

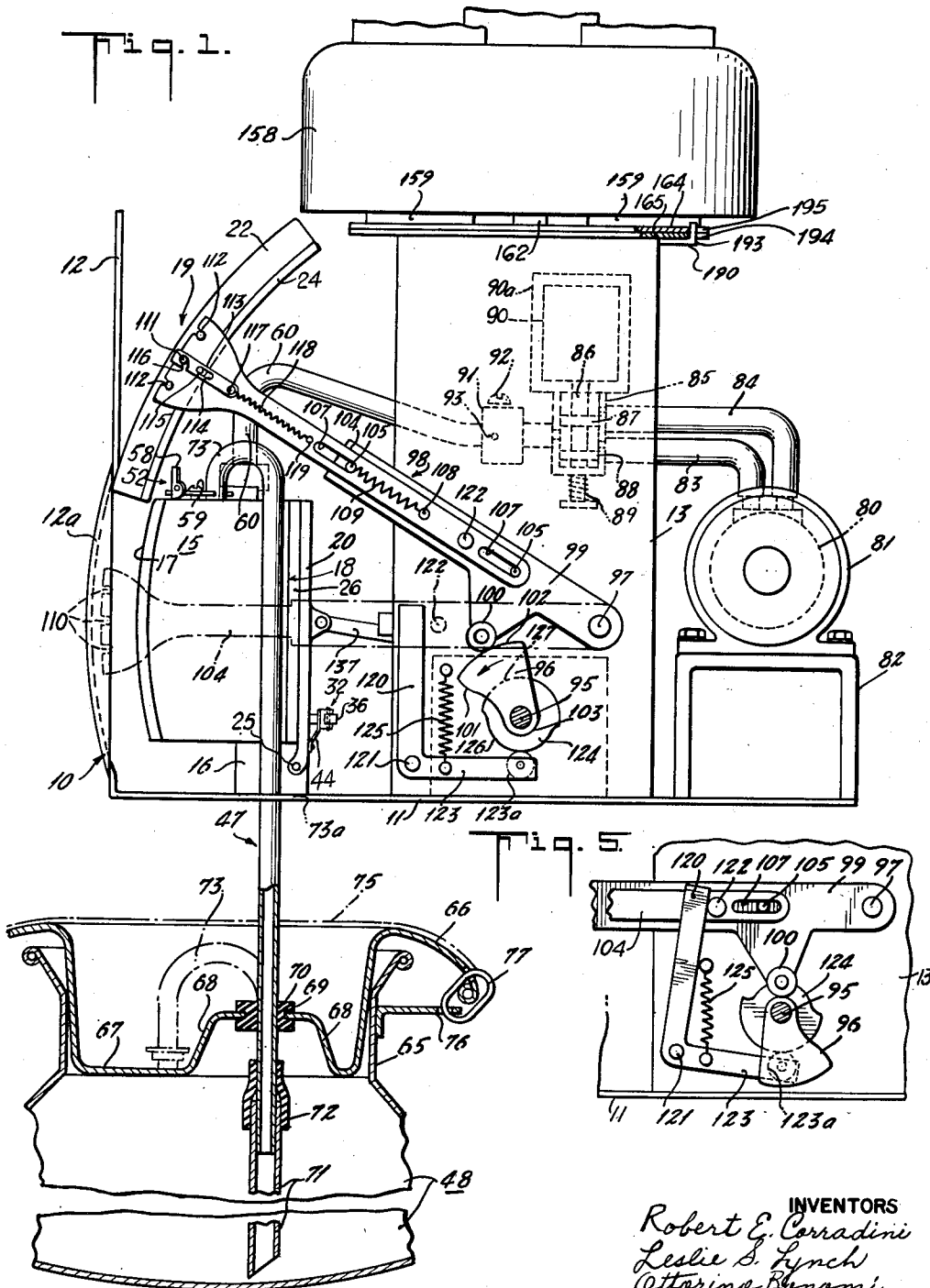
Oct. 6, 1953

R. E. CORRADINI ET AL
AUTOMATIC SANITARY APPARATUS FOR DISPENSING
MEASURED QUANTITIES OF LIQUID

2,654,517

Filed May 3, 1946

7 Sheets-Sheet 1



INVENTORS
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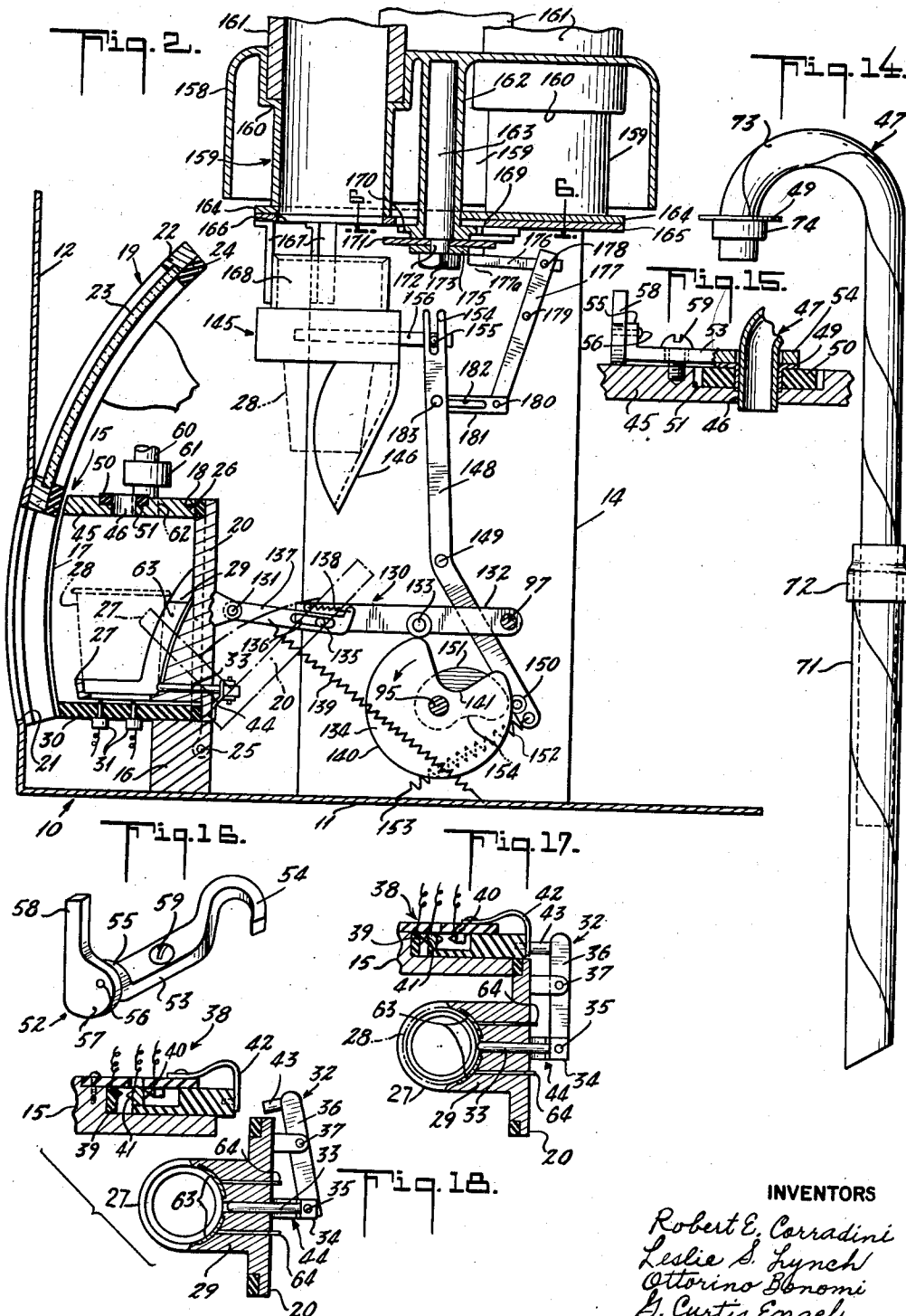
