Jan. 6, 1970 D. TANNER 3,487,980

METERING VALVE

Filed Nov. 19, 1968

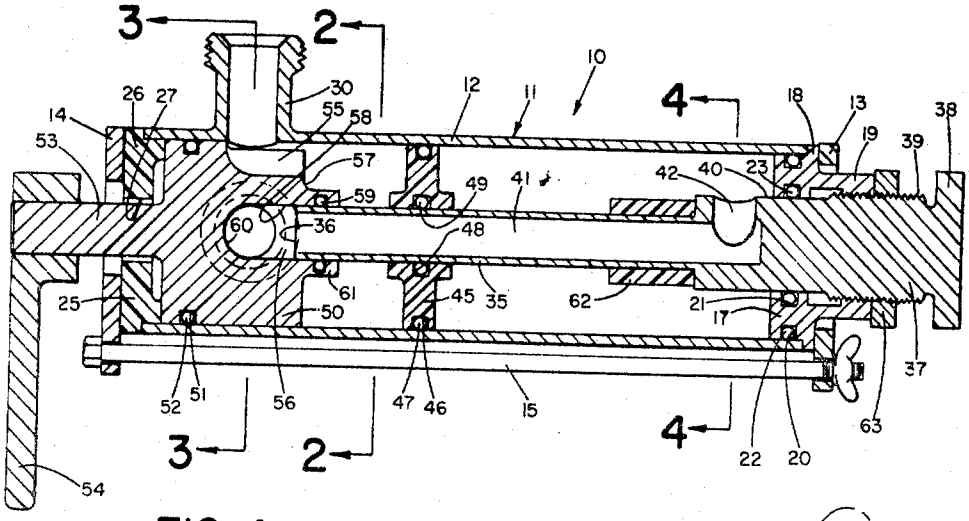


FIG. 1

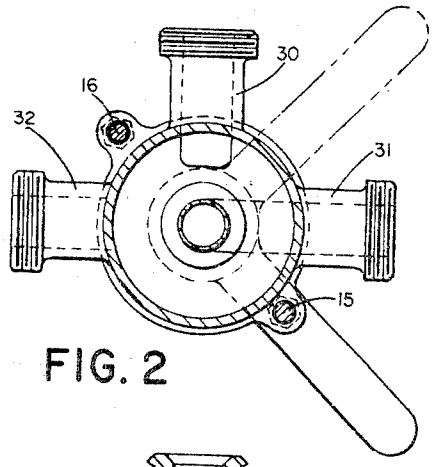


FIG. 2

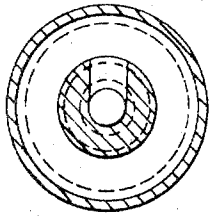


FIG. 4

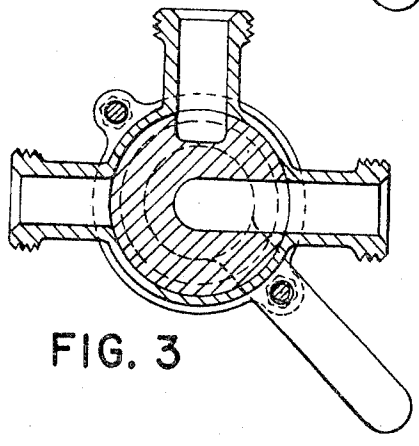


FIG. 3

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METERING VALVE

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ABSTRACT OF THE DISCLOSURE

A hollow casing having an internal conduit and a piston slidable in the casing along the conduit, including valve means for alternately passing fluid under pressure on opposite sides of the piston to effect piston displacement and consequent discharge of fluid from the relatively low pressure side of the piston.

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is related to my prior copending patent application filed May 23, 1966, Ser. No. 551,979, now Patent No. 3,419,053 issued Dec. 31, 1968, entitled Container-Filling Machine.

BACKGROUND OF THE INVENTION

In container-filling machines of the type disclosed in said copending patent application, and in other fluid metering applications, there are employed valves for metering or measuring desired quantities of fluid materials. Such valves, particularly in food handling operations, require extreme simplicity of construction for reliability in use and ease of disassembly and cleaning, and also require accurate adjustability of quantity without dismantling or removal from the line.

