

[54] MIXING PUMP ASSEMBLY

[75] Inventors: Richard Martin Keyes, Rockford;
Bertel Swan Nelson, Naperville,
both of Ill.

[73] Assignee: Beatrice Foods Company, Chicago,
Ill.

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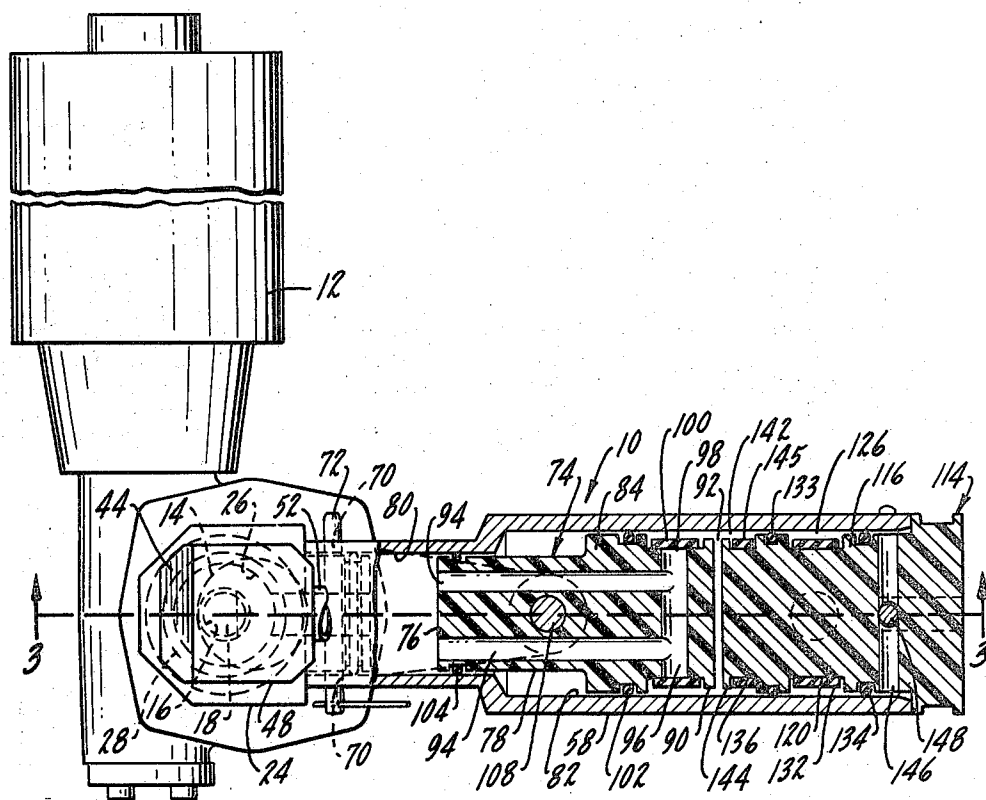
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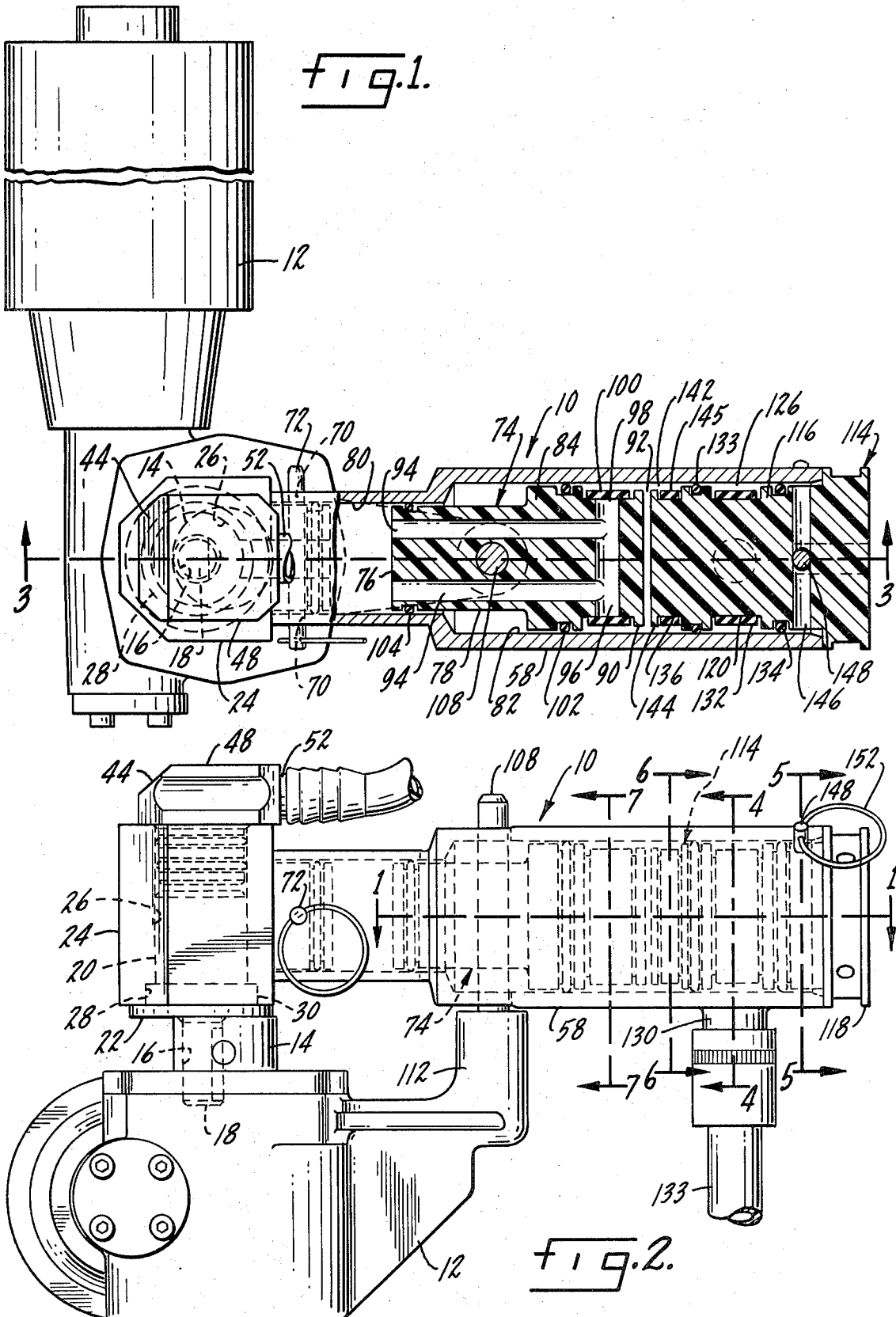
Primary Examiner—William L. Freeh
Attorney, Agent, or Firm—James M. Wetzel

