United States Patent [19]

Jaeger

[11] **3,830,405**

[45] **Aug. 20, 1974**

[54] **BEVERAGE DISPENSING APPARATUS FOR DISPENSING A PREDETERMINED QUANTITY OF FLUID**

[75] Inventor: **Wilbert J. Jaeger,** Orange, Calif.

[73] Assignee: **Lincoln-Hall Research Company,** Santa Ana, Calif.

[22] Filed: **Dec. 7, 1972**

[21] Appl. No.: **312,926**

Related U.S. Application Data

[63] Continuation of Ser. No. 38,800, May 19, 1970, abandoned.

[52] **U.S. Cl.** **222/129.3,** 222/144.5, 222/386

[51] **Int. Cl.** **B67d 5/56**

[58] **Field of Search** 222/129.4, 129, 129.1, 222/129.2, 129.3, 334, 386, 145, 144.5, 386.5, 309, 61; 239/305; 251/61.4, 63.6, 367, 33, 44

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Primary Examiner—Stanley H. Tollberg

Assistant Examiner—James M. Slattery

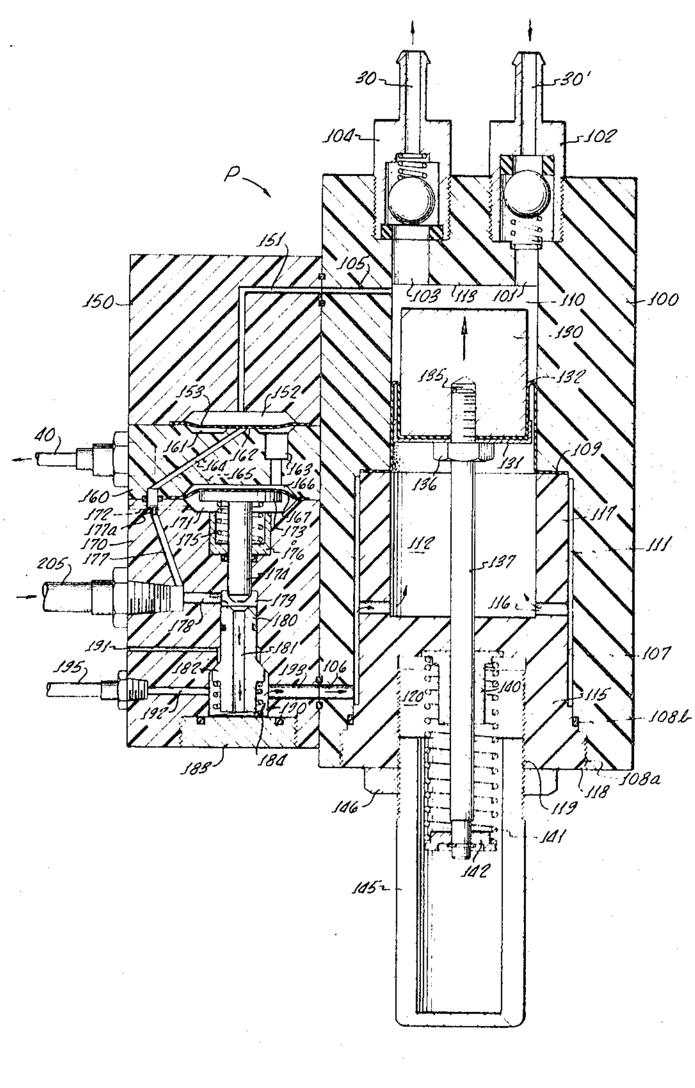
[57] **ABSTRACT**

An automated beverage dispensing system for dispensing liquor, soft drinks, or mixed drinks from a single dispensing nozzle assembly.

Liquor is drawn by vacuum from a vertically upright bottle having a tube inserted therein in loose fitting relationship so that atmospheric air pressure may be received within the bottle. Liquor is dispensed by a displacement pump having a liquid metering chamber whose volume may be adjusted. The displacement pump includes a reciprocating piston, and a gas expansion chamber at the rear of the piston to which pressurized gas is supplied for driving the piston forward.

The dispensing stroke of the liquor dispensing pump is initiated manually but is timed automatically. A push-button on the nozzle assembly is depressed for initiating the supply of energy to the dispensing pump, and the forward movement of the piston then generates liquid pressure which is detected in a control loop through a pressure-sensitive device and utilized for continuing the energization of the pump. When the piston strikes the forward end wall of the pump the operation of the control loop is interrupted.

10 Claims, 15 Drawing Figures



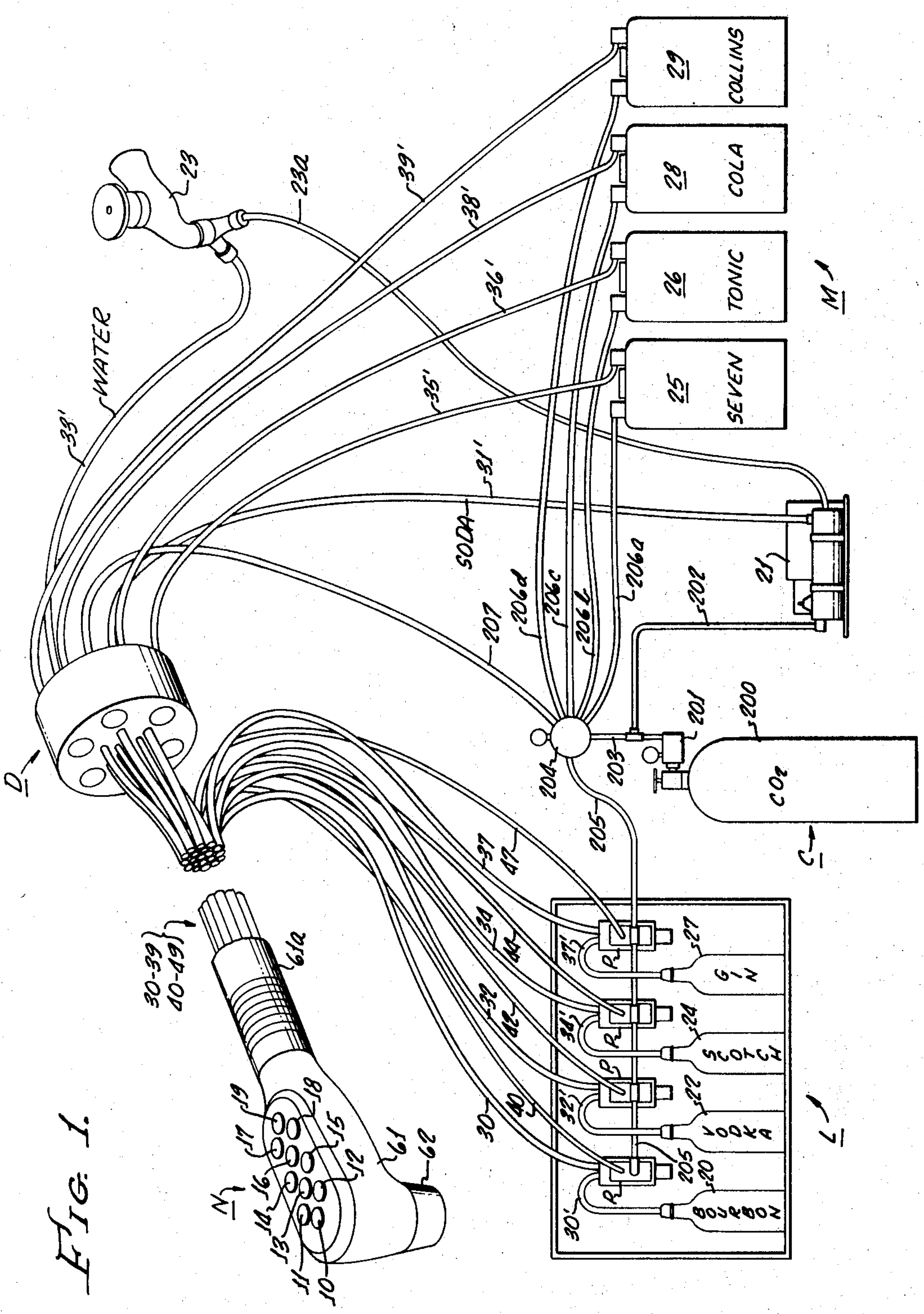


FIG. 1.

INVENTOR.
WILBERT J. JAEGER
BY Beehler & Arant
ATTORNEYS.

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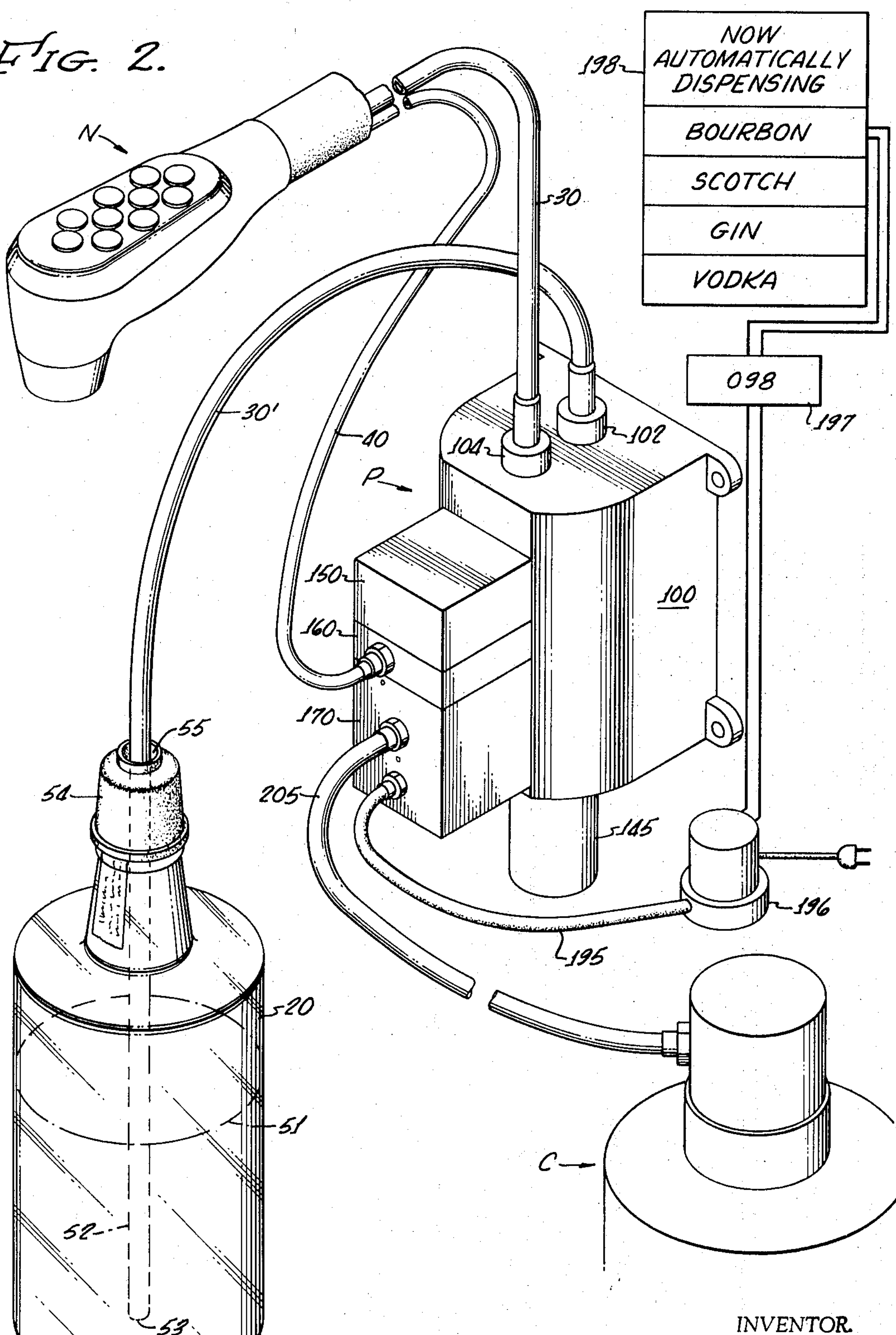
FIG. 2.