SUMMARY

Accordingly, it is an important object of the present invention to provide a metering valve of the type described which is extremely simple in construction for highly reliable operation throughout a long useful life, which can be easily disassembled for complete cleaning to maintain high sanitary conditions, and which is accurately adjustable while in the line and operating to assure precise metering operation.

While the metering valve of the present invention is intended for use in the container-filling machine of said patent application, it is appreciated that the instant valve is capable of many varied applications all of which are intended to be comprehended herein.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a longitudinal sectional view showing a metering valve of the present invention.

FIGURE 2 is a transverse sectional view taken along the line 2—2 of FIGURE 1, illustrating the handle in dot-and-dash outline in an alternate position.

FIGURE 3 is a transverse sectional view taken generally along the line 3—3 of FIGURE 1.

FIGURE 4 is a transverse sectional view taken generally along the line 4—4 of FIGURE 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, it will be seen that the metering valve is there generally designated **10**, and includes a generally cylindrical casing or cylinder **11** which may be composed of a cylindrical side wall **12** and a pair of generally circular end walls **13** and **14**. The end walls **13** and **14** may be secured to opposite ends of the cylindrical side wall **12** by any suitable means, such as tie-bolts **15** and **16** extending longitudinally along the exterior of the cylindrical side wall having their opposite ends extending through respective end walls. More specifically, an internal annular end piece or plug **17** may be inserted into one end of the cylinder **12**, the right-hand end as seen in FIGURE 1, being conformably engaged therein and formed with a radially outstanding, circumferential flange **18** overlying and in abutting engagement with the adjacent end edge of the cylinder **12**. The end piece or plug **17** may be further formed with an internally threaded nipple **19** extending longitudinally outwardly away from the cylinder **12**, spacedly through the central opening of annular end wall **13**; and, the end wall **13** may engage the longitudinally outer side of flange **18** to hold the latter firmly against the end edge of the cylinder **12**. The end piece or plug **17** may be externally and internally grooved, as at **20** and **21**, respectively, for receiving sealing rings **22** and **23**. The sealing ring **22** serves to effectively seal against the internal surface of cylinder **12**, and the function of the sealing ring **23** will be described hereinafter in greater detail.

Inserted in the other, left-hand end of the cylindrical side wall or cylinder **12** is an end piece or plug **25**, being conformably engaged in the cylinder and formed with a radially outstanding circumferential flange or rib **26** in abutting engagement with the adjacent end edge of the cylinder. The plug **25** is of annular configuration, including a central opening **27**, for a purpose appearing presently; and, the annular end wall **14** abuts against the outer side of plug **25** to maintain the flange **26** in firm abutting engagement with the adjacent end of cylinder **12**.

Adjacent to one end of the casing **11**, provided on the side wall or cylinder **12**, is a radially projecting tubular extension or inlet nipple **30**. That is, the nipple **30** is integral with or suitably fixed to the cylinder **12** so as to communictae with the interior thereof.

Generally coplanar with the inlet connection or nipple **30**, the casing is provided on its side wall **12** with a pair of spaced radially outwardly projecting tubular members or outlet nipples **31** and **32**. The outlet connections or nipples **31** and **32** also communicate with the interior of the casing **11** through the casing side wall **12**. The outlet nipples **31** and **32** are illustrated as being in diametrically opposed relation with respect to each other, each angularly spaced ninety degrees on opposite sides from the inlet nipple **30**. Other angular spacing may be employed, but it is essential that the outlet nipples **31** and **32** by equally angularly spaced from the inlet nipple **30**. The inlet **30** and outlets **31** and **32** may be externally threaded, as illustrated, or otherwise provided for connection to suitable inlet and outlet conduits.