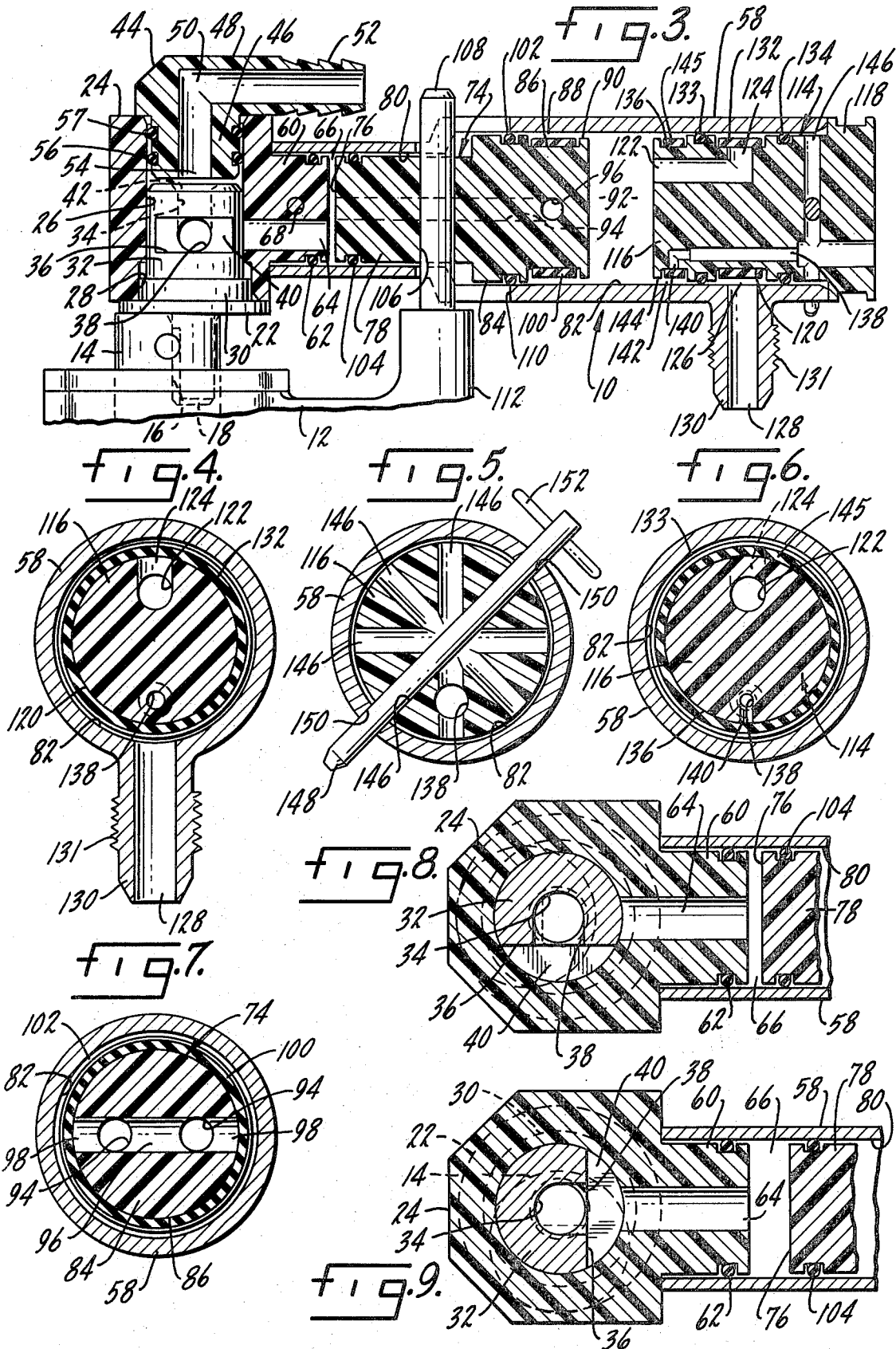
[57] ABSTRACT

A double-acting proportioning pump having a receiving chamber and a mixing chamber for accurately mixing and delivering two fluids such as a liquid and air in a system. The double-acting pump includes a single stationary piston and reciprocating cylinder whereby the fluids are conveyed and mixed by the alternate expansion and contraction of each pump chamber, with one of the fluids passing from the receiving chamber to the mixing chamber through the single piston element. The pump is cylindrical with end cap members at each end thereof; the piston is disposed between the end caps and the two pump chambers are each defined by an end cap member and one radial end face of the piston. Cyclical valve means alternately open and close the passage through which one of the fluids communicates with the receiving chamber. Adjustable air inlet means vary the quantity of air admitted to the mixing chamber, thereby varying the ratio of mixed ingredients in the final product.

8 Claims, 9 Drawing Figures







MIXING PUMP ASSEMBLY

This invention relates to proportioning devices, and more particularly to a new and improved proportioning pump for accurately controlling, and varying, the relative mixture of two fluids moving in a system.

The rapid dispensing of semifrozen confection food products of consumable quality requires that the proportioning equipment producing such foods mix the constituent ingredients accurately and uniformly in proper ratios. For example, some semifrozen confection food products are produced by mixing a prepared, storable liquid with a measured quantity of air. Such products are commonly known as "soft ice cream" or the like and are produced with combined proportioning and freezing apparatus. Present semifrozen confection food machinery utilizes a plurality of individual pumping, proportioning, and delivery elements, increasing the potential margin of error at arriving at a proper mixture as well as expanding size and cost.