INVENTOR.
WILBERT J. JAEGER

BY Beehler & Arant

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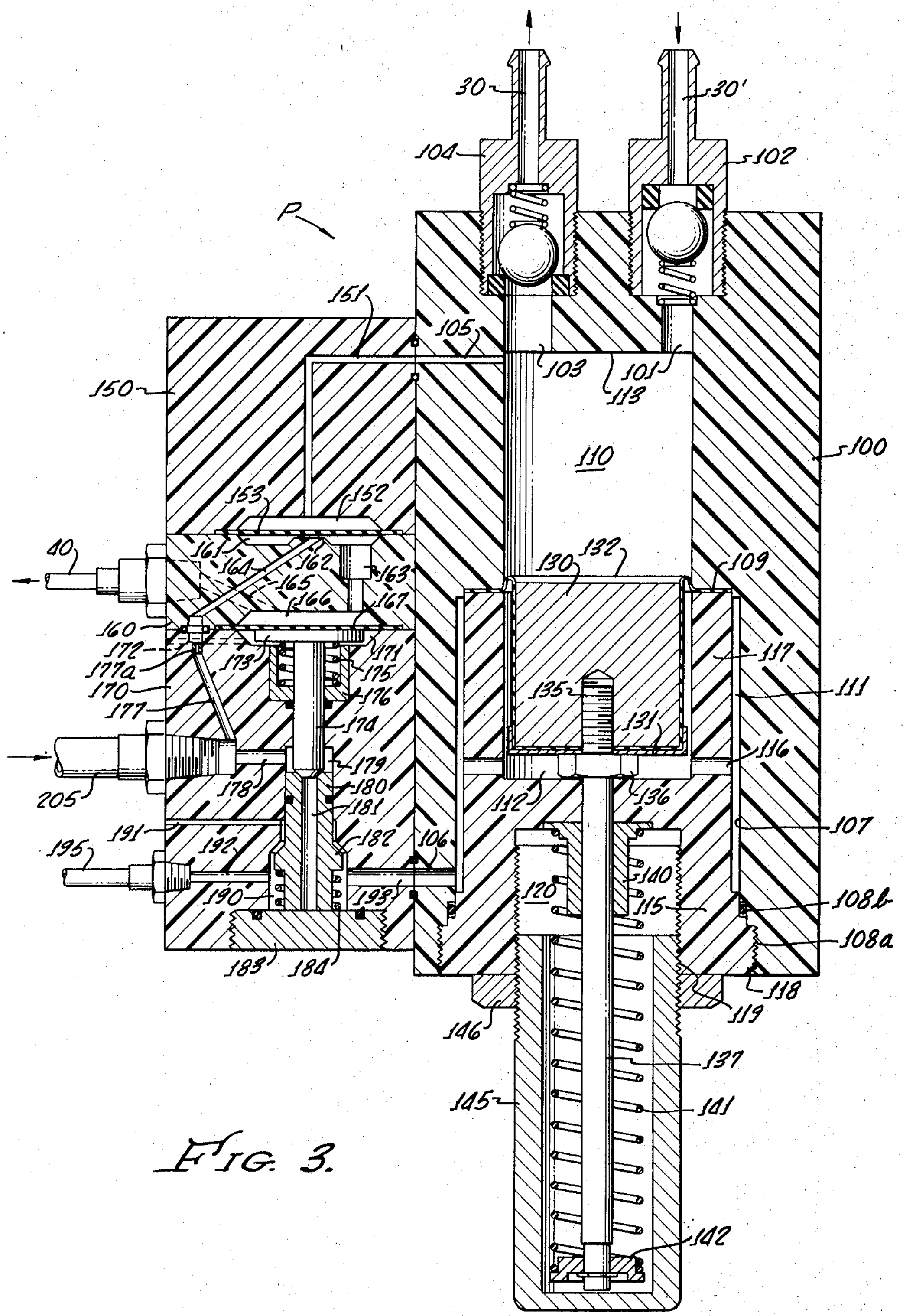

FIG. 3.

INVENTOR.
WILBERT J. JAEGER

BY Beehler & Arant

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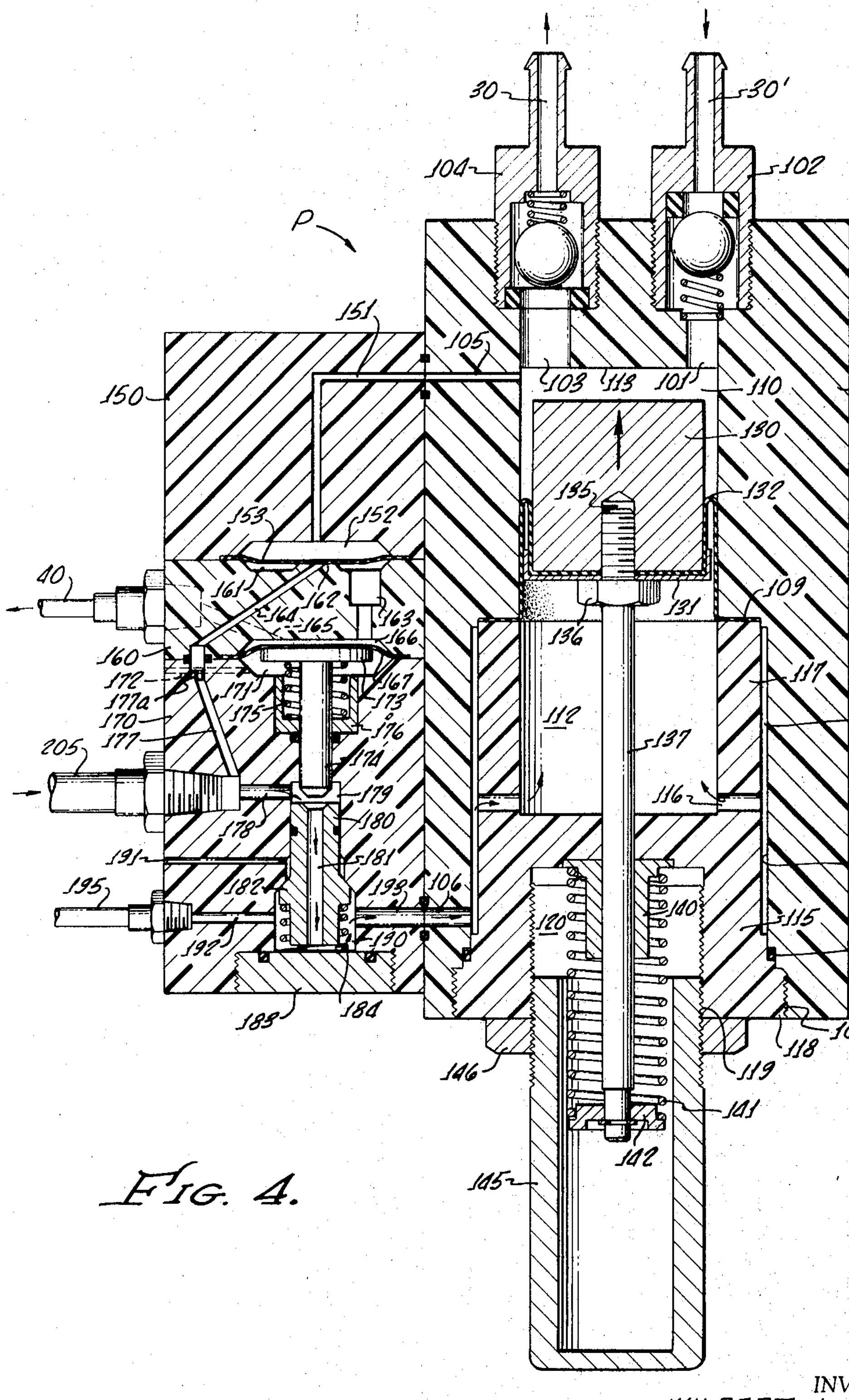
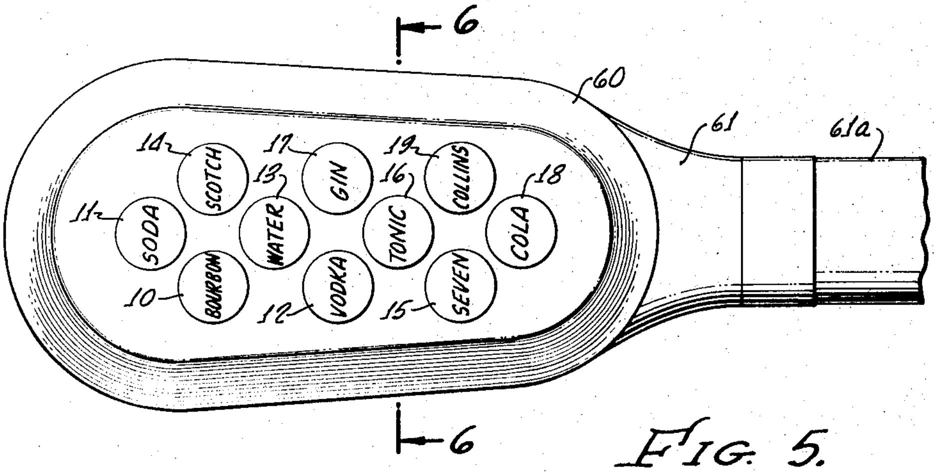


FIG. 4.

INVENTOR.
WILBERT J. JAEGER
BY Beehler & Arant
ATTORNEYS.



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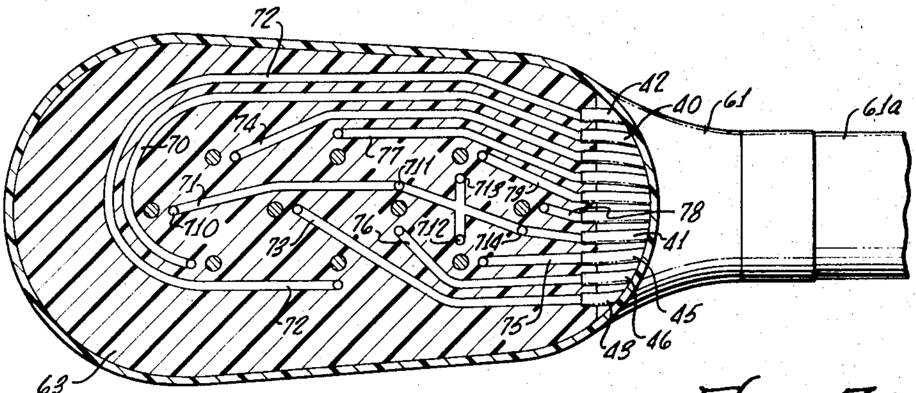

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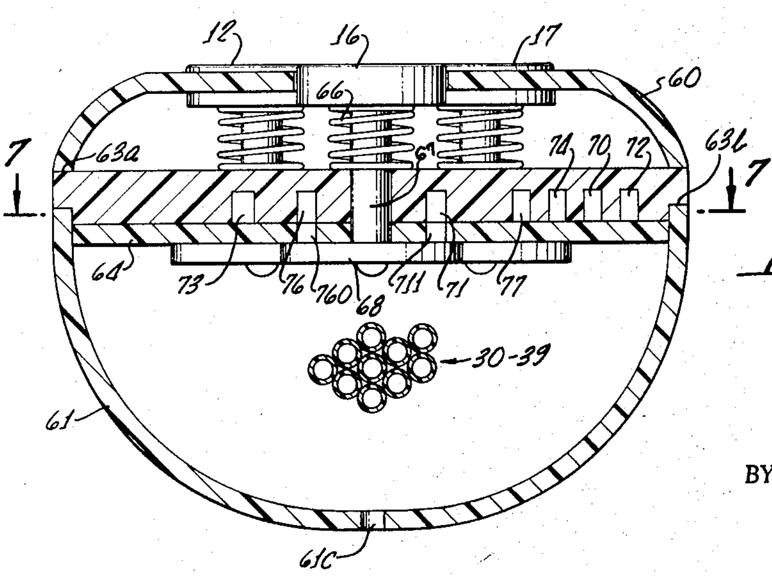


FIG. 6.

