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Henley et al.

[11] 3,827,467

[45] Aug. 6, 1974

[54] **FLUID DISPENSING APPARATUS**

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[21] Appl. No.: **355,516**

[52] **U.S. Cl.** **141/104**, 141/250, 222/2

[51] **Int. Cl.** **B65b 3/30**

[58] **Field of Search** 141/129, 94, 98, 100–107, 141/129, 250–284, 351–362; 222/2, 288

[56] **References Cited**

UNITED STATES PATENTS

3,254,749	6/1966	Scherer	222/2
3,312,372	4/1967	Cooper	222/2
3,349,962	10/1967	Levin	222/2
3,484,020	12/1969	Houle et al.	222/2
3,629,858	12/1971	Hayakawa et al.	222/2
3,750,626	8/1973	Smith	222/2
3,779,357	12/1973	Haller et al.	222/2

Primary Examiner—Houston S. Bell, Jr.

Attorney, Agent, or Firm—Biebel, French & Bugg

[57] **ABSTRACT**

A fluid dispensing apparatus simultaneously dispenses precise quantities of various fluids according to a predetermined schedule encoded onto a control card. The card has projections or bumps thereon which engage trigger arms as the card is moved at a constant speed through a channel past the trigger arms. The trigger arms control a plurality of valves by unlocking over-center locking arms which release previously pinched-off sections of resilient tubing to release the various fluids controlled thereby. Completed travel of the card causes reset of all the valves and terminates dispensing of the fluids.

