May 12, 1964 H. ROVIN ETAL 3,132,665

TWO-WAY VALVE

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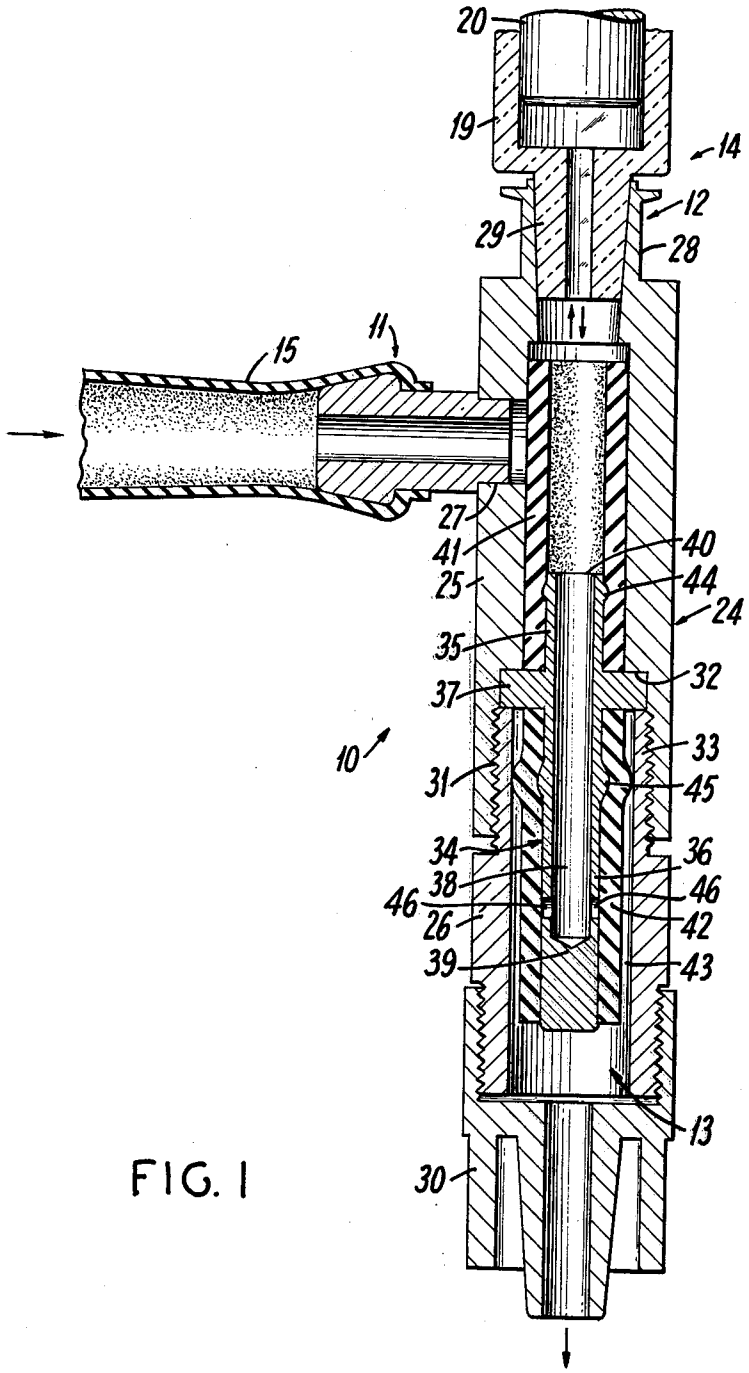


