A pump has a flexible liner which is expanded and contracted by application of positive and negative fluid pressure for receiving and discharging fluent material. The liner is received in a rigid shell which defines the maximum volume received. In discharging fluent material, a vacuum is applied to one side of the liner, while applying pressure to the other side so the liner is collapsed against the rigid shell. The liner is arranged so as to be the only part of the pump which contacts the fluent material, and is replaceable to effect rapid and easy cleaning of the pump. The liner has multiple pump cells which can expand and contract for moving fluent material through the pump cell. The pump cells can be sized and arranged so that by selection of particular pump cells which receive the fluent material, precise volumes can be metered by the pump. A merchandiser has a pump and a flexible bag which is deformed to selectively dispense fluent material.
FIG. 18

FLUID PRESSURE CONTROL SOURCE

CONTROL

SELECTOR

454

514

510

65, 71
PUMP HAVING FLEXIBLE LINER AND
MERCHANDISER HAVING SUCH A PUMP

CROSS-REFERENCE TO RELATED
APPLICATIONS


BACKGROUND OF THE INVENTION

[0002] This invention relates generally to pumps which meter predetermined volumes and more particularly to such a pump employing a flexible liner.

[0003] Pumps are often used in applications where the surfaces contacting a fluent material being pumped should be kept clean. Such fluent materials include food, beverages, and medicinal products in the form of liquids, powders, slurries, dispersions, particulate solids or other pressure transportable fluidizable material. For instance, where the fluent material is a food additive for a food product, it is imperative that surfaces contacting the material be maintained in an aseptic condition. Accordingly, the parts of the pump which contact the food are made of materials (e.g., stainless steel) which are highly resistant to corrosion and can be cleaned. However, such materials are expensive and significantly increase the cost of the pump. The pump must be periodically shut down to clean surfaces which handle the food product. Cleaning may also involve continuing to operate the pump while flushing with a cleaning liquid. In any event, the pump is not available for production operation while cleaning is taking place. Many fluent food products are prone to leave residue or debris as they are handled, which cause the pump to become unsanitary. Although necessary, it is inefficient to stop the pump frequently for cleaning and this increases the cost of manufacturing the product.

[0004] Manufacturing and merchandising processes frequently include the pumping and dispensing of a fluent material. Pumps used in such a process are called upon to meter fluent materials in precise quantities. A beverage merchandiser for dispensing a selected beverage should provide for precise mixing of beverage components, accurate volumetric delivery, and ready replenishment. Unfortunately, merchandisers of the prior art do not provide these capabilities in an efficient and clean system.

SUMMARY OF THE INVENTION

[0005] Among the several objects and features of the present invention may be noted the provision of a merchandiser such as a beverage dispenser for dispensing metered quantities of fluent material; the provision of such a merchandiser which can precisely mix various fluent material components in selected proportions, the provision of such a merchandiser which handles fluent materials while keeping the apparatus clean; the provision of such a merchandiser which is capable of maintaining aseptic conditions; and the provision of such a merchandiser which is economical and easy to use.

[0006] Further among the several objects and features of the present invention may be noted the provision of a flexible bag used to dispense a fluent material which is capable of dispensing at multiple outlets; the provision of such a flexible bag for use in beverage dispensing; the provision of such a bag which can be manipulated to dispense directly to an article from the bag within any intervening structure; the provision of such a bag which can store and deliver a product in an aseptic condition; the provision of such a flexible bag which contains multiple components of a mixture to be dispensed; the provision of such a flexible bag which can be rapidly replaced; the provision of such a flexible bag which can be used multiple times; and the provision of such a bag which is economical to use in manufacture.

[0007] In general, a merchandiser according to the present invention selectively dispenses fluent material. The merchandiser comprises a mount for supporting a flexible bag. A flow control is adapted to receive at least a majority of the flexible bag therein and to deform the bag to produce flow of fluent material without contact of the fluent material by the flow control. The flow control includes a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag. The receptacles each are connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the cell for use in dispensing fluent material. A selector is for actuation by a person to initiate operation of the flow control to dispense fluent material.

[0008] In another aspect, a beverage dispenser of the invention selectively dispenses a mixed beverage. The beverage dispenser comprises a mount adapted to support a flexible bag. A flow control is adapted to receive a majority of the flexible bag therein and to deform the bag to produce flow of beverage admixtures in the flexible bag without contact of the beverage admixtures by the flow control. The flow control includes a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag. The receptacles include a mixing receptacle adapted for communication with other of the receptacles for receiving beverage admixtures into the mixing receptacle when the flexible bag is received in the shell. The receptacles each are connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the pump cell for use in mixing and dispensing a beverage admixture. A selector is associated with the cabinet for actuation by a customer to initiate operation of the flow control to mix beverage components and to dispense a mixed beverage.

[0009] In yet another aspect, a pre-filled flexible bag of the invention is for use in dispensing a beverage. The pre-filled flexible bag comprises first and second sheets of flexible material in generally opposed relation with each other. Cells are defined by regions in which the first and second sheets are unconnected and which are substantially circumscribed by portions of the bag in which the first and second sheets are sealingly joined together. The cells each have an outlet. Beverage liquid is disposed in at least a plural number of cells for discharging from the cells through one or more of the outlets upon deformation of the flexible bag.

[0010] In still a further aspect, a flow control according to the present invention selectively dispenses fluent material.
The flow control comprises a shell adapted to receive the flexible bag and having at least three receptacles formed therein including a mixing receptacle. At least two of the other receptacles are adapted for communication with the mixing receptacle. The receptacles are adapted for receiving respective pump cells formed in the flexible bag. A fluid pressure control source is for selectively applying at least one of a vacuum pressure and a positive pressure to at least some of the receptacles to selectively expand and collapse the pump cell for use in dispensing fluent material. A controller operates the fluid pressure control when a flexible bag is received in the shell to deliver fluent material to the mixing receptacle from the at least two other receptacles, to act on the fluent material in the mixing receptacle to mix the fluent material, and to discharge the mixed fluent material from the mixing receptacle.

[0011] In yet a further aspect, a method of manufacturing a flexible bag pre-filled with fluent material according to the invention comprises the steps of positioning a first sheet and a second sheet of limp material in generally opposed relation and joining the first and second sheets together to define distinct cells having an inlet opening. One of the cells is filled with a first beverage liquid, and another of the cells is filled with a second beverage liquid. The inlets of the cells are sealed.

[0012] In one more aspect, a method of the invention dispenses mixed fluent material. The method comprises the steps of providing a flexible bag having cells formed therein, at least some of the cells containing a fluent material therein. The flexible bag is deformed to discharge fluent material from at least two of the cells into a mixing cell in the flexible bag. The flexible bag is deformed at the mixing cell to mix fluent material in the mixing cell. Mixed fluent material is discharged from the mixing cell.

