Feb. 25, 1958 L. J. ANDRES 2,824,585

METERING PUMP

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Fig. 1

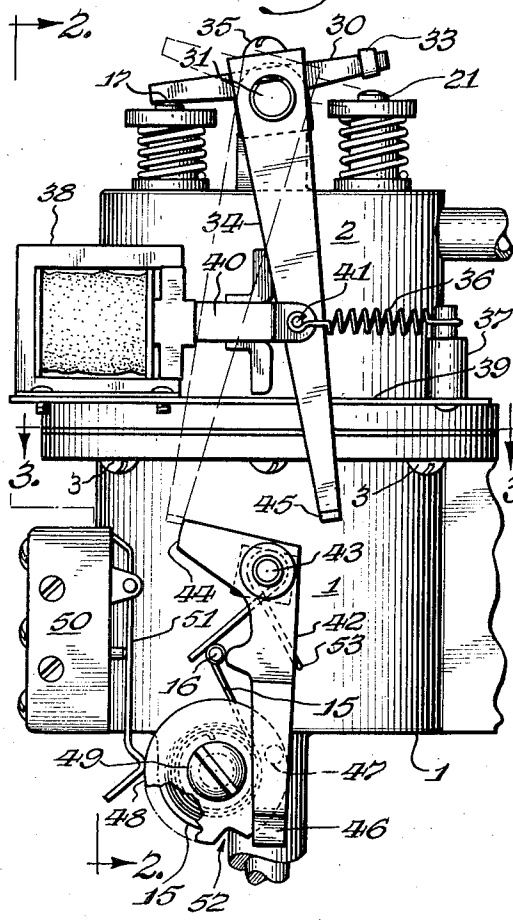

Fig. 2

