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This invention relates to dispensing heads, and more particularly, to a dispensing head for use with containers holding fluids.

In order to facilitate the handling of fluids by consumers, and more particularly, effervescent beverages, manufacturers have recently placed on the market beverage containers large enough to serve a number of persons. The advantage of such containers to a consumer arises from the fact that a single large container is generally of less volume than a plurality of smaller containers holding the same amount of beverage, and thus is easier to handle and store. The advantage to a manufacturer and dealer is, in addition to space saved, a reduction in cost of container per unit of beverage, since a relatively inexpensive disposable or re-usable container can be used.

Effervescent beverages are most palatable when they contain a certain amount of CO₂ dissolved therein. This fact is taken into account when containers of beverage are filled by a manufacturer by sealing the containers with the contents under sufficient pressure to maintain the proper amount of CO₂ in solution. Where the quantity of beverage per container is small, no problem arises as to maintaining the contents under pressure after the container is opened because the beverage is dispensed and consumed immediately thereafter. However, with the advent of larger containers, the contents thereof are not usually consumed at one time, and the beverage remaining in the containers must be stored and kept effervescent. Unless some provision is made to maintain the remaining contents under pressure during storage, the dissolved CO₂ comes out of solution thereby seriously affecting the palatability of the beverage.

It would be economical to package a beverage in an inexpensive container, such as a conventional metal can of proper size, market it, and have the consumer attach a dispensing head onto the can which will pressurize the contents and at the same time permit dispensing. A dispensing head of the class described ideally should provide a reservoir of high pressure dispensing gas which can be metered into the container as required to maintain the interior of the container at a pressure sufficient to hold the CO₂ in solution. In order to charge the dispensing head, it would be desirable if a standard CO₂ cylinder could be used. The pressure of such cylinder is far in excess of that required for pressurizing the contents and would easily burst the containers were provision made to vent the containers should the full pressure accidentally be introduced into the container. If the container is used, it is obvious that the dispenser rather than the container must have the requisite means for venting the container in these circumstances.

Metering of high pressure gas into the container is usually accomplished by means of a movable diaphragm which allows a limited amount of high pressure gas to enter the container in response to a reduction in pressure therein caused by dispensing the contents. If the dispensing head of the class described is not securely attached to a container, it is possible to directly connect the high pressure reservoir to atmosphere instead of to a closed container. Thus, gas from a container of CO₂ would be dissipated to atmosphere as soon as it would enter the reservoir thereby wasting the cartridge.

It is well recognized that the pressure required for maintaining the proper amount of CO₂ in solution far exceeds the pressure differential required to dispense the beverage from a pressurized container. Were one to use a dispensing head of the class described, the pressure interior to the container would violent push the beverage through the open orifice with great force. The turbulence so created, together with the sudden decrease in pressure, would cooperate to remove the dissolved CO₂ and whip the beverage to a froth. A pressure-reducing means is thus essential. However, conventional pressure-reducing means incorporate constricted passages, which while reducing the pressure, create turbulence which produces froth or foam.

Much effort has been expended by those skilled in the art to provide a dispensing head of the class described which (1) does not permit inadvertent pressurizing of a standard container to an unsafe pressure, (2) does not result in dissipating the charging gas when the head is improperly attached to a container, and (3) does not permit foaming created by the high container pressure when the beverage is dispensed; but so far as is known, the problems outlined above remain unsolved. It is an object of this invention to provide a dispensing head of the class described in which pressurizing a container beyond a safe internal pressure therefor, automatically vents the container to atmosphere, in which improper attachment to a container prevents pressurization of the reservoir, and in which the use of a relatively high internal pressure for holding the proper amount of CO₂ in solution does not result in excessive foaming when the beverage is dispensed.