[0013] In still another aspect of the present invention, a merchandiser for selectively dispensing fluent material comprises a mount for supporting a flexible bag and a flow control adapted to receive at least a majority of the flexible bag therein and to deform the bag to produce flow of fluent material without contact of the fluent material by the flow control. The flow control includes a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag. The receptacles each are connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the cell for use in dispensing fluent material. The flow control is constructed and arranged to direct fluent material discharged therefrom to mix the fluent material.

[0014] In a further aspect of the present invention, a merchandiser as set forth in the preceding paragraph. However, the flow control is constructed and arranged to mix fluent material prior to discharge from the flow control.

[0015] Other objects and features of the present invention will be in part apparent and in part pointed out hereinafter.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0016] FIG. 1 is a schematic of a drink dispensing apparatus of the present invention;

[0017] FIG. 2 is a schematic of a pump of the present invention;

[0018] FIG. 3 is a perspective of a shell of a pump of the present invention in the form of a compounding apparatus;

[0019] FIG. 4 is a plan of a liner of flexible material of the pump of FIG. 3;

[0020] FIG. 5 is a plan of a lower half of the pump shell with the liner received therein and schematically illustrating valves;

[0021] FIG. 6 is a cross section of the pump with halves of the pump shell and the pump liner exploded;

[0022] FIG. 7 is a schematic of a pinch valve of the pump;

[0023] FIGS. 8A-8D are fragmentary cross sections of the pump showing a single pump cell and illustrating the operation of the pump;

[0024] FIGS. 9A-9D are fragmentary cross sections of a pump of a second embodiment illustrating its operation;

[0025] FIG. 10 is a schematic plan of a pump of a third embodiment showing one half of a shell of the pump with a pump liner received therein and illustrating valves;

[0026] FIG. 11 is a schematic plan of a pump of a fourth embodiment showing one half of a shell of the pump with a pump liner received therein and illustrating valves;

[0027] FIG. 12 is a schematic plan of a pump of a fifth embodiment showing one half of a shell of the pump with a pump liner received therein and illustrating valves;

[0028] FIG. 13 is a schematic plan of a pump of a sixth embodiment showing one half of a shell of the pump with a pump liner received therein and illustrating valves;

[0029] FIG. 14 is a schematic plan of a pump of a seventh embodiment showing one half of a shell of the pump with a pump liner received therein and illustrating valves;

[0030] FIG. 15 is an elevation of a first merchandiser for selectively dispensing fluent material;

[0031] FIG. 16 is an elevation showing an interior of a cabinet of the merchandiser of FIG. 15;

[0032] FIG. 17 is an elevation of a second merchandiser for selectively mixing and dispensing fluent material;

[0033] FIG. 17A is a flexible bag for the merchandiser of FIG. 17; and

[0034] FIG. 18 is a block diagram of a control system for the merchandisers of FIGS. 15-17.

[0035] Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0036] Referring now to the drawings and in particular to FIG. 2, a pump 11 constructed according to the principles of the present invention is shown to comprise a liner 13 made of a limp, flexible material, such as an appropriate polymer, including without limitation polyvinyl chloride, polyolefin, polymer laminates and polymer alloys. In a preferred embodiment, the liner 13 comprises two sheets of the material (designated 13A and 13B, respectively) in face-to-face relation which are joined together at their peripheral edge margins as by welding, leaving a weld seam around the
peripheral edge (see FIGS. 4 and 6). The sheets 13A, 13B may be secured together in any other suitable manner, such as by adhesive or mechanical fasteners. The liner may be formed with a single sheet folded over and joined to itself, or otherwise so as to form a thin enclosure of flexible material capable of receiving and discharging fluent material. The sheets 13A, 13B are also welded together to define multiple pump cells 17, manifold pump cells 19 and a header pump cell 21 in the interior of the liner 13. All of these may be generally considered to be “pump cells” in that they are expandable for receiving fluent material and contractile for discharging the fluent material in operation of the pump 11. “Fluent material” is used to convey that a pump of the present invention can be used for gases and liquids, but it is also envisioned that the pump could be used with very finely divided solids. However, in the preferred embodiments described herein, the fluent material is a liquid and so the term “liquid” will be used herein without limitation as to the type of material which can be acted upon by a pump of the present invention. As will be described more fully hereinafter, the pump 11 has application for use in a drink dispenser, generally indicated at 23, capable of making a drink with different selected mixes of flavorings, as schematically illustrated in FIG. 1.

[0037] The sheets 13A, 13B of the liner 13 are also welded together so as to form inlets 25 and passages 27 for receiving liquid into the liner. The liner 13 illustrated in FIG. 4 is particularly configured for delivering variable and precise volumes to form a mixture. The pump cells 17 and manifold pump cells 19 are arranged in five groups (designated generally at 29) each including three pump cells of differing size and volume and a manifold pump cell. The pump cells 17 and manifold pump cell 19 of each group 29 communicate with the header pump cell 21 extending laterally of the liner 13 and having an outlet, constituting in this embodiment the outlet of the pump 11. The manifold pump cell 19 of each group 29 communicates with the passages 27 from the inlets, with each pump cell 17 in the group and also with the manifold pump cells 19. Liquid from the manifold pump cell 19 can enter either one of the pump cells 17 or the manifold pump cells 19, as will be described hereinafter. Although the pump of the preferred embodiment is illustrated as having multiple cells (17, 19, 21) and passages 27, it is to be understood that a pump (not shown) could have any number of cells, including only a single cell, without departing from the scope of the present invention. Moreover, the passages do not have to be expandable and collapsible for pumping fluid like passages 27, but may be of a fixed volume, in the manner of the inlets 25. The number and configuration of the cells and passages will be dictated by the particular application of the pump.


[0039] Referring now to FIG. 3, the liner 13 is received between an upper half 33A and lower half 33B of a rigid shell (generally indicated at 33). In the preferred embodiment, the material is a metal, but could be another rigid material such as a polymeric material. The shell 33 may have fewer or greater number of component parts. Moreover, the terms “upper” and “lower” have been chosen for convenience, as the component parts of the shell 33 may assume other relative positions. As shown, the upper and lower halves 33A, 33B are connected together by a hinge 35 for ease of opening and closing the shell 33 to remove, adjust or replace the liner 13 between the shell halves. The halves 33A, 33B need not be permanently connected. It will be readily appreciated that each shell half (33A, 33B) is formed with cooperating receptacle members arranged identically to the arrangement of pump cells 17, the manifold pump cells 19, the header pump cell 21, the inlets 25 and the passages 27 of the liner 13. The receptacle members are designated by the same reference number as the part of the liner 13 which they receive, but with the prefix “3” and the suffix “A” or “B” indicating their association with the upper shell half 33A or lower shell half 33B (e.g., 117A for the receptacle member receiving the pump cell 17 in the upper shell half 33A).