19 Claims, 12 Drawing Figures

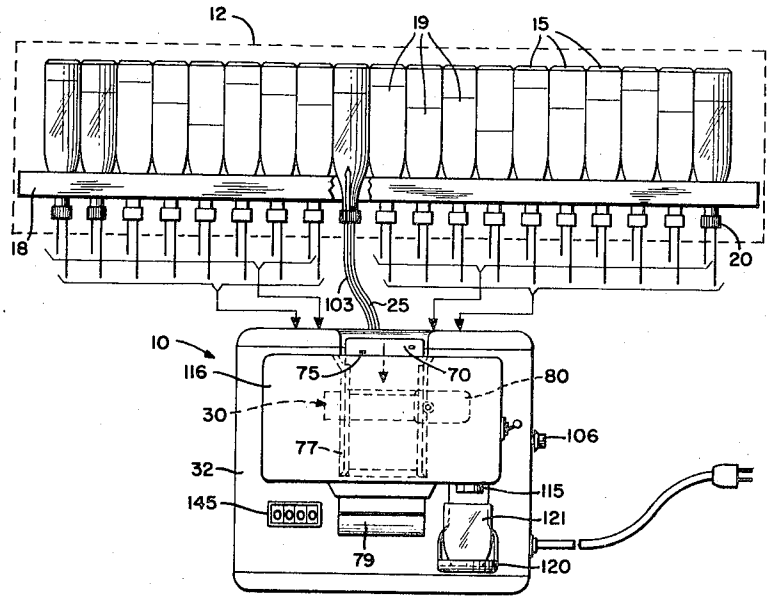


FIG-1

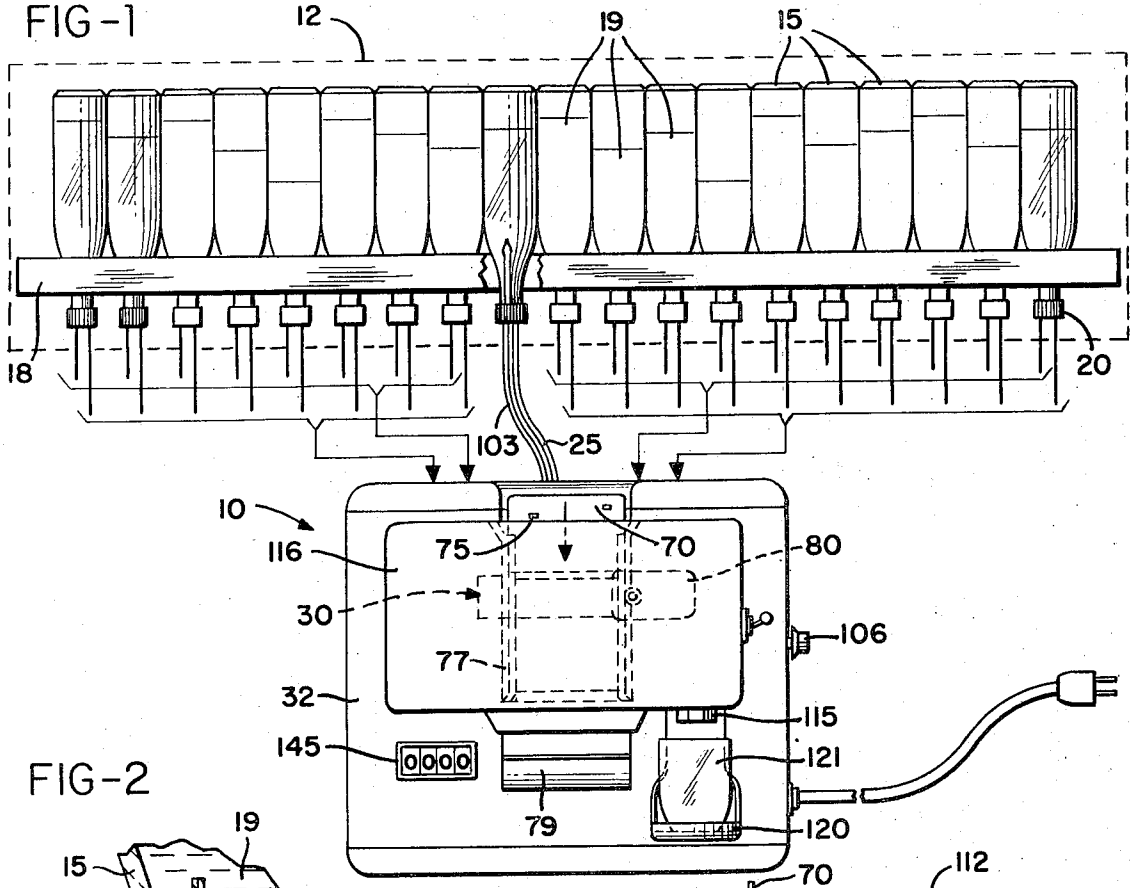

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FIG-2

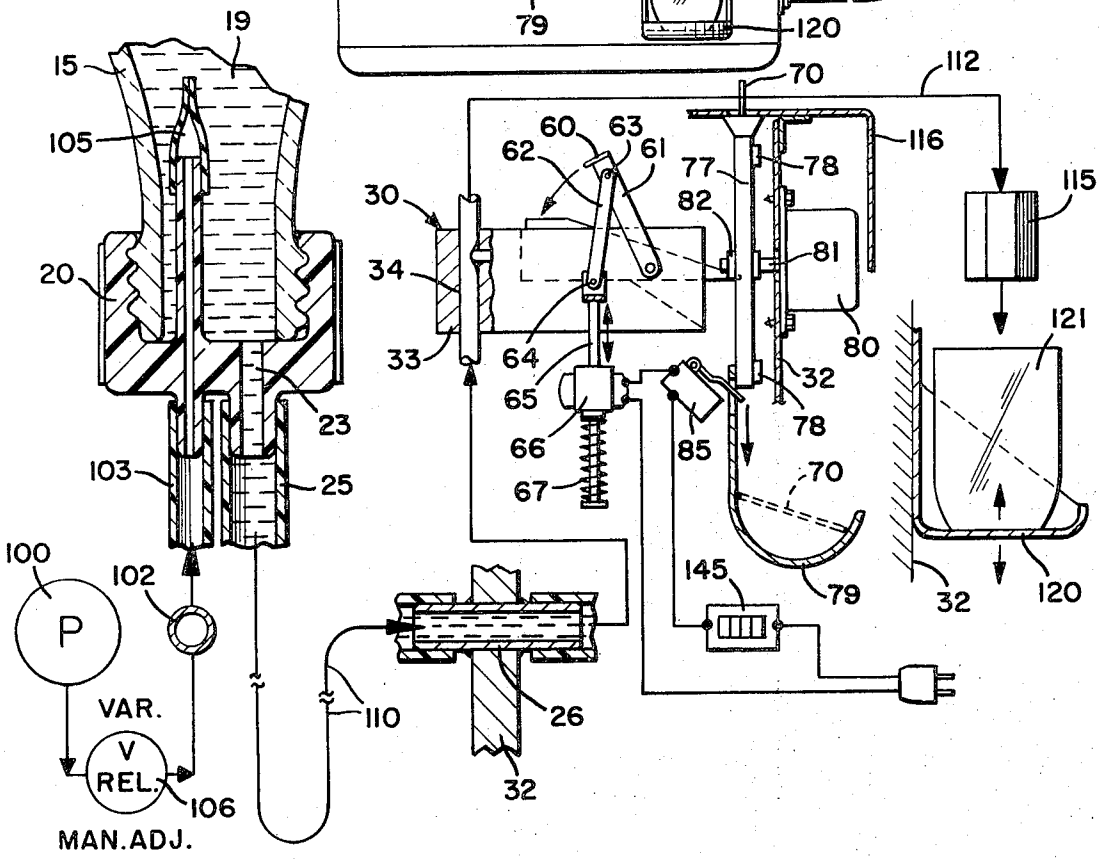

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FIG-3

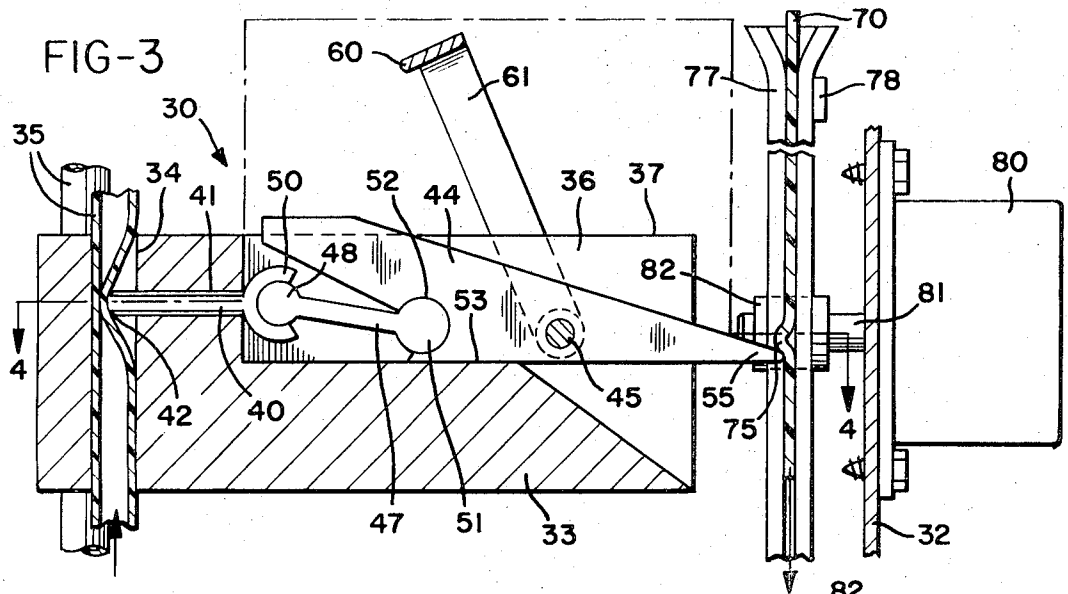


FIG-4

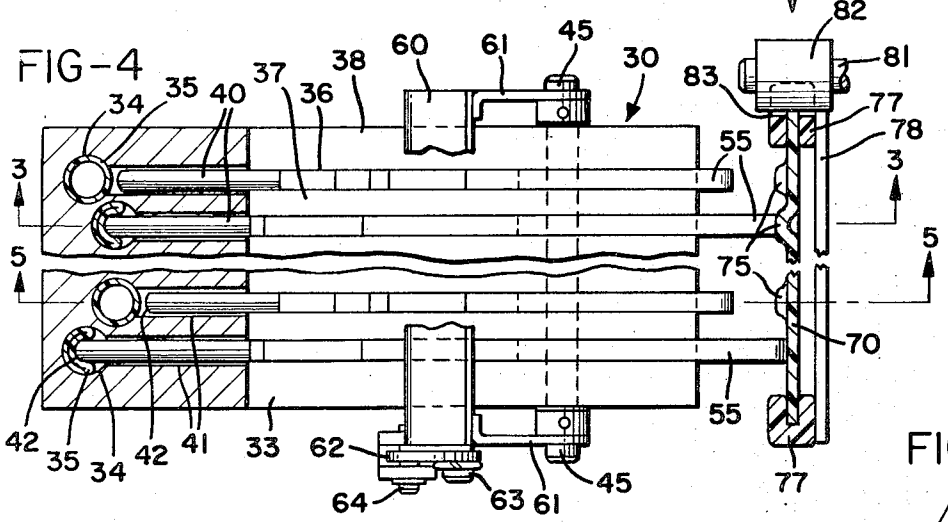


FIG-6

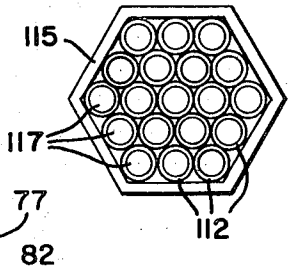


FIG-5

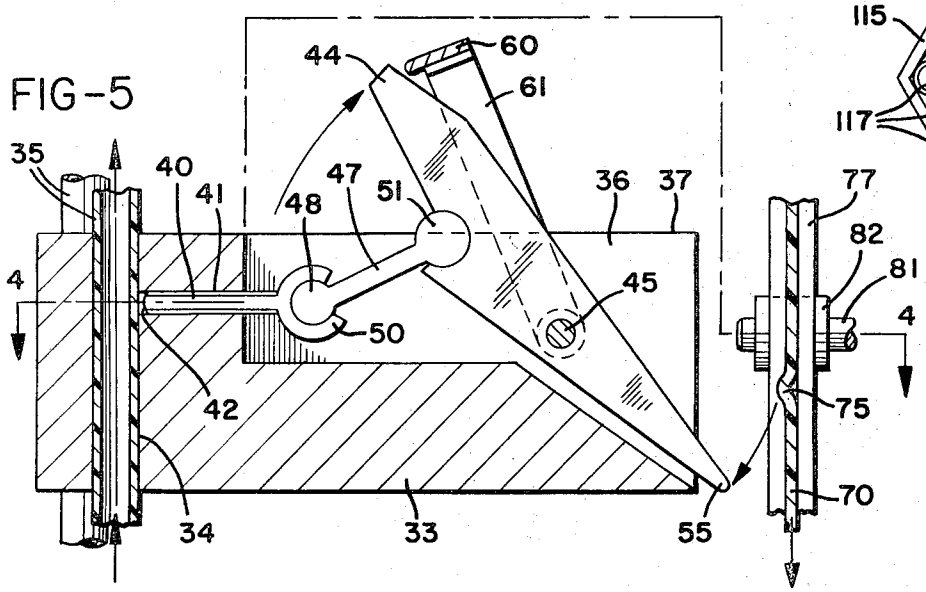


FIG-7

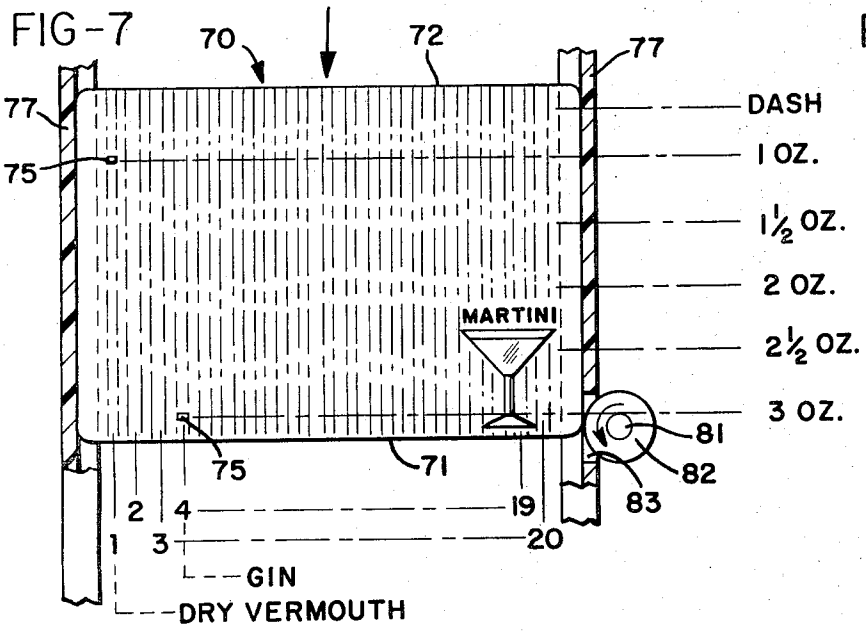


FIG-8

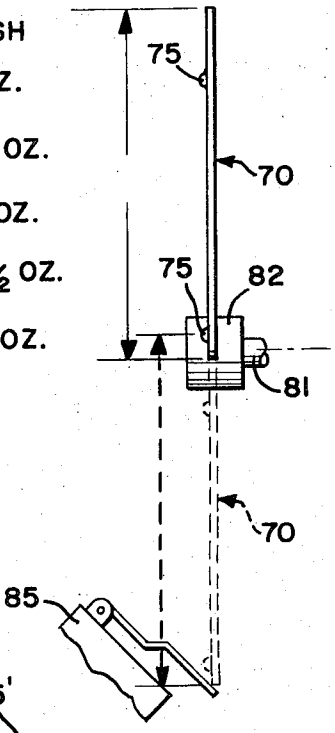


FIG-9

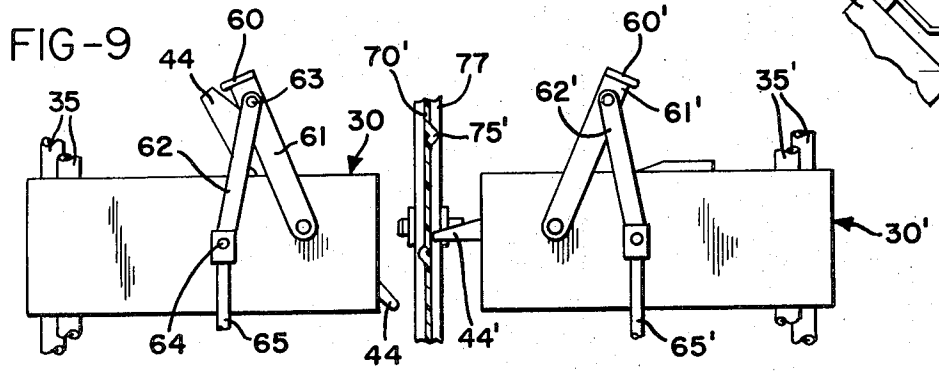


FIG-10

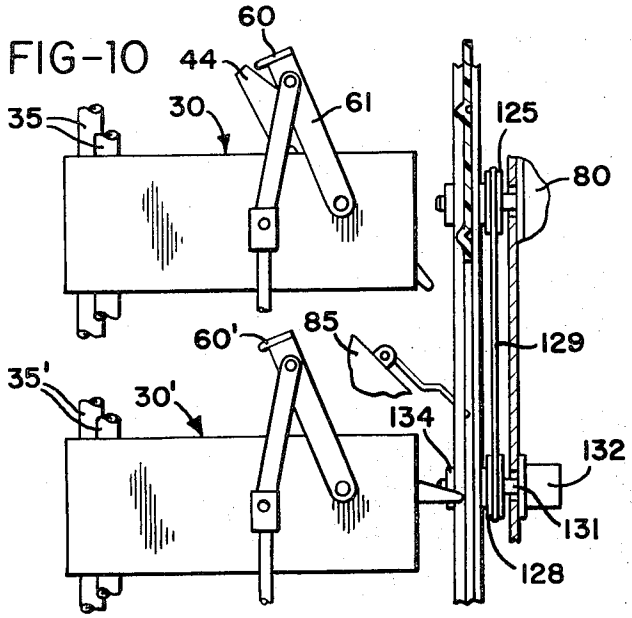


FIG-11

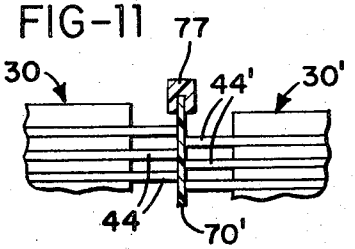
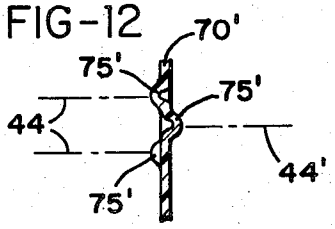


FIG-12



FLUID DISPENSING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to fluid dispensing apparatus, and more particularly to a device which can accurately, precisely, and simultaneously dispense predetermined quantities of any selected number of a substantial quantity of different liquids. The invention is particularly directed to an apparatus for dispensing mixed beverages, such as alcoholic drinks, although it is equally applicable to other environments, such as paint mixing, where predetermined quantities of different liquids must also be accurately dispensed.

The prior art is full of devices directed to solving the problem of automatically dispensing mixed drinks or other liquid concoctions. The effort to mechanize the bartender in an inexpensive and reliable fashion has engaged inventors for a long time, as may be seen, for example, in such U.S. Pat. as Nos. 903,203, 1,600,170, 3,067,912, 3,119,485, 3,409,176, and 3,675,820.

Few if any of these devices, however, have met with widespread acceptance. This has been due primarily to questions of cost (one presently available device costing thousands of dollars), versatility (most previous devices having been limited to but a very few drinks) or both.

The high costs encountered by the prior art have been in part a result of the use of complicated and expensive components, deemed necessary to achieve commercial reliability. For example, high quality electromagnetic control valves have often been specified. However, not only has this resulted in high initial costs, but service and maintenance costs have also been high when such maintenance has become necessary.

Further, the program for dispensing each drink is usually internal to the machine itself. The user simply pushes a button or turns a selector for the desired drink. However, this places a limit on the number of mixtures (drinks) available from the machine, and makes additions of other combinations very expensive or impractical.