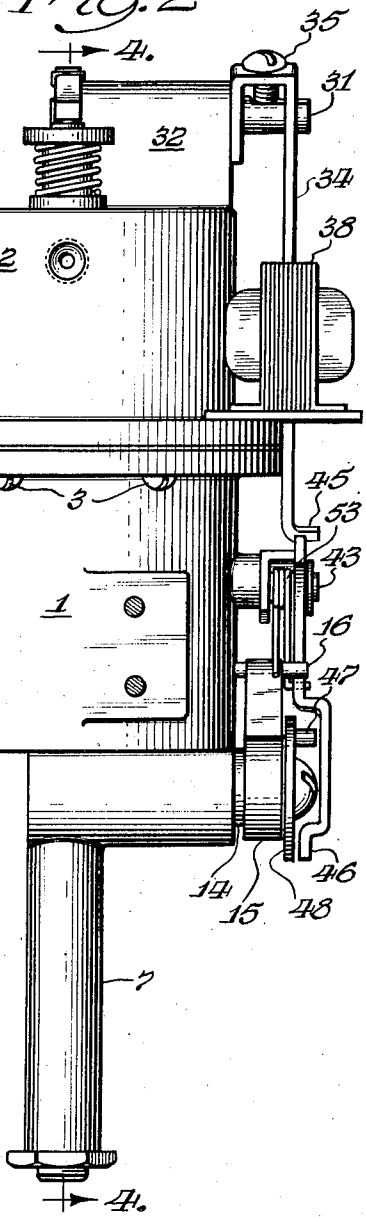

Fig. 3

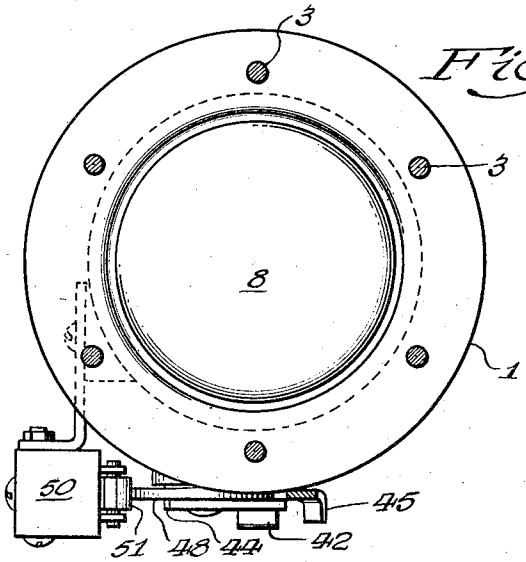

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Fig. 4

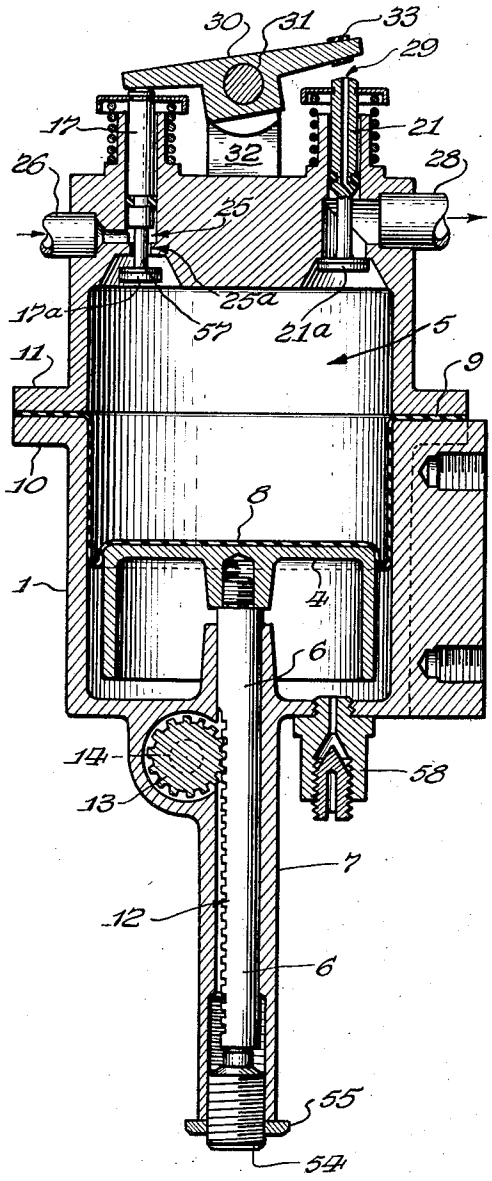

Fig. 5