FIG. 1

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2 Sheets-Sheet 2

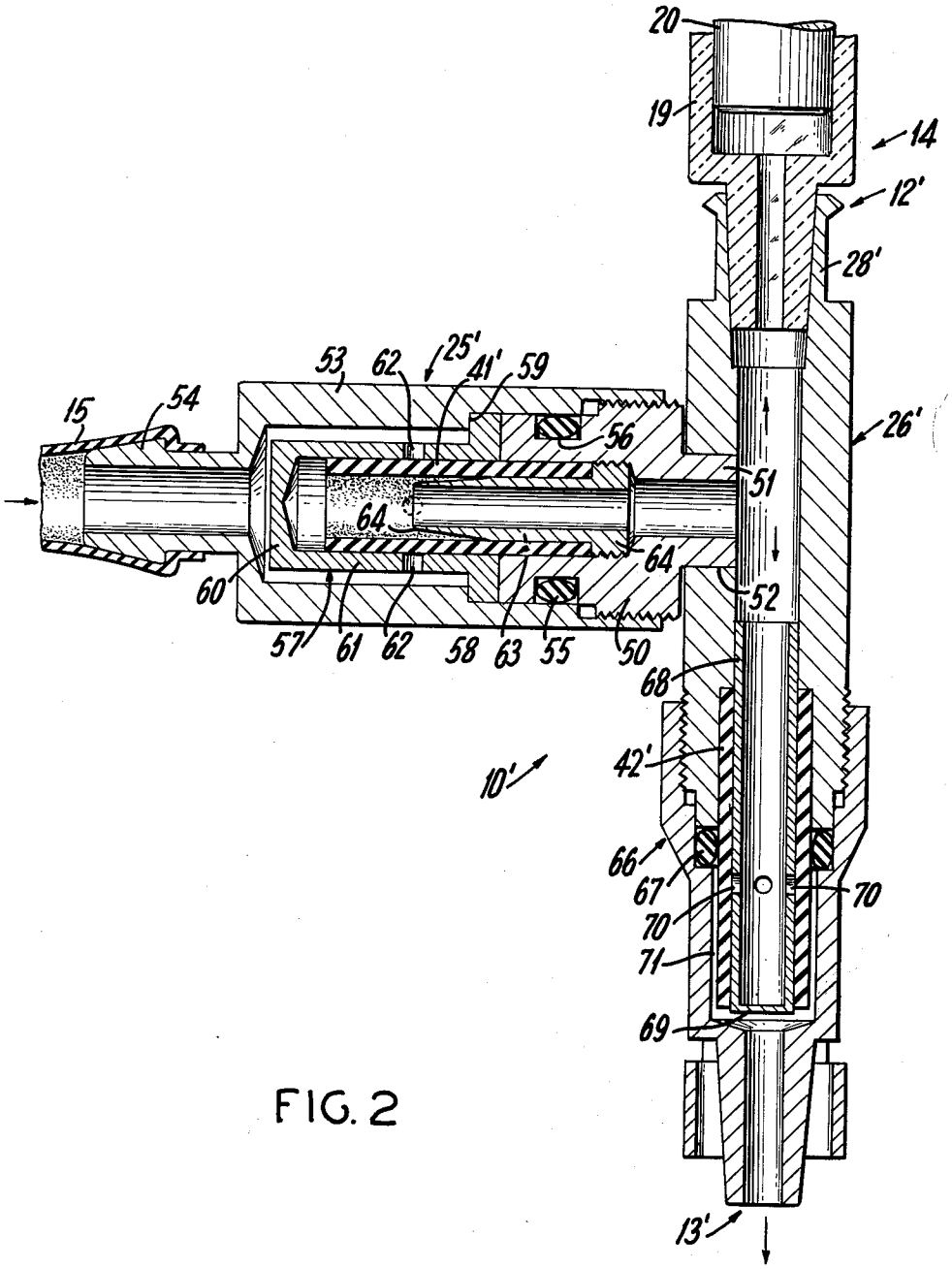


FIG. 2

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TWO-WAY VALVE

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This invention relates to two-way valves, and more particularly concerns valves for regulating the transfer of measured amounts of liquid between two containers.

