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PATENT SPECIFICATION

DRAWINGS ATTACHED

1.150.609

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COMPLETE SPECIFICATION

Improvements in means for Dispensing Liquids particularly Beverages containing Gases in Solution

We, ARTHUR GUINNESS SON AND COMPANY (PARK ROYAL) LIMITED, of Park Royal Brewery, London, N.W.10, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a flow control valve for dispensing beverages from a pressurised system and is an improvement in or modification of the flow control valve disclosed in our British Patent Specification No. 956,901.

The invention is primarily directed to a flow control valve for incorporation in the delivery line of a pressurised system or, as is preferably the case, in the dispensing tap itself.

The main use of the device is in connection with beverages which contain gas in solution, although it can be used with a still liquid capable of producing froth, principally the invention is applicable to fermented beverages of relatively low viscosity such as beer, ale, stout and similar liquors. The invention is also applicable to controlling flow in pressurised systems which contain non-alcoholic beverages which have been aerated, carbonated or otherwise gasified.

In our specification No. 956,901 we have described a flow control valve suitable for incorporation in the delivery line of a pressurised system of liquid. The valve comprises a tubular valve housing through which the liquid is passed, a plunger movable axially within the housing which plunger includes an intermediate body member having a cross sectional shape such as to permit flow of liquid between its outer surface and the surface defining the bore of the housing. There are provided bearing surfaces to centre the plunger slidably in the housing while permitting free axial movement of the plunger therein. Extending from the body member in an upstream direction is a coaxial

spigot which spigot is centred in an upstream restriction formed by reducing the diameter of a portion of the bore of the housing surrounding the upstream spigot to provide an annular passage serving to control the flow of liquid towards the body member. A further coaxial tapered spigot is provided extending from the body member in a downstream direction and reducing in diameter in this direction. The tapered spigot is itself centred in a downstream restriction formed by reducing the diameter of a portion of the bore of the housing surrounding the downstream spigot to form an annular inwardly directed thin flange having a central hole which can be obturated by the downstream spigot when the plunger is moved axially in a downstream direction within the housing, a number of holes of short axial length are provided in the flange of the downstream restriction whereby flow of liquid through these holes is permitted regardless of the position of the plunger within the housing. There is further provided a movable abutment located downstream of the downstream restriction and co-acting with the end of the downstream spigot for limiting and adjusting the axial position of the plunger within the housing. Relative movement between the plunger and housing results in a relative increase or decrease in the amount of "head" or foam on the beverage during discharge of the beverage from the system.

The valve described in our specification 956,901 is only suitable for use in controlling the amount of "head" or foam produced on the dispensed beverage. Consequently it is necessary to incorporate in the pressurised system, at a position downstream of the flow control valve, an on/off control valve which could conveniently be located in the dispensing tap. Consequently when dispensing a beverage from the pressurised system it is necessary to adjust both the flow control valve and the on/off valve before the beverage is dispensed with the

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SEE ERRATA SLIP ATTACHED

required "head"; it will be appreciated that such adjustment is inconvenient and the necessity for having accurately machined parts renders the tap relatively expensive. Furthermore the device has to incorporate an on/off valve.

It is an object of the present invention to provide a flow control valve for dispensing beverages from a pressurised system which valve is an improvement in the control valve disclosed in our British Patent Specification No. 956,901 and incorporates means whereby the "head" or foam on the dispensed beverage can be adjusted as required as can the quantity of beverage dispensed so that the flow control valve also serves as an on/off valve.