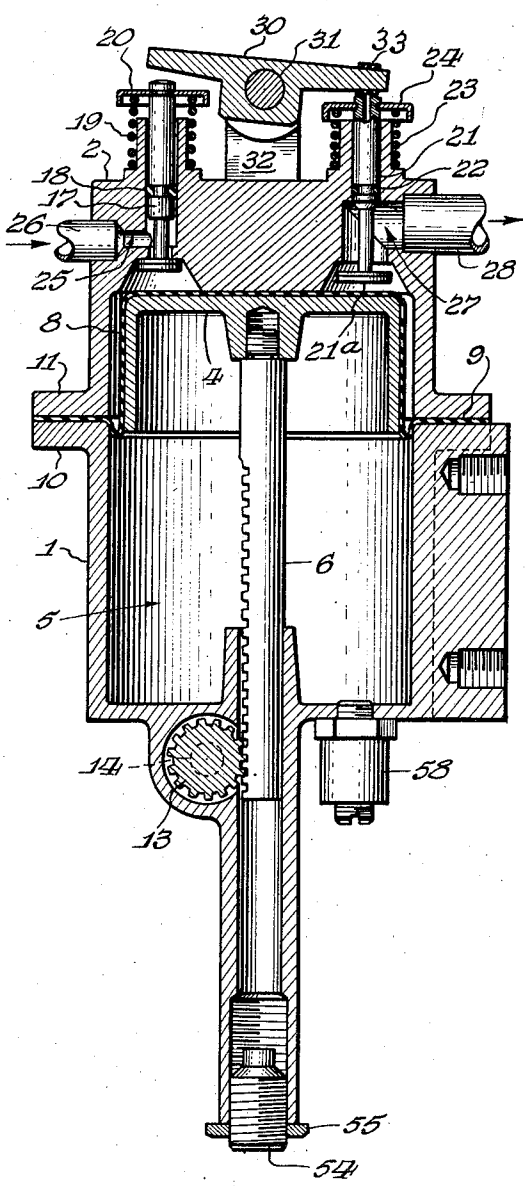

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Fig. 6

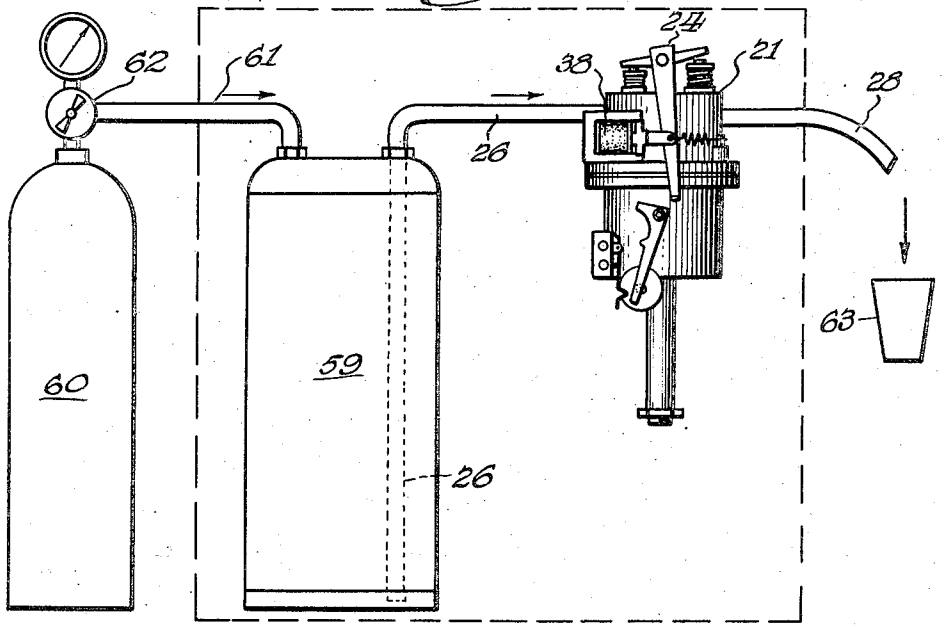
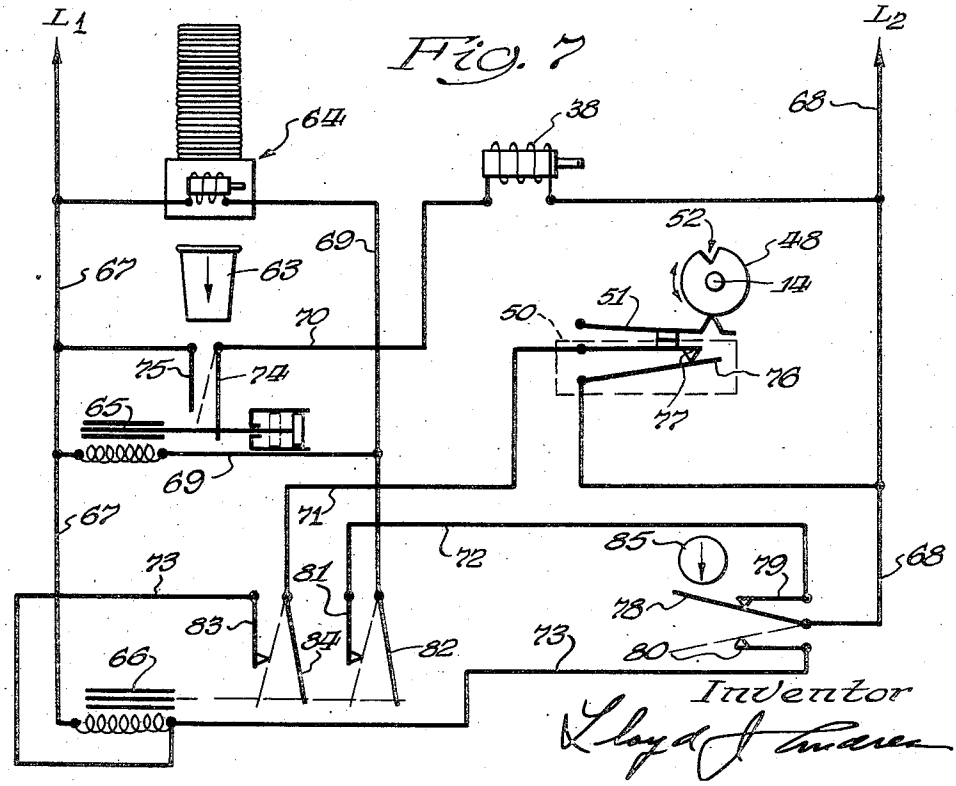