A need thus remains for an inexpensive yet highly reliable device which can accurately dispense an almost unlimited variety of mixed liquids. The device must be capable of withstanding continuous and heavy usage, such as would be expected in commercial establishments, must provide for inexpensive and rapid service and maintenance, and must be capable of dispensing a theoretically infinite variety of drinks according to the tastes and desires of the individuals (patrons) being served.

SUMMARY OF THE INVENTION

Briefly, the present invention provides a fluid dispensing apparatus in which control cards are provided with actuating means such as individual bumps or projections thereon to control simple and inexpensive mechanical trip valves. The valves accurately dispense any of a wide variety of available liquids, in any desired quantity within a practical range.

Each card is driven at constant speed through a card guide, and the projections or other actuating means on the card trip small mechanical valves to release the correspondingly selected individual liquids. The actuating means on the cards are located at selectively spaced locations to engage trigger arms which trip over-center locking arms. The over-center locking arms open the valves at predetermined intervals during the travel of the card through the card quide, in accordance with the location of each of the actuating means with respect to the leading and trailing edges of the card. Thus when a large quantity of a given liquid is to be dispensed, the corresponding actuating means is located near the leading edge of the card to trip the valve early in the course of the card travel (dispensing cycle). Where a small quantity of another liquid is to be included, the corresponding valve actuating means is near the trailing edge of the card, so that the valve is tripped open only near the end of the cycle.

Thus as each card travels through its course in the control mechanism of the liquid dispensing device, the valves are sequentially opened at multiple stages to cause correspondingly different timed dispensing operations. Predetermined quantities of the various different liquids are dispensed substantially simultaneously through all open valves.

At the end of the card travel, and hence at the end of the dispensing interval or cycle, the leading edge of the card trips means such as a sensitive micro-switch which actuates a solenoid to move a common valve closing bar. The common closing bar simultaneously engages all the overcenter locking arms, for the various open valves, and resets the arm assemblies to close the valves.

The dispensed liquids are supplied from a plurality of individual containers, which may be the bottles in which the liquids were originally supplied. The bottles are inverted in a slotted rack, and a special bottle cap, having tubing thereon connected to the corresponding valve in the valve assembly, is attached to each bottle. The tubing includes an air trp so that when a bottle is changed, air introduced into the tube near the cap will be expelled into the bottle, to prevent air from entering the tubes, valves, etc.

An air pressure pump supplies air to an air supply manifold to pressurize the contents of each liquid container. Individual air hoses connect from the manifold through the bottle caps to the interiors of each container. An air check valve on the air hose within each container prevents reverse flow of the liquid contents back into the air pressure supply system. A constant bleed valve releases air from the air pressure supply system to maintain a constant air pressure therein.

The valve assembly itself is inexpensive, uncomplicated, and highly durable. It may incorporate as many individual valves as desired, according to the number of different liquids to be dispensed. In the preferred embodiment illustrated herein, 19 valves are incorporated into a common valve assembly.

The valve assembly includes a comb having a vertical hole therethrough receiving each length of resilient elastomeric tubing. A separate pin channel for each piece of tubing is provided in the comb substantially perpendicular to the tubing channel itself. A valve pin is movably received in each pin channel and can be slid against the tubing to pinch the tubing closed against the wall of the tubing channel in the comb. The flow of liquid through the valve is thus controlled by pinching the tubing closed to close the valve, or releasing the pinch to open the valve.

Movement of the pin is controlled by an over-center locking arm assembly which, when moved donwardly, locks in a slightly over center position while pressing

the pin against the tubing, to close the valve. A trigger arm attached to the over-center locking arm assembly is engagable by the valve actuating means on the card to urge the locking arm assembly upwardly over center to unlock the arm assembly. When unlocked, the resiliency of the rubber tubing and the pressure of the liquid within the tubing press the pin away from the tubing, opening the valve and allowing the liquid to flow therethrough.

As mentioned, when the dispensing cycle has been completed, the card trips the resetting micro-switch to reset each valve. This pinches the valve tubing closed again, terminating the dispensing cycle. The dispensed liquids are conducted from the valve tubing to a common dispenser head where each liquid issues separately into a receptacle supported therebeneath.

For purposes of economy and compactness, each individual locking arm assembly is wholly contained within its respective thin arm channel in the comb. The thin arm channel permits the vertical movement of the locking arm assembly, for locking and unlocking thereof, and horizontal movement toward and away from the tubing, to enable the pin to be moved into and out of the pinching configuration. Lateral movement of the locking arm assembly is prevented, however, by the narrowness of the arm channels in which the arms are contained. Thus the pivots of the locking arm assembly need not be strengthened against lateral movement. As a result, they may not only be very much thinner, but are also much less expensive to manufacture. Rivoted pivots, for example, would be much more difficult to manufacture, more expensive, and much bulkier.

It is therefore an object of this invention to provide an improved liquid dispensing apparatus which is controlled by valve trip projections incorporated into a dispenser controlling card; which includes an uncomplicated valve having an over-center locking arm assembly to press a pin against a supported length of resilient rubber tubing to pinch the tubing to close the valve and to release the pinch to open the valve; which includes a constant speed drive mechanism and a card guide means to move each card having actuating means thereon past trigger arms to trip the over-center locking arm assemblies to open the valves at predetermined intervals for causing correspondingly different timed dispensing operations at multiple stages to dispense predetermined quantities of various liquids substantially simultaneously; which may dispense any of a wide variety of liquids and combinations thereof, in any desired quantities; which includes a comb supporting the resilient tubing, valve pins, and over-center locking arm assemblies as a unit, for minimizing the size and cost thereof; in which the valve-comb assembly provides for insertion and removal of the valve assembly as a unit in the liquid dispensing apparatus, for ease and efficiency of maintenance and service; in which the liquids may easily be dispensed directly from the containers in which they are sold without introduction of air into the valves and tubing of the liquid dispensing system; and in which each liquid is served directly from its individual tubing so that no rinsing is required between servings.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat schematic illustration of the liquid dispensing apparatus of this invention, showing nineteen liquid containers individually supplying liquid, and also showing the front of the dispensing portion of the invention;

FIG. 2 is a diagrammatic schematic illustration of the supply and control elements of the invention;

FIG. 3 is a cross-section of the valve assembly, dispenser controlling card, and card drive means, showing the card being driven downwardly through the card guides, and showing a trip projection thereon engaging and about to trip a valve trigger arm, the view being taken generally on line 3—3 of FIG. 4;

FIG. 4 is a cross-sectional view similar to FIG. 3, taken on lines 4—4 of FIGS. 3 and 5;

FIG. 5 is a cross-sectional view similar to FIG. 3, taken on line 5—5 of FIG. 4, and showing a valve assembly which has been tripped to the open position;

FIG. 6 is a bottom view of the dispenser nozzle showing the hexagonal arrangement which is used to obtain high density packing for the individual liquid outlets in the dispenser nozzle;

FIG. 7 is an illustration of a dispenser card programmed for dispensing a martini, showing the card as it commences travel through the card guides;

FIG. 8 is a side view similar to FIG. 7 illustrating the dimensional relationships between the dispenser controlling card, card drive motor, valve reset microswitch, and card trip projections, which dimensions assure positive driving of the card during the entire dispensing operation;

FIG. 9 illustrates an alternative embodiment in which two valve assemblies are arranged on opposite sides of the card guides, and appropriate valve trip projections are provided on each side of the card for the respective valve assemblies;

FIG. 10 illustrates still another embodiment in which two or more valve assemblies are arranged in tandem, and showing a drive belt and pulley arrangement for continuing the positive drive of the card as it moves through such a tandem configuration.