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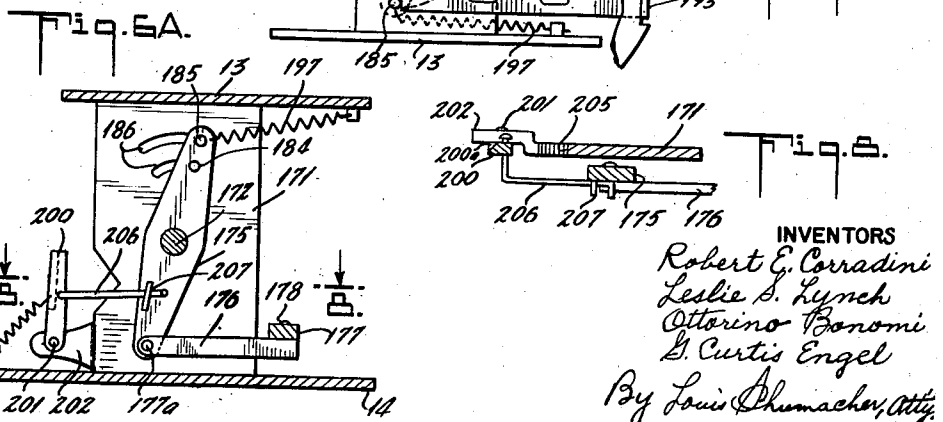
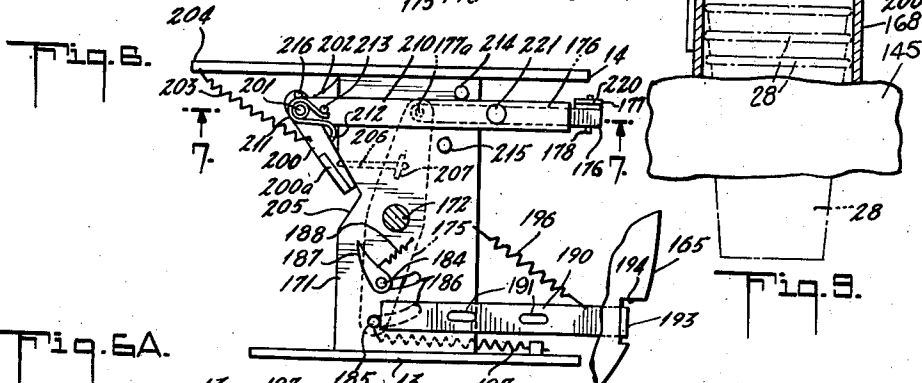
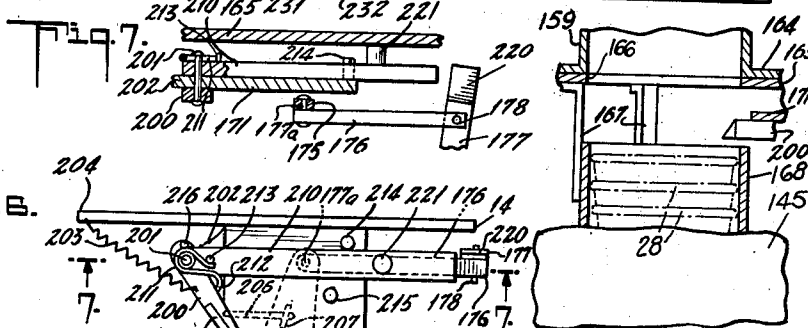
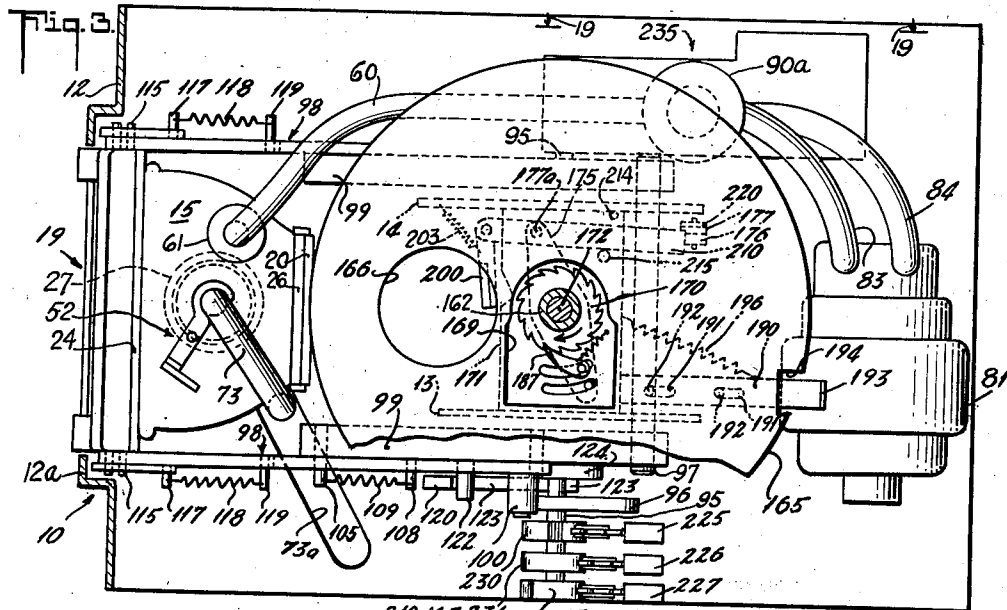