Fig. 7



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2,824,585

METERING PUMP

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6 Claims. (Cl. 141—174)

This invention relates in general to positive displacement pumps and more particularly to a novel pump means adapted to dispense, from a pressurized source predetermined volumes of liquids, particularly effervescent liquids such as carbonated beverages.

Previous to this invention, machines for vending beverages used electrically operated solenoid valves or motor actuated valves under the control of electric timers to deliver predetermined volumes of beverage. The volumes delivered were largely dependent upon the pressure at the beverage source and other variable factors. In the case of carbonated beverages, complicated restrictor dispensing valves having precise orifice controls were necessary to minimize excessive foaming of the delivered beverage. In practice, machines of this character failed to deliver precise volumes of beverage because of many variable factors affecting the solenoid valves and electric timers.

The present metering pump and associated control system overcomes the above objections and disadvantages by using a self-timing which will deliver a precise volume of beverage regardless of large variations in operating conditions.

A principal object of this invention is the provision of a self-loading pump adapted to discharge precise volumes of liquid from a pressurized source for each actuation thereof.

Another object of the invention is the provision of a self-loading, self-discharging and ringless reciprocating pump for delivering precise volumes of liquid from a pressurized liquid source when momentarily actuated.

Antoher object of the invention is the provision of a self-loading metering pump including spring means for automatically energizing the discharge cycle of said pump.

Another object of the invention is the provision of a self-loading positive displacement pump including piston driven means for operating the pump control valves and energizing the discharge cycle of said pump.

A further object of the invention is the provision of circuit and control means for operating said pump for delivering a predetermined volume of liquid when momentarily energized.

These and other objects and advantages in one embodiment of the invention are described and shown in the appended specifications and drawings in which:

Fig. 1 is a side elevation of the pump assembly.

Fig. 2 is an end elevation of the pump shown in Fig. 1.

Fig. 3 is a cross-sectional plan view taken through section-line 3—3, Fig. 1.

Fig. 4 is a cross-sectional elevation taken through section-line 4—4, Fig. 2.

Fig. 5 is a cross-sectional elevation same as Fig. 4, with the elements in changed position.

Fig. 6 is a diagrammatic view of the pump shown in Fig. 1 connected to a pressurized source of liquid.

Fig. 7 is a schematic circuit diagram illustrating the controls for the pump shown in Fig. 1.

Referring to Figures 1 and 2, the body of the pump

consists of a cylinder member 1 and a cylinder head member 2, secured in coaxial relation as shown by screws 3.

Referring to Figures 4 and 5, a cylindrical piston 4 is loosely fitted in the cylinder 5 which is formed by the mating cavities in the members 1 and 2. The piston 4 is secured to one end of a piston rod 6 journalled for reciprocation in the bore of an extension 7 of the cylinder member 1. A cup shaped diaphragm 8, known to the trade as a "Bellofram," is secured by its circular flange 9, integral therewith between the two flanges 10 and 11 of the cylinder and head members respectively. The cup shaped diaphragm 8 is adapted to roll between the outer wall of the piston and the cylinder wall when the piston is reciprocated as illustrated in Figures 4 and 5 which show the piston in lowermost and uppermost positions respectively. Since the diaphragm 8 is constructed of a fabric reinforced elastomer, a leak-proof cylinder piston combination is provided which offers a minimum of friction in operation and provides a high degree of sanitation when used with food products.