FIG. 11 shows the dual valve assembly of FIG. 9 in an off-set configuration; and

FIG. 12 illustrates somewhat diagrammatically the corresponding card valve trip projection arrangement for FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The liquid dispensing apparatus **10** illustrated in FIG. 1 includes a cabinet **12** enclosing a plurality of liquid containers **15**. Containers **15** may be any containers appropriate to the type and quantities of liquids being dispensed. The embodiment of the invention illustrated in FIG. 1 is a mixed drink dispenser for dispensing alcoholic beverages, and the containers **15** are therefore the original bottles in which the alcoholic beverages are commonly distributed.

The containers **15** are supported in inverted position in slots in a container rack **18**, so that the liquid contents **19** are against corresponding molded bottle caps **20**. Each cap **20** has a liquid discharge channel **23** therein connected to a corresponding flexible tube **25** of rubber, vinyl, or other appropriate material. Tubes **25** serve as liquid conducting means which are sepa-

rately connected to the individual containers **15** to carry the liquids out of cabinet **12** through stainless steel nipples **26** (FIG. **2**), from which the liquid is then conveyed to a valve assembly **30** shown as located in a separate housing **32** which may conveniently be mounted on the front or top of cabinet **12.**

Valve assembly **30** is a complete, unitary subassembly mounted for easy removal in housing **32.** The valve assembly includes a comb **33** provided with a plurality of tube supporting bores **34,** and a resilient tubing member **35** is received and supported in each of the bores **34.** Tubing members **35** are made of resilient material such as silicone, Neoprene, or surgical gum rubber, for reasons which will subsequently be explained. The upper corner portion of comb **33** at its end remote from the tubing member **35** has multiple slots **36** therein defined by partitions **37** and outer walls **38.**

The comb **33** supports a valve pin **40** for each piece of tubing **35,** each valve pin **40** being movable axially in a channel **41** which extends substantially perpendicularly away from its associated tube supporting bore **34.** Each valve pin **40** is individually movable toward and away from its corresponding tubing member **35,** so that the pin ends **42** which contact the respective tube members **35** are individually able to pinch individual members **35** closed by pinching the tubing against the wall of the corresponding tube supporting bore **34** (FIGS. **3** and **4**).

The tube-closing end **42** of each pin **40** has a radius of curvature substantially the same as that of the outer diameter of the tubing **35,** when free or at rest, minus two tubing wall thicknesses (see FIG. **4**). This pin end curvature pinches the tubing closed by reversing the curvature of the pressed wall in such a way as to complement the configuration of the portion opposite the pin, to effect a complete closing pinch of the tubing. It should be noted in this regard that a pin which is too small in diameter may simply press through the tubing without pinching it closed; a pin with too large a diameter may squash the tubing without pinching it closed; a pin of correct diameter but incorrect end curvature may produce similar results or damage the tubing. The pin diameter and end curvature should therefore be selected as above, to produce a pinch as illustrated in FIG. **4.**

Individual movement of the valve pins **40** inwardly and outwardly of the pin channels **41** is controlled by a plurality of over-center locking arm assemblies, one for each pin **40** and corresponding tubing member **35.** Each over-center locking arm assembly includes a trigger lever **44** mounted for rocking movement in one of slots **36** on a pivot pin **45** which is in turn mounted in the partitions **37** and outer walls **38** of comb **33.** A complementary coupling arm **47** connects each trigger lever **44** with its associated valve pin **40.** At one end of each arm **47** is a hinged disk portion **48** received for rocking movement in a socket **50** at the rearward end of the associated valve pin **40.** A similar hinge disk portion **51** at the opposite end of each arm **47** is similarly received in a socket portion **52** in the associated trigger lever **44.**

Each over-center locking assembly has a locked and an unlocked position, as may be seen more particularly with reference to FIGS. **3** and **5.** In the locked position (FIG. **3**), hinge disk **51** is placed slightly below an imaginary line between hinge disk **48** and pivot pin **45.** Pressure on the corresponding valve pin **40** tending to release the tubing pinch, and hence to drive the pin toward the locking arm assembly, will simply drive hinge disk **51,** and the heel **53** of lever **44,** against comb **33,** preventing movement of the pin and keeping the valve pinched closed. Since the tubing is a resilient tubing, a constant pressure is maintained against pin **40,** causing heel **53** to be held continuously against comb **33.** As a result, the over-center locking arm assembly is maintained in a locked position, and the tubing is continuously held in a closed or pinched-off configuration.

To release the pinch, and hence to open the tubing, it is necessary to apply only a very slight pressure to the outer end **55** of trigger lever **44,** in the same direction that heel **53** bears against comb **33.** Due to the considerable mechanical advantage provided by this configuration, slight pressure applied to end **55** will readily overcome the pressure on pin **40,** and trigger lever **44** will pivot about pivot pin **45,** lifting hinge disk **51** away from comb **33** and across the imaginary line between hinge disk **48** and pivot pin **45.** The over-center locking arm assembly will then be unlocked and will quickly move to the position shown in FIG. **5,** as a result of the pressure of the resilient tubing **35** on pin **40.** The slight movement of trigger lever **44** therefore trips the over-center locking arm assembly to release the tubing pinch, opening the tubing member **35.** The over-center locking arm assembly, valve pin **40,** tubing member **35,** and comb **33** thus form valve means having a closed, locked position and an open, unlocked position.

Movement of the respective valve-opening arm assemblies to their closed and locked position is effected by a reset mechanism comprising a bar **60** carried by a pair of arms **61** pivoted on the pivot pin **45** in straddling relation with comb **33.** The reset bar **60** is operated through a link **62** having one end pivoted at **63** to one of arms **62.** The other end of link **62** is pivoted at **64** to a rid **65** so connected to the plunger of a solenoid **66** that when the solenoid is energized, rod **65** is moved down and acts through link **62** to draw bar **60** down sufficiently to push any trigger levers **44** which are in unlocked position down to their locked position wherein they effect closing movement of their respective valve pins **40.** A spring **67** returns rod **65** and bar **60** to their raised positions ready for a new cycle as soon as solenoid **66** is released.

Hinge disks **48** and **51** may be of any appropriate configuration adequate to keep pin **40,** arm **47,** and lever **44** coupled together. However, in the present embodiment which is directed to dispensing of mixed beverages, compactness of the entire valve assembly **30** is an important feature. In addition, the hinge members **48, 50, 51,** and **52** should be as inexpensive, yet reliable, as possible. Thus for example, rivets are not used, but instead an even more compact and less expensive hinge is provided.

As shown, the slots **36** in comb **33** allow vertical movement of the over-center locking arm assemblies but prevent lateral movement thereof. This makes possible the simple disk and socket configurations for coupling arm **47** since the slots **36** are virtually no wider than the thickness of each lever **44** and arm **47,** and the hinge discs are therefore unable to come out of their respective sockets.

Another advantage of the construction is that, since the partititions and outer walls **37** and **38** provide the necessary lateral support for the valve-operating arm

assemblies, the individual parts of these assemblies can be made of relatively thin stock which is simpler and less expensive to fabricate than would be the case if these parts had to be laterally selfsupporting. This in turn contribues to the compactness of the valve assembly, which is also aided by staggering the bores **34**, as shown in FIG. **4**. The respective valve pins **40** are of the proper lengths, of course, to reach the corresponding tubing members **35**. The net result is an extremely compact valve assembly package **30**.