Present semifrozen confection food apparatus does not provide a proportioning pump means allowing the constituent ingredients to be proportionately blended in a positive displacement manner whereby the final mixture is fed to a freezing chamber or the like while being maintained under constant pressure. In addition, present machinery fails to provide means whereby the ratio of the constituent fluids, such as confection solution and air, may be varied by changing the flow rate of one of the fluids in the system.

Prior dispensing apparatus for semi-frozen confection foods have used gear type pumps to mix the confection material with air. However, gear pumps have not afforded the degree of efficiency and added advantages provided by the present invention. Gear pumps have a high wear factor, requiring frequent replacement. The tolerance or small clearance between the gears in a gear pump prevents in-place cleaning, requiring that the pump be disassembled for maintenance. The operator of the present piston-cylinder pump is not affected by the viscosity of the fluid, whereas the efficiency of a gear pump decreases with increase in viscosity.

Semifrozen confection food dispensers require thorough cleaning after each day's service. The pump units in such dispensers must be disassembled, hand washed, and then reassembled in the apparatus. Also, the several pump elements in present proportioning devices comprise numerous recesses and joints where bacteria have a tendency to accumulate.

In view of the foregoing, it is a general object of the present invention to provide a single, reciprocal pump and proportioning device which accurately and rapidly meters and delivers a proper mixture of two fluids in a system.

A further object of the present invention is to provide a proportioning pump for delivering a mixture of fluids while constantly maintaining the mixture under pressure.

Still another object of the present invention is to provide a proportioning pump which can be cleaned in place without being disassembled or removed from the apparatus in which it is installed.

An additional object of the present invention is to provide a proportioning pump which is compatible with the production of food products. The fluid conveying passages of the pump are designed to avoid the accu-

mulation of bacteria and allow smooth fluid flow there-through.