According to the present invention there is provided a flow control valve for dispensing beverages containing gas in solution from a pressurised system comprising in combination, a valve housing through which the beverage is to be passed; first flow control means in said housing having a restriction portion at an upstream end thereof and a tapered spigot portion at a downstream end thereof, the spigot portion converging in the downstream direction; second flow control means in the housing which means includes an upstream flow passage co-acting with the restriction portion of the first flow control means and a flange portion located downstream of the flow passage which flange portion is provided with a closure hole and a plurality of cavitation holes therein, the closure hole co-acting with the tapered spigot portion of the first flow control means; means for imparting relative movement between the first flow control means and the second flow control means whereby for relative movement in one sense of direction the restriction portion moves into the flow passage and the tapered spigot moves out of the closure hole to result in a pressure differential of the beverage in the path of flow of beverage between the restriction portion and the second flow control means to be relatively increased and permitting flow of beverage through the closure hole between the spigot portion and the second flow control means in increased quantity and through the cavitation holes in reduced quantity and for relative movement in the reverse sense of direction, the restriction portion moves out of the flow passage and the tapered spigot moves into the closure hole to result in the pressure differential of the beverage in the path of flow of beverage between the restriction portion and the second flow control means to be relatively reduced and resulting in flow of beverage through the closure hole between the spigot and second flow control means to be of relatively reduced quantity and through the cavitation holes to be of relatively increased quantity; and a closure member operatively associated with the first flow control means and the second flow control means and fixed relative to the first flow con-

trol means whereby at one end position of relative movement between said first and said second flow control means, the closure member cuts off flow of beverage through the valve.

Preferably the restriction portion provided on the first flow control means is in the form of a helix so that during movement of the helix into the flow passage provided in the second flow control means the beverage flows through a helical conduit formed between the helix and the surface defining the flow passage thereby relatively increasing the length of the path of flow of the beverage through the control valve which results in a relative increase in the drop in liquid pressure along the helical conduit so formed.

The flow control valve of the present invention provides a constant drop in pressure of beverage across the valve, say from 20 p.s.i. to atmospheric pressure. However, the volume of beverage dispensed per second remains substantially constant during a major part of relative movement between the first flow control means and the second flow control means and reduces during a minor part of such relative movement which minor part of relative movement is immediately prior to the flow of beverage through the annular passage being inhibited by the closure means. For example, with the valve opening from a closed position i.e. being "cracked," the volume of beverage dispensed per second gradually increases to a maximum over, say the first 10% of relative movement between the first and the second flow control means and, during the remaining 90% of such relative movement the volume of beverage dispensed per second remains substantially constant so that during such further relative movement between the first and second flow control means only the amount of "head" produced on the dispensed beverage is varied.

Preferably the closure means is arranged so that as the valve is increasingly opened the amount of "head" produced on the dispensed beverage is relatively increased. Alternatively the closure means can be arranged so that when the valve is cracked maximum "head" is produced on the dispensed beverage.

One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:—

Fig. 1 illustrates a general arrangement in cross-section and on an enlarged scale of a flow control valve constructed in accordance with the present invention;

Fig. 2 graphically illustrates the variation in pressure on the beverage during its flow through the control valve to provide a "head" on the dispensed beverage;

Fig. 3 graphically illustrates the variation in pressure on the beverage during its flow through the control valve to provide little, or no "head," on the dispensed beverage, and

Figs. 4 and 5 illustrate the first and second flow control means part of the valve illustrated in Fig. 1 and show modifications in the location of the closure member.

5 Where possible throughout the following description, like parts or members in each of the Figures have been accorded like references.

Referring firstly to Fig. 1, the control valve shown generally at 1 comprises a tubular piston housing 2 which housing defines a piston chamber 5a and conveniently forms part of a dispensing tap having an outlet 3a from a spout 3 and a control lever 4. Slidably mounted within the valve housing 2 and in sealed connection with the internal surface thereof is a tubular piston 5 which forms flow control means. The piston 5 is provided, at its upstream end, with an inwardly directed annular flange 6 having a downstream face 6a for the arcuate surface of the flange 6 forms a cylindrical flow passage 7. The end of the piston 5 remote from, and downstream of, the annular flange 6 is provided with an apertured plate 8 which defines a circular closure hole 9 and a plurality of cavitation holes 10 therein. The closure hole 9 is coaxial with the flow passage 7. The apertured plate 8 is secured to the piston 5 by screws 11. The piston 5 is provided with a control rod 13 which extends through the housing 2 and is pivotally connected at 12 to the control lever 4. The rod 13 is slidable through an end cap 14 of the valve housing 2 and the control lever 4 is pivotally mounted at 15 to the valve housing 2 so that pivotal movement of the control lever 4 about the pivot 15 imparts reciprocal sliding movement of the piston 5 in the valve housing 2. It will be appreciated that the control lever 4 can be of an alternative form, for example the "cam-lever" type as is well known in the art.