A plastic dispenser controlling card **70**, approximately 0.060 inch thick, is arranged to operate selected valve pins **40** by tripping selected over-center locking assemblies to open the corresponding valves for predetermined intervals and thereby to release and dispense the desired amounts of the particular liquids controlled thereby. Dispenser controlling card **70** includes leading and trailing edges **71** and **72**, and it has a plurality of bumps or valve trip projections **75** thereon. A pair of card guides **77** is mounted in housing **32** in position to define a card chute which guides each card **70** adjacent the ends **55** of trigger levers **44**. Guides **77** are formed of a low friction material such as nylon and are supported in housing **32** by upper and lower tie bars **78**. A card catcher tray **79** is located below guides **77** at the front of housing **32** to receive each card **70** at the end of the dispensing cycle.

A constant speed card drive motor **80** is mounted on the front of housing **32** and drives a shaft **81** on which a rubber sleeve **82** is attached. Sleeve **82** is received in a slot **83** in one of the guides **77** to engage and drive card **70** at a constant speed downwardly through the guides. The movement of the card through the guides causes the valve trip projections **75** to engage and actuate the ends **55** of selected trigger levers **44**. The projections **75** trip the appropriate levers **44** independently and selectively, to move the corresponding valve operating assemblies over center from locked to unlocked positions as the respective trigger levers **44** are engaged. The opening of the respective valves is controlled accordingly.

Thus when it is desired to dispense only one particular liquid, there will be provided but one valve projection **75** on the card, corresponding to the trigger lever **44** which controls the valve for that liquid. Where a plurality of liquids are to be dispensed, multiple appropriate projections **75** are provided.

Further, the quantity of liquid dispensed by each valve is a function of the length of time that the valve is open. Thus when a greater quantity of liquid is desired, the corresponding projection **75** will be located nearer the leading edge **71**, of card **70**, to engage the respective trigger lever **44** at an earlier time. A lesser quantity is dispensed by locating the corresponding projection **75** at a greater distance from leading edge **71** thus tripping the corresponding valve at a later time.

In order to terminate the dispensing cycle, a microswitch **85** senses the advancement of the leading edge **71** of card **70** and activates the reset solenoid **66**. The microswitch **85** is located a predetermined distance along the path of card **70** through guides **77** (FIGS. **2** and **8**) so that switch **85** is actuated only after card **70** has been driven by constant speed motor **80** for a predetermined elapsed time and movement through guides **77**.

To ensure positive opening of the desired valves as well as affirmative termination of the dispensing cycle, the valve assembly **30**, micro-switch **85**, card valve trip projections **75**, and drive motor **80** are all spaced and located with respect to one another such that first, the rubber drive sleeve **82** firmly engages and drives each card **70** before a projection **75** reaches a trigger lever end **55**. Secondly, they are so spaced that the card leading edge **71** reaches the micro-switch **85** while the card is still firmly engaged and driven by sleeve **82** (see FIG. **8**). In this manner, the proper opening and closing of the valves is assured, since the controlling card is positively driven at all times when operating these functions.

In order to assure that an adequate quantity of liquid will be supplied in a reasonably short time, an air pressure source **100** (FIG. **2**), such as an air tank or an air compressor, pressurizes the contents of each of the containers through an air manifold **102** connected thereto. Individual air hoses **103** pass from manifold **102** to each bottle cap **20** and connect therethrough to air check valves such as flapper valves **105** located within each bottle. The air flapper valves are one-way valves which allow air to enter the containers **15** but prevent reverse flow of the liquid contents **19** back into the air supply hoses **103**. Where an air compressor pump is used, an adjustable constant bleed valve **106** (FIGS. **1** and **2**) is utilized. It bleeds the air being pumped and thus serves as a pressure regulator to maintain the desired air pressure within the system.

In order to facilitate changing of the bottles without introduction of air into the flexible tubes **25**, each tube **25** is provided with an air trap **110** (FIG. **2**) which is simply a loop of tubing extending well below the container rack **18**. Thus when a particular container **15** is lifted out of rack **18** and cap **20** is removed therefrom, a column of liquid always remains within trap **110**. When cap **20** is then attached to the replacement container and the replacement container is inverted and placed in rack **18**, the air which has entered tube **25** and channel **23** simple rises into the new container, and the tube **25** is once again full of liquid. Trap **110** thus prevents entry of air into the tubing and valve system, and assures proper travel of the liquids being dispensed.

The tubes **25** connect through nipples **26** to the lower ends of the valve tubing members **35** so that the liquid **19** from containers **15** is conducted in an upward direction through the individual valve tubing members **35**. In this way, air which may initially be present in the valves is purged from the valves by the upward flow of the liquid therethrough.

The upper or outlet ends of the tubing members **35** are connected individually to flexible tubes **112** (FIG. **2**) which conduct the dispensed liquid from the individual valves to a common hexagonal dispenser head **115** located at the front of housing **32**, the head **115** being enclosed by the same hooded extension **116** on the front of housing **32** which also conceals the motor **80**. The ends **117** of tubes **112** in dispenser head **115** are all closely adjacent one another and constitute separate discharge outlets for each liquid **19**. The hexagonal configuration of dispenser head **115** provides the densest possible packing configuration for tube ends **117**, minimizing the size thereof.

A vertically adjustable receptacle support **120** receives a receptacle **121**, such as a beverage glass, be-

neath the dispenser head **115** and hood **116.** Support **120** locates the receptacle fairly close to the outlets **117** as they discharge the individual liquids into receptacle **121.** The liquids thus do not mix with the other liquids being dispensed until the liquids commingle in the glass or receptacle **121.** This eliminates the need for the discharge rinse required in devices where the liquids pass through a common discharge spigot.

FIG. **9** illustrates a variation of this invention in which two valve assemblies **30** and **30'** are operable by a single dispenser controlling card **70'.** In this case, the valve assemblies **30–30'** are mounted opposite one another on either side of the card chute defined by card guides **77'.** Assembly **30** to the left in FIG. **9** is opened by the valve projections which extend to the left, and assembly **30'** on the right is operated by rightward projections. The projections **75'** themselves, as well as the corresponding trigger levers **44–44'** may be arranged in the same vertical tracks for the two assemblies (that is, if there are nineteen valves in each valve assembly **30–30'**, there would be nineteen vertical tracks on the card).

Alternatively, twice as many vertical tracks may be used on the card, and the valve assemblies **30–30'** may be off-set as in FIG. **11,** providing individual vertical tracks on the card for each individual valve. FIG. **12** illustrates the off-set valve projections **75'** for the FIG. **11** configuration, schematically showing the opposing, off-set trigger levers **44–44'** being engaged by the projections.

FIG. **10** shows another arrangement which increases the versatility of the liquid dispensing apparatus by using a plurality of valve assembly modules **30–30'.** Here, the valve assemblies **30–30'** are operated in tandem, rather than opposite one another as in FIG. **9.** In the FIG. **10** configuration, the constant speed drive motor **80** includes a drive pulley **125** which operates a driven pulley **128** by means of a drive belt **129.** Driven pulley **128** rotates a second card drive shaft **131** supported in a bearing **132** and having a rubber card driving sleeve **134** similar to sleeve **82** on motor shaft **81.** Sleeves **82** and **134,** as well as the two valve assemblies **30–30',** are spaced to maintain positive, driven movement of card **70** as it moves continuously from the first valve assembly past the second.

FIG. **10** shows the reset micro-switch **85** for the first or upper valve assembly, and a similar micro-switch would be provided for the lower assembly. Alternatively, one reset switch following the lower assembly could function for both valve assemblies **30–30',** with the upper assembly continuing to dispense the selected liquids until both assemblies were reset by the common switch. The valve assemblies for the FIG. **10** tandem arrangement are preferably staggered as shown in FIG. **11,** so that individual valve trip projections **75** may be provided on card **70** for each particular trigger arm in each assembly.