INVENTOR.
WILBERT J. JAEGER

BY Beehler & Arant

ATTORNEYS.

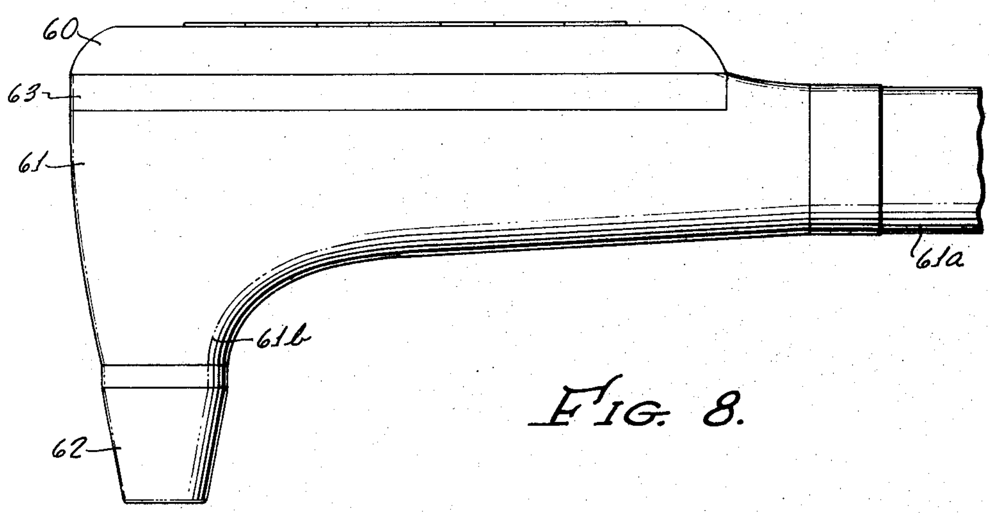
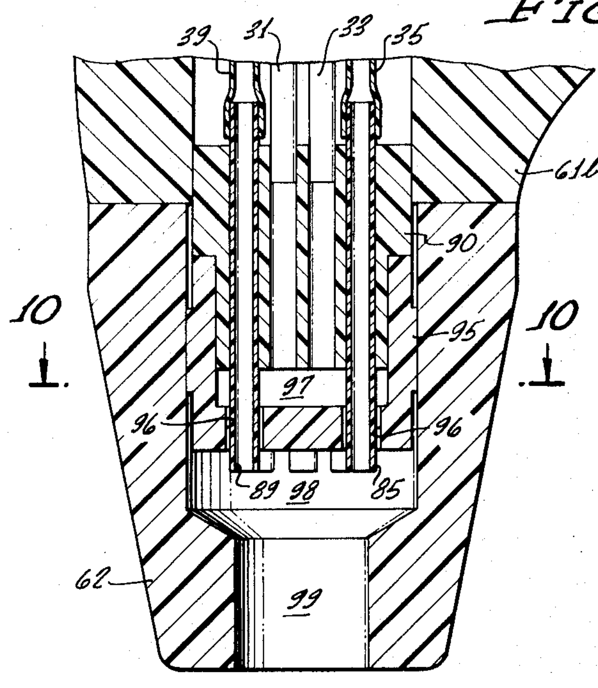


FIG. 8.

FIG. 9.



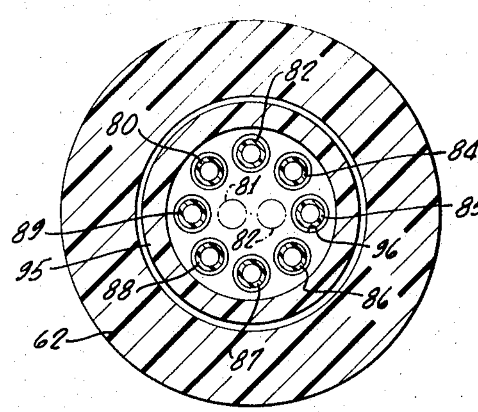


FIG. 10.

INVENTOR.
WILBERT J. JAEGER
BY Beehler & Arant
ATTORNEYS.

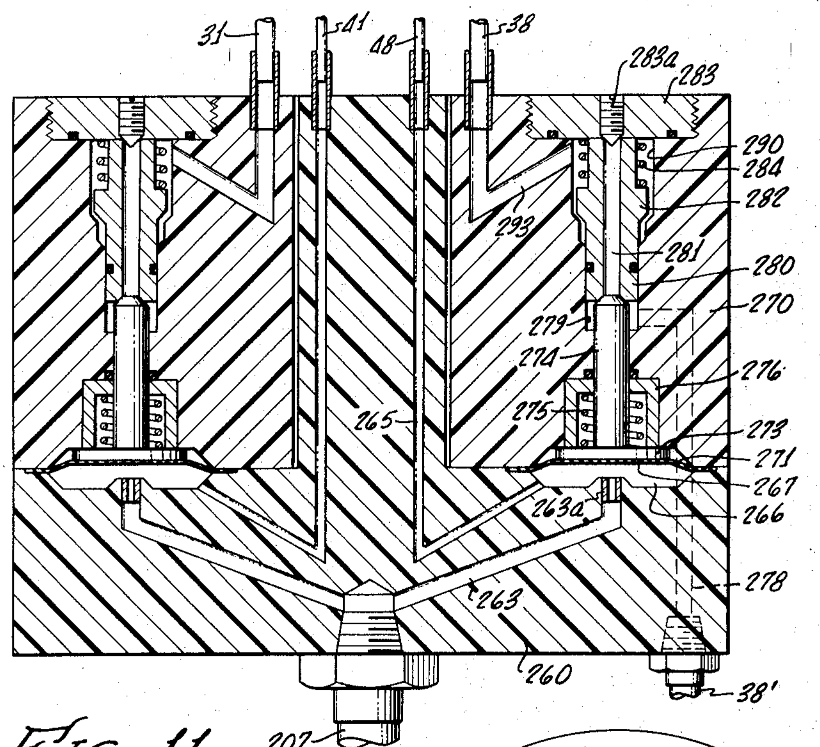


FIG. 11.

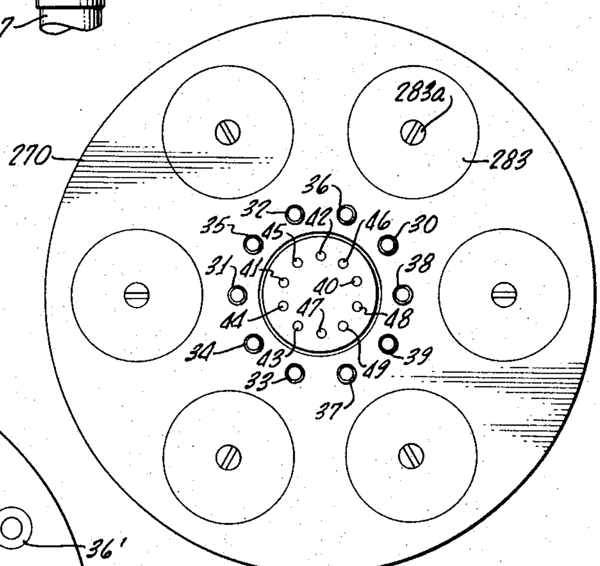
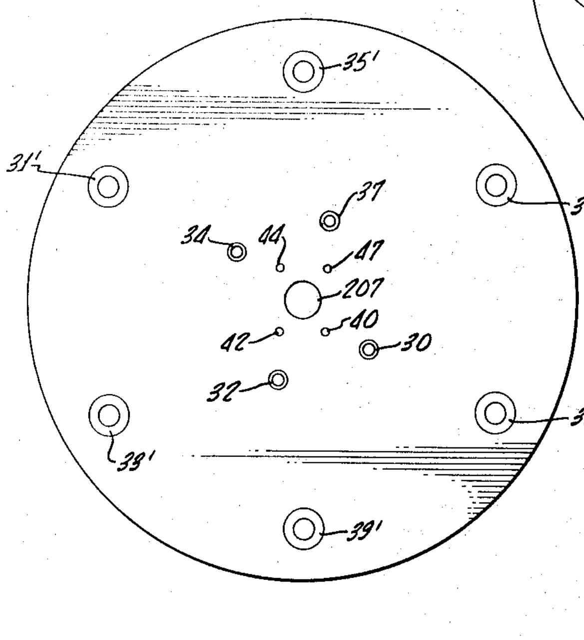


FIG. 12.

FIG. 13.



INVENTOR.
WILBERT J. JAEGER

BY Bechler & Arant

ATTORNEYS.

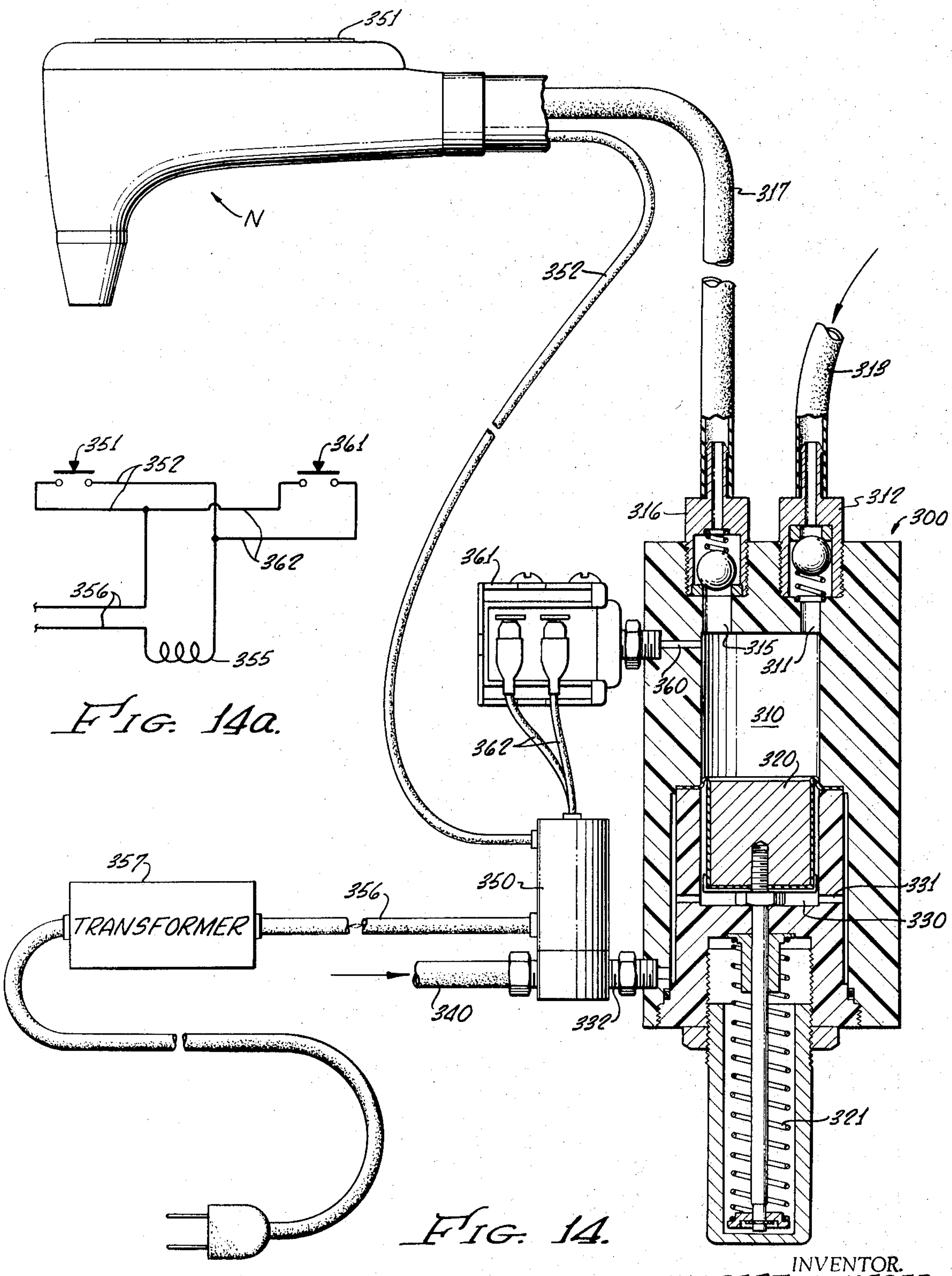


FIG. 14a.