[0040] The receptacle members (117A, 117B, 119A, 119B, 121A, 121B, 125A, 125B, 127A, 127B) of the upper and lower halves 33A, 33B are aligned when the shell 33 is closed to define receptacles having a shape closely corresponding to the shape of one of the pump cells 17, manifold pump cells 19 or of the header pump cell 21 for receiving the one pump cell, manifold pump cell or the header pump cell. Engagement of the shell halves 33A, 33B with the liner 13 should be sufficiently firm to produce a fluid tight seal of each receptacle formed for the mating receptacle members (117A et seq.), for reasons which will become apparent. It is envisioned that the seal could be sufficiently tight as to omit the necessity of preforming the welded seal around the peripheral edge, the pump cells 17, manifold pump cells 19, header pump cell 21, the inlets 25 and the passages 27. The liner 13 has a hole 39 at each of its four corners which is received on a respective stud 41 on the lower half 33B of the shell 33 to register the liner with the lower shell half 33B so that the pump cells 17, manifold pump cells 19 and header pump cell 21 are received in their corresponding receptacle members. Apertures 43 in the upper shell half 33A receive the studs 41 so that flat faces of the upper and lower halves 33A, 33B surrounding the receptacle members (117A et seq.) are parallel when closed. The apertures 43 are elongated so that they may receive the studs 41 as the upper shell half 33A pivot down to the closed position of the shell 33. The liner 13 on the lower shell half 33B is illustrated in FIG. 5.

[0041] The upper shell half 33A mounts a plurality of pinch valves 47 operable to open and close communication of the pump cells 17, manifold pump cells 19, header pump cell 21 and passages 27 as needed for operation. One of the pinch valves 47 is shown in FIG. 7 to comprise a cylinder 49 and a piston 51 having a head 51A slidingly received in the cylinder. The free end of the piston 51 outside the cylinder mounts a wedge 53 arranged to bear down against the liner 13 to bring the opposing walls (i.e., the interior surfaces of the liner sheets 13A, 13B) of the liner into sealing engagement for pinching off the liner to prevent fluid flow past the valve 47. The lower shell half 33B and the wedge 53 are shaped in a complementary manner so as to have a close fitting relationship when the pinch valve 47 is
actuated to facilitate a tight closure. As illustrated, a spring 55 in the cylinder 49 engages one side of the piston head 51A and biases the piston 51 to a retracted position into the cylinder such that the wedge 53 does not pinch off the liner 13 and fluid may flow through the liner past the valve. Air under pressure may be received through an inlet 57 in the cylinder 49 on the opposite side of the piston head 51A from the spring 55 to force the head down against the bias of the spring to extend the piston for pinching off the liner 13. However, the pinch valve 47 may be actuated other than pneumatically (e.g., electrically) without departing from the scope of the present invention. Moreover, the sheets 13A, 13B could be forced together such as by application of air pressure directly to the sheets or by magnet attraction, without the use of a separate mechanical valve. It is to be understood that the term “valve” as used herein is intended to encompass arrangements which use air pressure or magnetic force to close the liner. The valves 47 may be actuated independently, in sets or simultaneously as needed for operation of the pump 11 in a particular application.

Referring again to FIG. 2, the upper shell half 33A further includes a first port 61 connected by a valve 63 to a source of pressurized air (or other gas) indicated generally at 65. The lower shell half 33B includes a second port 67 connected by a valve 69 to a vacuum source indicated generally at 71. Valve 63 is also capable of connecting the first port 61 to the vacuum source 65. The locations of the first port 61 and second port 67 could be reversed. The pressure source 65 includes a first compressor 73, a higher pressure reservoir 75 and a lower pressure reservoir 77. The first compressor 73 is operated by a first compressor control 79 which receives a signal from a first pressure transducer 81 indicating the pressure of the air in the higher pressure reservoir 75 for operating to keep the air pressure in the higher at a selected value. The higher pressure reservoir 75 is connected via a pressure regulator 83 and a valve 85 to the lower pressure reservoir 77 containing air at an elevated pressure, but lower than that of the higher pressure reservoir. The valve 85 is operated by a control 87 according to the air pressure in the lower pressure reservoir 77 detected by a second pressure transducer 89 to open to allow air to enter the lower pressure reservoir for maintaining a predetermined air pressure in the reservoir. The pressure regulator 83 controls the pressure of the air entering the lower pressure reservoir 77 from the higher pressure reservoir 75 to stabilize the pressure in the lower pressure reservoir. The vacuum source 71 includes a second compressor 91 and a vacuum reservoir 93. The second compressor 91 is operated by a second compressor control 95 which receives a signal from a third pressure transducer 97 to maintain a substantially constant vacuum pressure in the lower pressure reservoir 93.

The basic operation of the pump 11 for a single pump cell 17 (as illustrated in FIG. 2 and FIGS. 8A-8D) relies on the liner 13 extending between the receptacle members 117A, 117B so that although the receptacle members are closely adjacent to define the pump receptacles, they are fluidically separated from each other. In other words, the liner 13 and each receptacle member 117A, 117B define an independently sealed chamber. First, the valves 63 and 69 are actuated so that the receptacle member 117A of the upper shell half 33A and the receptacle member 117B of the lower shell half 33B are both exposed to vacuum pressure from the vacuum reservoir 93. For purposes of the description the specific pinch valves will be designated as 47 and 47' to distinguish the upstream and downstream pinch valves. The pinch valves 47, 47' are operated by valves, designated 99A and 99B, respectively, which connect the cylinders 49 of the valves to the lower pressure reservoir 77 of the pressure source 65. At the same time the pinch valve 47 on the inlet side of the pump cell 17 is opened and the pinch valve 47' on the outlet side of the pump cell is closed. The valves 63 and 69 are operated to connect the upper and lower receptacle members 117A, 117B to the vacuum reservoir 93 of the vacuum source 71. The pump cell 17 expands by separation of the walls (i.e., the sheets 13A, 13B) of the liner 13 at the pump cell to create a volume and draw liquid into the pump cell (FIG. 8A). The walls 13A, 13B of the liner 13 are expanded substantially against the shell 33 in the receptacle members 117A, 117B so that the receptacle members define the maximum volume of the pump cell 17. The vacuum drawn has the effect of pulling the upper and lower shell halves 33A, 33B together as the pump cell 17 is filled. This increases the accuracy of the pump 11 because the volume defined by the receptacle members 117A, 117B formed within the rigid shell 33 is highly accurate and repeatable. When the shell halves 33A, 33B are drawn together so that spacing and hence the volume defined by the receptacle members 117A, 117B is always precisely the same.