It is frequently desirable to transfer relatively small quantities of liquid in precisely measured amounts from a storage container for the liquid, to a receiving container. When a number of such liquid quantities are to be transferred successively to receivers, a valved measuring device such as a pipette or pump has been used.

However, with known valve constructions which are of the two-way type; the operation thereof presents problems in priming the system; maintenance problems arise due to the use of moving parts in the valve; and is marked by reduced efficiency when handling liquids of relatively high viscosity.

Accordingly, an object of this invention is to provide an improved two-way valve of relative simple construction; which avoids the use of moving parts; which lends itself to ready priming and is able to handle liquids of relatively high viscosity.

Another object of this invention is to provide an improved two-way valve which comprises deformable inlet and outlet valve sleeves; said sleeves responding quickly to differential pressures induced by pumping and suction strokes of the pumping device associated therewith.

A further object of this invention is to provide a two-way valve of the character described, wherein the relative motion of the valve sleeves is small, thereby minimizing the lag between expansion and contraction of the inlet sleeve upon repetitive operation of the device.

Still another object of this invention is to provide a two-way valve of the character described wherein the operating pressure differential for the valve sleeves is quite small and thus allowing the piston of the pumping device associated with the valve to be retracted for the suction stroke with minimized effort.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

In the drawings, FIG. 1 is a vertical sectional view of a two-way valve embodying the invention; and

FIG. 2 is a view similar to that of FIG. 1, showing a modified form of the valve.

Essentially, the valve of the instant invention is of the two-way type, i.e. it is to be associated with a pumping and/or measuring device such as a syringe or the like, wherein the suction stroke of the pumping device withdraws a predetermined quantity of liquid from a supply container into the measuring device; and upon the movement of the piston for its pressure stroke, the measured quantity of liquid is delivered to a receiving container. The syringe may be arranged for successive operation to deliver precisely measured quantities of liquid in succession; the valve being adapted to alternate in its operation with rapidity and efficiency.

Thus, as shown in FIG. 1, a valve embodying the invention, generally indicated at **10**, and having a tubular inlet member **11**, a pumping port **12** and an outlet port **13**; is arranged to have a pumping-measuring device **14** detachably connected to the pumping port **12**, while a flexible tubing **15** is connected at one end to inlet member **11**, the other end of tubing **15** being introduced into liquid held in a supply container not shown. The outlet

port **13** of valve **10** is located over a receiving container not shown.

The device **14** may take the form of a syringe having the usual barrel **19** and slidable piston **20**, with provision for elevating the piston **20** after the downward pressure stroke, as by means of a spring not shown. Additionally, suitable means may be provided for setting the extent of the stroke of piston **20** as typically shown in Patents 2,798,647, 2,792,157; thus allowing the piston **20** to be depressed repeatedly, to deliver to receiving containers a precisely measured quantity of liquid from a supply container. The assembly of syringe **14** and valve **10** is suitably supported in a determined position.

The valve **10** comprises a tubular assembly **24** having interconnected tubular members **25, 26** of metal or plastic which are preferably inert and resistant to the liquids to be handled. The inlet member **11** is fitted into an opening **27** formed in an upper portion wall of member **25** at a point adjacent the pumping port **12**. Pumping port **12** may take the form of a tubular extension **28** at the upper end of member **25** for frictionally receiving the usual tip **29** of syringe **14**. The outlet port **13** may comprise an internally threaded tubular member **30** which is screwed on the lower threaded end of member **26** and may have a Luer lock construction to allow needles or other fittings to be attached thereto.

The tubular members **25, 26** are arranged to be screwed together; member **25** having a threaded socket portion **31** at the lower end thereof to provide an annular shoulder **32** to receive an externally threaded reduced end portion **33** on the upper end of member **26**.