As a feature of this invention whereby the objects thereof are achieved, a flexible diaphragm, which is movable in response to changes in pressure differential between the interior and exterior of the container, has a valve therein which is normally held closed, but which is opened upon movement of the diaphragm beyond a given position corresponding to a maximum permissible container pressure differential to vent the container to atmosphere. In addition, a locker lever engageable under the lip surrounding the mouth of the container for securing the dispensing head to the container, has an overcenter spring arrangement which automatically moves the lever to a terminal position blocking insertion of a charging cartridge if the lever is at any position other than engaged under the lip and securely locking the head to the container. Furthermore, a dispensing tube leading to the faucet has a rod therein of a diameter corresponding to the interior diameter of the tube, with flow constriction being supplied by providing longitudinally extending flats on the rod. Such constriction permits fluid friction created as the beverage flows through the elongated constrictions to do considerable work on the beverage in the laminar flow region and reduce its pressure without allowing foaming. The facility with which the tube and rod can be cleaned by the consumer advantageously affects consumer acceptance of the dispensing head as a device for large containers of beverage.

The more important features of this invention have thus been outlined rather broadly in order that the detailed description thereof that follows may be better understood, and in order that the contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will also form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be applied to other structures for carrying out the several purposes of this invention. It is important, therefore, that the claims to be granted herein shall be of sufficient
3 breadth to prevent the appropriation of this invention by those skilled in the art. In the drawings,

FIGURE 1 devotes a dispenser head made in accordance with the invention with parts removed to aid in understanding the invention.

FIGURE 2 is a view taken along section 2-2 of FIGURE 1 and shows how the head is charged when attached to a container.

FIGURE 3 is a sectional view similar to that of FIGURE 3 and shows the operation of the regulating means.

FIGURE 4 is a view similar to that of FIGURE 3 but showing how the container is vented to atmosphere if the pressure therein exceeds a given safe value.

FIGURE 5 is a view taken along section 5-5 of FIGURE 4 and shows a detail of the valve in the diaphragm.

FIGURE 6 is a bottom view of the dispenser head shown in FIGURE 1 showing how the locking lever and overcenter spring cooperate to prevent inadvertent charging of the head.

FIGURE 7 is a view taken along section 7-7 of FIGURE 6 and shows how the locking lever secures the dispenser head to the container.

FIGURE 8 is a view, partly in section, of the pressure-reducing tube and illustrating the manner in which the parts are releasably attached.

FIGURE 9 is a sectional view of the tube and rod of FIGURE 8 showing the flattened surfaces on the rod.

FIGURE 10 is a view taken along section 10-10 of FIGURE 6 and shows the means by which the faucet is attached to the body of the dispenser.

Referring now to FIGURE 2, a dispensing head made in accordance with this invention is designated generally at 10 and is shown inserted in mouth 11 of container 12. Container 12 may be a standard gallon sized sheet metal container having mouth 11 centrally located in the top. Mouth 11 has lip 13 extending circumferentially therearound which defines a cylindrical aperture in top 14. Container 12 may be filled with a beverage by a manufacturer thereof and the contents sealed under sufficient pressure to keep the proper amount of CO₂ in solution by means of a conventional closure cap (not shown) applied to mouth 11. To dispense the beverage contained in container 12, the closure cap is removed, and dispenser head 10 attached.

To facilitate manufacture, dispenser head 10 may be made in three separate parts, a lower housing 15, an upper housing 16 which form the body of the dispenser head, and a faucet assembly 17. Lower housing 15 and upper housing 16 are permanently attached together, by welding, to form a unitary structure, while faucet assembly 17 is removably attached to such structure as shown in FIGURES 6 and 10.

Lower housing 15 is generally cup-shaped and has curved side walls 18 and bottom 19. Centrally located on bottom 19 is cylindrical plug 20 which is of a diameter to closely fit within mouth 11 so that bottom 19 will be slightly raised from top 14 of container 12. Circumferential O-ring groove 21 is provided adjacent the free end face 22 of plug 20, and O-ring 23 inserted therein serve to provide a seal sufficient to maintain a pressure in container 12 in excess of atmospheric pressure.

Because bottom 19 is spaced from top 14, a plurality of spacing lugs 24 extending from the bottom provide support for dispenser head 10. Also extending from the bottom is boss 25 having a tapped hole therein for receiving a screw 26. bosses 25 and 26 are permanent to lower housing 15 is dispensing protrusion 27 and charging protrusion 28. Protrusion 27 has aperture 29 extending normal to the axis of plug 20 which connects via inclined aperture 30 to threaded aperture 31 in plug 20. Protrusion 28 has inclined aperture 32 therein which connects with the interior of the container 12.