After the pump cell is filled, the pinch valve 47' is closed and the pinch valve 47 is opened. A vacuum is maintained on the pump cell 17 in the receptacle member 117B in the lower shell half 33B, while the valve 63 is operated to expose the receptacle member on the upper shell half 33A to a positive pressure from the pressure source 65. As a result the bottom wall 13B of the liner 13 remains substantially conformed against the shell 33 in the lower shell half receptacle member 117B. The top wall 13A collapses against the lower wall 13B to discharge the liquid from the pump cell 17. This discharge process is illustrated in FIGS. 80-8D. By maintaining the lower wall 13B in contact with the shell 33 to discharge, the material of the liner 13 is held without wrinkles, which can affect the actual volume in the pump cell 17 and reduce accuracy. The overall operation of the pump 11 is the same for each pump cell 17 (the manifold pump cells 19, header pump cell 21 and passages 27 also operate in the same way). However, the sequence of operation of the valves (47, 47', 63, 67) can be selected to achieve the specific function needed for the pump 11.

A sequence of operation of the single pump cell 17 is illustrated in FIGS. 8A-8D. These figures show the pump cell 17 as being equipped with capacitance-type liquid level sensors 101. An example of a suitable sensor would be a QProx capacitive sensor available from Quantum Research Group Ltd. of Southampton, England. Sensors of this type operate by detection of the liquid mass, rather than direct detection of volume. These sensors 101 are mounted in the upper shell half 33A at the top of the receptacle member 117A and are connected to a pump master control 103 (FIG. 2). Other types of sensors (not shown), such as optical or ultrasonic sensors, could be mounted on the shell 33 for detecting the fill state of the pump cell 17. The sensors 101 are capable of detecting the separation of the liquid from the top of the receptacle member 117A. This permits the control 103 to calculate the precise, instantaneous volume of the pump cell 17. The sensors 101 may be used to operate the valves 47, 47' by detection of when the pump cell 17 is completely full or completely empty. Moreover, the sensor
101 can detect a blockage in the pump cell 17. However it is envision that by knowing the instantaneous volume of liquid in the pump cell 17 during discharge, the valves 47 may also be actuated to close off the pump cell 17 for delivery of partial volumes. In other words, the valve 47 could be actuated at a point during the discharge, such as shown in FIG. 8B or 8C, to prevent further liquid from leaving the pump cell 17.

[0046] The operation of a single pump cell of a pump 211 of a second embodiment is shown in FIGS. 9A-9D for use in delivering precise incremental volumes of liquid. Corresponding parts of the pump 211 of the second embodiment will be designated by the same reference numerals as the pump 11 of the first embodiment, with the prefix “2”. A pair of pinch valves (247A, 247B) on the outlet side of the pump cell 217 are capable of segregating a very small, discrete volume of the pump cell for delivering this small, discrete volume. It will be appreciated that if a pump cell has a very small maximum volume, it will be possible to deliver a very precise volume from the pump cell (even where the pump cell is fully emptied with each cycle of operation of the pump). However, delivery of such small volumes will require many cycles of operation to achieve the total volume of liquid needed. The pump 211 of FIGS. 9A-9D allows a full volume of the pump cell 217 to be discharged until the precise total volume is neared, at which time the valves 247A, 247B are operable to permit a partial volume to be discharged until the total volume is reached. The valves 247A, 247B include wedges 253A, 253B which are in the illustrated embodiment, slidably connected to each other, such as by a dovetail connection. In full volume discharge operation of the pump cell 217, the valve 247A moves up to pinch off the outlet side of the pump cell and down to permit liquid to be discharged from the pump cell. The valve 247B is not used.

[0047] The operation of the pump 211 for the pump cell 217 to deliver a partial volume is shown in FIGS. 9A-9D. In this embodiment, it is not necessary to detect instantaneous volumes or to time the closure of pinch valves to discharge a partial volume. In each cycle, the full volume of the pump cell or segregated portion of the pump cell is discharged. Initially, valve 247A is actuated to pinch off the outlet of the pump cell 217 and the entire pump cell is filled by application of a vacuum pressure to the pump cell (FIG. 9A). The valve 247B is actuated to pinch off the pump cell 217 just upstream of the outlet (FIG. 9B). It may be seen that the valve wedges 253A, 253B are shaped so as to define a small volume 200 in an outlet end region of the pump cell 217. The valve 247A is opened and pressure is applied to the pump cell 217 so that liquid is discharged from the small volume 200 is the only liquid discharged from the cell (FIG. 9C). The valve 247B holds the liquid in the remainder of the cell 217 from leaving the cell. Eventually, the small volume 200 is emptied (FIG. 9D) and the pump 211 is ready to repeat the operation or to return to discharging the full volume of the pump cell 217.

[0048] Having described the base operation (and one variant) of the pump 11 (211) for a single pump cell 17 (217), we will now discuss the operation of the pump 11 formed for using the specific liner 13 shown in FIGS. 4 and 5, with particular reference being made to FIG. 5. The pinch valves 47 mounted in the upper shell half 33A are shown in phantom. In a preferred embodiment, the pump 11 applies a vacuum to all of the pump cells 17, manifold pump cells 19, header pump cell 21 and passages 27 at the same time. Similarly, any air pressure applied in a discharge operation would be applied to all of the aforementioned components at the same time. While it would be possible to apply a vacuum or positive pressure to the various components individually, the arrangement would be more complex and costly. The pinch valves 47 can be used as needed to isolate or block off one or more of the cells (17, 19, 21) or passages (27) not to be filled with or emptied of liquid.

