my copending application Serial No. 490,293, filed February 24, 1955. The present application is a continuation in part of that copending application.

As a further object, the present invention proposes forming the pump with a cam actuated piston which, when a water faucet is turned on, will continuously feed liquid fluorine or a fluorine compound into the water stream in desired proportion to the flow of water and during its flow so that a thorough mixing with the water will take place without any increase or decrease in the concentration of the additive fluid at any time.

Still further, the present invention proposes constructing the pump structure as a compact unit for mounting on a conventional household water meter, with a piston actuating member being rotatably mounted in a housing and being driven by the flow wheel of the meter for operating the pump by the flow of water through the meter.

Another object of the invention proposes forming the pump with a central chamber, and connected with the chamber, two pairs of inlet and outlet ports separated by a piston having a piston rod at either end, a cam surface being formed on a piston actuating member for continuous travel around the piston to reciprocate the piston and provide a substantially continuous pressure stroke to add fluid whenever water is flowing through the meter.

Other objects, advantages and features will become apparent from the following description and accompanying drawing in which,

Fig. 1 is a diagrammatic view showing a pump constructed and arranged in accordance with the present invention with parts broken away to show detail, the pump being shown installed in a home water supply system;

Fig. 2 is a fragmentary view similar to Fig. 1 but showing the piston at the opposite or inner end of its stroke just prior to its substantially instantaneous suction stroke;

Fig. 3 is a view of a preferred form of the invention shown mounted directly on a meter casing;

Fig. 4 is a full size top plan view of the pump unit shown by Fig. 3;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 4; and

Fig. 6 is a sectional view taken on line 6—6 of Fig. 4.

Referring more particularly to the drawings, the pump in accordance with the simpler form of the invention illustrated by Figs. 1 and 2 is designated generally by the reference numeral 10.

Pump 10 is shown installed in a home water supply

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system having a conduit 12 and a faucet 14 with a control valve 16 which permits water to flow from the faucet under main or pump pressure only when the valve is turned to an open position.

Included in pump 10 is a conventional household type water meter 18 placed in the conduit 12 and driven by the water flow through the conduit. Water meter 18 has a shaft 20 which projects from the meter and is rotated by the meter. Shaft 20 has a cam member as disk 22 on its outer end with a continuous spiral peripheral edge surface 24 on which the high point 26 is connected to the low point 28 by a radial drop-off 30.

A conduit 32 is connected by a fitting 34 to the water supply conduit 12 on the inlet side of the water meter 18. Conduit 32 is connected also with the upper end of an elongated tubular housing 35 having a central chamber 36 and outlet and inlet chambers 38 and 40 respectively, above and below the central chamber 36. The chambers 36, 38 and 40 are separated by transverse or lateral walls 44 each of which has a central opening 46. The upper surface 48 of each wall 44 is concave and slopes inwardly toward the opening 46. A ball check valve 50 is disposed over each central opening 46 and the concave surface 48 of each wall 44 together with gravity keeps the balls of the check valves normally over the openings 46. In this manner inlet check valves are formed on the lower transverse walls 44 and outlet check valves in the upper transverse walls 44.

The lowermost chamber 40 is connected by a conduit 52 to a reservoir supply as a bottle container 54 having a fluorine solution 56 with a filler 58 and vented cap 60. An extension 62 of the conduit 52 extends down into the container 54 terminating adjacent and spaced from the bottom of the container.

The housing 35 has integrally formed as a part of and laterally projecting from the central chamber 36 a cylinder 64 for slidably receiving an elongated reciprocating piston 66 that projects longitudinally from the cylinder. Sealing bushing 68 is threaded on the end of cylinder 64 and seals the piston slidably in the cylinder. A collar or flange 72 is provided on the piston outside the cylinder and a compression coil spring 74 is mounted on the piston between the collar 72 and the sealing bushing 68. The spring 74 continuously urges the piston 66 outwardly to force the outer end 76 of the piston in constant engagement and abutment with the peripheral surface 24 of the cam member 22.