Plug 20 has eccentric circular aperture 33 therein into which the bottom portion 34 of upper housing 16 is engaged. Extending atop portion 34 is conical-shaped housing 35 which flares outwardly at top 35 eccentrically with respect to portion 34 to engage walls 36. Concen- tric with portion 34 is a hollowed out region in housing 37 forming chamber 36 having bottom 37, tapered side walls 38, and vertical threaded walls 39. Centrally located in bottom 37 is threaded aperture 40 which terminates short of bottom 37. Radial apertures 41 connects aperture 40 with annular chamber 42 defined when top 35 is welded to walls 38, and bottom portion 34 is welded to plug 20.

Aperture 32 is formed of three concentric holes of different diameters. Hole 43 is of maximum diameter and is threaded to detachably receive charger housing 44.

Interior to housing 44 is a standard CO₂ cartridge 45 which when seated on the bottom of housing 44 protrudes from the open mouth thereof as shown in FIGURE 2. Hole 46 is of intermediate diameter and is threaded to receive check valve 47 which may take the form of a bushing containing a piercing pin, O-ring seal and resilient flapper valve. When housing 44 is screwed into threaded hole 43, the neck of cartridge 45 engages the O-ring seal and the piercing pin pierces the head of the cartridge whereby the high pressure gas in the cartridge flows through the pin and moves the resilient flapper to enter annular chamber 42. The flow continues through aperture 32 into chamber 42, with the O-ring serving to prevent escape into atmosphere around the neck of the cartridge, until the gas can no longer lift the resilient flapper. Removal of housing 44 without affecting the pressure in chamber 42 can then be accomplished. Check valve 47 is conventional in nature, and while a specific type is shown, it is obvious that other similar types could be used.

Threaded aperture 31 has connector 48 threaded thereinto. Flow tube 49 is attached to connector 48 by flexible sleeve 50 and extends interiorly to container 12 into close proximity to the bottom thereof.

Faucet assembly 17 is triangular in section as shown in FIGURES 1 and 6 and is attached by base 51 to the body of the dispenser. Assembly 17 contains faucet housing 52 having an axial bore 53 therein, inclined with respect to the axis of plug 20. The axis of bore 53 is spout 54. Extending from base 51 is faucet plug 55 which extends normal to the axis of plug 20 into aperture 29. Valve 56 is slideably mounted in bore 53 and has at one end button 57 extending from housing 52, and at the other end, a threaded portion extending beyond plug 55. The portion of plug 55 which defines aperture 53 forms a valve seat for washer 58 attached to valve 56 by nut 59. Spring 60 acting on the rear of button 57 biases valve 56 so that washer 58 sets in the valve seat. O-rings 61 and 62 help to seal the faucet assembly.

Faucet assembly 17 may be attached to the body by bolt heads 63 engaged in key hole slots 64. As shown in FIGURE 10, the body surrounding aperture 29 has two holes 65 such that insertion of plug 55 into the aperture will seat heads 63 into the enlarged portion of the holes so that upon rotation of faucet assembly 17, heads 63 are securely engaged beyond the reduced portion of holes 64. O-ring 62 provides a seal to insure continuity between aperture 30 and bore 53.

Portion 34 of upper housing 16 has port 65 which connects bottom 37 with the interior of container 12 as shown in FIGURE 2. Screwed into threaded aperture 35 in bottom 37 is valve 66, which has stem 67 extending beyond bottom 37. Valve 66 is similar to the type of valve used in auto tires and is opened when stem 67 is depressed toward bottom 37 (see FIGURE 2) and is closed when stem 67 returns to its initial position shown in FIGURE 3. Since such valve is conventional in nature, no further description thereof is necessary to an understanding of the present invention.