40 Secured by bolts 16 to the valve housing 2 is an end plate 17 from which extends an integrally formed flow tube 18. The flow tube 18 extends outwardly from the valve housing 2 and communicates through a gauze disc 19 with the outlet 3a of the spout 3. The spout 3 can conveniently be secured to the flow tube 18 and end plate 17 by a suitable adhesive. The gauze disc 19 is preferably of 50-100 mesh size.

The outlet 3a, flow tube 18, closure hole 9 and flow passage 7 are situated in the tap to be coaxial.

55 Axially extending through the valve housing 2 is further flow control means shown generally at 20 which means is in the form of a substantially cylindrical body member 21 secured at the downstream end thereof to the end plate 17 by a bolt 22 to be coaxial with the closure hole 9 and flow passage 7. The body member 21 is provided with a restriction portion 23 located at the upstream end thereof and a tapered spigot portion 24 at the downstream end thereof. The restriction 23 is provided by a helix 25 the outside diameter of which is

slightly less than the diameter of the flow passage 7 so that the helix 25 can slide along the flow passage 7 in sealing engagement therewith. The spigot portion 24 converges in the downstream direction towards the end at which it is secured to the plate 17. The tapered spigot 24 has a maximum diameter slightly larger than the diameter of the closure hole 9.

70 The body member 21 is situated in the valve housing 2 substantially within the tubular piston 5 so that the tapered spigot 24 extends through the closure hole 9; consequently axial movement of the piston 5 through the valve housing 2 causes the piston 5 to move over the body member 21. The axial length of the body member 21 is such that during movement of the piston 5 upwardly through the valve housing 2, when the apertured plate 8 abuts the body member 21 the tapered spigot 24 obturates the closure hole 9 and the helix 25 is substantially removed from the passage 23. Conversely, when the piston 5 moves downwardly through the valve housing 2, the helix 25 moves into the cylindrical passage 7 and the apertured plate 8 moves over the tapered spigot 24 to form an annular passage between itself and the tapered spigot 24.

95 The body member 21 is provided with a radially extending, integrally formed closure flange 26 situated thereon between the helix 25 and the tapered spigot 24. The closure flange 26 situated thereon between the helix 25 and the tapered spigot 24. The closure flange 26 is of a diameter greater than the diameter of the flow passage 7 and is provided on its upstream face with an O-ring seal 27 which seal is of a mean diameter greater than the diameter of the flow passage 7. The seal 27 encircles the body member 21 and is fixedly secured in a complimentary annular recess 28 of the closure flange 26 by a suitable cement. The closure flange 26 and sealing ring 27 provide closure means for the flow control valve so that, during downward movement of the piston 5 through the housing 2, the sealing ring 27 abuts the downstream face 6a of the annular flange 6 thereby closing the flow passage 7 when both the helix 25 is located substantially within the flow passage 7 and the annular passage size formed between the spigot 9 and apertured plate 8 is at a maximum.

115 Provided in a side wall of the housing 2 is an inlet pipe 29 which communicates with the piston chamber 5a at a position upstream of the flow passage 7. The pipe 29 is provided with a coupling (not shown) for connection to a pressurised system.

120 The action of the flow control valve above described and illustrated with reference to Fig. 1 will now be described when dispensing, for example, beer containing gas in solution from a pressurised system.

125 With the piston 5 in the downward position so that the sealing ring 27 abuts the down-

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stream face 6a of the flange 6, no liquid can pass through the flow passage 7 and the valve is closed.

On initial opening or "cracking" of the valve by adjustment of the control lever 4 to move the piston 5 upwardly in the drawing, liquid in the piston chamber 5a upstream of the piston 5 flows through the helical conduit formed between the helix 25 and the arcuate surface of the flow passage 7 in the flange 6. The liquid passing through the flow passage 7 flows over the closure flange 26 and then through both the annular passage formed between the spigot 24 and the apertured plate 8 and the cavitation holes 10. Since the annular passage formed at the closure hole 9 is relatively larger than the passages formed by the cavitation holes 10 a larger proportion of the liquid flows through the closure hole 9 to be dispensed through the spout 3.