Rack teeth 12 are provided in one side of the piston rod 6 for engagement with a pinion 13, which pinion is integral with a shaft 14 journalled transverse to the piston rod in cylinder member 1, shown in Fig. 2.

Referring to Figures 1 and 2, a pre-loaded spiral clock spring 15 has its inner end secured to shaft 14 and its outer end secured to a stop pin 16 in the cylinder member. Said spring normally urges the piston 4 into its upper position, as shown in Fig. 5.

Referring to Fig. 5, an intake poppet valve 17 having a head 17*a* is adapted for reciprocation in cylinder head 2 to and from a seat therein and the stem of which is provided with an O-ring seal 18. A spring 19, by virtue of key washer 20, normally urges the valve in closed position. A poppet type exhaust valve 21 having a head 21*a*, is adapted for reciprocation in cylinder head 2 as shown and the stem is also fitted with an O-ring seal 22. A spring 23 and key washer 24 normally urge the valve into closed position.

The inlet channel 25 includes means for securing an inlet conduit 26. The outlet channel 27 also includes means for securing thereto a faucet or outlet conduit 28.

Referring to Fig. 4, the exhaust valve 21 has a coaxial bleed-passage 29 therein connecting the outlet channel 27.

A rocker arm 30 is secured to a horizontal shaft 31 is mounted through a vertical extension 32 of the cylinder head and is adapted to alternately and sequentially open and close the intake and exhaust valves when operated. A resilient seal 33 is mounted on the exhaust valve side of the rocker arm 30 to close and seal the bleed-passage 29 when the exhaust valve is in open position, shown in Fig. 5.

Referring to Figures 1 and 2, a valve operating lever 34 is secured to the end of shaft 31 by screw 35 and is normally urged into position shown in Fig. 1 by a spring 36 having one end secured to lever 34 and its opposite end retained by fixed stud 37.

An electric solenoid 38 secured to the cylinder head by means of plate 39 has its plunger 40 pivotally secured to lever 34 by pin 41. A latch 42 is pivotally mounted on fixed stud 43. Said latch has an upper off-set portion 44 for latching engagement with the end 45 of lever 34. The lower end 46 of lever 42 is positioned in the path of movement of a pin 47 in a cam disc 48. The disc 48 is secured for concentric adjustment on the end of pinion shaft 14 by screw 49.

An electric switch 50 secured to the cylinder member 1 by suitable bracket has an operating arm 51 which is urged against the edge of control disc 48 and holds the switch in a normally closed position as shown in Fig. 1.

A depression 52 in the edge of controlled disc 48 permits the arm 51 to momentarily open switch 50 when the disc 48 has rotated through a predetermined angle.

A torsion spring 53 retained around stud 43 bears against stop 16 and latch 42 and normally urges the latch in position shown in Fig. 1 against stop 16. Thus, when the solenoid 38 is energized, the lever 34 will be moved to the position shown in dotted lines with its end 45 latched behind the off-set end 44 of latch 42.

Referring to Fig. 4, the down travel, or intake stroke, of the piston 4 is controlled by a stop screw 54 threaded into the end of the bore in extension 7 and is retained by lock nut 55. The position of the stop screw 54 determines the distance of downward movement of the piston 4 and hence, determines the volumetric capacity of the cylinder.

It is to be noted that the cross-sectional area of the orifice 25*a* surrounding the small portion 57 of the intake valve stem is somewhat smaller than the exposed pressure area of the stem 17.