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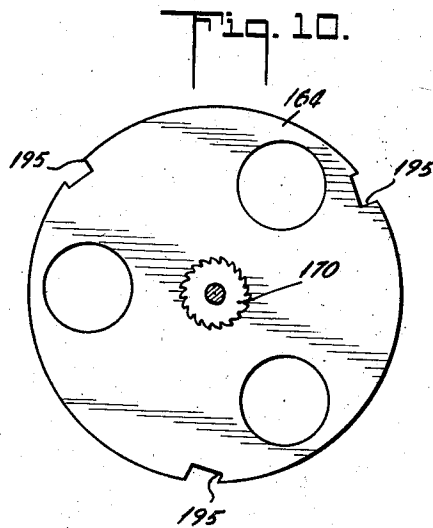
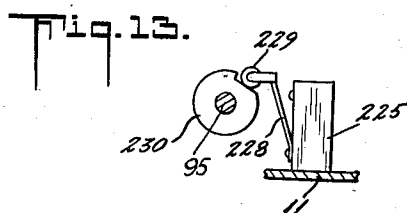
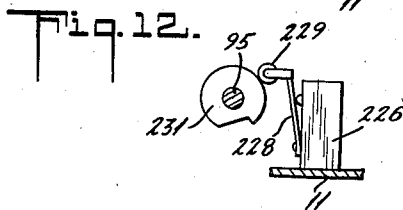
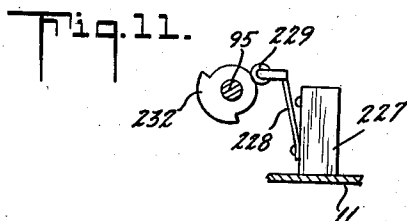
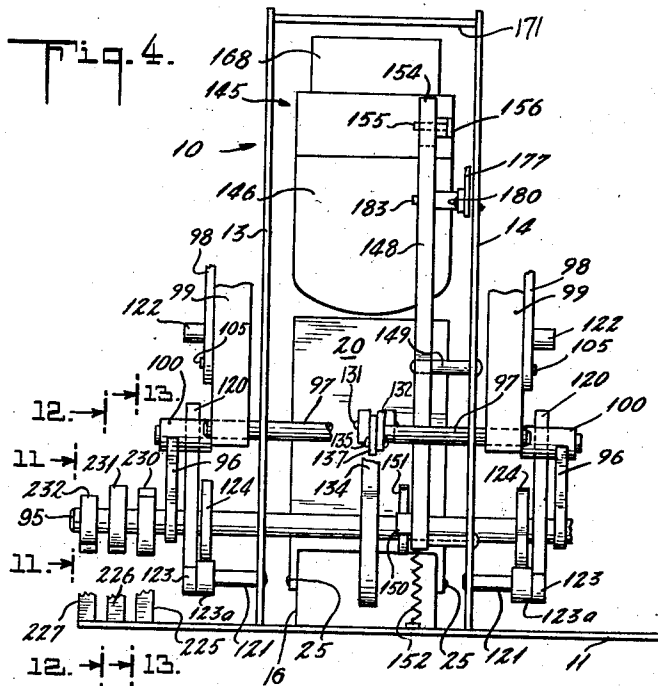
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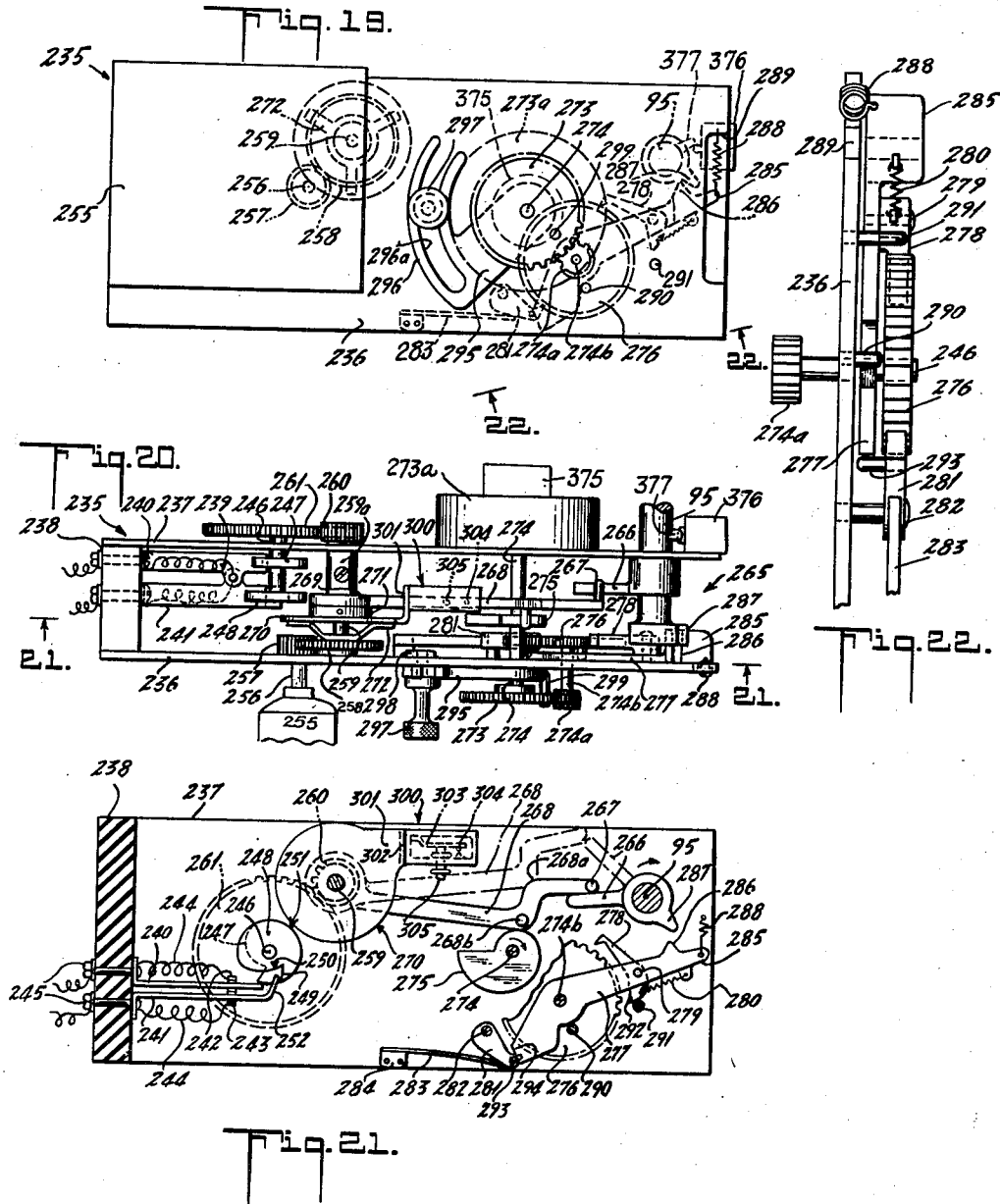