It will be appreciated that continued upward movement of the piston 5 in the housing 2 causes the length of the helical conduit formed between the helix 25 and the annular flange 6 to be progressively decreased and also causes the size of the annular passage formed between the spigot 24 and apertured plate 8 to be progressively decreased.

When the piston 5 is at the uppermost position of its stroke in the housing 2 (as shown in Fig. 1), the helix 25 is almost fully withdrawn from the passage 7 so that liquid passing therethrough only flows along a relatively short helical path and the spigot 24 obturates the closure hole 9. Consequently liquid from the piston chamber 5a upstream of the piston 5 flows almost directly through the passage 7 and thence wholly through the cavitation holes 10 to be dispensed through the spout 3.

When the control valve is to be closed, the piston 5 is moved downwardly through the housing 2 until the sealing ring 27 again abuts the annular flange 6.

It has been found that when the valve is initially opened the rate of flow of liquid through the flow passage 7 increases to a maximum over say, the initial 10% of relative movement between the body member 21 and piston 5; after such initial movement the rate of flow of liquid through the flow passage 7 remains substantially constant.

When dispensing beverage containing gas in a solution by a tap as above described and illustrated, during initial opening of the valve little or no "head" is obtained on the dispensed beverage. As the valve is further opened the amount of "head" produced on the dispensed beverage progressively increases until the position is reached at which the valve is fully opened (when the closure hole 9 is obturated by the spigot 24) and the maximum amount of "head" is produced on the dispensed beverage.

Hitherto, it has been thought that the pro-

duction of "head" or foam on the beverage, for example beer, dispensed from a pressurised system was proportional to the amount of turbulence which the beverage had to undergo during dispensing. However, it has been found experimentally that the amount of head produced on a dispensed beverage is related to variations in pressure applied to the beverage during dispensing. When a beverage containing gas in solution is passed from a pressurised system through a small aperture, a drop in pressure on the beverage occurs during its passage through the aperture; if the drop in pressure on the beverage is sufficient then the gas in the beverage comes out of the solution. The pressure on the beverage at which the gas comes out of solution is known as the "cavitation pressure" at which "cavitation" occurs. By providing conditions in the flow control valve which will result in a sufficient drop in pressure on the beverage during its passage through the cavitation holes 10 cavitation can be made to occur and the gas in the beverage comes out of solution to form a foam or "head" on the dispensed beverage.

In the embodiment illustrated, when the valve is fully open the path of beverage through the flow passage 7 is relatively short since the helix 25 is substantially withdrawn from the flow passage 7 and consequently only a relatively small drop in pressure on the beverage occurs during its flow through the flow passage 7. However, closure hole 9 is obturated by the spigot 24 and since the outlet 3a of the spout is at atmospheric pressure the maximum pressure differential occurs across the upstream and downstream ends of the cavitation holes 10. During passage of the beverage through the cavitation holes 10 cavitation occurs and maximum head or foam is produced on the dispensed beverage.

As the valve progressively closes the length of the helical conduit formed between the helix 25 and the annular flange 6 increases which results in a progressively increasing drop in pressure on the beverage in its flow through the flow passage 7. The closure hole 9 is progressively opened which initially results in cavitation occurring therein but also causes the pressure differential across the upstream and downstream ends of the cavitation holes 10 to be progressively reduced and consequently the degree of cavitation is progressively reduced as is the amount of head produced on the dispensed beverage.

Immediately prior to the valve closing, the beverage from the piston chamber 5a upstream of the piston 5 must flow through the maximum length of helical conduit formed between the helix 25 and flange 6 which results in a maximum drop in pressure on the beverage along the length of the helical conduit and further the closure hole 9 is almost at its maximum opening so that the pressure differential across the upstream and downstream ends of

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the cavitation holes 10 is at a minimum and is insufficient to cause cavitation, consequently little or no head is produced on the dispensed beverage.

5 The effect of relative movement between the body member 21 and the piston 5 to the pressure on the beverage in the system will now be considered with reference to Figs. 2 and 3. Fig. 2 graphically illustrates the approximate pressure on the beverage for a given position in the dispensing tap when the control valve is fully open (the closure hole 9 is obturated by the spigot 24) and Fig. 3 is a similar graph to that shown in Fig. 2 and illustrates the approximate pressure on the beverage when the control valve is almost closed (the helix 25 is situated almost fully within the passage 7 and the closure hole 9 is almost at its fullest opening).