Water flow through conduit 12 caused by opening faucet valve 16 causes the water meter 18 to rotate shaft 20. This rotates the cam member 22 and causes the piston 66 to reciprocate. Cam 22 rotates clockwise so that the continuous spiral cam surface 24 from the low point 28 to high point 26 causes the piston to move inwardly at a constant rate. This forces the lower ball check valves 50 onto the openings 46 closing these openings and opening the upper ball check valves 50. Chamber 36 and cylinder 64 having been charged with fluorine on the suction stroke of the piston as will be described, a constant and continuous flow of fluorine is thus injected into conduit 12 of water meter 18.

Cam surface 24 thus provides a continuous pressure stroke of the piston proportionate to the water flow and being on the inlet side of the meter further provides a thorough mixing of the fluorine with tap water drawn off at the faucet. The radial drop off serves to give a substantially instantaneous suction stroke. The outer end 76 of piston 66 will drop off high point 26 onto low point 28 of the cam surface 24 substantially alongside the radial surface at 30. When this occurs, the piston will be moved outwardly almost instantaneously by spring 74 and accomplish the suction stroke to refill chamber 36 and cylinder 64. During this stroke the two uppermost

ball valves 50 are seated to block the upper openings. The lowermost ball valves 50 are lifted off their seats to draw the desired quantity of fluorine from the container 54.

In the preferred form of the invention illustrated by Figs. 3 to 6, inclusive, the unit is designated generally by reference numeral 80. In the unit a cylindrically formed pump housing block 81 (Figs. 5 and 6) is formed with a central transversely disposed piston chamber 82. At opposite ends of chamber 82 (see Figs. 4 and 5) upper axially directed inlet ports are formed at 85 and 86 with laterally directed outlet ports at 87 and 88 (see Figs. 4 and 6).

A fluorine container connecting member 89 is at the top of the unit having an upstanding piercing drain needle 90 to hold and pierce the end closure 91 (Fig. 3) of a bottle container 92 having a supply of liquid fluorine or fluorine solution.

Member 89 fits on a cylindrically formed cap member 94 (Figs. 5 and 6) which in turn is fixed as by screws 93 to the top of housing block 81. The upper surfaces of members 81 and 94 are recessed and sealing gaskets 95 and 96 are provided between the depending portions of the recessed undersurfaces of members 94 and 89. The undersurface of member 94 is formed with divided recesses forming separated passages at 97 and 98 to housing inlet ports 85 and 86 respectively. In communication with the passages 97 and 98 and formed in member 94 are valved inlets 99 and 100. These later inlets lead to a common passage 101 and thence to the needle 90. Passage 101 is formed by the recessed undersurface of connecting member 89.

The inlets 99 and 100 are normally closed by ball checks 102 and 103 yieldably held on their seats by reed springs 104 secured as at 105 to the member 89.

The outlet ports of the housing block at 87 and 88 are similarly in normally closed condition. Ball check valves 106 of these ports are located at the outlet side of the housing block 81 as best seen by Figs. 4 and 6.

In the housing block the opening forming the central piston chamber 82 is enlarged at each end and in these ends are set piston rod guide members as the nylon plugs 110. The inner faces of the guides are formed with spaced pads 111 to fit against the end of chamber 82 and permit the intake of fluid from inlets 85 and 86. Piston rods 112 at each end of piston 113 are slidable in and extend through the guides to the exterior of the housing wall. Bearing against the ends of the rods at diametrically opposed locations is the inner wall 114 of a cup-shaped cam actuator ring 115. As best shown by Fig. 4, the wall 114 is eccentrically formed in the ring which is rotatably mounted at its lower end on a ball bearing 116 the inner race of which it fitted over the end of the axially depending portion at 117 of the housing block. Rotation of the ring 115 will thus reciprocate the piston 113 in the central chamber 82 to actuate the pump.