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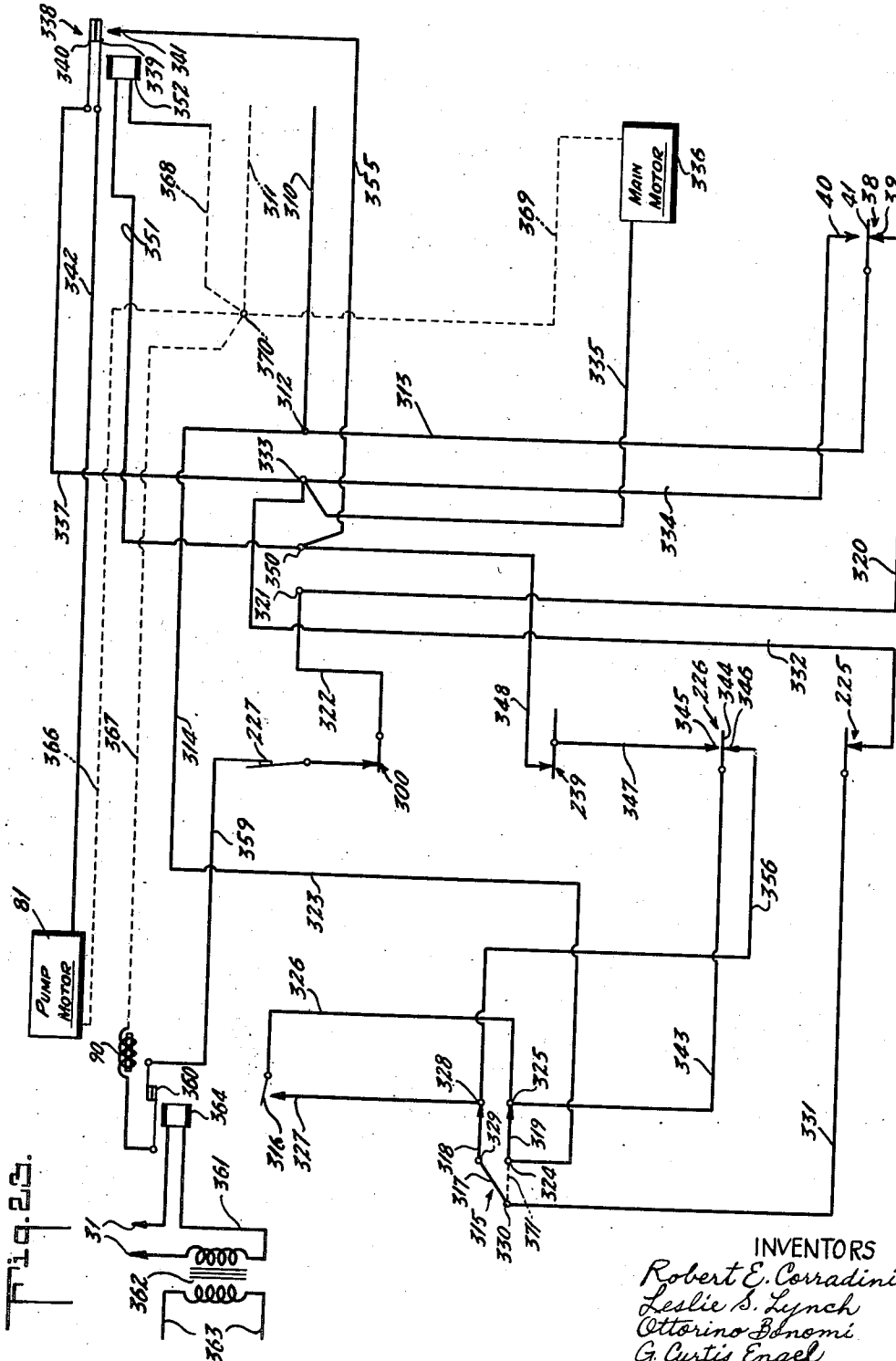
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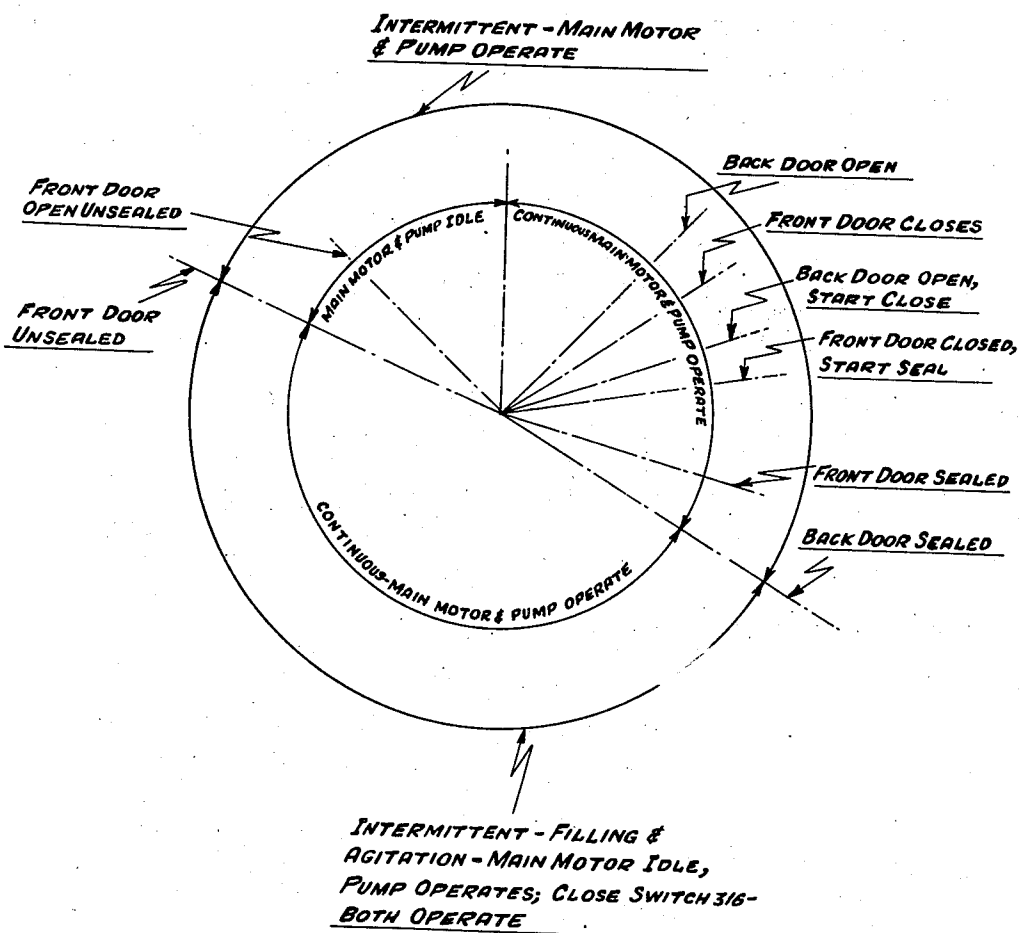
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Fig. 24.