FIG. 14.

INVENTOR.
WILBERT J. JAEGER
BY Beehler & Arant
ATTORNEYS.

BEVERAGE DISPENSING APPARATUS FOR DISPENSING A PREDETERMINED QUANTITY OF FLUID

This is a continuation of application Ser. No. 38,800, filed May 19, 1970 and now abandoned.

BACKGROUND OF THE INVENTION

Automatic beverage dispensing systems have come into use during recent years, and have had many advantages. Existing systems have been generally satisfactory, however, my careful reevaluation of existing apparatus did disclose deficiencies or limitations which appeared to offer the possibility for improvement.

The present invention, therefore, provides a number of specific improvements in beverage dispensing apparatus, the various improvements being essentially independent of each other and hence of significant value whether used separately or together.

Among the advantages of the invention are centralized control of the beverage dispensing system, higher operating speed, precision control of quantity in dispensing liquor shots, elimination of safety risks from exploding bottles, minimizing safety risks of use of electricity in the moist environment of a bar, and economizing on the use of liquor supplies.

Centralized control is achieved by dispensing both liquor and mix from a single dispensing nozzle which carries control pushbuttons for both.

Higher operating speed is achieved by automating the dispensing of liquor shots.

Precision control of the quantity of liquor shots is achieved by using a displacement pump having a liquid metering chamber of predetermined volume, and automatically timing the dispensing stroke so that full completion of the stroke is assured.

Safety risks from exploding bottles are eliminated by avoiding pressurization of the liquor bottles altogether. Instead, a novel vacuum drive is utilized for drawing liquor from the bottles.

Electrical safety risks are minimized by employing a fluidic control system instead of the conventional electrical control system. Specifically, CO_2 gas at a relatively low pressure is utilized for actuating control valves.

Economy of liquor supplies is achieved in part by automatic dispensing of precisely measured shots, and in part by use of half-gallon bottles which are easily handled by the vacuum drive method.

DRAWING SUMMARY

FIG. 1 illustrates my new beverage dispensing system, being shown partly in perspective and partly in diagrammatic form;

FIG. 2 illustrates an individual liquor dispensing unit in accordance with my invention, being shown partly in perspective and partly in diagrammatic form;

FIG. 3 is a cross-sectional elevational view of an individual liquor dispensing pump and its associated control mechanism;

FIG. 4 is a view like FIG. 3 but showing an alternate position which the pump assumes during a dispensing operation;

FIG. 5 is a top plan view of the dispensing nozzle assembly of FIG. 1;

FIG. 6 is a vertical cross-sectional view of the dispensing nozzle assembly taken on the line **6—6** of FIG. 5;

FIG. 7 is an internal horizontal cross-sectional view of the dispensing nozzle assembly taken on the line **7—7** of FIG. 6;

FIG. 8 is a side elevational view of the dispensing nozzle assembly;

FIG. 9 is a side elevational view of the diffuser and nozzle;

FIG. 10 is a horizontal cross-sectional view of the diffuser taken on line **10—10** of FIG. 9;

FIG. 11 is a cross-sectional view of the distributor D of FIG. 1;

FIG. 12 is a view of a slightly modified form of the distributor, seen from its upper end as shown in FIG. 11;

FIG. 13 is a view of the underneath end of the modified form of the distributor; and

FIGS. 14 and 14*a* show an alternate form of the liquor dispenser unit, being electrically controlled, and illustrated partly in cross-section and partly in perspective and diagrammatic forms.

GENERAL SYSTEM ARRANGEMENT — FIG. 1

Reference is now made to FIG. 1 which generally illustrates the complete beverage dispensing system of the present invention. Among the principal elements are a dispensing nozzle assembly N; a liquor cabinet L; drink mix sources M; a distributor D; and a compressed gas source C.

Dispensing nozzle assembly N is designed to be held in one hand by the bartender, and includes a set of ten push-buttons designated by numerals **10** to **19**, respectively. Each button may be depressed for dispensing either a particular liquor or a particular mix. In FIG. 5 each push-button is identified by the name of the beverage whose dispensing it controls, as well as by its associated reference numeral.

The liquor cabinet L contains a bottle **20** of bourbon, a bottle **22** of vodka, a bottle **24** of scotch, and a bottle **27** of gin. Drink mix sources M include a carbonator **21** for providing soda, a water faucet **23** for providing water, and syrup tanks designated **25** for Seven, **26** for tonic, **28** for cola and **29** for collins. It will be seen that in the assignment of reference numerals each beverage source is numbered **10** greater than the push-button which controls it; thus the push-button **10** controls the dispensing of bourbon from the bourbon bottle **20**, while pushbutton **19** controls the dispensing of collins from the collins tank **29**.

Liquor is dispensed from each one of the liquor bottles by means of a separate displacement pump P. Since all four of these pumps are identically constructed they are identified in FIG. 1 by the same reference character. Details of construction and operation of the pump P are shown in FIGS. **2, 3** and **4,** and subsequently described. The function of the displacement pump P is to dispense a predetermined and precisely controlled amount of liquor, such as for example, one ounce. However, as will appear from the later detailed description, it is also possible to adjust the pump so as to vary the precise quantity that is to be dispensed. The liquor cabinet L may be kept locked by the bar owner in order to avoid unauthorized removal of the liquor bottles or tampering with the adjustment of the dispensing pumps.

In the preferred form of the invention as illustrated in FIG. 1 there is no electricity required for the beverage dispensing operations, except to drive the carbonator. Water is dispensed from the water faucet **23** under ordinary line pressure, and the liquors and the other drink mixes are dispensed under energization from the compressed gas source C. The gas source C includes a tank **200** of compressed carbon dioxide (CO_2) at a rather high pressure level, in excess of 100 psi. A high-pressure regulator **201** is attached to the tank **200,** supplying the gas at a relatively high pressure level to carbonator **21** by means of a gas line **202,** and also by means of line **203** to a low-pressure regulator **204.** The carbonator **201** is of entirely conventional construction, and in addition to the high-pressure CO_2 gas received from line **202** it also receives water from the faucet **23** by means of a line **23***a*. The carbonator **21** also contains a pump driven by an electric motor, not specifically shown. The output of the carbonator **21** is soda, or carbonated water, supplied on a line **31'**.

From the output side of the low-pressure regulator **204** the compressed gas is supplied at a pressure level such as 20 psi, and is used not only to energize the dispensing of liquor and of mix, but also to energize the controls for the dispensing operations. From the regulator **204** an output line **205** provides low-pressure gas to all of the liquor pumps P, the main line **205** having four separate branches each of which is connected to a separate one of the pumps. The exact manner in which the gas is used for energizing both the dispensing of liquor, and the control of the dispensing, is described subsequently in connection with other drawing figures. From the low-pressure regulator **204** separate output lines **206***a*, **206***b*, **206***c* and **206***d* go to respective ones of the syrup tanks **25, 26, 28** and **29.** Another output line **207** is coupled from the regulator **204** to distributor D, where it energizes the various controls contained within the distributor, as will be more specifically described in conjunction with FIGS. **11, 12** and **13.**

Dispensing of syrups from the tanks **25, 26, 28** and **29** is done in an entirely conventional manner. Compressed gas occupies the upper part of the tank, and an elongated tubular probe (not specifically shown) is located in the interior of the tank and extends to a point near its bottom, the upper end of the tubular probe being connected to the output line. Thus from the tonic tank **26** the tonic syrup is dispensed on an output line **36'**; and from cola tank **28** the cola syrup is dispensed on an output line **38'**. The soda line **31'**, water line **33'**, Seven line **35'**, tonic line **36'**, cola line **38'** and collins line **39'** are all coupled to the distributor D, where the dispensing operations for these beverages are actually controlled. On the other side of the distributor the continuations of these same lines extend to the nozzle assembly N, but are there designated by the same numerals without the primes.

In the liquor cabinet L a short tube section **30'** extends from bourbon bottle **20** to the pump P which controls the dispensing of burbon, and from the output of that pump a line **30** extends to nozzle assembly N. In similar fashion a short tubing line **32'** couples the vodka bottle **22** to its pump, a short tubing line **34'** couples the scotch bottle **24** to its pump P, and a short tubing line **37'** couples the gin bottle **27** to its pump. The output lines from these three pumps are designaged **32, 34** and **37,** respectively, and are coupled directly to the nozzle assembly N.

The beverage dispensing system of the present invention also includes a number of pressure release lines, one for each beverage to be dispensed, which are coupled to the nozzle assembly N. The function of each of the pushbuttons **10 . . . 19** is to relieve the pressure from an associated pressure relief line, as will be described in detail in conjunction with FIGS. **5, 6** and **7.** In the assignment of reference numerals each relief line has a number which is greater by **30** than its associated pushbutton. For example, the dispensing pump P for bourbon receives the bourbon from bottle **20** on the line **30'**, and dispenses it on line **30,** under control of pressure release line **40** which is in turn controlled by the pushbotton **10.** Pressure relief line **44** for the scotch **24** is controlled by button **14,** relief line **42** for vodka **22** is controlled by button **12,** and relief line **47** for gin **27** is controlled by button **17.**

In a similar manner the pressure relief lines for soda, water, and the four syrups are controlled by the buttons **11, 13, 15, 16, 18** and **19,** respectively. These relief lines are designated by numerals **41, 43, 45, 46, 48** and **49,** respectively. Since the dispensing of soda, water, and the four syrups is controlled in the distributor D, these relief lines extend only to the distributor and do not extend back to the drink mix sources themselves.