A tubular valve stem **34** is disposed coaxially within tubular member **24**. Stem **34** comprises a short upper portion **35** and a longer lower portion **36** respectively extending from an annular flange portion **37** with a bore **38** closed by a lower end portion **39** adjacent outlet **13** and open at the upper end **40** thereof. The annular flange **37** locates stem **34** on an annular shoulder **32** in tubular member **25**, the end of reduced end portion **33** of tubular member **26** holding the flange **37** against shoulder **32**.

The relatively short upper portion **35** of stem **34** has one end of a deformable, resilient tubular inlet valve sleeve **41** of rubber or other suitable material mounted thereon. Sleeve **41** has an O.D. to snugly fit against the bore of tubular member **25** and a length greater than that of stem portion **35** to provide a portion in opposed covering relation to inlet opening **27** and to extend toward pumping port **12**.

A deformable, resilient tubular outlet sleeve **42** is snugly mounted on the outer surface portions of stem portions **36**. The bore of tubular member **26** has an I.D. somewhat greater than the normal O.D. of sleeve **42**, thereby providing a normal annular space **43** therebetween.

Sleeve **41** is resiliently sealed at its lower end between stem portion **35** and tubular member **25** by an integral annular sealing bead **44** on stem portion **35**. Similarly, sleeve **42** is sealed in place by an annular sealing bead **45** on stem portion **36** which frictionally pinches said sleeve against tubular member section **26**. Such beads **44, 45** also prevent longitudinal movement of the valve sleeves **41, 42** relative to their mounting stem portions **35, 36** respectively, and prevent leakage between the members **25, 26** through their threaded connection.

Stem portion **36** is formed with radially extending passages **46** to establish communication between pumping port **12** and outlet port **13** on the downward pumping stroke of piston **20**, as hereinafter described.

In operating the system using valve **10**, the upward movement of syringe piston **20** will result in a reduced pressure within valve sleeve **41** causing the same to collapse and to expose inlet opening **27**, thereby allowing

liquid to pass into the barrel 19 in measured amount. Such reduced pressure will also be effective to cause outlet valve sleeve 42 to tightly hug stem portion 36 and to seal openings 46 therein, to prevent liquid or air from being sucked up at outlet port 13.

On depressing piston 20 for its pressure stroke, the resultant increased pressure will expand and seal valve sleeve 41 against inlet opening 27 and simultaneously will expand outlet valve sleeve 42 into space 43 and to uncover passages 46 to thereby allow liquid to pass between the sleeve and the stem portion 36 to outlet port 13.

The relative motion of valve sleeves 41, 42 as they are alternately subjected to reduced and increased pressures, is extremely small, thereby avoiding any lag in operation; particularly when the syringe 14 is to be operated repetitively, as when dispensing successive quantities of liquid. Also, the sleeves 41, 42 quickly reassume their normal conditions aided by the "memory" of the resilient materials forming such sleeves and the concomitant positive and negative pressures exerted thereagainst.

In FIG. 2 there is shown a modified form of the valve at 10'. Here, the valve body is made up of a tubular assembly 25' and a tubular section 26' in right angle relationship. Assembly 25' comprises a nipple 50 with a reduced end portion 51 fitted into an opening 52 in section 26'. A barrel 53 is screwed onto an externally threaded portion of nipple 50, said barrel including an inlet nipple portion 54 for receiving one end of tubing 15. A sealing ring 55 in an annular groove 56 on nipple 50 seals barrel 53 on said nipple.

A cupped member 57 is coaxially disposed within the bore of barrel 53, said member 57 having an annular flange portion 58 received between the outer end of nipple 50 and an annular seat 59 on barrel 53. Cupped member 57 includes a closed end wall 60 outwardly disposed adjacent the inner end of inlet nipple portion 54 and its cylindrical side wall 61 spaced from the inner wall surface of barrel 53, is formed with radial openings 62.

