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(54) Fluid pressure device for actuating filling heads of carousel filling machines

(57) The push rod (19) which causes the secure closing or opening of the liquid shut-off valve (5), and which also causes the closing or opening of the gas circuit leading to the level tube (6), is connected structurally so as to form a single piece with the stem (28) of a fluid pressure actuator (A), preferably of the pneumatic type, and the body (26) of this actuator is fixed, for example by screwing or by some other method so as to be removable, with sealing means (25), to the upper end of the barrel or body (8) of the filling head, in such a way that it can be easily removed and fitted to facilitate any necessary maintenance, the area of connection between the pneumatic actuator and the said barrel (8) being isolated from the outside by highly reliable sealing means which comprise, in addition to static seals and lateral seals, a bellows (31) of any fluid-tight, flexible and pressure-resistant material which surrounds the extended part of the stem (28) of the actuator (A) and which has one of its ends connected with a seal to the lower part or base (126) of the body of the said actuator and has its other end connected to the lower end of the said stem, in the area in which this end is connected to the push rod (19) which actuates the filling head, the whole being designed in such a way that, when the actuator (A) is removed from the filling head, it remains attached to the push rod (19), whose sealing gasket (119) can also be periodically replaced.

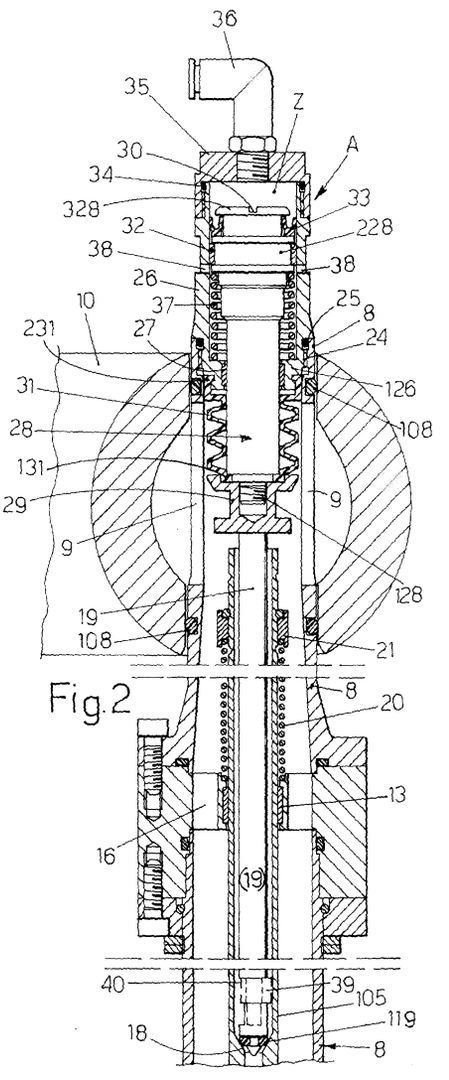

Fig.2

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Description

[0001] The invention relates to vertical-axis carousel machines for filling phials, bottles or other containers with liquid products. The carousel of such a machine is provided on its periphery with equally spaced heads, connected to the reservoir of liquid product to be packaged, with the interposition of a valve means which is securely closed or opened, usually by mechanical actuators which interact with a cam, and which has a downward-facing outlet with which the mouth of the bottle to be filled is made to interact coaxially and in a sealed way when so commanded. A tube which engages in the bottle to a predetermined depth projects and extends coaxially downwards from the lower outlet of the head, the lower end of the said tube being used to determine the level of filling of the liquid in the bottle. The tube allows the gas to escape from the bottle while the latter is progressively filled with the liquid, and before filling the same tube is used to pass pressurized gas, usually carbon dioxide, into the bottle, for cleaning the interior of the said bottle and for other purposes. The invention relates to filling heads with tubes which are fixed and interchangeable if necessary, of the counter-pressure type, with automatic pre-closing when the level determined by the insertion of the tube into the bottle neck is reached, and in which the said command for the secure closing or opening of the said liquid shut-off valve also causes the closing or opening of the circuit supplying gas to the tube.