An adjustable air valve 58 is threaded through the base of the cylinder 1 to provide a control passage of air beneath the piston so as to function as a dash-pot to provide predetermined velocity to both the intake and discharge strokes of the pump. One or two appropriate check valves may also be used in addition to or without valve 58 in the event different time cycles are desired for the intake and discharge strokes. The diagram, Fig. 6, illustrates the metering pump connected by intake conduit 26 to a source of a liquid container 59. The liquid is pressurized from a cylinder 60 containing compressed gas by conduit 61 under the control of pressure regulator 62. The discharge conduit 28 of the pump is shown positioned over a cup 63. The hydraulic operation of the metering pump, using Fig. 6 as an example, will first be described as follows:

Referring to Figures 1 and 4, and assuming that the piston 4 is at the top of its up-stroke liquid under predetermined pressure will flow from intake conduit 26 through intake passage 25, orifice 56 around valve head 17*a* into cylinder 5, forcing the piston downward against the counter-force exerted by spring 15 which will be wound by the rotation of shaft 14 driven by rack 12 and pinion 13. When the piston rod abuts the stop screw 54, the intake stroke is completed and the cylinder filled with a predetermined volume of liquid. All elements in this, their normal rest position are shown in Figures 1 and 4.

When the control lever 34 is moved to the left by the solenoid 38 or manually, as shown in dotted lines, Fig. 1, the intake valve will close and the exhaust valve 21 will be sequentially opened. The lever 34 will be latched in the dotted line position by the action of latch 42.

The piston will now automatically start its upward or discharge stroke by virtue of energy stored in spring 15. Thus, the liquid in the cylinder is forced around the exhaust valve head 21*a* through the discharge passage 27, conduit 28 and into cup 63, Fig. 6.

The velocity of the discharge strokes is retarded by the partial vacuum formed behind the piston 4 under the control of air valve 58.

It is to be noted that the intake pressure tending to open the intake valve when closed is overcome by the larger effective pressure area of the large portion of the valve stem which is acted upon by the same pressure, thus, there is a differential in pressure tending to hold the intake valve closed.

During the discharge stroke, the disc 48, Fig. 1, will have rotated until the pin 47 therein contacts the end 46 of latch 42 and moves same tripping the upper off-set end 44 out of engagement with lever 34. The spring 36, Fig. 1, will then return the lever 34 and the valves to their initial position which will automatically start a successive intake stroke.

It is to be noted that during the discharge stroke, the bleed passage 29 in the stem of the exhaust valve is held closed by seal 33. When the rocker 30 moved to its intake position, permitting the exhaust valve to close, the seal 33 opens the passage 29 to permit air to flow through the stem into the outlet channel 27 permitting all liquid therein to quickly gravitate from the conduit 28 without turbulence.

At a predetermined time during the discharge stroke, the operating arm 51 of switch 50 will engage the depression 52 in the disc 48 and momentarily open switch 50 for restoring the electric control circuit to be hereinafter described.

The above described hydraulic operation may be repeated as long as pressurized liquid is supplied to the pump.

The circuit diagram in Fig. 7 viewed in connection with the diagram Fig. 6, illustrates the metering pump adapted for use in an automatic machine for vending beverages. A cup dispenser 64 may be motor or solenoid actuated and is adapted to deliver a cup 63 from a magazine when energized.

Conductor 67 connects one side of a source of power L_1 to one side of motor or solenoid in the cup dispenser 64. One side of a time delay relay coil 65, one blade 75 of its normally opened switch and one side of master relay coil 66.

Conductor 68 connects the remaining side of said source of power L_2 to one side of pump solenoid 38, blade 76 of restore switch 50 and blade 78 of a S. P. D. T. operating switch.

Conductor 73 connects the normally opened blade 80 of the operating switch, the remaining side of relay 66 and one blade 83 thereof.

Conductor 71 connects the blade 84 of relay 66 to blade 77 of the restore switch 50.

Conductor 72 connects blade 81 of relay 66 to the normally closed blade 79 of the control switch.

Conductor 70 connects blade 74 of time delay relay 65 to the remaining side of the pump solenoid 38.