Disposed longitudinally and co-axially of the cylindrical casing **11** is a tubular member or conduit **35**. The conduit **35** terminates at a free end **36** adjacent to and spaced inwardly from the end piece **25**, and has its opposite end provided with an enlarged extension **37** projecting longitudinally outwardly through the end piece **17** and its nipple **19** beyond the exterior of the casing **11**, where it may be provided with an actuating knob or enlargement **38**. Further, the conduit extension **37** is preferably externally threaded, as at **39** in the region of end piece

nipple 19 for threaded engagement therewith, and is externally smooth, as at 40 in the region of the seal or O-ring 23 for effective sealing engagement with the latter. As best seen in FIGURE 1, the conduit 35 is internally hollow, as at 41, having its end 36 open for communication with the interior hollow. Further, the conduit 35 adjacent to the end plug 17 is formed with a lateral or radial opening 42 for communication between the conduit interior 41 and the interior of casing 11 adjacent to the end plug 17. The conduit extension 37 beyond the opening 42 may be solid or closed.

A piston or disc 45 is circumposed about the conduit 35 within the casing side wall 12 and in sealing engagement with the casing and conduit. More particularly, the piston or disc 45 may be provided on its external periphery with a groove 46 receiving a sealing member or ring 47 in sealing engagement with the interior of the casing; and, the inner periphery or bore of the piston 45 may be provided with an internal groove 48 receiving a sealing member or ring 49 in sealing engagement with the exterior of the conduit 35. In this manner, the piston 45 is slidable in the casing 11 along the exterior of the conduit 35.

Interiorly of the casing 11, adjacent to the end piece or plug 25, there is provided a valve element 50 in the form of a generally cylindrical member comformably received in the casing side wall 12 having an external groove 51 adjacent to the end member 25 and receiving an annular sealing member or ring 52 in sealing engagement with the interior of the casing side wall. The cylindrical valve member 50 may also be provided with an axial extension or stem 53 projecting spacedly through the adjacent end piece 25 and end wall 14 exteriorly of the casing 11, where it may be provided with a handle 54 or other suitable actuating means.

The valve member 50 is further formed, at locations longitudinally inward of the sealing ring 52 with a pair of ports 55 and 56. The port 55 may be defined by a groove extending longitudinally of the cylindrical axis of valve member 50, being formed in the outer surface thereof, opening through the inner end surface 57 for communication with the interior of the casing 11. That is, the groove defining port 55 opens through the inner end surface 57 of the cylindrical member 50 and terminates short of the sealing ring 52, so as to define communication between the inlet 30 and the interior of casing 11 on one side, the left side, of piston 45, as best seen in FIGURE 1.

The port 56 may include a bore 58 extending co-axially of the valve member and opening through the inner surface 57 of the valve member for rotatably receiving the end 36 of conduit 35. The interior of bore 58 may be provided with suitable sealing means, such as a sealing ring 59 in sealing engagement with the exterior surface of conduit 35. In addition, the port 56 may include a radial bore 60 extending from the inner end of bore 58 radially of the valve member 50 and opening through the peripheral surface thereof. The radial bore 60 of port 56 may extend at an angle with respect to the radial opening of port 55 equal to the angular spacing between inlet 30 and each outlet 31 and 32.

The end 36 of conduit 35 is thus supported in the bore 58 of port 56, while the valve member 50 is axially rotatable in the casing 11 relative to the conduit 35. In practice, the valve member 50 may be rotated from the solid line position of FIGURES 1 and 2 to shift its handle 54 to the phantom position of FIGURE 2. This is an angular rotation approximately equal to the angular distance between inlet 30 and each outlet 31 and 32. Such rotation to the phantom position of FIGURE 2 will shift port 55 from its communication with inlet 30 to communication with outlet 32, and will shift port 56 from its communication with outlet 31 to communication with inlet 30.

The inner end surface of valve member 50 may be provided with an annular extension or neck 61 circumposed about the conduit 35 and carrying the sealing ring 59. The annular neck 61 extends toward one side of the piston 45 and defines an abutment for limiting engagement with the piston, as will appear presently. Circumposed about the conduit 35, on the other or right side of the piston 45, may be a sleeve 62, which also defines an abutment for limiting bearing engagement with the right side of the piston.