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Patented Oct. 6, 1953

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UNITED STATES PATENT OFFICE

2,654,517

AUTOMATIC SANITARY APPARATUS FOR DISPENSING MEASURED QUANTITIES OF LIQUID

Robert E. Corradini, Madison, N. J., and Leslie S. Lynch, Flushing, and Ottorino Bonomi, New York, N. Y., and G. Curtis Engel, Ridgewood, N. J.; said Lynch, said Bonomi, and said Engel assignors to said Corradini

Application May 3, 1946, Serial No. 667,064

36 Claims. (Cl. 226—46.4)

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This invention relates to dispensing devices and has particular reference to dispensers for liquids.

One object of the invention is to provide improved means for dispensing liquids in highly sanitary, uniform, rapid and efficient manner.

The invention also embodies improvements on the devices of U. S. Letters Patents No. 2,081,650 and 2,081,651 which are incorporated herein by reference.

With the advent of homogenized milk, it is no longer essential but remains highly desirable to blow air through this liquid because its condition is thereby improved, although the agitation may be only an incidental factor. Thus we have discovered that the palatability of the milk is improved, and more important, its bacteria count is markedly decreased, apparently by oxidation. With liquids containing elements that tend to settle out, such as chocolate milk mixtures, tomato juice and the like, agitation is essential, and when performed by air, the other advantages mentioned are also obtained. Hence it is highly feasible to use the simple one-conduit pressure-suction air pump system of the above mentioned patents with a selector valve acting at will to cause suction to produce a flow of the liquid from a storage container to a drinking receptacle such as a glass or paper cup. Where the latter consists of paper, we found that it tended to collapse under the suction and hence ought to be in a suction chamber which should preferably be stationary. In other words, only lateral door means ought to be movable, especially if the chamber is associated in an improved manner with an automatic cup dispensing means to thus assure compactness, simplicity, durability and efficiency.

It is therefore an object of the invention to provide a device of the nature set forth having improved means for realizing the advantages mentioned. In this regard, it will be noted that the chamber referred to is highly useful even if the liquid is caused to flow under pressure instead of by suction, since various sources of contamination are thus guarded against during the filling of the receptacle.

Another object of the invention is to provide improved means sensitive to a film of milk on a wall of the chamber or on a portion adjacent to the seat to render the dispenser inoperative whereby cleanliness can be assured.

Heretofore automatic measuring means for the quantity of liquid dispensed have been of the weight responsive type. But these have generally had a considerable lag, and sometimes the weight of the receptacle varied, so that measurement within sufficiently close limits was unobtainable in commercial operation.

It is therefore an object of the invention to

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furnish improved means for measurement and control of the liquid dispenser; such means may be of a novel electrical capacitive type with the rapid, swirling flow of the liquid preferably uniformly circularly distributed, or of a novel mechanical type responsive to the fall in the liquid head to vary the time period of the pump or the resistance or area of a fluid passage.

Another object of the invention is the provision of a machine of the class alluded to having improved means adapted for coin, push button or other intermittent operation, as distinguished from what may be termed continuous operation wherein the act of removing a filled receptacle automatically initiates another cycle of the machine, the improved means permitting the machine to be operated either way by a relatively simple change therein.

Another object is to provide an improved continuously operating machine of the character described in which each cycle terminated with the chamber open for immediate removal of the filled receptacle.

Another object is to furnish an improved continuously operative machine in which a small or minute time interval occurs between the termination of the suction-filling condition and the opening of the chamber during which the single conduit pump system causes air to be blown into the liquid in the storage container.

Another object of the invention is to provide improved means which is not only responsive to the presence of a receptacle, but to an accurate seating thereof in filling position to control the flow of liquid whereby the accuracy of the automatic receptacle dispensing means may be checked; and a supplemental object is to furnish means whereby a receptacle which is highly pliant in character is adapted to cause a positive and reliable indicator or control operation.

Another object is to provide means so correlated that if the receptacle causes the liquid flow producing means to be inoperative, the mechanism for actuating the door means will perform its cycle of operation to permit instant removal of the improperly seated receptacle.