[0002] In the prior art the said valve means can be actuated not only mechanically by levers and cams, as stated above, but also by means of a fluid-pressure cylinder and piston unit. The said valve means is associated with a push rod which projects from the upper part of the head or of the liquid reservoir contained in the head, passing through lateral sealing means, the upper end of the said push rod interacting with the stem of an actuator having a reciprocating rectilinear motion, usually consisting of a fluid-pressure cylinder and piston unit, whose body is fixed to the upper and outer part of the carousel or of the reservoir, in such a way that it can be easily replaced when necessary, and which is supplied and actuated by means of suitable boxes and a rotary distributor located on the shaft of the said carousel. Examples of solutions of this type are described in European patent application EP 1266862 and in the prior US patent 4,995,431. These known solutions have the following limitations and drawbacks. The upper projecting portion of the push rod for actuating the filling head undergoes reciprocating movements which can lead to the ingress of atmospheric contaminants into the said head which is isolated from the outside essentially by means of lateral sealing gaskets. When it is necessary to carry out maintenance, to replace the sealing gaskets of the pneumatic actuators and the gasket of the push rod for controlling the gas circuit and for securely closing or opening the main valve of the filling head, lengthy and complex operations are required. The invention proposes to overcome these and other drawbacks of the prior art with the following idea for a solution. The push rod is connected structurally to form a single piece with the stem of the pneumatic actuator, and the body of the actuator is fixed, for example by screwing or by some other method so as to be removable, to the upper end of the body of the head, in such a way that it can be easily removed and fitted to facilitate any necessary maintenance. The area of connection between the pneumatic actuator and the body of the filling head is isolated from the outside by highly reliable sealing means which comprise, in addition to static seals and lateral seals, a bellows which surrounds the extended part of the stem of the actuator and which has one of its ends connected with a seal to the body of the said actuator and has its other end connected with a seal to the lower end of the said stem, for example in the area in which this end is connected to the push rod which actuates the filling head.

[0003] Further characteristics of the invention and the advantages derived therefrom will be made clear by the following description which refers to the figures of the attached drawings, in which:

- Fig. 1 shows a filling head with the improvements in question, in longitudinal section and in the closed state; and
- Fig. 2 shows an enlargement of the upper portion of the filling head of Figure 1. Figure 1 shows how the filling head comprises the body 1 of a valve means, fixed for example laterally or in another way to the periphery of a carousel 2 which rotates about a vertical axis, a chamber 3 being provided in the said body 1 with a outlet 103 opening downwards and with a lateral aperture 203 connected to a pipe 4 communicating with the reservoir of liquid to be packaged (not shown), this reservoir being coaxial with the carousel. The connection of the said outlet 103 to the chamber 3 is shut off by a plug 5 with corresponding sealing means, which is axially hollow and to which is fixed, in such a way as to allow for replacement, the tube 6 for supplying the gas and for determining the filling level of the bottle B, which is elevated, when so commanded, by known means M so that its mouth meets and forms a seal with a centring cone 7 provided in a known way under the outlet 103. The chamber 3 of the valve means is open at its top and communicates with the inner part of the vertical barrel 8 which forms the composite body of the filling head and whose upper end, provided with lateral apertures 9 and sealing means 108, abuts the toroidal manifold 10 which is fitted coaxially on the carousel and which is connected to means for supplying the pressurized gas, shown schematically by the arrow 11. The plug 5 forms the enlarged lower part of an axially hollow shaft 105 which engages coaxially in the barrel 8