A deformable inlet valve sleeve 41' is coaxially disposed within cupped member 57 and nipple 50, being mounted on a tubular stem member 63 which is formed at one end with an annular flange 64 to receive one end of sleeve 41'. The stem member 63 is tapered to a feather edge 64 at the other end thereof to allow the valve sleeve 41' which normally snugly fits against the inner surface of cupped member 57, to close passages 62 therein, to collapse under conditions of reduced pressure and thereby expose openings 62.

Section 26' comprises an extension 28' at its upper end to receive the tip of syringe 14, as previously described. Section 26' is threaded at its lower end to receive thereon the threaded end of a tubular Luer-lock connector member 66 with an annular sealing gasket 67 therebetween. A tubular stem member 68, closed at its lower end 69 and formed with radial openings 70, is disposed coaxially within the lower portion of the bore of member 26' and connector member 66, being force fitted at its upper end into the reduced bore of member 26'. A deformable outlet valve sleeve 42' is snugly fitted about valve stem member 68, being disposed in an enlarged bore portion of member 26'.

The outer surface of the lower portion of valve sleeve 42' is spaced from the opposed inner surface portions of connector member 66 to provide an annular space 71 therebetween to establish communication between pumping port 12' and outlet port 13' by way of openings 70, when sleeve 42' is expanded in response to the pumping stroke of piston 20 on syringe 14.

In using valve 10', the upstroke of piston 20 will reduce pressure in valve stem 63 causing collapse of valve sleeve 41' to allow liquid to be drawn up into syringe 14 by way of openings 62. At the same time, such reduced pressure will cause valve sleeve 42' to hug stem member 68 to seal openings 70 therein. The pressure stroke of piston 20 will reverse the conditions, causing sleeve 41' to expand and tightly close off openings 62 while sleeve 42' is expanded to expose openings 70, thereby passing the liquid drawn up into syringe 14, to the outlet port 13'.

It will be apparent that uneven performance and maintenance problems inherent with spring-pressed ball type and tack type valves will be avoided, and further, the valves 10, 10' disclosed herein may be operated in any position. Also, priming of the valves of the instant invention is facilitated.

It is understood that valves 10, 10' may be used with various forms of meter type pumping means connected to the pumping ports thereof.

As various changes might be made in the embodiments of the invention herein disclosed without departing from the spirit thereof, it is understood that all matter herein shown or described is illustrative and not limiting except as set forth in the appended claims.

What is claimed is:

1. In a valve comprising a tubular body member having a pumping port at one end thereof, an outlet port at the other end thereof and an inlet port formed in the wall thereof intermediate said pumping and outlet ports, the improvement comprising a tubular stem member mounted coaxially and within said body member, said stem having a closed end portion extending toward said outlet port and an open end portion terminating short of said inlet port, a tubular deformable inlet valve sleeve disposed within said body member, one end of said sleeve being mounted on the open end portion of said stem member and the other end of said sleeve projecting beyond the terminal end of the open end portion of said stem member and normally closing said inlet port, a tubular deformable outlet valve sleeve disposed within said body member and enclosing the closed end portion of said stem member, said closed end portion of the stem member having passages normally closed by said outlet sleeve, said stem member having flange means on an intermediate portion thereof engaging inner surface portions of said body member, to provide inlet and outlet compartments therein.

2. A valve comprising a tubular valve body including a pair of longitudinally related tubular sections, means interconnecting said tubular sections, one of said sections having an internal annular shoulder at the juncture thereof with the other section, one of said sections having an inlet port intermediate the ends thereof and a pumping port at the outer end thereof, the other section having an outlet port at the outer end thereof, a tubular stem disposed coaxially within said valve body, flange means on said stem seated on the shoulder of said one section for mounting said stem with an open ended portion of said stem projecting into said one section and terminating short of the inlet port therein and closed end portion thereof having passages therein projecting into the other section, a deformable valve sleeve mounted on the open ended stem portion, said sleeve having an outer end portion projecting beyond the terminal end of said open ended stem portion and normally snugly conforming to the bore of said one body section and to close the inlet port thereof, a deformable valve sleeve mounted on the closed end portion of said stem to normally close the passages therein, said second valve sleeve having its outer surface spaced from the bore of said other body section to provide an annular space therebetween for receiving the expanded portion of said second valve sleeve upon an increase in pressure within said stem to thereby open the passages therein and to thus establish communication between said pumping and outlet ports, said first valve sleeve collapsing upon a decrease in pressure within said stem to open said inlet port and to establish communication between said inlet and pumping ports while simultaneously therewith said second sleeve collapses to tightly close the passages in said stem.