Another object of the invention is to furnish a receptacle feeding means and a seating means for receiving the receptacle in filling relation to a discharge port or in flow control position, or for both purposes, wherein the different means are correlated in a novel manner, as by cooperating guides, to cause a reliable and rapid travel of the receptacle along its required path and preferably into a chamber, for instance, to laterally enter the same.

Another object of the invention is to provide improved means comprising a movable or tiltable receptacle seat with a guide or liquid flow control element or both, where the guide

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may serve as a chamber closure and the element may become operative by the tilting or other movement of the seat; the guide may cooperate with a lateral receptacle feeder or may serve to assure accurate seating of the receptacle or it may perform both these functions.

Because certain sanitary codes require that every part of the apparatus contacted by milk must be shipped to a responsible bottling or canning plant, to be sterilized before it can be used with another can of milk, difficulty was heretofore encountered because each milk can had to have its individual metallic telescopic conduit and dispensing head or related elements, thus greatly increasing the cost of the device.

It is therefore another object of the invention to furnish a discardable telescopic conduit of a paper-like or composition material, which is very cheap in construction, involving very simple sealing joints, and being so associated with the milk container or its locked cover as to render it difficult to adulterate the milk, and being so correlated with the milk dispenser or its suction chamber as to be capable of discharging directly into the drinking receptacle and to be sealed in an air tight manner with the chamber.

Another object of the invention is the provision of an improved receptacle dispenser comprising a plurality of sections for stacks of the receptacles which are shifted to successively come into operative relation to a receptacle feeder only after exhaustion of a stack; if the shift of a section occurs in a series of steps during the corresponding dispensing of a plurality of receptacles, the invention provides a novel correlation of parts whereby the feeder has a reserve of receptacles for the interim.

Another object of the invention is to furnish improved means for a novel succession or cycle of steps of liquid and receptacle dispensing means, with the provision of novel mechanical structures that are simple, compact, durable, reliable and efficient in use.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention comprises the novel features, combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a fragmentary view in side elevation, with parts in section showing an apparatus embodying the invention, with the front door open and parts shown in different positions in dot-dash lines.

Fig. 2 is a fragmentary vertical approximately central sectional view of the apparatus, with the front door open.

Fig. 3 is a fragmentary top plan view of the apparatus with parts removed and the front door closed.

Fig. 4 is a fragmentary view in end elevation of the apparatus, with parts omitted.

Fig. 5 is a fragmentary view in side elevation of a front door actuating structure in position for moving the same to inward sealing relation.

Fig. 6 is a fragmentary enlarged top plan view as seen approximately on line 6—6 of Fig. 2 of cup stack changing structure at one end of its path of operation.

Fig. 6A is a bottom plan view of the structure of Fig. 6 in a different position in the absence of a stack of cups.

Fig. 7 is a fragmentary sectional view on line 7—7 of Fig. 6.

Fig. 8 is a fragmentary sectional view on line 8—8 of Fig. 6A.

Fig. 9 is a fragmentary view with certain parts in section of certain details of a cup dispenser structure.

Fig. 10 is a bottom plan view of a cup stack holder.

Figs. 11, 12, and 13 are fragmentary views partly in elevation and partly in section showing certain cam switches in positions corresponding to that of Figs. 1 and 2.

Fig. 14 is an enlarged detail view of a milk can dispenser tube.

Fig. 15 is an enlarged fragmentary sectional view of seating and locking structure at the upper end of the dispenser tube.

Fig. 16 is an enlarged perspective view of the locking device of Fig. 15.

Figs. 17 and 18 are horizontal sectional views of the cup filling chamber with a cup test switch in different positions according as the rear door is in closed or open position.

Fig. 19 is a view in side elevation of a combined agitation and liquid level control, as seen on line 19—19 of Fig. 3.

Fig. 20 is a top plan view thereof with parts omitted.

Fig. 21 is a sectional view taken on line 21—21 of Fig. 20, with a different position of one of the parts shown in dot-dash lines.

Fig. 22 is an enlarged fragmentary view as seen on line 22—22 of Fig. 19.

Fig. 23 is a schematic view of the circuit with certain switches in position for causing filling of liquid into a cup.

Fig. 24 is a cycle diagram of the operation of the apparatus.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined, but useful embodiments may be produced involving less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing therefore, is submitted merely as showing a preferred exemplification of the invention.

Referring in detail to the drawing, 10 denotes an apparatus embodying the invention. The same comprises any suitable frame work including a base plate 11 from which extends upwardly a front wall 12 and a pair of spaced, vertical walls 13, 14 at right angles to the front wall and spaced rearwardly thereof. Between the latter and the front wall is a stationary cup receiving chamber 15 fixedly mounted at 16 on the base plate 11, this chamber being in alignment with the space defined between the walls 13, 14. At its front and rear, the chamber 15 is adapted to be wholly opened respectively at 17 and 18, the chamber being otherwise closed. For closing these openings, doors 19 and 20 are provided. Since the front door 19 is swingable about a pivot, as hereinafter described, this door is curved like a segment of a cylinder whose axis is at said pivot, and the opening 17 defines a surface correspondingly curved for accurately seating the front door in closed position. To open the front door, the same is swung to a position at least partially

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above the chamber 15 for free access of one's hand to the liquid filled cup seated therein. To accommodate the door 19, the front wall 12 is formed with an arcuate outwardly projecting track-like section 12a, having an opening 21 permitting full and free access into the chamber 15. To permit visibility of the contents of the chamber, the front door may have a generally rectangular frame 22 suitably carrying a transparent plate 23 of plastic or glass. To assure substantially gas-tight sealing of the opening 17, the front door may have a suitable liner 24 of cushioning material such as rubber continuously, permanently adhesively or otherwise connected to the frame 22 at its rear face to form a uniform gasket between the door and the chamber when the former is in closed position. To prevent wear of the gasket 24 against the seating surface at the opening 17, the door 19 is adapted for radial movement away from the seat while it is in motion, and toward the seat to clamp the gasket when the front door is in closing position. Therefore, the front door is shown spaced from the seat at 17 in open position. The means by which these radial movements are accomplished is described hereinafter.