and which is guided, with the possibility of axial movement, by a lower bush 12 fixed to the body 1 and by an upper sleeve 13 fixed to an intermediate composite portion of the barrel 8. Below the sleeve 12, the shaft 105 of the plug is provided with a collar 205 which is at a correct distance from the said sleeve 12 when the said plug is closed as shown in Figure 1, and which bears against the said sleeve when the plug is open, thus limiting the upward travel of the said plug. The base of the sleeve 205 is provided with vertical holes 14 for the passage of the liquid to be distributed, which rises in the barrel 8 until it reaches, for example, the level indicated by 15, in opposition to the pressure of the gas which enters from above through holes 16 which penetrate the upper sleeve 13. The collar 205 is fixed to a vertical pin 17 which slides in one of the holes 14 so as to prevent any possibility of rotation of the plug unit 5. The cavity of the shaft 105 of the plug opens at its top in a portion of larger diameter which in combination with the lower portion forms a conical step 18 interacting with the lower end, provided with a sealing gasket 119, of a push rod 19 which passes with a clearance through the said upper portion of the shaft 105 for connection to a reciprocating raising and lowering actuator which is described more fully below. A spring 20 having suitable characteristics (see below) is fitted on the upper portion of the shaft 105, bears on the sleeve 13 with its lower end, and acts with its upper end on a ring 21 which is fixed, in such a way that its height can be adjusted, to the said shaft 105, which is conveniently pushed upwards by this spring. A pipe 22, which can be connected to the outside through a normally closed shut-off valve 23, opens laterally into the outlet 103 which is closed at the top by the plug 105.

[0004] With respect to the parts described up to this point, the filling head is constructed according to the prior art, except as regards certain differences in construction, and operates in the following way. At the start of each cycle, the head is in the state shown in Figure 1. On command, the bottle B is raised so that its mouth is made to bear in a sealed way against the collar 7. In the next step, the push rod 19 is raised to allow the gas from the source 11 to pass through the hollow shaft 105 and to enter the bottle B through this shaft and the tube 6. In this step, the plug 5 remains closed, because the pressure of the gas on the level 15 of the column of product present in the barrel 8 and the pressure of the liquid on the top of the plug 5 are grater than the upward thrust exerted by the spring 20. When the pressure of the gas in the bottle B becomes equal to the pressure inside the barrel 8, the spring 20 acts to raise the plug 5, causing the product to flow from the pipe 4 to the chamber 3 through the outlet 103 and progressively fill the bottle B. When the level of the liquid in the bottle reaches the tube 6, the pressure of the gas on the lower face of the plug 5 is interrupted, and therefore the upper hydrostatic pressure becomes stronger and automatically closes the plug 5 against the action of the spring 20, preventing any further outflow of product through the outlet 103 and ensuring an identical and constant filling level of the bottles. In the next step, before the full bottle B is lowered, the push rod 19 is lowered so as to close the connection of the gas through the tube 6, causing the secure closing of the plug 5 and the actuation of the valve 23 so as to depressurize the outlet 103 and the upper inner part of the full bottle, to bring the whole to the level of the external atmospheric pressure, so that the level of the liquid in the bottle is not changed even to the slightest degree when the bottle is subsequently lowered.

[0005] According to the invention (see also Figure 2), the body 26 of a fluid-pressure cylinder and piston unit A is fixed removably, for example by screwing as indicated by 24 and with the interposition of sealing means 25, to the upper end of the barrel 8, the body 26 having at its lower end an integral base 126 provided at its centre with a hole having an annular gasket 27 through which passes, with a lateral seal, the stem 28 of the unit A which terminates below in a tapered threaded part 128 screwed into a cup 29 which is fixed to the push rod 19 and which can be shaped externally with parallel flat parts for manipulation with an open-ended spanner, for the purpose of screwing and unscrewing the parts in question, the upper end of the said stem 28 being provided for this purpose with, for example, a diametric slot 30 for use with a screwdriver, or being structured in any other suitable way, for example with an axial blind hexagonal socket. The portion of the stem 28 projecting downwards from the body 26 is surrounded by a bellows 31 of any flexible, fluid-tight and suitably pressure-resistant material, whose lower edge 131 is clamped in a sealed way between the lower end of the said stem 28 and the cup 29 and whose upper edge 231 is fixed to an annular recess provided laterally on the base 126 of the body of the unit A, this edge being retained in this recess by bearing against the inner lateral surface of the barrel 8. Clearly, any communication between the inner chamber of the barrel 8 and the outside is prevented in the first place by the bellows 31 and also, in a secondary way, by the sealing ring 27.