Mounted in the cavity 39 in upper housing 16 is flexible diaphragm 68 whose outer edge 69 is bulbous in
shape. Cylinder 70, surrounding edge 69, presses the same into a gas-tight seal with surface 38, as retainer 71 is screwed thereon. Diaphragm 68, which is of synthetic rubber or like material, has a central aperture 72. Aperture piston 73 is on one side of diaphragm 68, and disc 74 is on the other side of the diaphragm. Disc 74 has cylindrical hub 75 of a diameter to closely fit within the aperture in piston 73. On assembly, diaphragm 68 is scrunched between piston 73 and hub 75 being spun over into tight engagement with piston 73 as shown in FIGURE 3. The spinning process provides a gas-tight seal for the aperture 72 in the diaphragm.

Hub 75 has cylindrical aperture 76 therein which is normal to the plane of piston 68. On the side of disc 74 inner end 71 hub 75 is conical valve seat 77. Slidably mounted in aperture 76 is valve stem 79 of valve 78. One end of stem 79 is threaded as at 80 and the other end is headed as at 81. Groove 82 in stem 79 adjacent head 81 is provided for O-ring 83 which can then set in valve seat 77. Spring 84 acting against nut 85 thread on end 80 biases valve 78 in a direction to seat O-ring 83 tightly against valve seat 77. Spring 84 has a plurality of fingers which engage piston 78 and adjustment of nut 85 provides the requisite biasing force necessary to seal chamber 86 defined by one side of diaphragm 68 from cavity lug 96 thereon of stem 67. Diaphragm 68, other than 73, is in tension. While aperture 76 is circular in cross-section, stem 79 is provided with a plurality of axially extending flat surfaces 88 whose purpose will be apparent when the operation of the valve is described.

Conical compression spring 89 has one end engaged against retainer 71 and the other end engaged against piston 73. Consequently diaphragm 68 with piston 73 and disc 74 attached, are biased away from retainer 71, which is provided with at least one port 71 for connecting chamber 87 to atmosphere.

Flow tube 49 has two parts: an outer tube 90, and an inner rod 91 slidably engaged in bore 92 of tube 90. As described above, tube 90 extends substantially the height of container 12 so that end 90' is closely adjacent the bottom of the container. Near end 90', tube 90 is circumferentially grooved as at 93 to receive spring hook 94 fastened to the end of rod 91. By this means, rod 91 is resiliently attached and detached to tube 90. Rod 91 has a plurality of axially extending flat faces 94 so that a uniform constriction is formed which extends in length, many times the diameter of bore 92.

Pivotedally mounted on pivot bolt 26 is locking lever 95 having a handle 91 at one end and a pin 99 at the other end. Lever 95 is movable from a locked terminal position where lug 96 underlies lip 13 as shown in solid lines in FIGURE 6, to an unlocked terminal position where the lug is withdrawn from beneath lip 13 as shown in broken lines in FIGURE 6. In locked position, the lug retains head 10 on container 12; while the unlocked position, the head may be either inserted into mouth 11 or removed therefrom. Handle 97 on the free end of lever 95 is bent to extend parallel to walls 18 and be easily accessible so that actuation of the lever is facilitated. An over-center spring 98 has one end attached to pin 99 on lever 95 and the other end attached to pin 100 on bottom 19 of housing 15. As described above, in FIGURE 6, when lever 95 is in locked position, pin 99 is on the side of the line connecting pin 100 and pivot bolt 26 causing spring 98 to bias lever 95 into tighter locking engagement. The geometry of lever 95 and spring 98 is such that if lug 96 were engaged upon lip 13 instead of thereunder, pin 99 would be on the side of the line connecting pin 100 and pivot bolt 26 causing spring 98 to bias lever 95 into unlocked position. When lever 95 is rotated clockwise (as seen in FIGURE 6), by grasping handle 97, pin 99 will eventually cross the line connecting pin 100 and pivot bolt 26. Thereafter, spring 98 will bias lever 95 toward unlocking position. Thus spring 98 will itself cause lever 95 to move to the position shown in broken lines in FIGURE 6 after pin 99 moves over center. When in the unlocked position, handle 97 of lever 95 extends directly into a position opposite threaded opening 43. In such position, handle 97 will prevent the attachment of housing 44. In this position a CO₂ cartridge cannot be used to charge annular chamber 42. When dispensing head 10 is inserted in mouth 11 of container 12, lever 95 can occupy only one of two positions; either its locked or unlocked terminal positions. If lever 95 is intermediate its terminal positions, spring 98 acts to cause movement to these positions. It is thus impossible for chamber 42 to be charged if dispensing head 10 is not securely attached to the container with lug 96 engaged beneath lip 13. The importance of this feature will be appreciated when it is realized that a person using a dispensing head without such feature could very easily believe that he had secured the head to the container and proceed to attempt to charge the head with high pressure gas. Unless the container is sealed; i.e., the head is secured to the container, an attempt to charge the head would result in dissipating the CO₂ cartridge to atmosphere.