VACUUM-DRAW LIQUOR DISPENSER UNIT FIGS. 2 – 4

Reference is now made to FIG. **2** which illustrates a complete liquor dispensing unit in accordance with the present invention. FIG. **2** shows the dispensing nozzle assembly N, the bourbon bottle **20,** the bourbon dispensing line **30** which is coupled to the nozzle assembly, the pressure relief line **40** coupled to the nozzle assembly for controlling the dispensing of bourbon, the pump P for the bourbon, and the other apparatus which is required for dispensing the bourbon. The drink mix sources and the other liquor dispensing units contained in the system of FIG. **1** are not shown in FIG. **2.**

The pump P shown generally in FIG. **2** (its internal construction being shown in detail in FIGS. **3** and **4**) includes a main housing **100** within which the dispensing operation is performed, and an auxiliary or control housing. The control housing includes an upper block **150,** a middle block **160,** and a lower block **170.** The tube section **30'** extending from bourbon bottle **20** is coupled to the upper end of dispensing housing **100** through a valve unit **102.** Dispensing tube **30** leading to the nozzle N is also coupled to the upper end of dispensing housing **100,** through a valve unit **104.** Adjusting handle **145,** which is used for adjusting the precise amount of liquor to be dispensed in each shot, protrudes from the bottom of housing **100.**

The pressure relief line **40** from the nozzle assembly N is coupled into the center section **160** of the control housing. Gas pressure line **205** for energizing the dispensing operations is coupled into the lower section **170** of the control housing. In FIG. **2** the CO_2 tank C is shown, but for simplicity of illustration the regulators **201** and **204** are omitted.

FIG. **2** also illustrates an indicator system which may be used as optional equipment, and is not shown in FIG. **1.** A pulse transducer **196** is coupled to the lower section **170** of the control housing by means of a pulse tube **195.** The pulse transducer **196** is plugged into a source of electrical energy, and its function is to produce an electrical output pulse each time that it receives a gas pressure pulse at its input. The operation of lower section **170** of the control housing (FIGS. **3** and **4**) is such that each time a shot of liquor is dispensed a pulse of gas pressure is applied to the line **195** and hence to the transducer **196.** The transducer **196** has its output coupled both to a counter **197** and to a display sign **198.** The operation of the counter is cumulative, and it keeps track of all the shots that have been dispensed by this particular dispensing unit. In the drawing the counter reading is shown, as an example, at **098.** The display sign **198** has an illuminated upper portion reading "Now Automatically Dispensing," and after the pulse is received on line **195** a lower portion reading "BOURBON" is also illuminated for a brief interval.

The operation of the displacement pump P, as will be subsequently described in more detail, is such as to draw a vacuum on the line **30'**. A cap **54** is placed on top of the bourbon bottle **20**, and has an opening **55** through which the tube **30'** extends with a very loose fit. Air passes freely through the opening **55** around the tube **30'** so that the atmospheric pressure is fully applied to the upper surface level of the bourbon within the container, this surface level being indicated at **51.** An extension of tube **30'** designated at **52** extends down into the interior of the bottle **20**, with its lower extremity **53** being an open end positioned very near to the bottom of the bottle **20.** When displacement pump P draws a vacuum on the line **30'** the atmospheric pressure pushes down on the surface **51** of the bourbon within the bottle **20**, pushing a quantity of bourbon in through the open lower end **53** of the line **30'** and hence up through the line to the pump.

The vacuum method of drawing liquor from each of the liquor containers has some very important advantages. First, in some prior dispensing systems the liquor containers have been pressurized, and the pressurization has caused small particles of glass to chip off into the liquor and some of these particles have from time to time been dispensed to the customer with resulting undesirable effects. In other instances the pressurization of the liquor container has resulted in explosion of the container. These difficulties of the prior art are completely avoided by the present invention because the pressure level both inside and outside the liquor bottle is never greater than atmospheric pressure. Another important advantage of the vacuum draw method of the present invention is that the label on the liquor bottle can remain intact and fully exposed to view, as required by law. A further advantage of the vacuum draw method is that it is amenable to the use of half gallon liquor bottles, or larger sizes if desired, which result in a significant cost saving.

Reference is now made to FIGS. 3 and 4 illustrating the structure and operation of the dispensing pump P.

The dispensing housing **100** contains a chamber having forward end portion **110** and rearward end portion **112**, and a piston **130** which reciprocates between the end portions of the chamber. In the retracted position of piston **130** as shown in FIG. 3 the chamber portion **110** holds a precisely measured quantity of liquor. As the piston **130** travels forward the liquor is dispensed through valve fitting **104** into output line **30.** FIG. **4** shows the piston as it is moving forward and prior to striking the end wall **113** of the chamber.

More specifically, the dispensing housing **100** on its upper end has a passageway **101** which opens through the end wall **113** of the chamber **110, 112.** A standard check valve unit **102** is screwed into the outer end of passageway **101**, and receives the end of tube **30'**. Valve fitting **102** contains a check valve which permits liquor to flow from the tube **30'** into the chamber **110**, but will not permit flow in the opposite direction.

In similar fashion a passageway **103** communicates from the upper end of housing **100** through the wall **113** of the chamber. A valve fitting **104** is screwed into the outer end of passageway **103**, and receives the output tubing line **30.** Valve fitting **104** contains a check valve which permits liquor to flow from the chamber out into the line **30**, but not in the opposite direction.

A separate piston housing **115** provides the chamber portion **112** within which piston **130** may be retracted. Dispensing housing **100** is normally open at its lower end, and piston housing **115** is inserted therein to confine the piston **130** in the chamber thereby provided. The piston **130** is of generally cylindrical configuration and is covered by a flexible bellofram **132** which covers the lower end of the piston as well as its cylindrical sidewall and extends peripherally outwardly from the upper end of the piston (as seen in FIG. **3**). The peripheral extremity of bellofram **132** is retained between annular shoulder **109** of housing **100** and the upper circumferential end face of the piston housing **115.**

A metal end cap **131** fits over the lower end of piston **130** to retain bellofram **132** in place. A piston stem or rod **137** has its upper end threaded at **135** and screwed into a threaded opening in the piston **130.** A nut **136** carried on the threaded portion of stem **137** is tightened against the metal cap **131** for retaining the piston and piston rod in assembled relationship, and at the same time firmly pressing the end cap **131** against the bellofram. When the piston **130** travels forwardly the bellofram **132** is progressively peeled back from the circumference of the piston, and hence serves to maintain a tight pressure seal between the chamber portion **110** and the chamber portion **112** (see FIG. **4**).

Below its annular shoulder **109** the housing **100** has a cylindrical opening **107** within which the piston housing **115** is disposed in spaced relationship so as to define an annular space **111** therebetween. This annular space becomes filled with pressurized gas when it is necessary to drive the piston upward. Below the cylindrical opening **107** a recessed threaded portion **108*a*** of housing **100** is engaged by a threaded flange **118** of the piston housing **115.** Above these interengaging threads a sealing ring **108*b*** seals the space between housing **115** and housing **100**, thus preventing leakage of the pressurized gas from the lower end of annular space **111.**

The piston housing **115** in its lower center has a cylindrical recess **120** with a threaded wall **119.** A member **140** is seated at the upper end of opening **120**, and acts both as a spring retainer for a spring **141** and also as a sliding seal for the piston rod **137.** Thus, the piston rod **137** reciprocates through a central opening in the piston housing **115**, through a central opening in the member **140**, and extends rearwardly through the space **120** into the interior of adjusting handle **145.** The adjusting handle **145** is a hollow tubular member with exterior threads on its upper end which engage the threads **119** of opening of **120**, the lower end of the adjusting handle **145** being closed. In the fully lowered or fully retracted position of piston **130** as shown in FIG. **3** the lower end of piston rod **137** strikes the end wall of adjusting handle **145.** A spring retainer **142** is attached to piston rod **137** near its lower end, the expansion spring **141** being held between the retainer **142** and the member **140** and thus urging the piston **130** always towards its lowered or fully retracted position. The adjusting handle **145** may be screwed inwardly from its position as shown in FIG. **3,** in order to limit the downward or retracting movement of the piston **130,** and thus diminish the volume of the dispensing chamber **110.** A threaded nut **146** carried on the external threads of handle **145** is tightened against the lower end of piston housing **115** in order to lock the adjusting handle **155** in its particular position of adjustment.

As best seen in FIG. **2** the control housing **150, 160, 170** is attached on one side of the dispensing housing **100.** A single horizontal passageway **106** communicates from the annular space **111** through the wall of housing **100** and into the lower section **170** of the control housing, for receiving the pressurized gas which will drive piston **130** in an upward stroke. A plurality of passageways **116** are spaced circumferentially about the piston housing **115,** and communicate between the annular space **111** and the lower chamber portion **112.** Two of these passageways **116** are shown in the cross-sectional view of FIGS. **3** and **4.**

Thus, it will be seen that when the piston **130** is to be driven upward, pressurized gas is supplied from the control housing **170** into the passageway **106,** and then fills up the entire annular space **111** around the entire circumference of the piston housing **115.** The pressurized gas passes through a number of the openings **116** into the lower chamber **112,** and hence is applied to the retaining cap **131** for pushing piston **130** upward. Upon completion of its upward stroke the upper end of piston **130** strikes the chamber wall **113,** which mechanically prevents a further upward travel of the piston, and the cessation of movement by the piston results in a shutting off of the pressurized gas from its source, as will subsequently be explained. Not only is the source of gas pressure shut off but the pressurized gas is also relieved to atmosphere, so that the pressurized gas contained within chamber portion **112** flows back through the passages **116** and annular space **111** and hence through the passageway **106** and through further channels as will be described. The relief of gas pressure in the chamber portion **112** permits the spring **141** to return the piston **130** to its fully withdrawn position as shown in FIG. **3.**

The dispensing housing **100** also has a sensing passageway **105** formed therein, which communicates from the upper end of chamber portion **110** to the control housing **150.** The purpose of passageway **105** is to sense the liquid pressure in the chamber portion **110,** the response to this liquid pressure being utilized in the control system in a manner which will subsequently be described. The net flow of liquor back and forth in the sensing passageway **105** is of miniscule proportions, however, and it therefore does not affect the precision metering action achieved by the chamber **110.**

The operation of the displacement pump P in dispensing a predetermined and precisely measured quantity of liquor will now be described. Let it be assumed that piston **130** is in its fully retracted position as shown in FIG. **3.** Let it also be assumed that the chamber **110** is full of liquor and that the passageways **101, 103,** and **105** are likewise full of liquor. As piston **130** moves upward the valve **102** remains closed, hence there is no loss or gain of liquor with respect to passageway **101.** There is also no significant change with respect to passageway **105.** Upward movement of the piston **130** forces the liquor from chamber **110** through passageway **103** and through the valve fitting **104** into the output line **130.** When piston **130** strikes the chamber wall **113** the amount of liquor which has been supplied to the output line **30** is precisely equal to the volume which piston **130** has displaced within chamber **110.**

In the operation of the system it is also significant, as will be shown, that the output line **30** remains full of liquor at all times as does also the associated portion of the nozzle N. Capillary action is relied upon to prevent these passageways from becoming empty. The result is that the quantity of liquor dispensed at the nozzle N is precisely equal to the volume of chamber **110** that was displaced by the stroke of piston **130.**

During upward travel of piston **130** the valve **102** was closed while the valve **104** was open. When the piston ceases its forward travel the valve **104** closes. Upon the decay of gas pressure in chamber portion **112** the spring **141** forces the piston to retract, whereupon a partial vacuum is created within the chamber portion **110.** Valve **102** now opens and liquor is drawn from the bottle **20** through the line **30'.** The dispensing cycle may then be repeated.

In the operation of the dispensing pump P the setting up of the apparatus for dispensing the first shot involves conditions different from the repetitive dispensing operations thereafter. For proper starting conditions it is highly desirable, if not altogether indispensable, that both of the passageways **101** and **103** be at the upper end of chamber portion **110,** so that air bubbles cannot easily be entrapped. If air bubbles were to become entrapped in the chamber the precision of the dispensing operation would be destroyed.

CONTROL OF PUMP P

The method of controlling the operation of dispensing pump P is, in general, as follows:

The supply of compressed gas from the supply line **205** to the chamber **112** of the pump is controlled by a pilot-operated valve. This valve including moveable members **174** and **180** is shown in its closed position in FIG. **3,** while in FIG. **4** it is shown in its open position. The pilot-operated valve is in turn controlled by a pressure-sensitive diaphgram **153.** FIG. **3** shows the position of diaphragm **153** when the system has been pressurized by tank **200** and is ready to operate, while FIG. **4** shows the alternate position which the diaphragm assumes after pressure has been relieved through pressure relief line **40** by actuation of the button **10** of nozzle N.