As may be seen, therefore, this invention has numerous advantages. Virtually any liquids may be dispensed by this apparatus with great accuracy, and in virtually any desired quantity.

Card **70** and the valve trip projections **75** can be arranged to trip the individual valves selectivey at the appropriate predetermined time intervals to open one valve or as many valves as desired, at any predetermined intervals. Apparatus **10** is thus able to perform different dispensing operations simultaneously at various multiple stages, to dispense predetermined individual quantities of the liquids substantially simultaneously through the valves.

In the illustrated preferred embodiment used for dispensing mixed alcoholic beverages, the invention has provided a very inexpensive means for measuring liquids with great precision. Since surface tension across the discharge outlets **117** keeps the outlets filled, the apparatus is easily able to dispense as little as one drop, which may be desired, for example, when bitters are called for. Since the time of travel of card **70** through guides **77,** the air pressure in manifold **102,** and the location on card **70** of the valve trip projections **75** all determine the amount of liquid dispensed, the quantities may be selected and adjusted with ease. The arrangement of the containers **15,** rack **18,** and trap **110** allows bottles to be changed readily and quickly without having to purge the system of air each time.

The valve subassembly **30** is readily and easily removable from apparatus **10** for quick service and maintenance. Down time is thus minimized, since a substitute valve assembly **30** may quickly be inserted simply by reattaching the tubing members **35** of the replacement valve assembly **30.** Further, startup after replacement of the valve assembly is facilitated by the upward flow of the liquid through the tubing members **35,** which purges the air therefrom rapidly and quickly.

Further, the number of moving parts and the complexity has been absolutely minimized. Tubes **25** and **112** are made of three-eighths inch inert vinyl tubing such as Tygon, since this type of material has no effect on the flavor of the particular beverages being handled, and provides long and reliable service. The tubing members **35** are made of three-sixteenths inch surgical gum rubber, Neoprene, or silicone, since resiliency is important in the valve assembly itself. As may easily be seen, however, members **35** are also very easily replaceable so that if the resiliency of the tubing becomes too low, rejuvenation of the valves may be accomplished at extremely low cost. The low initial cost of fabrication, the high reliability, and the low maintenance and replacement costs, are all superior to solenoid and/or other mechanical valves commonly employed in dispensing devices.

The present invention is shown as dispensing nineteen different liquids, with a spare twentieth track shown on the card (FIG. **7**). The invention also includes a drink counter **145** to count the number of drinks which have been dispensed. As will be apparent, the number of possible drinks which this invention can dispense is limited only by the number of cards **70** which can be prepared. No internal programming of the apparatus itself is required, reducing costs even further. The cost of adding additional drink combination is minimal, since it is merely necessary to prepare the appropriate additional card or cards. Further, when it is desired to include additional types of liquid, it is within the scope of this invention to provide additional valves in assembly **30** with a wider card **70** having more projections **75** to accommodate the additional valves. It is also within the scope of this invention to provide projections **75** on both surfaces of card **70** (as in FIGS. **9, 11,** and **12**) to accommodate two or more valve assemblies face to face, to operate valve assemblies in tandem (as in FIG. **10**), and so on.

This invention provides complete standardization of the beverages or other mixtures being dispensed, by

giving precisely metered amounts. It is therefore also valuable in such applications as paint mixing, chemical analysis, and even in preparation of medical liquids such as radio-active cocktails, etc. In commercial establishments, this invention prevents cheating by assuring the customer of the full amount of liquid for which he is paying, and by keeping track of the number of drinks served.

Due to the long residence time of the various liquids within the apparatus **10**, it is not recommended that decomposable liquids, such as orange juice and tomato juice, be dispensed. In the mixing of alcoholic beverages, this is of no moment since the customer is paying primarily for the alcohol, not the mixer. In fact, since the apparatus measures the beverage very precisely, it is actually preferable to devote the capacity of the invention exclusively to the alcoholic portions of the beverages, reserving the mixers for manual addition.

Where extremely wide variations in quantity and viscosity are encountered, the diameters of tubings **25, 35** and **112** may be varied to bring the dispensing times for the various liquids into a common range. Alternatively, several different pressure heads may be maintained on the respective contents in containers **15** to cause differential dispensing within the same time range. Again, the invention is thus readily adaptable to virtually any environment where accurate and inexpensive dispensing of a variety of liquid combinations is desired.

Other variations will occur to those skilled in the art upon reading the present disclosure. For example, fluids such as gases may also be controllably dispensed by the present invention. Card **70** may include illustrations and instructions for the particular drink (or other mixture) which is to be dispensed, and may include instructions regarding the ingredients and garnishments to be included, as well as a photograph which shows the glass to be used and how the drink should appear when served (see FIG. **7**).

While the forms of apparatus herein described constitute preferred embodiments of this invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention.

What is claimed is:

1. Apparatus for dispensing selected mixtures of a plurality of fluids, comprising:

a. a plurality of means for supplying a corresponding plurality of fluids,

b. separate valve means for controlling the flow of fluid from each of said supply means,

c. separate operating means for each of said valve means movable between an operating position wherein the associated said valve means are closed and a release position effecting opening of said valve means,

d. said operating means each including trigger means responsive to tripping thereof to cause movement of said operating means from said operating position to said release position,

e. a control card having a leading edge and having actuating means for said selected said trigger means located thereon in predetermined spaced relations with said leading edge,

f. means defining a path for movement for said card in actuating relation with said trigger means,

g. drive means for moving said card along said path at a predetermined rate to cause said actuating means thereon to trip predetermined said trigger means sequentially in accordance with said spaced relations of said actuating means with said leading edge of said card and thereby to effect opening of the corresponding said valve means at corresponding predetermined stages of the movement of said card along said path, and

h. means responsive to a predetermined extent of movement of said card along said path for restoring all of said operating means to operating position effecting closing of all open said valve means.

2. The apparatus of claim **1** wherein each of said operating means includes an over-center locking means having a locked and an unlocked position and having a trigger lever extending therefrom adjacent the path of said movement of said card, wherein said actuating means on said card comprise projections for tripping said operating means by engaging selected said trigger levers to move corresponding selected said over-center locking means over center from said locked to said unlocked position, and wherein said resetting means is operative to move said over-center locking means back over center from said unlocked position.

3. The apparatus of claim **1** wherein said fluid supply means comprises a plurality of fluid containers and fluid conduction means separately conducting the fluid from each said container to a corresponding said dispensing control valve.

4. The apparatus of claim **3** wherein each said fluid conduction means includes a trap to eliminate air within said means subsequent to connection with a corresponding said container.

5. The apparatus of claim **3** further comprising air pressure supply means for pressurizing the contents of each said container, and an air check valve within each of said containers to prevent back flow of the contents thereof into said air pressure supply system.

6. Apparatus for dispensing selected mixtures of a plurality of fluids, comprising:

a. a plurality of means for supply a corresponding plurality of fluids,

b. separate valve means for controlling the flow of fluid from each of said fluid supply means,

c. each said valve means including a resilient tubing member,

d. means supporting at least a portion of each of said tubing members in said apparatus,

e. separate closing means for each said tubing member including a valve pin having an end movable against the corresponding said supported tubing portion to close said tubing by pinching said tubing against said supporting means,

f. separate operating means for each said valve closing means movable between an operating position wherein said valve pin is moved against said tubing to pinch said tubing against said tubing support and thereby to close the associated said valve means, and a release position releasing said tubing pinch and thereby effecting opening of the associated said valve means,

g. said operating means each including trigger means responsive to tripping thereof to cause movement of said operating means from said operating position to said release position,

h. a control card having trigger actuating means thereon,

i. means for moving said card along a path causing said trigger actuating means thereon to trip predetermined said trigger means in predetermined sequence and thereby to effect opening of the corresponding said valve means for dispensing predetermined quantities of fluid through said valve means, and

j. means for restoring all of said operating means to operating position effecting closing of all open said valve means following dispensing of predetermined quantities of said fluids.