Conductor 69 connects the remaining sides of motor or solenoid in cup dispenser 64, time delay relay coil 65 and the remaining blade 82 of the master relay 66.

In operation and referring to Figures 1, 6 and 7, and under the assumption that the pump is filled with pressurized liquid and the elements are positioned at rest, as shown in Figures 1 and 7, the operation of the control switch by coin 85, or manually, the master relay 66 will be momentarily energized and held energized by the closure of its holding blades 83—84 which complete a circuit through the normally closed restore switch 50.

The operation of relay 66 will complete a second circuit through its blades 81—82 from the now closed blades 78—79 of the operating switch through conductor 67 through time delay relay 65 and the motor or solenoid in the cup dispenser 64. The cup dispenser will then drop a single cup to filling position under the faucet 28 illustrated in Fig. 6.

Following a predetermined delay, in order to permit the descent of the cup, the blades 74—75 of relay 65 will close and complete a circuit to the pump solenoid 38.

When the solenoid 38 is energized, it will pull the lever 34 to its left latched position which will start the discharge stroke of the pump and deliver one volume of beverage into the waiting cup.

As soon as the delivery of the beverage is completed, pin 47 will initiate the loading or intake stroke of the pump as previously described. Also, during the discharge stroke, the disc 48 will momentarily open switch 50 and de-energize relay 66 which, in turn, will de-energize the cup dispenser 64 and the time delay relay 65, thus, returning all elements of the system to their normal rest position.

When the pump is used with highly effervescent beverages which are subject to foaming, it is important that the pre-load of the spring 15 against piston 4 be relatively

high in order to maintain a relatively small pressure differential between the inlet conduit and the cylinder 5.

Having described my invention, I claim:

1. In a pump of a character described a piston-cylinder type pump having intake and discharge passage-ways including intake and discharge valve means for alternately and sequentially opening and closing said passage-ways, valve operating means for normally positioning said valve means into intake position with said intake passage-way open and said discharge passageway closed and to close said intake and sequentially open said discharge passage-way when moved to a discharge position, a source of pressurized liquid connected to said intake passageway, a piston means in said pump adapted to be displaced through a predetermined intake stroke when said liquid flows through said intake passageway into said pump cylinder, spring means associated with said piston means positioned and secured to be energized by said piston means during its intake stroke, said spring means responsive to the movement of said valve operating means at its said discharge position to move said piston through said discharge stroke to displace a predetermined volume of liquid from said discharge passage-way, tripping means operatively articulated with said piston means and said valve operating means for releasing the latter from its said discharge position into its said intake position at the end of said discharge stroke for refilling said pump with an equal said volume of pressurized liquid.

2. In a metering pump a positive piston-cylinder type pump adapted to displace a predetermined volume of liquid from a pressurized source for each intake and discharge strokes thereof, valve means in said pump for admitting into and discharge from said pump predetermined volumes of said liquid when said valve means is moved from its normal intake position to its discharge means, spring means on said pump connected to and adapted to be energized by the piston in said pump during the said intake stroke thereof when driven by said pressurized liquid, control means on said pump for moving said valve means to said discharge position for permitting said piston to move through its discharge stroke and displacing a said volume of said liquid when operated, cycling means on said pump responsive to the movement of said piston at the end of its discharge stroke to return said valve means to normal intake position for repeating said intake stroke of said pump, said cycling means including a cam adapted to move in timed relation with said piston, an electric solenoid operatively connected to said control means for moving the latter from said intake position to said discharge position, an electric switch on said pump positioned to be operated by said cam at a predetermined position thereof during said discharge stroke, electric control means including a circuit means connecting said solenoid and said switch for cycling said pump to discharge one said volume of liquid therefrom when said circuit is energized and said switch is operated.