A further object of the present invention is to provide a single unit, double-acting cylinder-piston type proportioning pump for accurately metering two fluids in a system, whereby the pump supplies, mixes, and delivers the fluids with a reciprocal stroke of the cylinder-piston unit.

An additional object of the present invention is to provide control means for a proportioning pump which cyclically permits and interrupts the supply of one fluid to a receiving chamber in the pump.

Still another object of the present invention is to provide a proportioning pump including single drive means which simultaneously functions to operate a cyclical fluid inlet valve and reciprocate the pump unit.

An additional object of the present invention is to provide means in a proportioning pump for varying the input flow of one of the fluids to be mixed, thereby permitting the pump unit to supply a plurality of mixture ratios.

Still another object of the present invention is to provide means for transferring fluid from one chamber of a double-acting pump to a second chamber without the use of unnecessary external conduit means.

These and other objects and features of this invention will be better understood by reference to the following detailed description of one embodiment thereof, selected for purposes of illustration and shown in the accompanying drawing; in which:

FIG. 1 is a top view of the proportioning pump of the present invention, showing the drive motor housing and a top cut-away section of the pump elements taken along the line 1—1 in FIG. 2;

FIG. 2 is an elevation view of the proportioning pump;

FIG. 3 is a side section view of the proportioning pump of the present invention taken along lines 3—3 in FIG. 1;

FIGS. 4—7 are vertical section views of several portions of the present invention, taken along lines 4—4, 5—5, 6—6 and 7—7 in FIG. 2;

FIG. 8 is a detail section of the fluid inlet valve forming a part of the present invention, showing the valve in a closed position; and

FIG. 9 is a detail section view of the fluid inlet valve illustrated in FIG. 8, showing the valve in an open position.

Referring to FIGS. 1, 2 and 3, the proportioning pump 10 of the present invention is attached to a housing 12 for a drive motor, which housing is rigidly secured to the apparatus in which the pump 10 is functioning. The drive motor in housing 12 rotatably drives a coupling shaft 14, which comprises an axially extending slotted portion 16 therein which is radially offset with respect to the central axis of coupling member 14. During rotation of shaft 14 by the drive motor, slotted portion 16 revolves through a circular trace around the central axis of shaft 14. Extending into slot 16 is shaft 18 which is secured to valve member 20. Slot 16 comprises a flat face along one side thereof which mates with a corresponding flat surface on shaft 18, whereby rotation of coupling member 14 causes shaft 18 to rotate therewith while simultaneously revolving through the aforesaid trace.

Valve member 20 includes a wide flange portion 22 which abuts inlet block member 24 of pump 10 (FIG.

3). Valve 20 is rotatably disposed in a relatively large diameter port 26 which extends through block member 24. Port 26 comprises a recessed portion 28 for engaging and sealing flanged portion 30 of valve member 20. Valve member 20 includes a body portion 32 which comprises a hollow central chamber 34 and a cut-away chordal section 36 (FIGS. 8,9). Port 38 extends from chordal section 36 to chamber 34 and communicates with rotating cavity 40 formed by cut-away chordal section 36. Port 42 located at one axial end of body portion 32 communicates between chamber 34 and port 26, for purposes to be explained.

Located at the opposite end of port 26 is fluid inlet fitting 44 comprising a plug member 46 disposed at right angles to portion 48 of fitting 44. Inlet passage 50 extends through fitting 44 and terminates at one end with ribbed stem fitting 52 providing attachment to a flexible hose or conduit or the like extending from a source of fluid, such as liquid confection food solution. As best seen in FIG. 3, outlet port 54 of inlet passage 50 is directly adjacent port 42 of valve 20, permitting fluid in passage 50 to flow through ports 54 and 42 into port 38 and rotating cavity 40. A seal, such as O-ring 56 or the like, is located between fluid inlet fitting 44 and block member 24 to form a fluid-tight chamber internally of port 26. O-ring 57 extends around plug 46 and snaps into a shallow groove in block member 24 where it acts as a keeper member to secure plug member 46 from axial movement relative to block member 24.

Other suitable valve means may be employed to control the flow of fluid from passage 50. For example, a one-way, or check valve may be used, such as an elastic band valve.

Pump 10 includes a cylinder 58, one end of which receives circular end plug member 60 of fitting 24. O-ring member 62 encircles end plug 60 and forms a fluid tight seal between the end plug and cylinder 58. Fluid passage 64 extends through end plug member 60 and communicates with port 26 at one end and with a first or receiving chamber 66 internally of cylinder 58 at the other end. As best seen in FIG. 3, passage 64 is radially disposed away from the central axis of end plug 60. This is to prevent interference between passage 64 and smaller hole 68 extending diametrically through end plug 60. The ends of hole 68 are located adjacent holes 70 in cylinder 58 (FIG. 1), and a removable pin 72 is inserted through holes 70 and hole 68 for maintaining end plug member 60 and inlet block member 24 in a removably fixed position relative to cylinder 58. By removing pin 72, end plug member 60 and inlet block member 24 may be readily removed from cylinder 58.