[0049] Operation will be described with reference to one of the groups 29 of pump cells 17 and manifold pump cells 19, the operation of the others being substantially the same. The passages 27 are connected to one or more liquid sources (not shown) at the inlets 25 for admitting the liquid into the pump 11. To draw liquid into the passages 27, valves 63, 69 are opened to apply a vacuum to the entire shell 33 and specifically to the passage receptacles 127A, 127B. The pinch valves 47 at the inner ends of the passages 27 are closed so that liquid is drawn into the fingers, but passes no further in this cycle of operation of the pump 11. Preferably, each of the passages 27 has suitable fill sensors, such as the capacitive liquid level sensors 101 shown in FIGS. 8A-8D. Such sensors would be capable of detecting that a particular one of the passages 27 had not filled in the cycle. In response, an indication may be given that one of the liquid sources is empty or that a blockage is present. Before the liquid source is replaced or immediately after the blockage is removed, the pump 11 is actuated to collapse the one passage 27 so that any liquid and air in the passage is expelled back into the inlet 25 and the liquid source. All of the pinch valves 47 except the one at the inlet 25 of the one passage 27 will have been closed so that the pump 11 does not otherwise operate to pump the liquid even though pressure and vacuum is applied to all of the cells (17, 19, 21) and the passages 27. In this way, the inlet 25, and any delivery tube (not shown) connecting the inlet to the liquid source, is re-primed so that after replacement of the liquid source (or removal of the blockage) the one passage 27 will not be again partially filled with air. The pump 11 is made to recouple with the pinch valves 47, save the pinch valve connecting the one passage 27 to the liquid source, in the same manner to fill the one passage. The pump 11 then returns to normal operation. It will be appreciated that closely similar kinds of detection and remedial could be applied for the cells (17, 19 and 21) fitted with liquid level sensors. The need for such detection varies with the particular application of the pump 11. The passages 27 generally have an elongate, curved shape which facilitates the expulsion or “scavenging” of liquid from the passages, which increases the accuracy of the pump 11.

[0050] All of the passages 27 communicate with the manifold pump cell 19 of the group 29. The other three pump cells 17 are all connected to the manifold pump cell 19 and the manifold pump cell has an outlet opening directly into the header pump cell 21. Thus, it will be understood that the manifold pump cell 19 can operate just like a standard pump cell 17 described previously, by receiving liquid and discharging the liquid into the header pump cell 21 without involving any of the other pump cells. If the passages 27 are connected to sources containing a different liquid, the manifold pump cell 19 also becomes a pre-mixing chamber prior to any mixing which may occur in the header pump cell 21.
The manifold pump cell 19 and the pump cells 17 in the group 29 have different sizes preferably selected to give flexibility in discharging the precise amounts needed in a particular application. Each of the pump cells 17 can be filled with liquid from the manifold pump cell 19 by opening the pinch valve 47 leading to that particular pump cell, applying a vacuum to both receptacle members 117A, 117B, and to the manifold pump cell via the receptacle members 119A, 119B. The manifold pump cell 19 and at least some of the passages 27 remain in fluid communication with the liquid source(s) so that they refill with liquid at the same time the pump cell(s) 17 is filled. The pump 11 can be operated to discharge from the manifold pump cell 19 into any one or any selected set of the pump cells 17 in the group 29. This is accomplished by closing the pinch valves 47 leading to the pump cells 17 not to be filled. The control 103 is operable to select the pump cells 17 in the group 29 (including the manifold pump cell 19 which also can discharge directly into the header pump cell 21) to be used in order to achieve the volume of the particular liquid needed in the fewest number of cycles of operation. Again, this is carried out by opening and closing the particular pinch valves 49. The pump cells 17 are capable of discharging into the header pump cell 21 by substantially the same operation. The flexibility in operation of the individual pinch valves depends upon the precision as well as the variations in liquid volume and composition which is required for a particular application.

The pump 11 of the present invention has application in various systems, including compounding or mixing systems, such as the drink dispenser 23 shown in FIG. 1. The dispenser has a selected number (three in the illustrated embodiment) of reservoirs 104 of drink flavorings, each of which is connected by a respective line 105 to the pump 11 of the present invention for dispensing to a container C. The internal construction of the pump 11 would be different than shown in FIGS. 4 and 5, requiring fewer pump cells, but having the same general components. The pump 11 is configured so that the flavorings can be intermixed in the pump (such as in a header pump cell) prior to discharge from the pump. The pump 109 shown diagrammatically in FIG. 1 would also have the pressure source and vacuum source, such as is shown at 65 and 71 in FIG. 2, for full operation. A discharge line 106 is connected to the pump outlet and also to a mixing chamber 107 which receives a base liquid (e.g., carbonated water) from a base liquid reservoir 108. As shown, the base liquid reservoir has its own pump 109 for feeding the base liquid to the mixing chamber 107. The pump 109 may have a similar or substantially different construction than the pump 11 of the present invention.

Notably, it is possible to keep the pump 11 clean with a minimum of labor. The line connections from the flavoring reservoirs 104 can be disconnected and the pump shell 33 can be opened to expose the liner 13. The liner can be simply removed and replaced with a fresh liner. Preferably the discharge line 106 is formed as part of the liner 13 so that it is simultaneously replaced. As can be seen, it is not necessary to use any detergents or other cleaning chemicals or implements. No flushing of the pump 11 is required. It will be understood that the drink dispenser 23 is but one application in which a pump of the present invention is useful. The pump is envisioned as being useful in any application in which it will be necessary to frequently clean the pump, or in which small, relatively precise quantities are to be metered by the pump.

Referring to FIG. 10, a pump (broadly, “flow control”) of a third embodiment of the invention is shown schematically and indicated generally at 300. The pump 300 includes a shell 302 (only the lower half of which is shown in FIG. 10) adapted for dispensing multiple fluent materials in metered volumes to provide pre-determined quantities of each fluent material. The shell 302 comprises three receptacles 304 having different volumes for receiving three corresponding pump cells 306 of a flexible bag 308. The pump cells 306 are connected to respective reservoirs 310 external to the pump shell 302 containing a liquid (or other fluent material). Each receptacle 304 is free of fluid communication with the other receptacles. Consequently, there is no mixing between the fluent materials within the shell 302. The shell 302 has three outlets 312 for delivering the metered quantities of each fluent material, each quantity corresponding to the size of the respective pump cell 306. Pinch valves 314 are disposed for pinching engagement with the flexible bag 308 to block flow into or out of each of the pump cells 306. A pump having a different number of receptacles and pump cells, or having uniformly sized pump cells for providing equal quantities of each fluent material, does not depart from the scope of this invention. The shell 302 (and shells of other embodiments according to this invention) may be placed at any orientation, including horizontal or vertical. Because pressure is the actuating mechanism for moving fluent material, force due to gravity is not required and the shell 302 is not required to be positioned at an elevation lower than reservoirs 310 of fluent material, as with other systems which rely on gravity.

A fourth embodiment of the invention (FIG. 11) provides a flow control, indicated generally at 330, which permits mixing of multiple fluent materials, each in a generally fixed quantity. A shell 332 of the fourth embodiment includes a mixing cell 334 in a mixing receptacle 336 which receives as inflow fluent materials from the other pump cells 338 and delivers as outflow mixed material to a common outlet 340 from the shell. First, second, and third outlets 342 on the respective receptacles 344 are provided for communication with the mixing receptacle 336. Mixing is facilitated by natural diffusion and flow turbulence in the mixing cell 334 and may be enhanced by cyclical application of pressure and vacuum thereto. In other words, the mixing cell 334 may be pulsed to ensure complete mixing. The pump cells 338 are connected to respective external reservoirs 346 of liquid.