The rear door 20 has a fixed pivotal mounting at 25 a little below its bottom edge, on the chamber supporting portion 16, this pivotal axis being in the plane of the door and parallel to the axis of the front door 19 and to the plane of the rear opening 18 of the chamber 15. At its front side, the rear door is continuously marginally undercut to receive a packing or cushioning element 26 adhesively or otherwise permanently secured thereto whereby this door seats in a gas tight manner on the surface at the opening 18. Accordingly, when the front and rear doors are closed, the chamber 15 is adapted to maintain a suitable partial vacuum therein, hereinafter referred to as a gaseous suction condition, for the suction filling of liquid into a cup disposed in the chamber. The means for swinging the door to the closed dot-dash line position and powerfully to closed sealing position are described hereinafter.

Also provided in the chamber 15 is a seating member 27 for a cup or other receptacle 28. This seating member is adapted to embrace the cup against lateral movement. In consequence it may be formed as a ring of tapered or angular form in cross section, as shown. The seat is angularly movable preferably with the rear door 20, and is therefore permanently secured to that door, desirably at right angles thereto. Acting in conjunction with the door 20 and the cup seat 27 is a track or concave guide element 29 at an angle thereto. The guide extends from an upper portion of the rear door downwardly and forwardly into the seating member 27. The arrangement is further indicated in that when the rear door is swung open to an upwardly rearwardly inclined position, at an angle of about 45 degrees, a cup dropped on the door slides down the guide or chute 29 into the seating member 27, and when the door is righted to closed position, the seating member becoming horizontal, the cup is positioned in vertical generally central relation to the chamber 15 for the liquid filling operation. This construction permits the rear end of the chamber 15 and its opening 18 to be made narrower than the corresponding parts at the front of the chamber. The cup seating and guide portions 27, 29 are spaced above the bottom wall 30 of the chamber for adequate clearance. Secured in the

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bottom wall 30 of the chamber in insulated relation thereto is a plurality of spaced electrodes 31, disposed below the cup seating member. If any liquid spills over onto the bottom wall it forms a circuit between the electrodes serving to indicate the untidy condition to the operator.

For indicating the presence of a properly seated cup 28, a feeler switch 32 may comprise a feeler finger or pin 33 slidably fitted in the rear door 20 in such snug relation thereto as to avoid any substantial leakage of gas with respect to the closed chamber 15. This pin is radial to the seating member 27 and is adapted to press inwardly on a cup 28 adjacent to the bottom thereof. If the cup is made of paper, and hence collapsible, it nevertheless possesses a fair degree of stiffness at its bottom, and the bottom portion of the cup is buttressed by the annularly engaging seating member 27. A highly advantageous association of parts thus arises. When the rear door is in open cup guiding position, the feeler pin is normally retracted as in Fig. 18 so as not to form an obstruction in the path of the cup. After the latter has engaged in the seating member 27, and as the rear door swings toward closed position, as in Fig. 17, the feeler pin is advanced yieldingly until it contacts the cup, whereupon further advance is prevented at a given indicator position. If there is no cup present, or if the cup is improperly seated, the pin continues its advance to a second indicator position; electrical indicator means are provided responsive to each of these positions.

The feeler pin 33 may have a head 34 to which is connected by any suitable lost motion pivotal connection at 35 a lever 36 having a fixed pivot 37 carried by the door 20. The connection at 35 may include a pin and a slot or fork in the lever. Responsive to the latter is a switch 38 mounted on a side of the chamber 15 in stationary relation thereto. This switch may include spaced contacts 39, 40. A reciprocatory switch member 41 may move between these contacts to engage one or the other thereof. This switch may be insulatingly engaged with the free-end portion of a strip spring 42 fixedly mounted at its other end. The free end portion of the strip spring lies in the path of the head 43 of the lever 36. Normally the switch member 41 is moved by the spring 42 to engage contact 40, but when the head 43 deflects the spring, the switch member 41 engages contact 39. Opposing the spring 42 is a substantially weaker strip spring 44 mounted at one end on the door 20, its other end bearing on the head 34 to serve to retract the pin 33. When the rear door 20 swings away from the main section of the chamber 15, the lever 36 releases the switch 38, and the spring 44 retracts the feeler pin 33. When the rear door swings to closed position, the lever 36 abuts the switch spring 42 which overcomes the spring 44 to advance the feeler pin. When the latter is stopped by the cup 28, the pressure on the lever 36 causes it to deflect the spring 42 for causing engagement between contacts 39, 41. If no cup is present, the feeler pin continues to advance, and the lever merely swings without deflecting spring 42 so that the switch contacts 40, 41 remain interengaged. The switch elements may be insulated in any feasible manner. The operation of the feeler switch device 32 will be described in connection with the circuit diagram hereinafter referred to.

The top wall 45 of the chamber 15 is provided with a liquid discharge port or opening 46 which is coaxial with the annular seating member 27

so that the liquid flow is central, reducing swirls, waves, and the like to a minimum. Due to the momentum of the stream, the surface of the rising liquid in the cup will form a slight central concavity or cone, and the latter will be quite even circularly, avoiding any tendency to cause overflow and facilitating measurement of the liquid level by electrical capacitance means hereinafter described. A conduit 47 may intercommunicate the chamber 15 with a liquid container 48 disposed preferably below the base 11. This conduit may have an end portion provided with an annular flange 49 adapted to seat on a ring gasket 50 set into an annular recess 51 concentric with the opening, the extreme end of the conduit entering the opening 46 and preferably extending slightly therebeyond so that the liquid shall not contact the wall of the chamber 15 at any point. A locking device 52 serves to releasably lock the conduit to the chamber and to press the flange 49 into snug sealing engagement with the chamber at the gasket 50. The device 52 may include a lever 53 having at one end an open ring portion 54 adapted to laterally receive the conduit 47 and to seat on the flange 49 thereof. At its other end the lever may have an upturned ear 55 on which is pivotally mounted at 56 a vertically disposed cam 57 having an angular finger piece 58. Intermediate of the ends of the lever, the same is connected at 59 to the chamber top wall by means so loosely related as to permit movement of the lever in a vertical plane and in a horizontal plane. The connection 59 may consist in a screw having sufficient clearance with its hole in the lever to permit the requisite lost motion engagement. Accordingly, the lever 53 can swing around the screw so that the open ring portion 54 may receive and release the conduit 47 and the cam 57 is angularly movable so that when the finger 58 is upright, the cam 57 extends below the bottom of the lever 53 and rides on the top wall 45 of the chamber to tilt the lever and cause the portion 54 to bear down on the flange 49 for the sealing engagement. The cam friction in this seating on the top wall 45 will retain the device 52 in locked position. If the cam is turned to bring the finger piece 58 horizontal, the downward pressure of the portion 54 on the flange 49 is relieved, the lever tilting, frictional engagement is avoided, and the lever 53 may be freely swung so that its portion 54 disengages the conduit 47 and the flange 49 and permits removal and replacement of the conduit 47.

