Gravity filling valve device for ungassed liquids, with a self-levelling system operating under slight gas pressure, for bottling machines.

To prevent contact between the liquid (4) and the atmosphere during bottling, the final level of the liquid (4) transferred into the bottle (5) is established by injecting an inert gas under slight pressure into the full bottle (5) through the hose (37) and the hole (36). The gas rises together with the excess liquid through a tube (11) coaxial with the vertical duct (15). The level of the liquid in the bottle becomes definitive when it skims the lower end of the tube (11).
This invention relates to a gravity filling valve device with a self-leveling system operating under slight gas pressure, for bottling machines.

Gravity filling valves have been known for some time. As is apparent, with these valves the liquid is transferred into the bottle by gravity.

After filling, to ensure that all the bottles are filled with the same quantity of liquid the valve effects an operation known as "levelling". This consists in practice of removing from the bottle that (variable) liquid quantity in excess of a predetermined level equal for all the bottles, and set in proximity to the bottle mouth.

In known gravity filling valves, the levelling operation is such that the removed and/or transferred liquid come into contact with the atmosphere, with consequent contamination.

This phenomenon is particularly felt in the case of wine which, as is well known, is particularly sensitive to atmospheric contamination at this stage.

The object of the invention is to obviate the aforesaid drawbacks by providing a gravity filling valve device able to execute all the bottling stages without the liquid coming into contact with the atmosphere.

This object is attained by a filling valve device in accordance with the first claim.

According to the invention, inert gas is pumped into the bottle through the lower part of the vertical duct, to remove the excess liquid quantity from the bottle through the coaxial tube. This liquid quantity reaches the tank, from which it is transferred by gravity without contact with the atmosphere. The bottled liquid quantity also does not come into contact with the atmosphere.

The invention is illustrated by way of non-limiting example in the figures of the accompanying drawings, in which:

Figures 1-6 are sectional views of the filling valve device shown respectively in the following conventional stages: bottle entry, filling, end of filling, closure of delivery channel, levelling, bottle exit;

Figures 7 and 8 are two details indicated by VII and VIII in Figure 1;

Figure 9 shows the contour portion of a cam used during the stage illustrated in Figure 1;

Figure 10 is an enlarged detail indicated by X in Figure 2;

Figure 11 is an enlarged detail indicated by XI in Figure 3;

Figure 12 is an enlarged detail indicated by XII in Figure 4;

Figures 13 and 14 are two details indicated by XIII and XIV in Figure 5;

Figures 15 and 16 show the contour portion of a cam used during the stages illustrated in Figures 4, 5 and 6 respectively.

The gravity filling valve device 1 is positioned below a tank 2 of a bottling machine 3 (only partly visible) for ungassed liquids 4 which are to be transferred into bottles 5.

It comprises, arranged coaxial to the bottling axis 6, tubular or sleeve elements comprising, in the stated order from the outside to the inside of the valve device 1, a first element 7, a second element 8, a third element 9, a fourth element 10, and a tube 11. The element 7 enables the valve 1 to be fixed to the machine structure 3, and in particular to the tank 2, against which it is hydraulically sealed by the ring gasket 12.

The element 8 can slide axially within 7 under fluid-tight conditions by virtue of the ring gasket 13. In it there are provided two slots 14 which connect the tank 2 to a vertical duct 15 of annular cross-section defined between the elements 10, 8 and 9.

Between the elements 8 and 10 there is interposed an elastic element, preferably a helical spring 16, which is in a compressed state when the valve 1 is at rest (see Figure 1).

The elements 8 and 10 can slide relative to each other or float along the axis 6 through a certain part of their length, ie until the shoulder 17 on the element 8 engages the lower shoulder 18 to open the duct 15, or the upper end 19 of the element 8 engages the upper shoulder 20 on the element 10 to close the duct 15. At the lower end of the element 8 there is a cavity 21 housing a second elastic element, preferably a helical spring 22, which is compressed against the element 9 when the valve 1 is at rest.

A cam 23 acts on this lower end of the element 8 via a preferably idle roller 24.

The idle roller 24 rotates on a pivot 28 having its axis 25 perpendicular to the axis 6 and fixed on a collar 29. The collar 29 is fixed to the lower end of the tubular element 8 by at least two pins 30.

Between the tubular element 8 and the element 7 there is interposed a third elastic element, preferably a helical spring 26, which is compressed and hence preloaded when the valve 1 is at rest.

On the tubular element 9, which is slidable within 8 by the action of the spring 22, there is a ring gasket 27 which provides a hydraulic seal between said two elements.

The tubular element 9 supports a reference pin 31, the position of which relative to a recess 32 in the tubular element 8 determines the angular phasing of the hose 37 to the axis 25.

Between the lower ends of the tubular elements 9 and 10 within the vertical duct 15 there are provided, in the stated order from the top downwards, a syphon trap 33, a conical sealing surface 34 coaxial with the bottling axis 6, a ring gasket 35, a communication hole 36, a hose 37, and a ring
seal gasket 38.