A multi-diametered piston 74 is slidably disposed in cylinder 58, one face 76 of which forms a reciprocable wall for receiving chamber 66. Piston 74 includes a first smaller diametered portion 78 extending into smaller-diametered segment 80 of cylinder 58. As best seen in FIGS. 1 and 3, cylinder 58 has a second, larger diametered segment 82, into which a correspondingly larger diametered portion 84 of piston 74 extends. A recessed portion 86 of the larger diametered portion 84 of piston 74 forms a chamber 88 in cylinder 58. A flange 90, which is larger in diameter than recessed portion 86, but smaller in diameter than the main body of second portion 84 of piston 74, forms one end of piston 74 adjacent chamber 88 and permits fluid entering chamber 88 to pass into a second or mixing chamber 92 of cylin-

der 58, as will be explained.

Referring to FIG. 1, dual passages 94 extend from face 76 of piston 74 to a point where they intersect transverse passage 96, the latter having either end communicating with chamber 88 through ports 98. Passages 94 are radially disposed from the axial center line of piston 74 for purposes to be explained. An elastic band valve member 100 extends around recessed portion 86 and permits unidirectional passage of fluid through ports 98 into chamber 88 and second or mixing chamber 92, while preventing the flow of fluid from chamber 88 back through passage 96. O-ring 102 is disposed around the main body of the large diametered portion of piston 74 to form a fluid seal for chambers 88 and 92. An additional O-ring 104 is circumferentially disposed adjacent the end of smaller diametered portion 78 of piston 74 to insure, with O-ring 62, that receiving chamber 66 is fluid tight.

Transverse slot 106 extends diametrically through piston 74, and due to the offset disposition of dual passages 94 does not interfere with nor contact these passages. A fixed pin 108 extends through elongated slots 110 in cylinder 58, and passes through transverse slot 106 (FIG. 3), rendering piston 74 immobile in a lateral direction relative to pin 108. Pin 108 is rigidly fixed to an extensible portion 112 of the fixed housing 12 and is thereby held stationary relative to the device in which pump 10 is installed. It is readily apparent that pin 108 will hold piston 74 laterally stationary as cylinder 58 is permitted to reciprocate in a manner and for purposes to be described. Piston 74 is able, however, to rotate about pin 108, which is necessary due to the slight sideward movement of cylinder 58 occurring when pump 10 is operating.

Located in one end of larger diameter segment 82 of cylinder 58 is end plug 114 comprising a main body portion 116 and a cap portion 118, the latter abutting against the end of cylinder 58 to axially locate end plug 114 in cylinder 58. End plug 114 comprises a first recessed area 120 communicating with radially offset passage 122 through port 124 (FIG. 3). The opposite end of passage 122 communicates with second or mixing chamber 92. Recessed area 120 creates an exhaust chamber 126 in cylinder 58 from which exhaust passage 128 extends through connection means 130, the outside of the latter comprising suitable coupling means 131 for the attachment of a conduit 133 for the transmission of the fluid mixture from pump 10 (FIG. 2), to the freezing chamber of a semifrozen confection food dispenser, for example. An elastic band valve member 132 is circumferentially disposed around recessed area 120 and permits unidirectional flow of fluid from chamber 92 and passage 122 to exhaust chamber 126. O-rings 133 and 134 segregate exhaust chamber 126 from the remaining chambers of pump 10 and render the exhaust chamber fluid tight.

End plug 114 further comprises a second recessed area 136 communicating with radially offset fluid passage 138 through cap portion 118. Passage 138 opens to atmosphere for the purpose of admitting air into chamber 142 formed by recessed area 136 in cylinder 58. One wall of chamber 142 is formed by flange 144 which is of smaller diameter than the main body portion 116 of end plug 114, thus permitting air flowing through passage 138 to pass into second or mixing chamber 92 through port 140 and chamber 142. An elastic band valve member 145 permits unidirectional

flow of air from passage 138 to chambers 142 and 92. Chamber 92 is maintained fluid tight by O-rings 102 and 133.

A plurality of transverse holes 146 are circumferentially provided through end plug 114 adjacent cap member 118 (FIG. 6). Removable pin 148 extends through holes 150 in cylinder 58 for the purpose of maintaining end plug 114 stationary relative to cylinder 58. Pin 148 may be removed by means of ring 152 whereby end plug 114 is able to slide out of cylinder 58.