The control housing **150, 160, 170** and mechanisms contained therein will now be described in detail.

The upper control housing section **150** is a solid member such as a plastic block having a chamber **152** formed in its lower end surface. A sensing passage **151** communicates with chamber **152** and with the sensing passage **105** of housing **100.** The peripheral edge of chamber **152** is recessed for receiving the diaphragm **153.** The peripheral edge of diaphgram **153** is supported upon the flat surface of control housing section **160.**

Control housing section **160** has a chamber **161** formed in its upper central surface, and chamber **161** in its center has a raised surface portion **162** which is spaced only a short distance away from the under surface of diaphragm **153**, when diaphragm **153** is in its flat position as shown in FIG. **3.** A chamber **166** is formed in the center of the under surface of housing section **160.** A vertical passageway **163** interconnects chamber **161** with chamber **166.** Pressure relief line **40** is connected at one side of the control housing section **160**, and a passageway **165** couples the relief line **40** to the chamber **166.** Another passageway **164** has its upper end opening through the raised surface postion **162** of the chamber **161,** while its lower end extends to the lower surface of housing section **160,** but to one side of the chamber **166.** The peripheral edge of chamber **166** is recessed to receive the peripheral edge of a diaphragm **167.**

In the control housing section **170** the compressed gas line **205** is connected at one side, and is coupled to passageways **177** and **178.** Passageway **177** extends upward through the housing block **170** and communicates with passageway **164** of the housing block **160.** Passageway **178** communicates with one side of a central opening **179** which is formed in the lower center of the block **170.**

Housing block **170** in its upper center has a complex recess or chamber **171** formed therein, for receiving various parts of the mechanism. A base plate **173** is centrally located beneath the diaphgram **167** and secured to the under surface of the diaphragm. A plunger **174** is attached underneath the base plate **173** and extends vertically downward to the chamber **179.** A cup-shaped bushing **176** occupies the lower portion of recess **171** and has a central opening through which the plunger **174** passes. An expansion spring **175** is located within the cup **176,** its lower end being retained by the bottom wall of the cup while its upper end is retained by the plate **173.** Spring **175** is effective to urge the plate **173,** and hence the diaphragm **167,** in an upward direction.

The recess **179** is generally cylindrical but enlarged at its lower end. Located within the recess **179** is a perforated valve member **180,** which is of a generally cylindrical configuration to fit the dimensions of the recess, and is enlarged near its lower end by means of a flange **182.** A central passageway **181** extends vertically through the complete length of member **180.** The lower end of recess **179** is closed by a plug **183,** which is screwed into a threaded opening representing an enlargement of the lower end of recess **179.** Below the flange **182** there is an annular space **190** between the lower end of valve member **180** and the circumferential wall of recess **179.** An expansion spring **184** occupies the annular space **190,** the lower end of the spring resting on plug **183** while its upper end engages the under surface of the flange **182.** Spring **184** normally urges the valve member **180** toward an upward position. The upper end of passageway **181** in the valve member **180** is conically tapered, and the lower end of plunger **174** is likewise conically tapered, and in the normal position of the valve mechanism the passageway **181** is closed off by the plunger **174,** as shown in FIG. **3.**

The housing block **170** also contains a vent opening **172** which communicates between chamber **171** and the exterior surface of the block, or atmosphere. Vent opening **172** does not intersect the passageway **177.** Another vent opening **191** communicates between chamber or recess **179,** just above the location of flange **182,** and the atmosphere. The pulse output line **195** is coupled to one side of the housing block **170** and hence through a passageway **192** to the annular space **190.** On the other side of annular space **190** a passageway **193** communicates with passageway **106** of the dispensing housing **100.**

In the valve position shown in FIG. **3** the chamber **166** above diaphragm **167** is occupied by pressurized gas at a significant pressure level. The pressure level is sufficient to hold the diaphragm **167,** base plate **173,** and plunger **174** in the downward position against the force of spring **175.** Furthermore, the gas pressure is also sufficient to hold the perforated valve member **180** (whose upper end opening is engaged by plunger **174**) in its downward position against the force of spring **184.** The pressure in chamber **166** exists by virtue of open communication from the supply line **205** through passageway **177,** passageway **164,** chamber **161,** and passageway **163.**

The chamber **152** above diaphragm **153** is normally filled with liquor, and remains so. The gas pressure on the underside of diaphragm **153** is normally sufficient to offset the weight of the liquor in chamber **152,** so that the diaphragm remains in a flat or unstressed condition.

It will be noted that pressure relief line **40** communicates directly with chamber **166** through the passageway **165.** When button **10** is depressed the pressure in relief line **40** is relieved, and the pressurized gas in chamber **166** also escapes through passageway **165** into the relief line **40** and hence to atmosphere. Gas continues to flow from the supply line **205** through passageways **177, 164, 161** and **163** into the chamber **166,** but there is a drop in the pressure level within the chamber **166.** The pressure drop is significant because of a flow restriction **177*a*** that is deliberately inserted in the passageway **177.** Passsageway **177** is more restricted than relief line **40.** Therefore, the spring **175** pushes the plunger **174,** base plate **173,** and diaphragm **167** into their upper position as shown in FIG. **4.**

When the valve moves to its open position as shown in FIG. **4,** the perforated valve member **180** is driven upward by its spring **184,** but can move only a short distance until its flanged portion **182** is stopped by the associated wall surface of the recess **179.** A vertical separation does result between the lower end of valve member **180** and the upper surface of plug **183.** The upward movement of valve member **180** is much less than the upward movement of plunger **174,** so a large gap exists between the lower end of plunger **174** and the passageway **181** of member **180.** Hence pressurized gas is able to flow from the supply line **205** through passageway **178** into the upper portion of recess **179,** and thence through the passageway **181** in the valve member **180** and down to the lower end of recess **179** above the surface of the plug **183,** from whence it escapes into the annular space **190** and then into passage **193** and passage **106** to reach the annular space **111** of dispensing housing **100.**

When the valve first moves to its open position as shown in FIG. **4** the diaphragm **153** initially remains spaced from the raised portion **162** which has the end of passageway **164** formed therein. After a slight time delay, however, a sufficient quantity of pressurized gas flows into the annular space **111** and hence into the chamber **112** so that piston **130** is propelled in a forwardly (upwardly) direction. The forward movement of piston **130** not only drives liquor out of chamber **110** through the valve mechanism **104** into the output line **30**, but it also raises the liquid pressure in the sensing passageway **105, 151.** This sharp increase in the liquid pressure is also transmitted to the chamber **152,** driving the diaphragm **153** strongly down against the protuberance **162** and thus closing off passageway **164.** This position of diaphragm **153** is shown in FIG. **4.** The flow of gas from supply line **205** into gas chamber **166** is therefore interrupted, and the gas pressure in chamber **166** drops even further. It is then no longer necessary for relief line **40** to bleed pressurized gas out of the chamber **166,** in order to keep the valve mechanism open.

As a matter of fact, one of the very desirable features of my invention is that a liquor push-button such as button **10,** for example, need be depressed only momentarily in order to control the dispensing of a shot of liquor. Once the piston **130** has started to move forwardly the button **10** may be released, closing the relief line **40,** but the high level of liquid pressure in chamber **152** will keep the valve mechanism locked in its open position. Meantime, the bartender, after having pressed the liquor button only momentarily, can then move his thumb or finger to another button to control the dispensing of a mix for a desired period of time.

The chamber **171** on the underside of diaphragm **167** is vented to atmosphere through passageway **172,** hence the under surface of diaphragm **167** is subject only to atmospheric pressure. The vent **172** permits air to move freely into chamber **171** when the diaphragm **167** is raised to its position as shown in FIG. **4,** and permits the air to move freely outward when the diaphragm returns to its original position.

The dispensing movement of piston **130** as shown in FIG. **4** comes to an end when the piston strikes the wall **113** at the end of chamber **110.** The fluid pressure level immediately drops in the chamber **110** and in the passageways **101, 103,** and **105.** The valve **104** which was open during the forward movement of the piston now closes under pressure of its spring. The drop in fluid pressure is transmitted through passageway **151** to chamber **152,** permitting diaphragm **153** to return to its normal position. This movement of diaphragm **153** is aided by the fact that gas pressure has continued to exist in the passageway **164.** Hence the initial movement of diaphragm **153** is to open the end of passageway **164,** but the gas pressure then rises rapidly in chamber **166,** passageway **163,** and chamber **161,** resulting in restoring the diaphragm **153** to its normally flat or horizontal position as shown in FIG. **3.** At the same time the rising pressure in gas chamber **166** causes diaphragm **167** to move downward to its normal position, and the valve mechanism then re-assumes its closed position shown in FIG. **3.** The gas pressure in chamber **166** is not bled off at this time through the relief line **40,** because the pushbutton **10** had been closed earlier.

When the valve mechanism is in its open position as shown in FIG. **4** the vent **191** is effectively closed by the wedging of flange **182** against the sloping walls of recess **179,** hence there is no bleeding off of the gas pressure in annular space **190.** However, when the valve mechanism returns to its closed position of FIG. **3,** the flange **182** disengages from the wall of recess **179** and there is a communicating space which couples the vent **191** to the annular space **190.** Therefore, the pressurized gas in chamber **112** which had driven the piston **130** in the forward direction now passes out through the passageways **116,** annular space **111,** passageways **106** and **193,** annular space **190,** and the space around the circumference of valve member **180** into the passageway **191** by which it is vented to atmosphere. The apparatus is now in condition to repeat the dispensing cycle when the button **10** is depressed again.

The pulse line **195** is simply coupled in communication with annular space **190** by means of the passageway **192,** hence every increase or decrease in the gas pressure in space **190** is communicated through the line **195** to the transducer **196.** While details of design and operation of the transducer **196** are not shown, they are within the skill of the art and need not be described in detail here.

DISPENSING NOZZLE ASSEMBLY N FIGS. 5 TO 10

Reference is now made to FIGS. **5** to **10,** inclusive, illustrating the dispensing nozzle assembly N of the present invention.

As shown in FIGS. **1** and **8** the nozzle assembly N has a gun or handle portion **61** which is equipped with a rearward extension **61***a*, and the ten beverage tubes **30** to **39,** inclusive, and ten pressure relief lines **40** to **49,** inclusive, enter the handle **61** through the extension portion **61***a*. The gun or handle **61** is actually a hollow housing, as best seen in FIG. **6,** being open at the top and having through most of its length a cross-sectional configuration which corresponds approximately to a half-circle. At its forward end, as best shown in FIG. **8,** the gun or housing **61** has a L-shaped downward extension portion **61***b*, to which is affixed the diffuser cover **62.** The otherwise open top of the housing **61** is covered by a channel plate **63** which is in turn covered by an escutcheon plate **60.**

As best seen in FIG. **6,** the channel plate **63** has a number of channels formed in its underside, which is covered by the cover plate **64.** The plan or arrangement of these channels is shown in FIG. **7.** Thus it will be seen that the relief line **40** is connected to a channel **70;** relief line **41** is connected to a channel **71;** and so on, there being a separate channel for each of the relief lines **40** to **49,** inclusive. At the end of each channel, located in the interior of the nozzle structure, there is a vent opening formed through the cover plate **64.** For example, for the tonic channel **76** there is a vent opening **760** which is shown in plan view in FIG. **7** and in a cross-sectional view in FIG. **6.** Each of these vent openings is normally closed, but may be opened by depressing the associated one of the control pushbuttons **10** to **19,** inclusive.