When in contact with the annular seal gasket 35, the conical sealing surface 34 closes the vertical duct 15 as a result of the relative sliding of the tubular elements 9 and 10.

The hose 37 connects the hole 36 to a valve 39 fixed to an annular vessel 39/1 which delivers an inert gas 40/1 having characteristics identical to the gas in the tank 2 above the liquid 4 to be bottled, but at a slightly higher pressure. The valve 39 is normally closed, but opens by the action of a stem 41 operated by the cam 41/1 positioned on members, not shown, of the bottling machine 3.

The annular gasket 38 seals hydraulically against the neck 42 of the bottle 5. To enable the gasket 38 to be housed in the tubular element 9, the lower end of this latter is in two pieces, of which the lower element 43 is annular.

To prevent the liquid to be transferred from turbulent hitting the base of the bottle 5, the final part of the element 10 is conical and is directed towards the inner surface of the neck 42 of the bottle 5.

In this manner, the liquid which emerges reaches the bottom of the bottle or the surface of the liquid already contained in it by running with laminar flow along the inner surface of the walls of the bottle 5.

The tube 11 is slidable within the element 10 connected to the rod 45, which is operated by the cams 44 and 44/1. At the rod 45, the tube 11 is provided with a hole 46 through which the excess liquid passes on its return, mixed with the inert gas 40/1 fed during the levelling stage.

Any splashing of returning liquid is prevented by a deflector 47 which downwardly directs the flow leaving the tube 11 through the holes 46.

The bottling cycle is described starting conventionally from Figure 1.

In this figure, the bottle 5 to be filled is in position below the filling valve 1. Generally in the case of fillers the bottle can be positioned either by being moved relative to the base of the bottling machine 3, or by the filling valve 1 being moved relative to the base of the machine 3, or by both the bottle 5 and the valve 1 being moved relative to the base of the machine. In this case however, the filling valve is moved relative to the base.

The cam 23 (Figure 9) acts via the roller 24 on the tubular element or sleeve 8 so as to maintain it urged upwards and preload the helical spring 26. The tube 11 is in its retracted position and the inert gas 40 which has penetrated into the tube 11 through the holes 46 leaves from the central bore downwards (Figure 7).

The vertical duct 15 is closed by the engagement between the annular gasket 35 and the conical sealing surface 34 (see Figure 8). The valve 39 is closed.

The bottle entry stage is followed by the filling stage, which is described with reference to Figure 2. By the action of the cam 44 the tube 11 penetrates into the neck 42 of the bottle. It stops when its lower end reaches a level just less than the required future level of the liquid 4 which is to be transferred.

The roller 24 disengages from the cam 23. The helical spring 26 extends, and the annular gasket 38 seals against the bottle neck 42 with an elastic pressure due to the action of the helical spring 22 which is compressed. The ring gasket 35 disengages from the conical sealing surface 34 (see Figure 10), and the free vertical duct 15 connects the tank 2 to the interior of the bottle 5. The liquid 4 flows into the bottle 5 by gravity, while the air and gas contained in the bottle reaches the top of the tank 2 via the tube 11.

The filling stage stops by virtue of the syphon trap 33 when the liquid that has reached the end of the tube 11 within the bottle 5 and when the pressure of the liquid 4 and of the residual air within the top of the bottle neck are equal. By the effect of the pressure exerted upwards by the liquid the end of the tube 11 remains immersed in the liquid in the bottle, to hence determine a provisional level (Figure 3).

The end of the filling stage is followed by the closure of the delivery channel, ie of the duct 15, which is described with reference to Figures 4, 12 and 15. With particular reference to Figure 4, the cam 23 is engaged (see also Figure 15) to again act on the tubular element 8, which rises through only part of its total travel. The helical spring 26 is compressed and the helical spring 22 is released so that the ring gasket 35 engages the conical sealing surface 34, to hermetically seal the vertical duct 15 of annular cross-section with the aid of the spring 16 (see Figure 12), while maintaining the bottle neck 42 sealed against the valve 1 by the gasket 38.

The closure of the delivery channel 15 is followed by the levelling stage, which is described with reference to Figures 5 and 13-15.

The stem 41, engaging the cam 41/1, opens the valve 39 and the pressurized inert gas 40/1 flows through the hose 37 to pass through the hole 36 into the end part of the vertical duct 15, and then into the bottle neck 42 to cause a back flow of liquid and gas which rises through the tube 11 as the annular duct 15 is closed above the hole 36 by the gasket 35 (see Figure 14).

Through the holes 46 this back flow of gas and liquid reaches the tank 2, where the liquid and gas separate by gravity.

The liquid level in the bottle falls and becomes stable when it coincides with the lower end of the
tube 11.