3. A valve comprising a pair of tubular body sections interconnected in communicating relation and to dispose said body sections at right angles to each other, one of

said sections having an inlet port at the outer end thereof, the other section having a pumping port at one end thereof and an outlet port at the other end thereof, a tubular valve stem mounted coaxially within each body section, the valve stem in said other body section having a closed end extending toward the outlet port thereof and passages in the wall thereof, a deformable valve sleeve enclosing said last mentioned valve stem and normally closing the passages therein, a second deformable valve sleeve mounted exteriorly on the valve stem in said first body section, a closed end cupped member mounted within said first body section and disposed coaxially about said second valve sleeve, said cupped member having passages in the wall thereof and said second valve sleeve normally closing the passages therein, said valve sleeves being collapsed in response to a reduction in pressure within said body sections whereby said first valve sleeve seals the passages in said first valve stem and said second valve sleeve opens the passages in said cupped member to thereby establish communication between said inlet and pumping parts, and whereby said valve sleeves are expanded upon an increase in pressure within said body sections to effect a closure of the passages in said cupped member to disconnect said inlet port from said pumping port and to open the passages in said second valve stem to connect said pumping and outlet ports.

4. A two-way valve comprising a pair of tubular body sections in longitudinally connected relation, a valve stem open at one end and closed at the other end coaxially disposed within the bores of said body sections, said valve stem having first and second portions, an inlet port in one body section, the open end of said one body section providing a pumping port, the open end of the other body section providing an outlet port, the open end of said valve stem extending into said one body section and terminating short of the inlet port thereof, the closed end of said valve stem extending into the other body section, said closed end of the valve stem having openings in the wall thereof, a first deformable valve sleeve of a length greater than the length of said first valve stem portion mounted thereon with the outer end thereof projecting beyond the terminal end of the open end of said valve stem toward said pumping port and normally closing said inlet port, a second deformable valve sleeve on said second valve stem portion and normally closing the openings therein, said valve sleeves being expandible upon an increase in pressure within said valve stem to tightly close said inlet port and to expose the openings in said second valve stem portion whereby said pumping and outlet ports are interconnected and said pumping and inlet ports are disconnected; said valve sleeves being collapsible upon a decrease in pressure within said valve stem to open said inlet port and to close the openings in said second valve stem portion whereby said pumping and inlet ports are interconnected while said pumping and outlet ports are disconnected.

5. A valve as in claim 4 wherein said first valve sleeve has an outside diameter substantially equal to the bore diameter of said one body section, annular bead means for sealing the mounted inner end of said first valve sleeve between said first valve stem portion and the bore of said first body section; and said second valve sleeve having an outside diameter less than the inside diameter of said second body section to provide an annular space between said second sleeve and said second body section, and annular bead means for sealing the inner end of said second valve sleeve between said second valve stem portion and said second body section.

References Cited in the file of this patent

UNITED STATES PATENTS

1,413,568	Bjornstad	Apr. 25, 1922
2,191,458	Duden	Feb. 27, 1940
2,662,485	Ilfrey	Dec. 15, 1953
2,902,049	Ilfrey	Sept. 1, 1959
2,953,248	Troland	Sept. 20, 1960
3,077,205	Butterworth	Feb. 12, 1963

FOREIGN PATENTS

305,959	Italy	Feb. 21, 1933
853,135	Gemany	Oct. 23, 1952