End plug 114 is also adjustable to a plurality of rotative positions for the purpose of varying the ratio of the ingredients mixed by the pump 10. With pin 148 removed, end plug 114 may be rotated until the ends of any one of holes 146 align with holes 150. Pin 148 is then reinserted to maintain end plug 114 fixed in its new rotative position. As the plug rotates, the position of passage 122 changes in a vertical sense relative to the axial centerline of circular mixing chamber 92.

The pump 10 operates as follows:

A power source suitably connected to the drive motor in housing 12 operates the drive motor which causes coupling shaft 14 to rotate at approximately 150 r.p.m.'s. Due to the offset location of slotted portion 16 in shaft 14, valve member 20 is rotated eccentrically, which drives inlet block member 24 in a circular path. Referring to FIG. 3, the horizontal component of the movement of inlet block member 24 is applied to cylinder 58 due to the juxtaposition of the cylinder and the inlet block member, thereby causing cylinder 58 to reciprocate back and forth relative to stationary housing 12. Due to the circular path traveled by block member 24, piston 74 swings in a small arc about pin 108.

As cylinder 58 reciprocates, piston 74 is held stationary by pin 108, which passes through elongated slots 110 of cylinder 58. Therefore, as cylinder 58 is moved to its right-most position as seen in FIG. 3 by the circular path movement of inlet block member 24, piston 74 will assume the position shown in FIG. 3 whereby first receiving chamber 66 is contracted and second mixing chamber 92 is expanded. As the cyclical, reciprocal motion of cylinder 58 continues, the cylinder moves to the left (FIG. 3) whereby the stationary piston 74 assumes the position shown in FIG. 1. In this latter position, chamber 66 has moved from a contracted condition to an expanded position, while chamber 92 has contracted.

The proportioning pump of the present invention is designed to mix a fluid, such as a liquid entering inlet passage 50, with air fed into chamber 92 through passage 138. The liquid entering passage 50 passes through portion 48 of inlet block member 44 and enters hollow central chamber 34 of the valve member 20 through port 54 (FIG. 3). As best seen in FIGS. 3, 8 and 9, the valve member 20 rotates in port 26 whereby rotating cavity 40 is cyclically in contact with fluid passage 64 (FIG. 9), and out of contact with fluid passage 64 (FIG. 8). Liquid from chamber 34 passes through port 38 into cavity 40 where it is transmitted to chamber 66 through passage 64 when the valve 20 is rotated to the position shown in FIG. 9 by coupling shaft 14. Valve member 20 is designed so that rotating cavity 40 communicates with passage 64 when chamber 66 is expanding. This occurs when cylinder 58 moves to the left as seen in FIG. 3, whereby the expansion of chamber 66 tends to create a vacuum in the chamber which forces fluid in passage 50 to be drawn through chamber

34, cavity 40 and passage 64 into receiving chamber 66.

Valve member 20 is designed and located such that inlet passage 50 communicates with passage 64 only when chamber 66 is expanding. In this regard, the direction of rotation of valve 20 is important. If rotated in the wrong direction, pump 10 will not operate correctly.

The amount of liquid conveyed to receiving chamber 66 is regulated by the expansion of chamber 66. Cut-away chordal section 36 of valve member 20 is disposed to cut off communication between passage 64 and inlet passage 50 when cylinder 58 moves to the right (FIG. 3) and chamber 66 begins to contract (FIG. 8). By this means, fluid in chamber 66 is not allowed to be forced back through valve member 20 and inlet passage 50 when receiving chamber 66 contracts.

As chamber 66 contracts, the liquid therein is forced through dual passages 94 in piston 74, through passage 96. Elastic band valve member 100 expands under the pressure of fluid in passage 96, permitting the flow of liquid through ports 98 to chamber 88. The liquid in chamber 88 passes around flange 90 of piston 74 and enters the second or mixing chamber 92. During this phase of operation, cylinder 58, as viewed in FIG. 3, is moving to the right whereby chamber 66 is being contracted simultaneously with the expansion of chamber 92. The suction force created in expanding chamber 92 assists in drawing the liquid from chamber 66 through passages 94 internally of piston 74, means are provided for conveying fluid from first receiving chamber 66 to second mixing chamber 92 without requiring external passages or conduits.

During the expansion of chamber 92, air is also being drawn in to the chamber through fluid passage 138, and enters chamber 142 through port 140. Elastic band valve member 145 is designed so that the difference between atmospheric pressure in passage 138 and the vacuum pressure created in chamber 92 during movement of cylinder 58 to the right creates a force whereby elastic valve member 145 opens port 140 as chamber 92 expands. Air in chamber 142 passes around flange 144 and enters chamber 92 where it mixes with the liquid entering through ports 98. By virtue of the difference in diameters of the cylinder segments 80 and 82, chamber 92 expands at a faster rate than chamber 66 contracts. Air is thereby drawn into chamber 92 as the flow of fluid from chamber 66 is insufficient to completely fill expanding chamber 92.