Having inserted dispensing head 10 on the container with lever 95 in its locked position with lug 96 beneath lip 13, the position of diaphragm 68 will be as shown in FIGURE 2, with head 81 of valve 78 engaged with stem 67 divides compartment 86 into two chambers: chamber 86 which is enclosed and connected to the interior of container 12 by port 65, and chamber 87 which is exposed to atmospheric pressure because of port 71. Atmospheric pressure acting on the exterior surface of diaphragm 68 together with conical spring 89 urges the diaphragm to a position which defines a minimum volume for chamber 86. Thus, upon attachment of head 10 onto a container, chambers 86 and 87 are at atmospheric pressure and spring 89 causes the diaphragm to occupy the position shown in FIGURE 2.

As housing 44, with cartridge 45 therein, is screwed into opening 43, the forward end of the cartridge is sealed by the O-ring in check valve 47 as the piercing pin pierces the cartridge. The high pressure gas contained in the cartridge enters annular chamber 42 and through port 41 acts on one side of diaphragm 68. As described above, valve 66 is of the type which is closed and thus disconnects chamber 42 from chamber 86 when stem 67 is resiliently urged to its extended position (see FIGURE 3), and which is open and thus connects chamber 42 with chamber 86 when stem 67 is depressed. Since stem 67 is depressed by spring 89 acting through head 81, when valve 78, the high pressure gas in chamber 42 thus enters enclosed chamber 86 where it acts interior to the container and upon diaphragm 68 to increase the volume of chamber 86 against the resistance of atmospheric pressure and the pressure of spring 89. As the pressure in chamber 86 increases, diaphragm 68 moves away from bottom 19, and stem 67, still engaged with head 81, moves toward its closed position. Eventually, diaphragm 68 moves to an equilibrium position where the force acting thereon due to the gas pressure in chamber 86 exactly balances the force acting thereon due to atmospheric pressure in chamber 87 and spring 89. In such equilibrium position, stem 67 is fully extended as shown in FIGURE 3, chamber 42 is cut off from chamber 86, and the pressure interior to the container is intermediate atmospheric pressure and that in chamber 42. By properly choosing spring 89, the pressure interior to the container may be made exactly right to keep the proper amount of CO₂ in solution.

It may be possible that valve 66 will stick in open position if stem 67 does not return to its projected position when head 81 of valve 78 no longer contacts the stem 67. In such case, the interior of the container is directly exposed to the full pressure in chamber 42, which pressure would easily burst a standard container. Accidental over-pressurization is prevented by valve 78.

Head 81 of valve 78 is exposed to the gas in chamber
86, and the resultant force acting thereon plus the force due to spring 84, seals O-ring 83 in valve seat 77 and precludes escape of gas from chamber 86 to chamber 87. However, as the pressure in chamber 86 increases, diaphragm 68 moves from its equilibrium position toward retainer 71. Eventually, nut 85 on valve 78 abuts retainer 71 which serves to arrest any further movement of head 78. The increasing pressure in chamber 86 causes valve seat 77 to separate from O-ring 83 as best shown in FIGURE 4 as spring 84 is compressed. When valve 78 is thus opened, gas from chamber 86 enters chamber 87 through orifices defined by surface 76 on hub 75 and flats 88 on stem 79. Thus, the interior of the container is vented to atmosphere whenever the pressure interior to the container approaches an unsafe value.