From its position in Figs. 4 and 5 the piston will be moved to the left during one-half revolution of the cam ring 115. The fluid in that end of the piston will thus be expelled through outlet 87. The ball check 102 in the inlet line to port 85 seals off fluid from the container supply. At the opposite end of the piston section is created to seal off outlet 88 and to draw the ball check 103 away from the inlet 100 and permit the chamber to be charged with fluid at that end. At the completion of the first half revolution of cam 115 the piston travel is then reversed. The valve conditions are thus reversed, and additive fluid is fed from pump outlet 88 into the main stream while fluid enters the chamber 82 at the opposite end through inlet 85. Except for the momentary dwell as the piston travel is reversed a continuous pressure stroke is imparted by the cam and fluid is thus constantly fed into the main stream for thorough mixing whenever the main stream flows through the meter.

At its lower end the ring 115 is provided with an ex-

ternal ring gear 118 which, as shown by Fig. 3, is adapted to mesh with a gear 119 of the meter. The gear 119 is of a conventional type for driving the standard dial indicator mechanism of a water meter.

The housing block 81 of the unit as will be noted from Figs. 5 and 6 is T-shaped in cross section and is housed in a cylindrical casing 120. Casing 120 is provided with an internal shoulder at 121 on which the upper cylindrical wall of the block 81 rests. An O-ring at 122 seals the connection and a snap ring 123 holds the assembly in the casing. At its lower end the casing 120 is reduced at 124 to seat in the top opening at 125 of a cap member 126 of meter 127.

The outlet ports 87 and 88 of the pump chamber at opposite sides of the piston 113 (Figs. 4 and 6) empty into the annular passage 130 in which the upper end of cam ring 115 revolves between the lower section of the housing block 81 and casing 120. The lower end of the casing being in communication with the upper chamber of meter 127 delivery of fluid from the pump is thus introduced into the main stream flow of liquid and into the conduit leading to the faucet discharge.

It will be seen from the above description of the preferred form of the invention that a small compact unit is provided for installation with a conventional household water meter with very little change in the usual meter structure itself. The dial indicator drive wheel 119 is utilized and the meter housing cap structure may conveniently replace the standard cap so as to mount the unit 80 in an appropriate opening.

The unit is self-contained and preferably the eccentric cam ring ball bearing mount 116 is drive fitted on the end 117 of the housing. With the snap ring 123 holding the top of the housing 81 seated in the casing 120 the unit is effectively sealed against idle tampering or amateur attempts to dismantle the pump. For its intended use as a home fluorinator it is of some importance that authorized persons only handle the pump for inspection or repair.

More importantly it will be appreciated that the fluorine is continuously fed into the main stream of water in an amount proportionate to the flow of the main stream and at all times while flow is actually taking place. In other words the additive liquid is injected into the main stream uninterruptedly for immediate dilution and thorough mixing whenever any flow occurs. At the discharge nozzle therefore, water drawn off in any desired amount at any time will be mixed with the proper amount of additive fluid.

What is claimed is:

1. Fluid injection pump apparatus for the continuous feed of an additive fluid into the main stream of another fluid proportionate to the rate of flow of said main stream, said apparatus comprising a metering device actuated in response to flow of said main stream and at a rate in fixed ratio to the rate of flow thereof, a supply container for additive fluid, a casing for said metering device, a double acting pump having a casing attached to and interiorly of said metering device casing, two passageways respectively placing said container in communication with either end of said double acting pump, a check valve in each passageway permitting flow of fluid only towards said pump, passageway means placing both ends of the pump in communication with the interior of said casings, check valve means in each of said passageway means permitting flow of fluid only from said pump to said casing interior, and means driven by said metering device for driving said double acting pump in direct proportion to the rate of operation of said metering device.

2. Fluid injection apparatus as in claim 1 wherein the pump driving means comprise a gear driven by the metering device, a ring gear in mesh therewith and rotatable on said pump within the meter casing, a flange secured to said ring gear and surrounding said pump, an eccentric-

ly formed cam surface on the interior of said flange and a piston rod extending from both ends of said pump with both ends of said piston rod engaging said eccentric cam surface at opposed points.

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