The interior of the hollow housing **61** is not sealed, but is open to the outside atmosphere. Thus one or more openings such as the opening **61***c* shown in FIG. **6** are formed in the wall of the housing **61,** so that gas pressure released from the channels may in turn be released to the surrounding atmosphere.

The channel plate **63** is a relatively thick plate made of a suitable plastic material, and has its lower longitudinal edges notched at **63***a* and **63***b* so as to fit precisely onto the upper longitudinal edges of the housing **61.** See FIG. **6.** The cover plate **64** is glued or otherwise secured to the channel plate **63** prior to assembly with the housing **61**. The escutcheon plate **60** has its longitudinal edge surfaces curved downward so as to engage the upper longitudinal edges of the channel plate **63**, where they are firmly secured. The central portion of the escutcheon plate **60** is spaced some distance above the channel plate **63** to provide suitable space for the pushbutton mechanisms.

The tonic pushbutton **16** is shown in full detail in FIG. **6**. The button itself is not supported from the escutcheon plate, and is located within a circular opening in the escutcheon plate, protruding a short distance above the surface of that plate. A spring **66** located beneath the button has one end resting upon the upper surface of the channel plate **63** while its other end engages the button. From the center of the button a fixed shank **67** projects downwardly through the spring **66**, and also through openings which are provided for that purpose in the plates **63** and **64**. A closure member **68** is fastened to the lower end of the shaft **67** and normally closes the vent opening **760** in the cover plate **64**. In the normal position of pushbutton **16**, as shown in FIG. **6**, the spring **66** is sufficiently compressed so that the closure member **68** provides a reliable seal for the vent opening **760**.

When a pushbutton such as button **16** is to be actuated it is simply pressed downwardly, which further compresses the spring **66**, and moves the closure member **68** down and away from the plate **64** with its opening **760**. Gas then escapes from the relief line **46** through channel **76** and vent opening **760** into the interior of housing **61**, and thence through opening **61***c* into the surrounding atmosphere. As soon as the pushbutton is released the vent opening is again closed by action of spring **66**.

The soda channel **71** differs from the other channels in that it has a number of the vent openings associated with it. Thus at the outer end of the channel adjacent the soda pushbutton **11** there is a vent opening **710**. Adjacent the tonic button **16** there is a vent opening **711**, and as can be seen in FIG. **6** the operation of the tonic button **16** is effective to release gas from both the tonic channel **76** and the soda channel **71**. Soda channel **71** also has branches with end openings **712** and **713** which are positioned adjacent to the Seven button **15** and collins button **19**, respectively. Soda channel **71** also has a vent opening **714** adjacent the cola button **18**. Thus for each of the four mixes, tonic, Seven, collins and cola, the operation of the corresponding pushbutton not only causes the syrup to be dispensed from the syrup tank, but at the same time causes soda to be dispensed. The manner of operation will be described subsequently in greater detail, in conjunction with the distributor D.

Although the pressure relief lines **40** to **49**, inclusive, terminate on the rearward end of the channel plate **63** (see FIG. **7**) the associated beverage lines **30** to **39**, inclusive, extend into the hollow housing **61** beneath the channel plate (see FIG. **6**). The beverage lines continue to the forward end of housing **61** and are turned downward to connect to the mixer, diffuser, and nozzle, as shown in FIGS. **9** and **10**.

The structure as shown in FIG. **9** includes the barrel **90**, diffuser **95**, and nozzle **62**. The barrel **90** is a generally cylindrical structure which is vertically disposed, and has ten vertical passageways which correspond to the beverage tubes **30** to **39**, respectively. The housing portion **61***b* has a cylindrical opening therein which is vertically disposed, and the upper end of barrel **90** is inserted within that opening.

The passageways in barrel **90** are identified by reference numerals **80** to **89**, inclusive, and to these passageways are attached the beverage lines or hoses **30** to **39**, respectively. The passageway **81** for soda and the passageway **83** for water are positioned in the center of barrel **90**, as is best seen in FIG. **10**. The other passageways are positioned in a circular arrangement. The barrel **90** is preferably an integral structure formed of plastic material, and the passageways for the liquors and syrups (all the passageways except **81** and **83**) are in the form of tubes which extend below the lower end of the barrel. Thus in FIG. **9** the downwardly projecting ends of the tubes **85** and **89** are shown.

The diffuser **95** has a generally cylindrical configuration with its lower end being closed. The lower end of diffuser **95** has a set of eight openings **96** which are arranged in a circular pattern so as to receive the projecting ends of the liquor and syrup tubes. The barrel **90** on its lower end has its exterior surface recessed to receive diffuser **95**, and the diffuser extends downward a sufficient distance so that the lower end wall of the diffuser is spaced from the lower end of the barrel **90** to provide a diffusion chamber **97** therebetween. The soda and water passageways **81, 83** from the barrel **90** empty directly into the diffusion chamber **97**. The liquor and syrup tubes, however, pass through the diffusion chamber **97**, and through the openings **96** and project somewhat below the lowermost end of the diffuser **95**.

The nozzle **62** has a cylindrical opening therein which fits over the barrel **90** and diffuser **95**. The nozzle **62** also provides a mixing chamber **98** which opens into the discharge port **99**. All of the liquor and syrup tubes open into the mixing chamber **98**, whose lateral dimension is somewhat greater than that of the discharge port **99**.

It is significant that each of the openings **96** in the diffuser **95** is large enough so that there is an annular space surrounding the particular liquor tube or syrup tube which passes through that opening. The only exit from the diffuser chamber **97** is through the eight openings **96**, hence whenever soda or water is dispensed it impinges directly on the flat bottom surface of the chamber **97** (i.e., the bottom wall of cap **95**), then spreads laterally in all directions and is discharged through all of the openings **96** into the mixing chamber **98**. This method of diffusing the soda and the water has the advantage of continuously washing the ends of the liquor and syrup tubes, and provides a continuous cleaning action. The actual mixing of the liquor and/or syrup with the soda or water takes place in the mixing chamber **98**.

A problem of prior art dispensers has been that dispensing of a particular liquor and/or syrup has left a residue which affects the flavor or taste of the next succeeding drink. According to the present invention this problem is solved by the continuous washing of the liquor and syrup tube ends.

DISTRIBUTOR D FIGS. 11 TO 13

Reference is made to FIG. **11** illustrating the internal construction of distributor D. The function of the distributor is to control, through a separate valve mechanism for each, the flow of the four syrups, water and soda.

The six valve mechanisms contained within the distributor are all identical to each other, and for that reason only one of them will be described in detail. Furthermore, each of these valve mechanisms is very much similar to the valve mechanism that controls the flow of pressurized gas to chamber **112** of piston P, as shown in FIGS. **3** and **4**. Where a part in the distributor valve corresponds to a similar or identical part in the pump valve it is given the same reference numeral, but raised by **100**. For example, the diaphragm **267** of the distributor valve is constructed in essentially the same manner and has essentially the same function as the diaphragm **167** of the pump valve.

More specifically, the distributor D includes a housing formed of two separate blocks **260, 270.** These blocks are preferably formed of hard plastic material, like the blocks **100, 115, 150, 160** and **170.** The block **260** includes a flat cylindrical base with a smaller cylinder rising up from the center of the upper surface of the base. The block **270** is of annular configuration and fits over the raised portion of block **260,** so that the two blocks together form essentially a cylinder.

The block **260** has circumferentially spaced around the upper flat surface of its base part a group of six gas chambers **266.** Each of these gas chambers receives pressurized gas through a passageway **263** from the supply line **207.** Supply line **207** is connected by a fitting to the lower center of the block **260.** Each of the chambers **266** is also connected through a passageway **265** to one of the relief lines, such as line **48.**

Each of the chambers **266** is covered by a diaphragm **267.** The block **270** fits over the peripheral edge of diaphragm **267** and holds it in place. A chamber formed in block **270** above the diaphragm **267** is designated **271.** Base plate **273** is secured to the upper surface of diaphragm **267.** A plunger **274** is attached above the base plate and extends vertically upward through a sliding seal opening in the block **270** into an enlarged chamber **279.** A cup-shaped bushing **276** occupies the upper portion of chamber **271** and has a central opening through which the plunger **274** passes. An expansion spring **275** is located within the cup **276,** its upper end being retained by the bottom wall of the cup while its lower end is retained by the plate **273.** Spring **275** urges plate **273** and diaphragm **267** in a downward direction.

Chamber **279** is generally cylindrical but enlarged at its upper end. Located within chamber **279** is a perforated valve member **280,** of a generally cylindrical configuration but enlarged near its upper end by means of a flange **282.** A central passageway **281** extends vertically through the entire length of member **280.** The upper end of chamber **279** is closed by a threaded plug **283,** against the lower surface of which the member **280** normally rests. Above the flange **282** there is an annular space **290** within the circumferential wall of chamber **279** and surrounding the upper end of valve member **180.** An expansion spring **284** occupies the space **190,** its upper end engaging plug **283** while its lower end engages the upper surface of flange **282.** Spring **284** normally urges valve member **280** toward a downward position. The lower end of passageway **281** in valve member **280** is conically tapered, the upper end of plunger **274** being likewise conically tapered, and in the normal position of the valve mechanism as shown in FIG. **11** the passageway **281** is closed off by the plunger **274.** In the normal position of the valve mechanism the gas pressure in chamber **266** holds diaphragm **267** in an elevated position.

A vent opening **272** (not shown) may, if desired, be used to relieve pressure in chamber **271** to atmosphere.

It will be noted that the associated pressure relief line such as relief line **48** communicates directly with chamber **266** through the passageway **265.** When the associated button **18** of dispensing nozzle assembly N is depressed, the pressure in relief line **48** is relieved, and the pressurized gas in chamber **266** escapes through passageway **265** and the relief line **48** to atmosphere. A restriction **263***a* in passageway **263** makes the flow of gas from line **207** insufficient to maintain the pressure in chamber **266.** Therefore, spring **275** pushes the plunger **274,** base plate **273,** and diaphragm **267** into a lowered position (not specifically shown). Diaphragm **267** closes off passageway **263.** This is the open position of the valve mechanism.

When the valve moves to its open position the valve member **280** is driven downward by its spring **284,** but can move only a short distance before its flanged portion **282** is stopped by an associated sloping wall section of the chamber **279.** A vertical separation results between the upper end of valve member **280** and the lower surface of plug **283.** The downward movement of valve member **280** is much less than the downward movement of plunger **274,** hence a large gap exists between the lower end of member **180** and the upper end of plunger **274.**

The cola syrup line **38'** is coupled through a passageway **278** to the lower end of chamber **279.** When the valve mechanism moves to its open position the syrup is able to flow through its supply line **38'**, the passageway **278,** the lower end portion of chamber **279,** the passageway **281** in valve member **280,** through the space between the upper end of valve member **280** and plug **283,** into the annular space **290.** A passageway **293** couples the annular space **290** to cola output line **38.**

There is no self-locking feature for the valve mechanisms of distributor D. It is therefore necessary that the pressure in the pressure relief line controlling the particular valve mechanism continue to be relieved as long as the valve is required to remain open. In other words, the associated pushbutton must remain depressed so long as it is desired for the flow of syrup to continue. When a sufficient amount of syrup has been dispensed from the dispensing nozzle assembly N (as judged by the eye of the bartender) then he releases his thumb or finger from the drink mix pushbutton. Gas pressure immediately builds up in the chamber **266,** the valve mechanism returns to its position as shown in FIG. **11,** and the flow of syrup is interrupted.