[0006] The top of the stem 28 terminates in an enlarged part 228 acting as a piston, which slides with a lateral seal on the inner surface of the body 26 with its gasket 32 and with a head 328 provided with an annular recess engaged by a lip seal 33 which also forms a seal with the inner lateral surface of the body 26 of the unit A which is closed at its top in a sealed way by means of the gasket 34 and the cap 35 which is fixed removably, by screwing for example. The cap 35 is provided with a threaded hole to which is fixed the connector 36 for connecting the pressure chamber Z to the circuit for the cyclic supply of pressurized air or for connecting the said chamber Z to the atmosphere, preferably through calibrated discharge means (not shown) in such a way that

the raising of the piston 28 is slowed conveniently by the action of an opposing spring 37 which operates in the lower chamber of the unit A, and which bears upwardly against the piston 128 and downwardly against the base 126. The said lower chamber of the unit A communicates freely with the atmosphere through one or more lateral holes 38, to prevent excess pressure or cavitation phenomena. The outer lateral surfaces of the body 26 and of the cap 35 are preferably shaped so that they can be easily manipulated with spanners for screwing and unscrewing. Clearly, it is possible, by unscrewing the body 26 from the top of the barrel 8, to remove the whole cylinder and piston unit A from the filling head, while the push rod 19 remains attached to this unit, so that the gasket 119 of this component can also be replaced periodically without the need to carry out the specific dismantling and re-assembly operations which are required in the prior art. The operations for replacing the various gaskets of the unit A and of the bellows 31 are simple and rapid. Finally, Figure 2 shows how, when the push rod 19 is in the operating position inside the hollow shaft 105, it is guided and centred correctly in the said shaft by a sleeve 39 of any suitable material which has a low coefficient of friction and is usable with food products, provided longitudinally and externally with one or more grooves or flats 40 for the passage of the gas.

Claims

1. Fluid-pressure device for actuating counter-pressure heads with fixed interchangeable tubes (6) of carousel filling machines for packaging liquid products in phials, bottles or the like, the heads being provided with automatic pre-closing when the level determined by the insertion of the said tube into the neck of the bottle is reached, the actuator for securely closing or opening the liquid shut-off valve (5) comprising a push rod (19) which also closes or opens the gas circuit leading to the said tube (6), **characterized in that** the said push rod (19) is connected structurally so as to form a single piece with the stem (28) of a fluid-pressure actuator (A), preferably of the pneumatic type, and the body (26) of this actuator is fixed, for example by screwing or by some other method so as to be removable, and with sealing means (25), to the upper end of the barrel or body (8) of the filling head, in such a way that it can be easily removed and fitted to facilitate any necessary maintenance, the area of connection between the pneumatic actuator and the said barrel (8) being isolated from the outside by highly reliable sealing means which comprise, in addition to static and lateral seals, a bellows (31) of any fluid-tight, flexible and pressure-resistant material which surrounds the extended part of the stem (28) of the actuator (A) and which has one of its ends connected with a seal to the lower part or base (126) of the body of the said actuator and has its other end connected to the end of the said stem, for example in the area in which this end is connected to the push rod (19) which actuates the filling head, the whole being arranged in such a way that, when the actuator (A) is removed from the top of the barrel (8), this actuator remains attached to the push rod (19), whose sealing gasket (119) can also be periodically replaced.

2. Device according to Claim 1), in which the body (26) of the pneumatic actuator (A) has in its lower part a base (126) provided at its centre with a hole with an annular gasket (27) through which passes, with a lateral seal, the stem (28) of the said actuator, which terminates below in a tapered threaded part (128) screwed into a cup (29) which is fixed to the upper end of the push rod (19) and which can be shaped externally with parallel flat parts for manipulation with a spanner, for the screwing and unscrewing of the parts in question, the upper end of the said stem (28) being provided for this purpose, for example, with a diametric slot (30) for use with a screwdriver, or being structured in any other suitable way, for example with an axial blind hexagonal socket.