The levelling stage is followed by the bottle exit, described with reference to Figures 6 and 16.

With reference to Figure 16, the cam 23 acts on the element 8 such as to separate the valve 1 from the neck 42 of the bottle 5, which is fed to a subsequent capping station.

Simultaneously the cam 44/1 returns the tube 11 to the inside of the valve 1.

The components of the valve 1 are now arranged in a similar manner to that shown in Figure 1, so that the valve 1 is ready to operate on the next bottle 5.

It should be noted that the bottles remain at rest relative to the machine base during all the bottling stages. It is therefore not necessary for the bottling machine to be provided with cylinder-piston units for raising the bottle during the filling stage, as instead are required in the case of bottling machines provided with certain types of traditional filling valves.

As the bottle remains at rest relative to the machine base during all the bottling stages, the productivity of a bottling machine provided with a valve according to the invention is higher than a bottling machine of equal capacity but provided with traditional filling valves.

The filling valve of the invention is preferably used on machines which operate in a rotary manner about a vertical axis, and in which all the bottling stages take place in one of the angular sectors into which the machine is divided.

**Claims**

1. A gravity filling valve device (1) for bottling machines (3) for ungassed liquids (4) comprising, axially to a bottling axis (6):
   - a tube (11) insertable into a bottle (5) to be filled, by being moved along said axis (6) until its lower end coincides with the predetermined final liquid level, its upper end opening above the liquid level in a tank (2) holding the liquid (4),
   - a vertical duct (15) connecting to the interior of the bottle (5) the base of the tank (2) of liquid (4) to be transferred, characterised in that said vertical duct (15) is connected to a shutoff valve (39) for a pressurized inert gas (40/1) downstream of means (34, 35) which sealedly close said vertical duct (15) against the tank (2),
2. A filling valve device as claimed in claim 1, characterised in that the vertical duct (15) is of annular cross-section and is delimited on its inner side by a tubular or sleeve element (10) within which the tube (11) is slidable, and on its outer side by the tubular or sleeve elements (9) and (8), which are telescopically slidable relative to each other and to the tubular or sleeve element (7) under hydraulically sealed (13, 27) conditions, by the action of elastic means (22), (26), the tubular or sleeve element (7) being rigid via a hydraulic seal (12) with the tank (2), the tubular elements (8) and (10) being also slidable relative to each other under the action of interposed elastic means (16), the tubular element (10) acting as a drive element for the sliding of the remaining tubular elements (9-10) within the vertical duct (15) of annular cross-section, which is provided with a syphon trap (33) defined between the walls of the tubular elements (10) and (9).
3. A filling valve device as claimed in claim 2, characterised in that the tubular element (8) is moveable under the action of a cam (23) acting on it via a roller (24) arranged with its axis (25) perpendicular to the filling axis.
4. A filling valve device as claimed in claim 1, characterised in that the lower opening of the vertical duct (15) is flared to direct the exit liquid flow onto the inner surfaces of the walls of the bottle (5).
5. A filling valve device as claimed in claim 1, characterised in that the tube (11) is movable vertically under the action of a rod (45) driven by the cams (44) and (44/1).
6. A filling valve device as claimed in claim 1, characterised in that at the upper end of the tube (11) there is provided a deflector (47) for the fluid emerging from holes (46).
7. A filling valve device as claimed in claim 2, characterised in that the lower portion of the tubular element or sleeve (9) is formed in two pieces to enable a gasket (38) to be housed for sealing against the neck of the bottle (5).
8. A filling valve device for automatic filling machines for ungassed liquids using a gravity system with self-levelling of the product, characterised in that the closure of the liquid passage within the filling valve and the sealing of the bottle, with consequent isolation of the product from the external atmosphere, are achieved by utilizing the force difference between the springs, which act in mutual opposition.
9. A filling valve device as claimed in claim 8, characterised in that the bottle self-levelling is achieved by utilizing the upward mechanical movement of the filling valve by means of a slight gas pressure applied to the bottle when sealed against the filling valve, to permit the excess liquid to rise directly into the tank.

10. A filling valve device as claimed in claims 8 and 9, characterised in that the self-levelling stage effected with the bottle engaged eliminates any contact between the liquid and the atmosphere external to the bottle, hence safeguarding the product from contamination.

11. A filling valve device as claimed in claims 8 to 10, characterised in that the use of this type of valve dispenses with the need to use cylinder-piston units for raising the bottle, so considerably simplifying the construction and relative cost of the machine in that instead of the bottle being raised against the filling valve, it is this latter which is lowered to penetrate into the bottle, the filling and self-levelling being effected simultaneously without any intermediate bottle removal, which would result in contact with the surrounding atmosphere.
**DOCUMENTS CONSIDERED TO BE RELEVANT**

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<th>Category</th>
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**TECHNICAL FIELDS SEARCHED (Int. Cl.)**

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The present search report has been drawn up for all claims

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