A fifth embodiment of the invention (FIG. 12) includes a pump, indicated generally at 360, adapted for improved flexibility by mixing variable quantities of multiple fluent materials. The pump includes a shell 362 having a receptacle 364 for a manifold cell 366, receptacles 368 for four pump cells 370 of varying sized volumes, and a mixing cell 372. With this arrangement, multiple fluent materials may be pre-mixed in the manifold cell 366 (within the manifold receptacle 364) into a first admixture and delivered to one or more of the pump cells 370 which has a desired volume. Similarly, other admixtures may be prepared from other combinations of fluent materials and deposited into a pump cell 370 of selected volume. Alternatively, a single, unmixed fluent material may be delivered into one or more
of the pump cells 370. After filling one or more of the pump cells 370 with metered quantities, the contents of the pump cells are subsequently delivered to the mixing cell 372 for mixing and then to an outlet 374 of the shell. The pump 360 produces an accurately proportioned mixture of the desired composition with flexibility in choice of components and quantities.

[0057] A pump of a sixth embodiment (FIG. 13), indicated generally at 380, includes a shell 381 having a large reservoir receptacle 382 and six smaller metering receptacles 384 which receive a corresponding reservoir cell 386 and metering cells 388 of a flexible bag 390. Each of the metering cells 388 has an outlet 392 for discharging liquid from the pump. Different selected quantities of liquid from the reservoir cell 386 can be discharged by use of different combinations of metering cells 388 in respective metering receptacles 384 to draw liquid from the reservoir cell and discharge the liquid. Air pressure is also preferably applied to the reservoir cell 386 in the reservoir receptacle 382 to facilitate flow to the metering cells 388. In this embodiment, the flexible bag 390 is pre-filled with liquid and sealed for subsequent use in the pump. Various seals can be broken upon placement in the pump shell 381 for use of the flexible bag 390. The metering cells 388 have generally uniform volumes, but could have varying volumes without departing from the scope of this invention.

[0058] A system of a seventh embodiment, indicated generally at 400 in FIG. 14, provides mixing of multiple liquids. Six reservoirs 402 of liquids are connected in communication with six corresponding pump cells 404 disposed in respective pump cell receptacles 406 in a pump shell 408. Each pump cell 404 may be actuated by the pump to deliver a metered volume of material to a central passage 410, comprising a mixing pump cell. A reservoir 412 of flushing material (e.g., pure water) is connected to cleanse the mixing cell 410 between uses to inhibit carryover contamination and eliminate residue. The shell 408 (and the flexible bag 414) includes two outlets 416, one of which may be dedicated for use in a flushing procedure using the flushing material from the reservoir 412. Containers 418 shown adjacent each outlet 416 are illustrative only. For instance, one of the outlets 416 could discharge to a drain.

[0059] One application of the pump and pump cell of the present invention is illustrated by a first merchandiser 430 (FIGS. 15 and 16) for selectively dispensing fluent material and vending food or beverage products. The merchandiser 430 includes a cabinet 432 having a front face 434 and an interior compartment 436 containing one or more reservoirs 438 of fluent material and a pump 440 having a shell 442 with receptacles 444 receiving a flexible bag 446 including metering cells 448. It is to be understood that "cabinet" also encompasses built in, as opposed to stand alone merchandisers. The pump is shown in FIG. 16 with one half of its shell 442 removed to reveal internal construction. The front face 434 is part of a door hingedly mounted on the remainder of the cabinet 432. In this embodiment each flexible bag 446 includes a larger reservoir portion and a smaller metering cell 448 connected by a conduit section 450. The bag 446 is hung such as by a peg 452 in the cabinet above the pump 440 to facilitate gravity flow of liquid into the pump. The pump 440 is mounted in the cabinet 432 and receives the metering cell 448 of each flexible bag 446 and deforms each metering cell to produce flow of fluent material out of the bag. There is no contact of the fluent material by the pump, producing a reduced likelihood of contamination such that components of the invention may be made of a greater variety of materials (e.g., not restricted to stainless steel). Each receptacle 444 is connected to the fluid pressure control source (e.g., schematically illustrated at 65 and 71 in FIG. 2) to selectively expand or collapse the corresponding pump cell 448.

[0060] A selector, indicated generally at 454, is associated with the cabinet 432 for actuation by a person to initiate operation of the pump 440 to dispense fluent material. Preferably, the selector 454 is located on the front face 434 of the cabinet, is coin operated, and includes selection indicators 456 (FIG. 15) as conventionally known in the vending machine industry. In this sense, the term "coin" refers to money of all forms including metallic coinage and paper currency. It is envisioned that standard vending machine selection and control devices may be employed. A conventional money receptacle 458, coin return 460, and cup holding shelf 462 are precluded in the cabinet 452. The first merchandiser 430 may be constructed to simultaneously dispense fluent material to several articles.

[0061] A second merchandiser 480 is shown in FIG. 17 which includes point of sale mixing of fluent materials. The merchandiser 480 has a pump 481 which receives a flexible bag 482 having a mixing cell 484, metering cells 486, and other cells comprising reservoir cells 488. Each cell may be actuated by pressure and functions as a pump cell. One reservoir cell 490 has a volume larger than all of the remaining reservoir cells 488. Typically, the larger cell 490 holds a base fluent material (e.g., carbonated water) and the remaining reservoir cells 488 hold at least two different fluent additives adapted for mixing with the base fluent material (e.g., cola syrup, orange flavoring, etc.). The reservoir cells 488 have inlets 492 and outlets 494 formed therein for receiving fluent material from without the flexible bag to replenish fluent material without replacing the bag. In this embodiment, all beverage components are preferably pre-packaged in a single flexible bag 482 as shown in FIG. 17A. The merchandiser 480 facilitates dispensing material exclusively from one reservoir cell 488, or alternatively facilitates mixing of beverage components from two or more cells to produce a desired mixture. A system with multiple flexible bags, in lieu of a single flexible bag combining all the cells, does not depart from the scope of the invention.

[0062] A mount 494, such as a peg, is provided to removably mount at least one flexible bag 482 of fluent material in the interior compartment. The flexible bag 482 includes a hanger 496 for hanging the bag. The provision of the bag ensures that the merchandiser 480 is easily supplied with fluent material. The bag 482 may be readily removed, is disposable, easily replaced, and avoids the need for cleaning the merchandiser. The entire delivery path for the fluent material is replaced, from the reservoirs 488 and inlets 492 to outlets 498, by bag replacement. When the material forming the bag 482 is transparent or partially transparent, visual inspection of a material upper surface 500 is possible for detecting low quantity and the need for refilling or replacement.