3. Device according to Claim 2), in which the portion of the stem (28) projecting downwards from the body (26) of the pneumatic actuator (A) is surrounded by a bellows (31) whose lower edge (131) is clamped in a sealed way between the lower end of the said stem (28) and the said cup (29) and whose upper edge (231) is fixed to an annular recess provided laterally on the base (126) of the said body (26) of the actuator (A), this edge being retained in this recess by bearing against the inner lateral surface of the barrel (8).

4. Device according to Claim 2), in which the stem (28) of the pneumatic actuator (A) terminates upwardly in an enlarged part (228) acting as a piston, which slides with a lateral seal on the inner surface of the body (26) of the said actuator, by means of at least one of its gaskets (32), this piston having an upper head (328) provided with an annular recess engaged by at least one lip seal (33) which also forms a seal with the inner lateral surface of the said body (26) of the actuator (A), this body being closed at its top in a sealed way by means of a gasket (34) and a cap (35) fixed removably, by screwing for example, and provided with a threaded hole to which is fixed the connector (36) for connecting the pressure chamber (Z) to the circuit for the cyclic supply of pressurized air or for connecting the said chamber (Z) to the atmosphere, preferably through calibrated discharge means in such a way that the raising of the piston (28) is slowed conveniently by the action of an opposing spring (37) which operates in

the lower chamber of the actuator (A), and which bears upwardly against the piston (228) and downwardly against the base (126), this lower chamber of the actuator communicating freely with the atmosphere through one or more lateral holes (38).

5. Device according to the preceding claims, in which the outer lateral surfaces of the body (26) and of the cap (35) of the pneumatic actuator (A) are shaped so as to be easily manipulated with spanners for screwing and unscrewing.

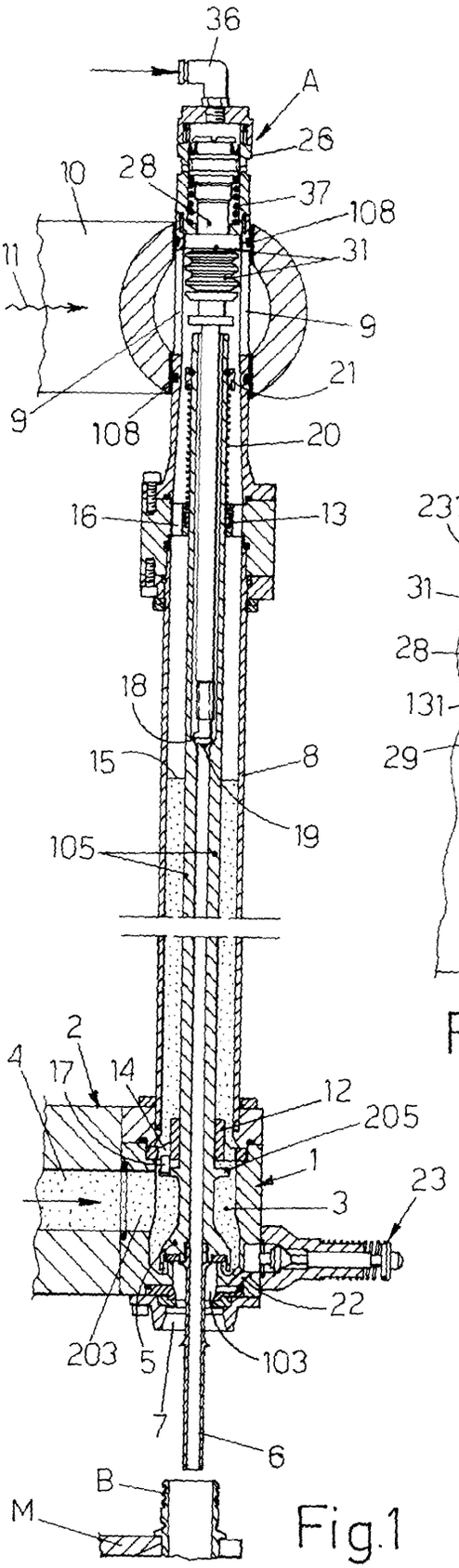
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Fig.1