When button 57 is depressed, washer 58 is unseated from the valve seat in faucet housing 52 and the pressure in chamber 86 forces the contents of container 12 through flow tube 49 into apertures 30, 31, and out of spout 54. This causes a decrease in the volume of the contents thereby decreasing the pressure in chamber 86. If this pressure is decreased sufficiently, head 81 again depresses stem 67 and the cycle is repeated to maintain interior to container 12 a pressure which is intermediate the pressure in annular chamber 42 and atmospheric pressure.

As described above, flow tube 49 has a plurality of orifices defined by internal surface 92 and flats 94 on rod 91. These orifices have a longitudinal dimension which is much greater than any transverse dimension and, as a result, the beverage flow therefrom is laminar rather than turbulent. Thus, there is very little mechanical mixing of the beverage as the fluid friction created in the flow tube acts on the fluid to destroy its high pressure. Because of the length of flow tube 49, the pressure of the fluid on entering tube 41 is only slightly in excess of atmospheric pressure and the beverage leaves spout 54 without excessive foaming.

Those skilled in the art will now appreciate that this invention provides a dispensing head that is readily secured to a standard container, but which cannot be charged with CO₂ upon improper attachment. In addition, accidental pressurization of the container in an unsafe condition is automatically precluded by venting the container to atmosphere as the pressure builds up. Furthermore, a relatively high internal pressure can be employed to maintain the proper amount of CO₂ in solution, without resulting in excessive foaming when the beverage is dispensed.

What is claimed is:
1. A dispenser head having a cylindrical portion adapted to be inserted into the mouth of a container having a lip therearound, said head having an annular chamber attached to said cylindrical portion for containing high pressure dispensing gas, regulator valve means in said head operatively connected to said annular chamber for maintaining the pressure interior to said container less than in said annular chamber but greater than atmospheric pressure, faucet means in said head for dispensing the contents of the container under pressure, connector means operatively connected to said annular chamber through which the latter is adapted to be charged with high pressure gas, means on said head movably mounted from a first position cooperable with said faucet for releasably maintaining said cylindrical portion in the mouth against the pressure interior to said container to a second position out of engagement with said lip and into interfering relationship with said connector means for effecting removal of said cylindrical portion and preventing charging of the annular chamber high pressure gas, and over-center toggle means for preventing said last named means from occupying any other but the first and second positions.
2. A pressurizing head having a cylindrical portion adapted to be inserted in annular chamber and connector, said mouth having an outwardly extending lip therearound, movable locking means on said head adapted to be engaged under said lip for releasably retaining said portion in said mouth, said head defining an annular chamber for containing high pressure dispensing gas, a variable volume chamber in said head connected by a port in said portion to the interior of said container for equalizing the pressure therebetween, valve means between the chambers, regulator means for connecting the chambers when the pressure in said variable volume chamber reaches a minimum value and for disconnecting the chambers when the pressure reaches a maximum value, said movable locking means when engaged with said lip serving to prevent the container pressure from pushing said portion out of the mouth, check valve means for effecting insertion of dispensing gas into said chamber and preventing escape of the gas into the atmosphere, a connector opening to the exterior of said head associated with said check valve, said connector adapted to have a source of high pressure located thereto for charging said annular chamber whereby said regulator means connects said chambers until the container is pressurized intermediate the pressure in said annular chamber and atmosphere, and means to prevent attachment of the source of high pressure to said connector except when said movable locking means is engaged with said lip whereby inadvertent attachment of a source of high pressure is prevented when said movable locking means is not engaged under said lip.
3. A pressurizing head for a container having a mouth with an outwardly extending lip therearound comprising means forming a chamber for containing high pressure dispensing gas, said head containing an orifice into which a source of high pressure gas can be attached for charging said chamber, a lock spring pivotally mounted on said head and having a lug thereon, said lever movable from a locked terminal position where the lug underlies said lip and retains said head on said container to an unlocked terminal position where the lug is withdrawn from beneath said lip and said head may be removed from said container, over-center spring means for automatically moving said lever to its unlocked terminal position when it is any position except locked position, and means on said lever obstructing said orifice when said lever is in its unlocked terminal position.

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