It has previously been explained that the control channel for soda in the dispensing nozzle assembly N is so arranged that soda is not only dispensed in response to the soda pushbutton, but also in response to each of the four drink mix pushbuttons. Thus, for example, when the cola button **18** is depressed the result is that cola syrup and soda flow concurrently through the distributor D and thence through their respective supply lines **38, 31** to the dispensing nozzle assembly N. When the pushbutton is released the flow of both ingredients is discontinued at the same time.

In the distributor D each of the valve plugs **283** carries an associated adjusting screw **283***a*. The adjusting screw occupies a threaded opening in the plug **283** and extends all the way through the plug. The lower end of the adjusting screw has a conical tip which occupies the upper end of passageway **281** when the valve mechanism is in its closed position. When the valve mechanism is in its open position the flow volume out of the upper end of passageway **281** is influenced by the position of the adjusting screw **283***a*. More specifically, if the adjusting screw is raised so that its point does not project below the under surface of plug **283**, then a maximum flow is achieved. But if the adjusting screw is set down to a lower position it will limit the volume of flow of liquid coming out of the passageway **281**. By use of these adjusting screws it is therefore possible to adjust the rates of flow for each of the syrups, for water and for soda. More specifically, the adjusting screws for the syrup valves and the adjusting screw for the soda valve may be utilized to establish a desired ratio of flow of soda relative to the flow of syrup. Once this adjustment has been established it does not normally need to be changed. Depressing one of the drink mix buttons for tonic, collins, Seven, or cola, therefore, results in a flow of the syrup and of soda in a particular desired ratio.

While in FIG. **11** the distributor D is shown in a particular gravitational orientation, the springs **275** and **284** and gas pressure in chamber **266** provide sufficiently positive controls so that any gravitational position may be used.

In the overall arrangement of the dispensing apparatus as shown in FIG. **1** the liquor output lines **30, 32, 34** and **37** are shown as being coupled directly from the dispensing pumps P to the dispensing nozzle assembly N. However, from the standpoint of mechanical packaging it is actually preferred to have these liquor lines, and their associated pressure relief lines, pass through the distributor. This alternate arrangement is shown in FIGS. **12** and **13**. The reason for passing these lines through the distributor is that on the output side of the distributor all twenty lines are conveniently bunched together, which makes it easier to wrap them in a tight bundle for connection to the dispensing nozzle assembly N.

Thus FIG. **12** shows the face of the distributor housing block **270** with the six plugs **283** located therein. The cola line **38**, tonic line **36**, Seven line **35**, soda line **31**, water line **33**, and collins line **39** are located adjacent their respective controlling valve mechanisms (as indicated by the location of the respective plug **283**). Interspersed among these lines are the liquor lines **30, 32, 34,** and **37** which simply pass through suitable openings in the distributor housing without having any internal connections thereto.

FIG. **13** shows the face of the distributor housing block **260**. The product lines **38', 36', 35', 31', 33'**, and **39'** are shown coupled to the block **260** near its peripheral edge, for delivering the respective products under control of the respective valve mechanisms located inside the distributor. In the center of block **260** is shown the gas pressure line **207**. Also shown in the distributor block **260**, in positions near the gas pressure line **207**, are the liquor lines **30, 32, 34, 37** and their associated pressure relief lines **40, 42, 44, 47**.

ELECTRICALLY CONTROLLED DISPENSING UNIT FIGS. 14 & 14*a*

Reference is made to FIGS. **14** and **14***a* illustrating an electrically controlled form of the liquor dispensing unit. The arrangement of the dispensing pump is the same as before but the three-way valve is controlled electrically, rather than by pressurized gas.

Thus the displacement pump **300** has a metering chamber **310** with inlet opening **311** and outlet **315**. Beverage flows into the chamber **310** from a supply line **313** through a check valve **312** that is coupled to the inlet opening **311**. Beverage flows out from chamber **310** through an outlet opening **315**, outlet check valve **316**, and output line **317** to the dispensing nozzle assembly N.

A reciprocating piston **320** within the chamber **310** is normally retracted from that end of the chamber in which the passageways **311, 315** are located. Spring means **321** normally keeps the piston **320** in its retracted position.

Drive means for the piston **320** are provided by a space **330** at the rearward end of chamber **310**. Pressurized gas enters the space **330** through inlet openings **31**, being supplied from the pressure line **332**. A source of pressurized gas such as CO_2 is represented by a supply line **340**, and the liner **340** is selectively coupled to the line **332** by means of a three-way valve **350**.

While the details of construction of the three-way valve **350** are not shown, it is of conventional construction. In one position of the valve mechanism there is an open passageway from supply line **340** through supply line **332** into the chamber space **330**. In the other position of the valve mechanism there is an open passageway from supply line **332** through the interior of the valve to atmosphere, which permits pressurized gas from the chamber portion **330** to be discharged; at the same time the pressure line **340** is closed off. The three-way valve normally occupies its latter position, but is selectively driven to its former position by energization of the solenoid winding **355** (FIG. **14***a*).

A step-down transformer **357** is used in order to supply energy on a line **356** at voltage substantially below the standard 115V level. Line **356** is permanently coupled to one side of the coil **355**, and may be selectively coupled to the other side of the coil by closing either the switch **351** or the switch **361**. Switch **351** is a push-button switch carried by the nozzle assembly N, and coupled to valve **350** by means of conductors **352**. Switch **361** is a pressure-sensitive switch coupled to valve **350** by means of conductors **362**. Conductors **362** are connected in parallel with conductors **352**.

At the upper end of chamber **310** the liquid pressure is sensed through a passageway **360** which communicates with the pressure-sensitive switch **361**. While the mechanism of switch **361** is not illustrated here in detail, it is of conventional construction, and includes a bellows responsive to applied pressure for closing a pair of switch contacts. When piston **320** strikes the upper end wall of chamber **310** the liquid pressure drops, and the switch contacts of switch **361** open.

Thus the liquor dispensing unit of FIGS. **14** and **14***a* operates in the same general manner as the dispensing unit of FIGS. **2** to **4**. That is, a push-button carried on the dispensing nozzle assembly N is momentarily depressed by the thumb or finger of the bartender, and that actuates a three-way valve which in turn permits driving energy to be supplied to the reciprocating piston. Forward movement of the piston causes an increase of liquid pressure, which is sensed by a sensing device coupled to the forward end of the metering chamber. The pressure-sensing device is coupled to the three-way valve in a parallel control arrangement with the push-button. Once the liquid pressure increase resulting from forward movement of the piston has been sensed by the device, the release of thumb or forefinger from the push-button on the dispensing nozzle does not interfere with the continued operation of the pump. On the contrary, the pump is locked in by its own action, and continues its cycle to completion, at which time the loss of liquid pressure causes the three-way valve to switch in the opposite direction and thus discontinue the driving energy for the piston.

The invention has been described in considerable detail in order to comply with the patent laws by providing a full public disclosure of at least one of its forms. However, such detailed description is not intended in any way to limit the broad features or principles of the invention, or the scope of patent monopoly to be granted.

What is claimed is:

1. Beverage dispensing apparatus comprising:
a source of beverage to be dispensed;
a dispensing nozzle;
a normally open pilot-operated valve coupled between said beverage source and said nozzle;
a moveable diaphragm mechanically coupled to said valve for controlling the operation thereof, said diaphragm having one surface exposed to a gas chamber;
a source of pressurized gas coupled to said chamber for keeping said valve closed until the pressure in said chamber is relieved;
a normally-closed push-button valve supported from said dispensing nozzle and having one side open to atmosphere;
and a relief line coupled between said chamber and the other side of said push-button valve, for relieving the gas pressure in said chamber while the push-button remains depressed to thereby permit liquid to flow through said first-named valve to said dispensing nozzle.

2. Apparatus as claimed in claim **1** wherein said beverage source is a tank, and said source of pressurized gas is also coupled to said tank for energizing the flow of beverage from said tank to said nozzle.

3. Apparatus as claimed in claim **1** wherein said diaphragm is responsive to the resumption of normal gas pressure in said chamber for closing off said first-named valve and thereby shutting off the flow of beverage.

4. Beverage dispensing apparatus comprising:
a displacement pump having a liquid metering chamber;
a piston adapted to move forward in said chamber for discharging liquid therefrom;
means for driving said piston;
a source of energy for said drive means;
first control means operable manually for initially coupling said energy source to said drive means;
and second control means responsive to the forward movement of said piston for maintaining the coupling of said energy source to said drive means;
whereby the timing of the dispensing stroke of said piston is independent of said first control means.

5. Apparatus as in claim **4** wherein said drive means includes a gas expansion chamber at the rearward end of said piston, and passageways coupled to said expansion chamber for conveying pressurized gas thereto.

6. Apparatus as in claim **4** wherein said first control means is a push-button switch having two electrical contacts.

7. Apparatus as in claim **4** wherein said first control means includes a pressure relief line and a pushbutton valve for selectively coupling said relief line to atmosphere.

8. Beverage dispensing apparatus comprising:
a displacement pump having a liquid metering chamber, an outlet port communicating with one end of said chamber, an outlet check valve associated with said outlet port, a reciprocating piston within said chamber, and spring means normally urging said piston into the other end of said chamber;
a dispensing nozzle coupled to said outlet port;
means for selectively driving said piston forward into said one end of said chamber so that a predetermined quantity of liquid measured by said chamber is delivered to said nozzle;
said one end of said chamber also having an inlet port, and an associated inlet check valve, for admitting liquid to refill said chamber each time that said piston is withdrawn by said spring means;
an energy source for said driving means;
first manually operated control means selectively coupling said energy source to said driving means for initiating the forward movement of said piston, said first control means including a push-button mounted on said dispensing nozzle and normally held in unoperated position by associated spring means;
and second control means coupled in parallel with said first control means, including means for sensing the liquid pressure in said one end of said chamber and being operable in response to liquid pressure generated by the forward movement of said piston;
the forward movement of said piston thus serving to maintain the energization of said driving means, after said push-button has been released, until said piston is stopped by striking the end of said chamber.

9. Apparatus for dispensing a beverage in precisely controlled individual shots, comprising:
a. a beverage container having means for admitting atmospheric pressure therein;
b. a suction tube having an input end submerged beneath the beverage in said container, and having an output end;
c. a displacement pump having
1. a liquid metering chamber,
2. an inlet port communicating with one end of said chamber, and
3. an outlet port also communicating with said one end of said chamber, said output end of said tube being coupled to said inlet port;
d. an outlet tube having one end coupled to said outlet port, and also having a remote end;
e. a hand-held nozzle carried on said remote end of said outlet tube;
f. said pump also having
4. a reciprocating piston within said chamber,
5. an inlet check valve normally closing said inlet port and openable in response to a pressure differential condition in which the pressure level in-

side said suction tube is higher than the pressure level inside said chamber, and

6. an outlet check valve normally closing said outlet port and openable in response to a pressure differential condition in which the pressure level inside said chamber is higher than the pressure level inside said outlet tube;

g. spring means normally maintaining said piston in a retracted position at the other end of said chamber;

h. means for selectively driving said piston forward from its retracted position to said one end of said chamber; and

i. a push-button mounted on said nozzle and coupled to said drive means for actuating the same;

whereby when said liquid chamber and said tubes are initially filled with beverage and said push-button is depressed, the forward movement of said piston closes said inlet valve and opens said outlet valve and delivers a measured quantity of beverage from said chamber through said outlet port and said nozzle, and the subsequent withdrawal of said piston to the other end of said chamber under control of said spring means creates a partial vacuum in said chamber, closes said outlet valve, and opens said inlet valve so that the atmospheric pressure on the upper surface of the beverage in said container drives the beverage in said tube upwards against the force of gravity and hence into said chamber.

10. Apparatus as claimed in claim **9** which further includes a flexible diaphragm coupled between said piston and the chamber wall for sealing the rearward end of said chamber.

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