20 In the Figs. 2 and 3 the references marked on the abscissa relate to specific points in the dispensing tap as follows:—

(A) — the upstream input end to the helical conduit formed between the helix 25 and flange 6

(B) — the downstream output end of the helical conduit formed between the helix 25 and the flange 6

(C) — the upstream end of the cavitation holes 10

(D) — the downstream end of the cavitation holes 10 and

(E) — the output end of the spout 3

35 In Figs. 2 and 3 the effective distance on the abscissa from (A) to (B) is comparable with the length of the helix inserted with in the passage 7 and from (C) to (D) is comparable (but on a much larger scale) with the thickness of the apertured plate 8.

40 Referring to Fig. 2 it will be seen that since the helix 25 is almost removed from the passage 7, a large pressure differential occurs in the beverage across the ends of the cavitation holes 10 and a large pressure drop occurs on the beverage during its passage through the cavitation holes. The pressure drop is sufficient to attain cavitation at which the gas in the beverage comes out of solution and forms the "head" or foam. It will be noted that in the pressure system illustrated for one particular type of beverage, the region of pressure within which cavitation occurs is below atmospheric pressure.

55 Referring to Fig. 3, the helix 25 is situated almost wholly within the flow passage 7 and the helical conduit so formed is relatively longer than that considered in Fig. 2; consequently a substantial pressure drop occurs on the beverage between the ends of the helical conduit. A substantially less pressure differential is obtained across the upstream and downstream ends of the cavitation holes and although a slight drop in pressure on the beverage during its passage through the cavitation holes does occur this pressure drop is

insufficient to attain cavitation and the gas in the beverage does not come out of solution and little or no head is produced on the dispensed beverage.

70 Several modifications are possible to the above described embodiment without departing from the scope of the present invention. For example the piston 5 can be fixed relative to the housing 2 and the body member 21 adapted to move relative thereto; in such a case the flange 6 can be formed as an integral part of the housing 2, the apertured plate 8 can be removably attached to the housing 2 and the body member 21 can be fixedly secured to the rod 13 for reciprocal movement through the housing 2. The restriction portion 23 can take several alternative forms, for example a spigot slidable within a complementary aperture thereby forming an annular passage between the spigot and the wall of the aperture so that by relative movement between the body member and the aperture the effective length of the annular passage can be varied thereby providing means to vary the pressure differential on the beverage flowing through the annular passage in a similar manner as above described. The closure means can be arranged so that the flow of beverage through the dispensing tap is cut off at a position in which maximum head or foam is produced. In the embodiment illustrated several alternative positions for the closure flange 26 and sealing ring are possible; for example, in Fig. 4 an extension member 21a is provided on the body member 21 which extension member passes upwardly through the flow passage 7 and carries at the upstream end thereof the flange 26 and sealing ring 27 which are located upstream of the flow passage 7 so that when the piston 5 is at its uppermost position the sealing ring abuts the upstream face of the flange 6 and obturates the passage 7 (thereby closing the valve at maximum head on the dispensed beverage) — with this arrangement the rod 13 is preferably bifurcated at its lower end 13a so as not to foul the extension member and flange on the body member 21. Alternatively (see Fig. 5) the flange 26 and the sealing ring 27 can be located on the downstream end of the spigot portion 24 at a position downstream of the apertured plate 8 so that on downward movement of the piston 5 through the housing 2 the sealing ring 27 abuts the apertured plate 8 on the downstream face thereof to obturate the closure hole 9 and cavitation holes 10.

WHAT WE CLAIM IS:—

1. A flow control valve for dispensing beverages containing gas in solution from a pressurised system comprising in combination, a valve housing through which the beverage is to be passed; first flow control means in said housing having a restriction portion at an upstream end thereof and a tapered spigot portion at a downstream end thereof, the spigot



the cavitation holes 10 is at a minimum and is insufficient to cause cavitation, consequently little or no head is produced on the dispensed beverage.