As the movement of cylinder 58 reaches top dead center in its rightward movement, the cylinder begins to move to the left as viewed in FIGS. 1 and 3. When this occurs, chamber 92 begins to contract, thereby raising the pressure in the chamber above atmospheric. This higher pressure is applied to the outer surfaces of elastic band valve members 100 and 145, preventing the flow of liquid-air mixture in chamber 92 back through passages 96 and 94, and through passage 138. However, as chamber 92 contracts, the liquid-air mixture passes into passage 122 and through port 124, at which time elastic band valve member 132 opens. The liquid-air mixture then passes into chamber 126 and exhaust passage 128.

By removing pin 148 and rotating cap portion 118 and end plug 114, the ration of air to liquid mixture in chamber 92 may be varied. With end plug 114 in the position shown in FIG. 3, fluid delivery passage 122

and port 124 leading therefrom are adjacent the upper portion of chamber 92. A mixture of air and liquid exists in chamber 92 as a result of the just completed expansion of chamber 92. In this mixture, the air tends to rise above the liquid. As cylinder 58 moves to the left, contracting chamber 92, the liquid in the bottom of chamber 92, being incompressible, rises and is carried from chamber 92 through passage 122. Air in chamber 92 above the liquid is also forced out of the chamber and into passage 122 and mixes with the liquid.

As cylinder 58 moves to the right after reaching top dead center, chamber 92 commences to expand. Since the air that was previously in chamber 92 has been exhausted through passage 122, a void is created in the expanding chamber, which void is satisfied by air supplied through passage 138 and port 140.

The air-liquid mixture delivered by pump 10 can be changed by rotating end plug 114 such that passage 122 is disposed adjacent the bottom portion of chamber 92. When cylinder 58 moves to the left and chamber 92 is contracting, the liquid portion of the mixture is forced out of passage 122, while the portion of the air located above the liquid and above passage 122 compresses in the chamber and does not escape. The mixture thus produced has a higher liquid-to-air ratio than that delivered when passage 122 is disposed adjacent the upper portion of chamber 92.

As chamber 92 expands during the next cycle of operation, the compressed air remaining in the chamber expands, thereby creating a lesser demand for additional air than described above. As a result of this decreased demand, less air is taken in through passage 138. The liquid-to-air ratio increases since the amount of air in the mixture is a function of the air entering through passage 138, rather than being a function of the air in chamber 92 when passage 122 is in its lowermost position.

As cylinder 58 completes its movement to the left (FIG. 3) under the influence of rotating inlet block member 24, chamber 92 becomes completely contracted, whereby all of the mixing fluid therein is exhausted through passage 122 and the exhaust means 128. Simultaneously with the contraction of chamber 92, chamber 66 has expanded and drawn therein liquid from inlet passage 50 and rotating cavity 40, as previously described. The cycle is continually repeated, and the pump of the present invention continues to produce a mixture of liquid and air under constant pressure and in desired proportions with a minimum amount of moving parts.

The proportioning pump 10 is able to be cleaned in place without disassembly or removal from the apparatus in which it is installed. The fluid passages through inlet block member 24, including inlet passage 50, and through piston 74 and each of end plugs 60 and 144 comprise a minimum number of abrupt joints and recesses, which virtually eliminates areas where bacteria can accumulate while assuring smooth fluid flow through pump 10. Further, by utilizing valve member 20 as part of the reciprocal drive means for cylinder 58, the number of operating parts is minimized, thereby reducing the quantity of parts and surfaces coming into contact with the food product flowing through the pump.

To clean the pump 10, a suitable cleaning solution is supplied to inlet passage 50 while coupling shaft 14 is

driving the pump, and the cleaning solution will be forced through the pump in the manner previously described relative to the passage of the first fluid through the pump. The cleaning solution cleans the inside walls and joints of the pump, and ultimately passes out through passage 128. A rinse may also be applied in a similar manner to purge the cleaning solution from the pump, whereby the device becomes ready to receive a fresh supply of confection solution.

From the foregoing description, those skilled in the art will appreciate that numerous modifications may be made in this invention without departing from the spirit thereof. It is not intended that the scope of this invention be limited to the specific embodiment illustrated and described. It is intended that the scope of this invention be limited by the appended claims and their equivalents.