[0063] The mixing cell 484 is adapted for fluid communication with other of the cells for receiving fluent material therefrom for use in mixing the fluent material from the
other cells. The mixing cell 484 is formed with a first inlet 502 from each of the reservoir cells 488 and a second inlet 504 adapted to open to exterior of the bag 482 for receiving fluent material from without the flexible bag. The second inlet 504 is attached to a passage 506 for providing flushing material (e.g., water) to rinse and cleanse the mixing cell 484 between uses to inhibit carryover contamination or eliminate residue. The mixing cell 484 has first and second outlets 498 for use in discharging mixed fluent material from the mixing cell. The metering cells 486 receive fluent material from the reservoir cells 488 and deliver metered volumes to the mixing cell 484. Each metering cell 486 has a volume which is less than the volume of a corresponding reservoir cell 488. Another metering cell (not shown) can be positioned between the larger cell 490 and the mixing cell 484 to deliver metered volumes to the mixing cell. Mixing within the mixing cell 484 occurs by natural diffusion and fluid turbulence. Improved mixing is facilitated, if desired, by pulsing the mixing cell through cyclic application of pressure and vacuum. That varies the geometry of the mixing cell 484 and causes motion of the fluent contents to facilitate mixing.

[0064] The flexible bag 482 (FIG. 17A) is pre-filled with beverage components prior to mounting in the merchandiser 480. The bag 482 is manufactured by joining first and second sheets 13A, 13B (FIGS. 2 and 6) of limp material in a generally opposed, face-to-face relation. The sheets 13A, 13B are secured together by a suitable method such as by heat-sealing, welding, adhesive, or fasteners. The sheets are joined so as to form the pump cells 484, 486, 488, 490 as defined by regions in which the first and second sheets are unconnected and which are circumscribed by sealed regions. Each cell is suitable for holding a fluid. Beverage additives are deposited in the reservoir cells 488, and the larger reservoir cell 490 is filled with a base beverage liquid.

[0065] A block diagram of a control system 510 of the merchandiser is shown in FIG. 18. The selector 454 is connected to a control 514 which is responsive to the selection indicators 456 to select from at least two different operation modes of the pump to dispense a beverage. The control 514 is pre-programmed with quantities of beverage components and/or pump metering instructions for various selections from the selection indicators. The selection indicators 456 are capable of selecting modes of operation of the pump to dispense fluent material. Typically the control system 510 (FIG. 18) determines the favored operation mode, based upon a selection made by the person relating to a composition or quantity of material requested. The modes of operation differ in at least one of the following ways: the amount(s) of beverage component dispensed and the pump cell or pump cells 484, 486, 488, 490 from which components are discharged. For example, in at least one of the modes of operation of the FIG. 17 merchandiser, the pump 481 discharges beverage components from at least two pump cells 484, 486, 488, 490 at the same time. In another, the pump 481 discharges beverage component from one of the pump cells (e.g., the large reservoir cell 490) in all modes of operation of the pump. The controller 514 is responsive to the selector 454 to operate the appropriate fluid pressure control source 65, 71 and pump so that when a flexible bag 482 is received by the pump 481, beverage components are discharged from reservoir pump cells 488 into the mixing pump cell 484 received in the mixing receptacle. The mixing cell 484 is acted upon by the fluid pressure control source 65, 71 to mix beverage components. The control 514 is adapted to operate the pump 481 to discharge a mixed beverage from the mixing cell 484.

[0066] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

[0067] When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles “a”, “an”, “the” and “said” are intended to mean that there is one or more of the elements. The terms “comprising”, “including” and “having” are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0068] As various changes could be made in the above without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A merchandiser for selectively dispensing fluent material, the merchandiser comprising:
   a mount for supporting a flexible bag;
   a flow control adapted to receive at least a majority of the flexible bag therein and to deform the bag to produce flow of fluent material without contact of the fluent material by the flow control, the flow control including a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag, the receptacles each being connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the cell for use in dispensing fluent material; and
   a selector for actuation by a person to initiate operation of the flow control to dispense fluent material.

2. A merchandiser as set forth in claim 1 wherein the selector is coin operated.

3. A merchandiser as set forth in claim 2 wherein the selector includes selection indicators adapted for manipulation by the person to select from at least two different operation modes of the flow control to dispense fluent material.

4. A merchandiser as set forth in claim 3 wherein the selection indicators are capable of selecting modes of operation of the flow control which differ in at least one of the following ways: the amount of fluent material dispensed and the pump cell or pump cells from which fluent material is discharged.

5. A merchandiser as set forth in claim 4 wherein in at least one of the modes of operation the flow control is adapted to discharge fluent material from at least two pump cells of the flexible bag at the same time.

6. A merchandiser as set forth in claim 5 wherein the flow control is constructed and arranged to direct fluent material discharged therefrom to mix the fluent material.

7. A merchandiser as set forth in claim 1 wherein the shell has at least three receptacles formed therein including a mixing receptacle, at least two of the other receptacles being adapted for communication with the mixing receptacle.
8. A merchandiser as set forth in claim 7 further comprising a controller responsive to the selector to operate the flow control so that when a flexible bag is received by the flow control, fluent material is discharged from pump cells received in said at least two other receptacles into a pump cell received in the mixing receptacle, and the pump cell in the mixing receptacle is acted upon by the fluid pressure control source to mix fluent material in the pump cell in the mixing receptacle.

9. A merchandiser as set forth in claim 8 wherein the controller is adapted to operate the flow control to discharge mixed fluent material from the pump cell received in the mixing receptacle.

10. A merchandiser as set forth in claim 7 wherein the shell has a manifold receptacle formed therein adapted for communication with each of said at least two other receptacles.

11. A merchandiser as set forth in claim 7 further comprising first and second outlets, and wherein the mixing receptacle is adapted for communication with the first and second outlets.

12. A merchandiser as set forth in claim 7 wherein at least some of said at least two other receptacles have different volumes.

13. A merchandiser as set forth in claim 1 wherein each receptacle is free of communication with the other receptacles.

14. A merchandiser as set forth in claim 1 wherein the flow control comprises pincher valves disposed for pinching engagement with the flexible bag when the flexible bag is received in the shell to block flow into or out of one or more of the pump cells.

15. A merchandiser as set forth in claim 1 in combination with the flexible bag.

16. A merchandiser as set forth in claim 1 further comprising a cabinet defining an interior compartment, the mount being located in the interior compartment of the cabinet.