5 The effect of relative movement between the body member 21 and the piston 5 to the pressure on the beverage in the system will now be considered with reference to Figs. 2 and 3. Fig. 2 graphically illustrates the approximate pressure on the beverage for a given position in the dispensing tap when the control valve is fully open (the closure hole 9 is obturated by the spigot 24) and Fig. 3 is a similar graph to that shown in Fig. 2 and illustrates the approximate pressure on the beverage when the control valve is almost closed (the helix 25 is situated almost fully within the passage 7 and the closure hole 9 is almost at its fullest opening).

20 In the Figs. 2 and 3 the references marked on the abscissa relate to specific points in the dispensing tap as follows:—

(A) — the upstream input end of the helical conduit formed between the helix 25 and flange 6

(B) — the downstream output end of the helical conduit formed between the helix 25 and the flange 6

(C) — the upstream end of the cavitation holes 10

(D) — the downstream end of the cavitation holes 10 and

(E) — the output end of the spout 3

35 In Figs. 2 and 3 the effective distance on the abscissa from (A) to (B) is comparable with the length of the helix inserted with in the passage 7 and from (C) to (D) is comparable (but on a much larger scale) with the thickness of the apertured plate 8.

40 Referring to Fig. 2 it will be seen that since the helix 25 is almost removed from the passage 7, a large pressure differential occurs in the beverage across the ends of the cavitation holes 10 and a large pressure drop occurs on the beverage during its passage through the cavitation holes. The pressure drop is sufficient to attain cavitation at which the gas in the beverage comes out of solution and forms the "head" or foam. It will be noted that in the pressure system illustrated for one particular type of beverage, the region of pressure within which cavitation occurs is below atmospheric pressure.

55 Referring to Fig. 3, the helix 25 is situated almost wholly within the flow passage 7 and the helical conduit so formed is relatively longer than that considered in Fig. 2; consequently a substantial pressure drop occurs on the beverage between the ends of the helical conduit. A substantially less pressure differential is obtained across the upstream and downstream ends of the cavitation holes and although a slight drop in pressure on the beverage during its passage through the cavitation holes does occur this pressure drop is

insufficient to attain cavitation and the gas in the beverage does not come out of solution and little or no head is produced on the dispensed beverage.

70 Several modifications are possible to the above described embodiment without departing from the scope of the present invention. For example the piston 5 can be fixed relative to the housing 2 and the body member 21 adapted to move relative thereto; in such a case the flange 6 can be formed as an integral part of the housing 2, the apertured plate 8 can be removably attached to the housing 2 and the body member 21 can be fixedly secured to the rod 13 for reciprocal movement through the housing 2. The restriction portion 23 can take several alternative forms, for example a spigot slidable within a complementary aperture thereby forming an annular passage between the spigot and the wall of the aperture so that by relative movement between the body member and the aperture the effective length of the annular passage can be varied thereby providing means to vary the pressure differential on the beverage flowing through the annular passage in a similar manner as above described. The closure means can be arranged so that the flow of beverage through the dispensing tap is cut off at a position in which maximum head or foam is produced. In the embodiment illustrated several alternative positions for the closure flange 26 and sealing ring are possible; for example, in Fig. 4 an extension member 21a is provided on the body member 21 which extension member passes upwardly through the flow passage 7 and carries at the upstream end thereof the flange 26 and sealing ring 27 which are located upstream of the flow passage 7 so that when the piston 5 is at its uppermost position the sealing ring abuts the upstream face of the flange 6 and obturates the passage 7 (thereby closing the valve at maximum head on the dispensed beverage) — with this arrangement the rod 13 is preferably bifurcated at its lower end 13a so as not to foul the extension member and flange on the body member 21. Alternatively (see Fig. 5) the flange 26 and the sealing ring 27 can be located on the downstream end of the spigot portion 24 at a position downstream of the apertured plate 8 so that on downward movement of the piston 5 through the housing 2 the sealing ring 27 abuts the apertured plate 8 on the downstream face thereof to obturate the closure hole 9 and cavitation holes 10.