We claim:

1. In a double acting proportioning pump, a cylinder having end caps disposed at each end of said cylinder, a piston having oppositely disposed radial faces located substantially centrally in said cylinder and reciprocally movable relative to said cylinder between said end caps;

first and second chambers in said cylinder disposed between said piston faces and said respective end caps;

means for expanding said first chamber and simultaneously contracting said second chamber including

means for alternatively contracting said first chamber and simultaneously expanding said second chamber and drive means operably connected to said cylinder for reciprocating said cylinder and means for maintaining said piston stationary relative to said cylinder;

means for communicating a first fluid with said first chamber when said first chamber is expanding and when said second chamber is simultaneously contracting including valve means operably connected to said drive means for cyclically admitting said first fluid to said first chamber and preventing said first fluid from exhausting from said first chamber; means for communicating a second fluid with said second chamber when said second chamber is expanding and when said first chamber is simultaneously contracting;

passage means for transmitting said first fluid from said first chamber to said second chamber when said first chamber contracts and when said second chamber simultaneously expands, whereby said first fluid mixes with said second fluid in said second chamber; and

means for exhausting said mixed fluid from said second chamber when said second chamber contracts and when said first chamber simultaneously expands.

2. In a double acting proportioning pump, a cylinder having end caps disposed at each end of said cylinder, a piston having oppositely disposed radial faces located substantially centrally in said cylinder and reciprocally moveable relative to said cylinder between said end caps;

first and second chambers in said cylinder disposed between said piston faces and said respective end caps;

means for expanding said first chamber and simultaneously contracting said second chamber including

means for alternatively contracting said first chamber and simultaneously expanding said second chamber;

means for communicating an incompressible liquid with said first chamber when said first chamber is expanding and when said second chamber is simultaneously contracting;

means for communicating a compressible gas with said second chamber when said second chamber is expanding and when said first chamber is simultaneously contracting;

passage means for transmitting said liquid from said first chamber to said second chamber when said first chamber contracts and when said second chamber simultaneously expands, whereby said liquid mixes with said gas in said second chamber; and

means for exhausting said mixed liquid and gas from said second chamber when said second chamber contracts and when said first chamber simultaneously expands comprising an exhaust passage in one of said end cap means and communicating with said second chamber, said exhaust passage being radially disposed from the central axis of said one end cap whereby the relative position of said exhaust passage and said second chamber determines the liquid-gas ratio of the exhausted mixture.

3. Fluid mixing pump means comprising:

a cylinder;

a piston disposed in said cylinder;

a first end plug disposed in one end of said cylinder;

a second end plug disposed in the other end of said cylinder;

a first chamber in said cylinder defined between said piston and said first end plug;

a second chamber in said cylinder defined between said piston and said second end plug;

means for reciprocally driving said cylinder to thereby cause said first chamber to contract and to simultaneously cause said second chamber to expand and to cause said first chamber to expand and to simultaneously cause said second chamber to contract;

a first valve associated with said first end plug and operative for supplying a first fluid to said first chamber as said cylinder and piston move causing said first chamber to expand and said second chamber to simultaneously contract;

a second valve associated with said second end plug and operative for supplying a second fluid to said second chamber as said cylinder and piston move causing said second chamber to expand and said first chamber to simultaneously contract;

a fluid conduit operative to transmit said first fluid from said first chamber to said second chamber;

a third valve associated with said fluid conduit and operative for transmitting said first fluid from said first chamber to said second chamber as said cylinder and piston move causing said first chamber to contract and said second chamber to simultaneously expand whereby said first and second fluids are mixed in said second chamber;

a fluid outlet in said cylinder; and

a fourth valve associated with said second end plug and operative for transmitting mixed first and second fluids from said second chamber to said fluid outlet as said cylinder and piston move causing said second chamber to contract and said first chamber to simultaneously expand.

4. The fluid mixing pump of claim 3 wherein the amount of said second fluid supplied to said second chamber is regulated by means for varying the pre-existing volume of said second fluid in said chamber.

5. The fluid mixing pump of claim 3 wherein said first fluid is an incompressible liquid and said second fluid is a compressible gas and where said fluid outlet includes a passage in said second end plug communicating with said second chamber and radially offset from the central axis of said second end plug, and means allowing rotation of said second end plug relative to said second chamber whereby, the amount of said second fluid entering said second chamber is regulated by the pre-existing amount of said second fluid within said chamber which is a function of the rotative position of said second end plug.

6. The fluid mixing pump of claim 5 wherein said first valve cyclically supplies said liquid to said first chamber as said cylinder and piston move causing said first chamber to expand and said second chamber to simultaneously contract, and shuts off said supply of said liquid to said first chamber as said cylinder and piston move causing said first chamber to contract and said chamber to simultaneously expand.

7. The fluid mixing pump of claim 6 including:

a first fluid inlet passage,

said first valve having inlet port means communicating with said first fluid inlet passage and an outlet port communicating with said first chamber, whereby said first valve moves from a first position connecting said first fluid inlet passage to said first chamber to a second position interrupting communication between said first fluid inlet passage and said first chamber.

8. The fluid mixing pump of claim 7 wherein:

said first valve is rotatably movable from said first position to said second position, and said means for reciprocally driving said piston and cylinder also rotates said first valve.

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