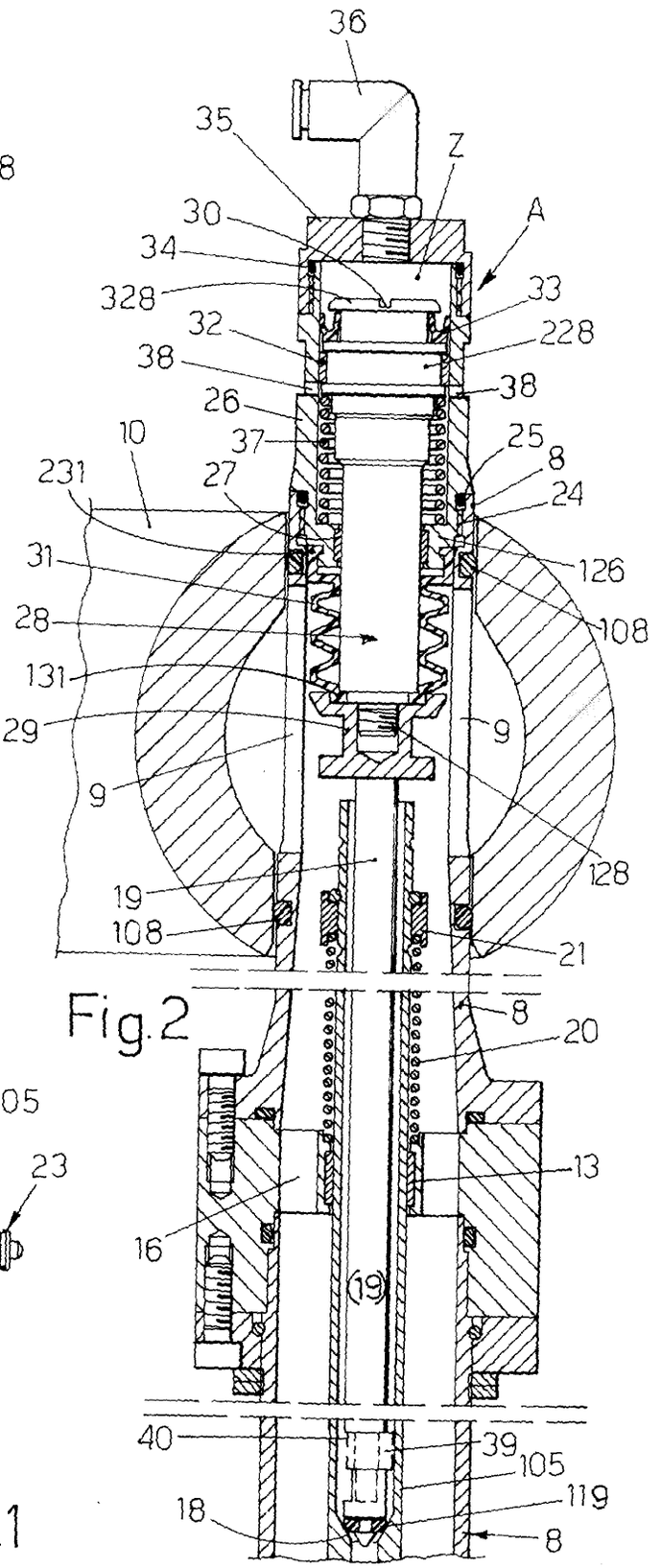
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Fig.2

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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 0254

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B67C

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 April 2005	Smolders, R

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