7. The apparatus of claim **6** wherein said valve pin has a radius of curvature on said tubing closing end which is substantially the same as that of the tubing outer wall rest diameter minus approximately two tubing wall thicknesses, to pinch said tubing closed by reversing the pressed portion thereof to complement the configuration of the portion opposite said pin.

8. The apparatus of claim **6** wherein each of said operating means includes an over-center locking means having a locked and an unlocked position and having a trigger lever extending therefrom for engagement by said card actuating means when brought into said engaging relation therewith, wherein said actuating means on said card comprises projections for tripping said operating means by engaging selected said trigger levers to move corresponding selected said over-center locking means over center from said locked to said unlocked position, and wherein said resetting means is operative to move said over-center locking means back over center from said unlocked position.

9. The apparatus of claim **6** wherein said fluid supply means comprises a plurality of fluid containers and fluid conduction means separately conducting the fluid from each said container to a corresponding said dispensing control valve.

10. The apparatus of claim **9** wherein each said fluid conduction means includes a trap to eliminate air within said means subsequent to connection with a corresponding said container.

11. The apparatus of claim **9** further comprising air pressure supply means for pressurizing the contents of each said container, and an air check valve within each of said containers to prevent back flow of the contents thereof into said air pressure supply system.

12. Apparatus for dispensing selected mixtures of a plurality of fluids, comprising:

a. a plurality of means for supplying a corresponding plurality of fluids,

b. separate valve means for controlling the flow of fluid from each of said fluid supply means,

c. each said valve means including a resilient tubing member,

d. means supporting at least a portion of each of said tubing members in said apparatus,

e. separate closing means for each said tubing member including a valve pin movable lengthwise against the corresponding said supported tubing portion to close said tubing by pinching said tubing against said supporting means,

f. separate operating means for each said valve closing means movable between an operating position wherein said valve pin is moved against said tubing to pinch said tubing against said tubing support and thereby to close the associated said valve means, and a release position releasing said tubing pinch and thereby effecting opening of the associated said valve means,

g. said operating means each including trigger means responsive to tripping thereof to cause movement of said operating means from said operating position to said release position,

h. a control card having a leading edge and having actuating means for said selected said trigger means located thereon in predetermined spaced relations with said leading edge,

i. means defining a path for movement for said card in actuating relation with said trigger means,

j. means for moving said card along said path at a predetermined rate to cause said actuating means thereon to trip predetermined said trigger means sequentially in accordance with said spaced relations of said actuating means with said leading edge of said card and thereby to effect opening of the corresponding said valve means at corresponding predetermined stages of the movement of said card along said path, and

k. means responsive to a predetermined extent of movement of said card along said path for restoring all of said operating means to operating position effecting closing of all open said valve means.

13. The apparatus of claim **12** wherein each of said operating means includes an over-center locking means having a locked and an unlocked position and having a trigger lever extending therefrom adjacent the path of said movement of said card, wherein said actuating means on said card comprises projections for tripping said operating means by engaging selected said trigger levers to move corresponding selected said over-center locking means over center from said locked to said unlocked position, and wherein said resetting means is operative to move said over-center locking means back over center from said unlocked position.

14. The apparatus of claim **13** further comprising subassembly mounting means mounting at least said tubing support means, pin means, and over-center locking means as an easily removable and replaceable unitary subassembly in said fluid dispensing apparatus.

15. The apparatus of claim **14** further comprising comb means having said tubing support means therein, pin channel means mounting said valve pins for movement therein, and slot means for said over-center locking means movably receiving and supporting said over-center locking means therein.

16. The apparatus of claim **12** wherein said fluid supply means includes trap means to eliminate air from the fluid supplied by said fluid means.

17. The apparatus of claim **12** further comprising:

a. a common dispenser head for said fluids including means defining a separate discharge outlet for each of said fluids, and

b. means connecting each said dispenser head outlet to a respective said valve means for dispensing fluid received therefrom.

18. In a fluid dispensing apparatus including a plurality of containers containing various fluids, and means for supporting a receptacle for receiving fluids dispensed from the containers, the combination comprising:

a plurality of individual flexible valve tubing members,

b. first fluid conducting means sepaately connected between individual containers and corresponding said valve tubing members for conducting the respective fluids from the containers to the corresponding valve tubing members,
c. trap means on each of said first fluid conducting means to eliminate air within said first fluid conducting means subsequent to connection thereof with a corresponding container.
d. comb means,
e. means supporting at least a portion of each of said valve tubing members in said comb means,
f. first guide means in said comb means defining a pin channel opening adjacent and substantially perpendicularly to said supported portion of each of said valve tubing members,
g. valve pin means in each said pin channel having an end movable against said valve tubing member to close said tubing by pinching said tubing against said supporting means,
h. over-center operating means for each said valve pin including interconnected arms movable generally in one plane over center between locked and unlocked positions, and connected to said valve pin means to move said pins means simultaneously in substantially the same said plane to close said valve means by pinching said tubing against said comb means when said operating means is in said locked position and to open said valve means by releasing said tubing pinch when said operating means is in said unlocked position,
i. second guide means in said comb defining a channel receiving each said operating means in laterally guided relation limiting movement of said operating means to said plane,
j. a dispenser controlling card,
k. valve trip means on said card,
l. trigger arm means engageable by said card trip means and connected to each operating means to move each said operating means independently over center from said locked position to said unlocked position upon engagement and movement of the respective said trigger arm by a corresponding said trip means on said card,
m. card guide means mounted adjacent said comb for guiding said card past said trigger arms to bring said trip means into engagement therewith,
n. constant speed drive means for driving said card in timed relation through said card guides and past said trigger arms to cause each said trip means thereon to trip a corresponding one of said trigger arms at a predetermined stage of the movement of said card through said card guides to open each corresponding selected said valve for a predetermined interval causing a correspondingly timed dispensing operation for each such selected valve,
o. reset means for said valves mounted adjacent said operating means to engage and move unlocked said operating means back over center to said locked positions, closing the previously opened valves,
p. means responsive to predetermined elapsed time and movement of said card past said trigger arms for actuating said reset means,
g. substantially constant pressure air supply means,
r. an air pressure supply manifold connected to the output of said air supply means,
s. means connecting the contents of each of the fluid containers to said air pressure manifold to pressurize the container contents,
t. check valve means on each said air pressure connecting means to prevent reverse flow of the fluid contents of the respective containers back into said air pressure supply means,
u. separate fluid discharge means connected to each of said valve means to conduct the fluid released thereby to a receptacle on the receptacle supporting means, and
v. a common dispense head for the ends of said fluid discharge means adjacent the receptacle causing each fluid separately issuing into the receptacle to be discharged from a corresponding separate opening in said common dispenser head.

19. The apparatus of claim **18** wherein at least one of the containers is an inverted bottle, and further comprising bottle cap means having an outlet opening therethrough connecting with said first fluid conducting means to supply the fluid contents from said container to said conducting means for conduction to said valve means, said air check valve being within said bottle, and said bottle cap means also including connection means therethrough connecting said air pressure supply means to said check valve means within said bottle.

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