In operation, say commencing from the valve member position shown in FIGURE 1, fluid under pressure may enter inlet 30, pass through port 55 into the interior of casing 11 but exteriorly of the conduit 35. The pressure of this fluid entering through port 55 is exerted on the left side of piston 45 to displace the piston rightward to a limiting position in engagement with abutment sleeve 62. Were there any fluid in the casing 11 on the right side of the piston 45, this fluid would have been caused to be discharged through opening 42, conduit 41, port 56 and outlet 31. Upon rotational shifting of the valve member 50 to place the port 56 in communication with inlet 30 and port 55 in communication with outlet 32, fluid under pressure may enter through inlet 30, port 56, conduit 35, opening 42 and pass into the casing 11 on the right side of piston 45 to effect displacement of the piston leftward. This causes discharge of fluid from the left side of the piston 45 outward through port 55 and communicating outlet 32. Upon return of the valve member 50 to the solid line position the above-described procedure is repeated indefinitely. It will be appreciated that the quantity of fluid discharged is always a measured amount determined by the displacement or stroke of piston 45 between abutments 61 and 62. This metered quantity may be accurately adjusted by rotation of the conduit extension 37 in its threaded engagement with nipple 19 to displace the abutment 62 toward or away from the abutment 61. That is, the spacing between abutment 61 and 62 is selectively adjustable to determine the quantity of fluid to be metered. At a desired position of adjustment the conduit extension 37 may be locked in position by any suitable means, such as a lock-nut 63 threadedly circumposed about the extension for abutting engagement with the nipple 19.

From the foregoing, it is seen that the present invention provides a metering valve which is extremely reliable and efficient in operation and structure, eliminating the need for any external piping other than inlet and outlet, wherein control is more simply effected by rotary actuation, rather than the need for reciprocatory or other movement; wherein volumetric adjustment is incorporated interiorly of the device and selectively adjustable from exteriorly of the device; and wherein a single cylindrical structure serves both as a valve housing and piston-receiving cylinder.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. A metering valve comprising a casing, a hollow conduit disposed longitudinally of and within said casing, a piston slidable in said casing longitudinally thereof along the exterior of said conduit, said conduit having an opening communicating with the interior of said casing on one side of said piston, an inlet communicating with the interior of said casing on the other side of said piston, a pair of outlets communicating with the interior of said casing on said other side of said piston and equally angularly spaced on opposite sides of said inlet, and a rotary multiport valve element interiorly of said casing having one port permanently communicating with the interior of said casing on said other piston side and having another port communicating with said conduit and angularly spaced from said one port a distance equal to the

angular space between said inlet and each of said outlets, said valve element thereby being movable between a first position with said one port communicating with said inlet and said other port communicating with one of said outlets and a second position with said one port communicating with the other of said outlets and said other port communicating with said inlet, whereby in said first position fluid entering said one port passes into said casing on said other piston side to displace the piston and discharge fluid from said casing on said one piston side through said conduit and said other port, and in said other position fluid entering said other port passes through said conduit into said casing on said one piston side to displace the piston and discharge fluid from said casing on said other piston side through said one port.

2. A metering valve according to claim 1, said one port opening longitudinally into said casing and radially outward for selective communication with said inlet and outlets, and said other port opening longitudinally into said conduit and radially outward for selective communication with said inlet and outlets.

3. A metering valve according to claim 1, in combination with abutment means at spaced locations in said casing for limiting engagement with said piston.

4. A metering valve according to claim 1, said casing being cylindrical, said conduit being cylindrical and disposed axially within said casing, and said valve element comprising a generally cylindrical member disposed axially within said rotatable relative to said casing, said one port opening longitudinally into said casing and radially outwardly for selective communication with said inlet and

outlets, and said other port opening endwise into said conduit and radially outwardly for selective communication with said inlet and outlets.

5. A metering valve according to claim 4, in combination with abutment means at selectively spaced locations along said conduit for limiting engagement with said piston to determine the piston stroke.

6. A metering valve according to claim 5, said abutment means comprising a first abutment member on said cylindrical valve member, and a second abutment member carried by said conduit on said one side of said piston, said conduit being shiftable longitudinally to selectively space said abutment members.

7. A metering valve according to claim 6, said conduit including a longitudinal extension projecting in threaded engagement through and out of said casing on said one side of said piston for selective longitudinal positioning of said conduit and said second abutment.

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