3. A metering pump comprising body means forming a hollow cylinder and cylinder head, an independent inlet and discharge passage-way in said head, valve means in said head for alternately opening and closing each said passage-way when operated, lever means pivoted on said body means for alternately operating said valve means including means for urging said lever means in one direction for normally positioning said valve means with said inlet passage-way open and said discharge passage-way closed, a latch means secured for movement on said body adapted to engage and latch said lever means in displaced position for operating said valve means for temporarily closing said inlet passage-way and opening said discharge passage-way, a piston means in said cylinder adapted to reciprocating movement from a discharge position to a loaded position, a drive means operatively connected to said piston means and adapted for positive timed movement therewith, a spring means biased between said body means and said drive means for urging said piston means toward its said discharge position, an abutment positioned on said drive means for engaging and moving said latch for disengaging said lever means therefrom when said piston means is moved to predetermined said discharge position, a source of pressurized liquid, a conduit connecting said source of liquid to said inlet passageway whereby said liquid will flow through said inlet passage-way into said cylinder and move said piston from said discharge position to said loaded position against the restraining action of said spring means and whereby the movement of said lever means to its latched position will alternate said valve means to close said inlet passage-way and open said discharge passageway and permit said spring means to move said piston means to its discharge position and discharge a predetermined volume of liquid through said discharge passageway and to then move said abutment to a position to unlatch said lever means and alternate said valve means to recycle said pump.

4. A pump system for sequentially displacing like volumes of liquid from a source of liquid under pressure comprising a reciprocating pump means having a valve means for controlling the intake and discharge cycles thereof and adapted to displace one volume of said liquid when operated, said valve means adapted to be shifted from a normal intake position to a temporary discharge position, said pump including a self-recycling means for automatically shifting said valve means from normal to discharge position at the end of said discharge cycle, an electric restore switch on said pump positioned for operation by said recycling means during said discharge cycle, an electric solenoid for shifting said valve means from said normal position to said discharge position when energized for initiating the displacement of one said volume of liquid from said pump, a momentary electric switch for initiating the operation of said pump, an electric relay having a pair of normally open control contacts and a pair of self-holding contacts and an operating coil, a source of electric power, a series circuit connecting said restore switch and said relay coil to said source of power, a second series circuit connecting said control contacts said solenoid and said momentary switch with said source of power, a third series circuit connecting said relay coil and said hold contacts with said source of power, a fourth series circuit connecting said momentary switch and said relay coil with said source of power, a main circuit means connecting all said series circuits whereby the operation of said momentary switch will energize said relay coil and the closure of its contacts will energize said solenoid to operate said pump and displace one said volume of liquid and to automatically refill with a subsequent said volume of liquid and whereby said recycling means will operate said restore switch to de-energize said relay.

5. A pump system for sequentially displacing like volumes of liquid into sequentially deposited cups from a source of liquid under pressure comprising a self-cycling pump means connected to a source of pressurized liquid for displacing a predetermined volume of said liquid when operated, faucet means connected to said pump means for directing said liquid displaced therefrom, solenoid means on said pump for initiating the automatic operation thereof when energized, a cup dispenser adapted to deposit one said cup under said faucet from a magazine of cups when electrically energized, a main relay for energizing said cup dispenser, a time-delay relay for energizing said solenoid, a momentarily operating switch, a source of electric power, a circuit means connecting said source of power said solenoid means said cup dispenser said main relay said time-delay relay and said momentary switch whereby the momentary operation of the latter will first energize said cup dispenser to deposit a cup under said faucet and then energize said solenoid to operate said pump means to displace one said volume of liquid through said faucet into said cup.

6. In a metering pump of the character described a piston-cylinder type pump for displacing a predetermined volume of liquid for each operation thereof, means in said pump forming a discharge passage-way entering the pump cylinder and connecting an outlet conduit, a normally closed valve means is said passage-way, a stem for opening said valve means and said passage-way when depressed, said stem having an air vent bore therein entering the end thereof and opening into said passage-way, a valve operator on said pump for engaging and depressing said stem for opening said valve means to permit the discharge of said fluid through said passage-way and conduit and to seal said bore when operated and whereby the release of said stem by said operator will permit air to flow through said bore and permit the gravity displacement of liquid from said passage-way and conduit.

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