WHAT WE CLAIM IS:—

1. A flow control valve for dispensing beverages containing gas in solution from a pressurised system comprising in combination, a valve housing through which the beverage is to be passed; first flow control means in said housing having a restriction portion at an upstream end thereof and a tapered spigot portion at a downstream end thereof, the spigot

portion converging in the downstream direction; second flow control means in the housing which means include an upstream flow passage co-acting with the restriction portion of the first flow control means and a flange portion located downstream of the flow passage which flange portion is provided with a closure hole and a plurality of cavitation holes therein, the closure hole co-acting with the tapered spigot portion of the first flow control means; means for imparting relative movement between the first flow control means and the second flow control means whereby for relative movement in one sense of direction the restriction portion moves out of the closure hole to result in a pressure differential of the beverage in the path of flow of beverage between the restriction portion and the second flow control means to be relatively increased and permitting flow of beverage through the closure hole between the spigot portion and the second flow control means in increased quantity and through the cavitation holes in reduced quantity and for relative movement in the reverse sense of direction, the restriction portion moves out of the flow passage and the tapered spigot moves into the closure hole to result in the pressure differential of the beverage in the path of flow of beverage between the restriction portion and the second flow control means to be relatively reduced and resulting in flow of beverage through the closure hole between the spigot and second flow control means to be of relatively reduced quantity and through the cavitation holes to be of relatively increased quantity; and a closure member operatively associated with the first flow control means and the second flow control means and fixed relative to the first flow control means whereby at one end position of relative movement between said first and said second flow control means, the closure member cuts off flow of beverage through the valve.

2. A flow control valve as claimed in claim 1 wherein the restriction portion is in the form of a helix so that during movement of the helix into and out of the flow passage the beverage flows through a helical conduit of increasing and decreasing length respectively formed between the helix and the surface defining the flow passage.

3. A flow control valve as claimed in claim 1 wherein the restriction portion is in the form of spigot axially slideable in the flow passage so that during movement of the spigot into and out of the flow passage the beverage flows through an aperture defined between the surface of the spigot and the surface defining the flow passage, the axial length of said aperture increasing and decreasing respectively.

4. A flow control valve as claimed in any one of the preceding claims wherein the tapered spigot portion obturates the closure hole at a predetermined position during its move-

ment into said closure hole.

5. A flow control valve as claimed in any one of the preceding claims wherein the first flow control means is fixed relative to the valve housing and the second flow control means is adjustably movable relative to the first flow control means.

6. A flow control valve as claimed in claim 5 wherein the valve housing defines a piston chamber and the second flow control means comprises a tubular piston which piston is provided at its upstream end with an inwardly directed flange which defines the flow passage and at its downstream end with the flange portion having the closure hole and cavitation holes.

7. A flow control valve as claimed in any one of claims 1 to 4 wherein the second flow control means is fixed relative to the valve housing and the first flow control means is adjustably movable relative to the second flow control means.

8. A flow control valve as claimed in any one of the preceding claims wherein the closure member is carried by the first flow control means.

9. A flow control valve as claimed in any one of the preceding claims wherein the closure member is located at a position between the restriction portion and tapered spigot portion and said closure member closes the flow passage at the downstream end thereof when the restriction portion is inserted into the flow passage.

10. A flow control valve as claimed in any one of claims 1 to 8 wherein the closure member is located at a position downstream of the flange portion of the second flow control means and is spaced from the larger sized end of the tapered spigot portion, said closure member being adapted to close the cavitation holes and closure hole at the downstream end thereof when said tapered spigot is substantially withdrawn from the closure hole.

11. A flow control valve as claimed in any one of the claims 1 to 8 wherein the closure member is located at a position upstream of the flow passage and spaced from the upstream end of the restriction portion, said closure member being adapted to close the flow passage at the upstream end thereof when the restriction portion is substantially withdrawn from the flow passage.

12. A flow control valve as claimed in claim 11 when dependent on claim 8 wherein the closure member is carried on an extension of the first flow control means which extension projects through the flow passage.

13. A flow control valve as claimed in any one of the preceding claims wherein the flow passage, restriction portion, tapered spigot portion and closure hole are co-axial.

14. A flow control valve substantially as herein described and illustrated with reference



to Fig. 1, or as modified according to Fig. 4 or Fig. 5 of the accompanying illustrative drawings.

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