17. A beverage dispenser for selectively dispensing a mixed beverage, the beverage dispenser comprising:

- a mount adapted to support a flexible bag;
- a flow control adapted to receive a majority of the flexible bag therein and to deform the bag to produce flow of beverage admixtures in the flexible bag without contact of the beverage admixtures by the flow control, the flow control including a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag, the receptacles including a mixing receptacle adapted for communication with other of the receptacles for receiving beverage admixtures into the mixing receptacle when the flexible bag is received in the shell, the receptacles each being connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the pump cell for use in mixing and dispensing a beverage admixture; and

- a selector for actuation by a customer to initiate operation of the flow control to mix beverage admixtures and to dispense a mixed beverage.

18. A beverage dispenser as set forth in claim 17 in combination with the flexible bag, wherein at least one of the beverage admixtures comprises a base liquid and at least two other beverage admixtures comprise flavorings.

19. A pre-filled flexible bag for use in dispensing a beverage, the pre-filled flexible bag comprising:

- first and second sheets of flexible material in generally opposed relation with each other;
- cells defined by regions in which the first and second sheets are unconnected and which are substantially circumscribed by portions of the bag in which the first and second sheets are sealingly joined together, the cells each having an outlet;
- beverage liquid disposed in at least a plural number of cells for discharging from the cells through one or more of the outlets upon deformation of the flexible bag.

20. A pre-filled flexible bag as set forth in claim 19 wherein one of the cells comprises a mixing cell, the mixing cell being free of beverage liquid, the mixing cell being adapted for fluid communication with other of the cells for receiving beverage liquid therefrom for use in mixing the beverage liquid from said other cells.

21. A pre-filled flexible bag as set forth in claim 20 wherein the mixing cell is formed with a first inlet for each of said other cells to establish fluid communication with the mixing cell and a second inlet adapted to open to exterior of the bag for receiving fluent material from without the flexible bag.

22. A pre-filled flexible bag as set forth in claim 21 wherein the mixing cell comprises a first outlet and a second outlet for use in discharging mixed beverage from the mixing cell.

23. A pre-filled flexible bag as set forth in claim 20 wherein the cells include a metering cell for each of said other cells adapted for fluid communication with the mixing cell, the metering cells each being adapted for fluid communication with one of said other cells and the mixing cell.

24. A pre-filled flexible bag as set forth in claim 23 wherein each metering cell has a volume which is less than the volume of said one of said other cells.

25. A pre-filled flexible bag as set forth in claim 20 wherein one of said other cells has a volume larger than any of the remaining other cells.

26. A pre-filled flexible bag as set forth in claim 25 wherein the beverage liquid in said larger volume other cell comprises a base beverage liquid and the beverage liquid in the remaining other cells comprises beverage additives, at least one of the beverage additives being adapted for mixing with the base beverage liquid.

27. A pre-filled flexible bag as set forth in claim 19 wherein said plural cells hold at least two different fluent materials.

28. A pre-filled flexible bag as set forth in claim 27 wherein said plural cells have inlets formed therein for fluid communication from without the flexible bag to replenish beverage liquid in said plural cells.

29. A pre-filled flexible bag as set forth in claim 19 further comprising a hanger for hanging the flexible bag.

30. A flow control for selectively dispensing fluent material, the flow control comprising:

- a shell adapted to receive the flexible bag and having at least three receptacles formed therein including a mixing receptacle, at least two of the other receptacles being adapted for communication with the mixing
receptacle, the receptacles being adapted for receiving respective pump cells formed in the flexible bag; 

a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to at least some of the receptacles to selectively expand and collapse the pump cell for use in dispensing fluent material; and

a controller for operating the fluid pressure control when a flexible bag is received in the shell to deliver fluent material to the mixing receptacle from said at least two other receptacles, to act on the fluent material in the mixing receptacle to mix the fluent material, and to discharge the mixed fluent material from the mixing receptacle.

31. A flow control as set forth in claim 30 wherein the shell further comprises a manifold receptacle adapted for communication with each of said at least two other receptacles.

32. A flow control as set forth in claim 30 wherein the shell further comprises first and second outlets, and the mixing receptacle is adapted for communication with the first and second outlets.

33. A flow control as set forth in claim 30 wherein at least some of said at least two other receptacles have different volumes.

34. A flow control as set forth in claim 30 wherein the flow control further comprises pincher valves disposed for pinching engagement with the flexible bag when the flexible bag is received in the shell to block flow into or out of one or more of the pump cells.

35. A method of manufacturing a flexible bag pre-filled with fluent material comprising the steps of:

positioning a first sheet and a second sheet of limp material in generally opposed relation;

joining the first and second sheets together to define distinct cells having an inlet opening;

filling one of the cells with a first beverage liquid;

filling another of the cells with a second beverage liquid; and

sealing the inlets of the cells.

36. A method of dispensing mixed fluent material comprising the steps of:

providing a flexible bag having cells formed therein, at least some of the cells containing a fluent material therein;

deforming the flexible bag to discharge fluent material from at least two of the cells into a mixing cell in the flexible bag;

deforming the flexible bag at the mixing cell to mix fluent material in the mixing cell; and

dispensing mixed fluent material from the mixing cell.

37. A method as set forth in claim 36 further comprising a step of flushing the mixing cell.

38. A method of servicing a point of sale merchandiser capable of delivering fluent material to an article upon demand by a customer, the method comprising the steps of:

accessing a location in which at least one bag of flexible material is located;

removing the flexible bag from the location;

replacing the flexible bag with another flexible bag containing fluent material to be dispensed.

39. A method as set forth in claim 38 wherein said step of removing the flexible bag includes removing the entire flow path of fluent material in the merchandiser, and said step of replacing the flexible bag includes providing a new flow path of fluent material in the merchandiser.

40. A merchandiser for selectively dispensing fluent material, the merchandiser comprising:

a mount for supporting a flexible bag;

a flow control adapted to receive at least a majority of the flexible bag wherein and to deform the bag to produce flow of fluent material without contact of the fluent material by the flow control, the flow control including a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag, the receptacles each being connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the cell for use in dispensing fluent material, the flow control being constructed and arranged to direct fluent material discharged therefrom to mix the fluent material.

41. A merchandiser for selectively dispensing fluent material, the merchandiser comprising:

a mount for supporting a flexible bag;

a flow control adapted to receive at least a majority of the flexible bag therein and to deform the bag to produce flow of fluent material without contact of the fluent material by the flow control, the flow control including a shell adapted to receive the flexible bag and having receptacles formed therein adapted for receiving respective pump cells formed in the flexible bag, the receptacles each being connected to a fluid pressure control source for selectively applying at least one of a vacuum pressure and a positive pressure to the receptacle to selectively expand and collapse the cell for use in dispensing fluent material, the flow control being constructed and arranged for mixing the fluent material prior to discharge from the flow control.