If a suction condition is utilized to cause liquid to flow from container 48 through conduit 47 and thence into the cup 28, a suction conduit 60 is provided, leading through any suitable air filter 61 and being connected at 62 to the top wall 45 to communicate with the chamber 15 and create therein a suction communicable through the conduit 47 with the liquid container 48 for drawing liquid through the conduit to fill the cup 28. The top wall 45 is spaced well above the cup, and the suction port is sufficiently high so that any liquid froth that may form as the cup fills up shall not be accidentally drawn into the suction conduit, so that the cleanliness of the latter may be maintained. The conduit 47 also terminates well above the cup 28 so as not to interfere with the latter when the same is being raised from its seat 27 and removed from the chamber. No part of the mouth portion of the cup is in contact with any section of the chamber whereby sanitary conditions are preserved. The chamber 15 is

therefore so proportioned relative to the size and shape of the cup used as to permit these conditions to be maintained.

To automatically gage the maximum desired liquid level in the cup 28, an electrical capacitance means may be provided in the chamber 15 sensitive to the liquid in the cup. Such means may be in accordance with principles of devices and circuits such as those disclosed in U. S. Patents Nos. 1,701,975, 1,708,073 and 2,094,351, whereby an indicator or control is operated at a certain volume or level of a liquid, for cutting off further flow of liquid or for other purposes. According to the present invention, two electrically conductive plates such as condenser plates 63 are disposed along the track or groove portion 29 so as to cover substantially the entire area thereof above the pin 33 and in spaced relation thereto. These plates are spaced from each other along the center of the track and they may serve as a non-frictional facing for the latter. These plates may be insulated from the adjacent parts 20, 29 or the latter may be electrically non-conductive material. Suitably insulated conductor wire 64 may connect these plates into a circuit through openings in the rear door which openings may be sealed closed. A feature of this device is that both plates 63 lie at one side of the cup instead of at opposite faces thereof, to permit the operator to easily grasp and remove the filled cup. The plates lie close to the cup and have the maximum possible area to obtain the desired sensitivity. By this construction, as the liquid rises, the dielectric at or between the plates 63 changes until there is sufficient capacitance to produce the requisite electrical energy for causing the flow of liquid to be cut off with great precision. The liquid cut-off means are described hereinafter.

The liquid container 48 in the case of milk is formed as a large metal can having a neck 65 for receiving a cover 66. The latter may have its central depressed section 67 formed with an eccentric raised portion or boss 68 having an opening 69 in which is suitably fitted a rubber ring or bushing 70 which may be externally annularly grooved to engage the edge of the hole. The conduit 47 extends slidably through the bushing 70 and is sealed thereby to the container 48. This conduit is preferably telescopic and includes a supplemental section 71 in which the main section 47 is sleeved. The section 71 may be cut off at its lower end at an angle to maintain full communication with the liquid in the can. It is sealingly engaged with the section 47 by a rubber tube or coupling 72 which may be of initially uniform or varying diameter. A tube of uniform diameter suffices to grip both conduit sections 47 and 71, and since the section 71 is of relatively greater diameter, the coupling is held thereon more strongly, while the smaller section 47 is adapted for sliding movement relative to the coupling. The latter is protectively enclosed in the can and is of course larger than the opening in the bushing so that the coupling cannot be removed therethrough. At its upper end, the conduit 47 is provided with a goose neck or U curve 73 whereby the conduit may extend upwardly alongside the chamber 15 to clear the rear door 20 and align with liquid discharge opening 46 in the top wall 45. The curved portion is adapted to readily pass through an opening 73a in the base plate 11. The flange 49 may be inexpensively formed as a grommet, with a flange or collar 74 snugly engaged around the conduit in

air sealed relation thereto. When the conduit is collapsed, the curved part 73 lies protectively within the cover 66 as shown in dot-dash lines in Fig. 1. It may be enclosed in a sanitary manner by a secondary cover 75. The neck 65 may carry a bracket 76 to which the covers 66, 75 may be individually or collectively locked in any suitable releasable manner at 77. The can 48 and its associated parts is shipped in thoroughly sterilized condition, and at its destination, the cover 75 is removed whereupon the conduit 47 is pulled upward and locked to the chamber 15. Adulteration of the milk is not possible, since breaking of the seal and lock for the cover 66 is prohibited. Should water be poured into the compartment 67 of the cover, the raised boss 68 is a safeguard, and if the water level is higher than the boss, the sealing bushing 70 will prevent leakage into the can 48. If the conduit section 47 should be completely withdrawn for pouring water through the bushing, this tube cannot be reinserted into the rubber coupling 72, which with its conduit section 71 will fall laterally out of line with the bushing 70. Thus means are provided to make it difficult to attempt to adulterate the milk. After the milk in the can has been consumed, the conduit or part thereof may be discarded and the can returned to the milk plant to be sterilized and refilled.

By the provision of a discardable conduit 47, 71, considerable expense and trouble are avoided, since otherwise each can would require a telescopic conduit of relatively costly permanent nature, with parts subject to loss or to breakage or distortion. The conduit may be made of any cheap material such as a paper-like substance. For instance, each of the sections 47 and 71 may be made of paper helically wound and adhesively united in a well-known manner to form tubes which may be finally coated with a waterproof adhesive, varnish or plastic to form as smooth a surface as possible. In making the curved portion 73, that portion of a straight tube may be wetted to soften it and then forced onto a curved mandrel, upon which it may be dried by the application of heat while pressure is applied by an external die to compress and smooth out the wrinkles formed in bending the tube. Before the tube is wholly dry, the mandrel and die are removed, after which the tube dries completely for a permanent rigid set of the curved portion. Now the grommet 49, 74 may be forced in place. Before or after application of the grommet the tube 47 may be coated with a waterproofing material mentioned which tends to adhesively seal the grommet to the tube and smooths out the irregularities especially in the curved portion to minimize friction and hence turbulence of the liquid flow, permitting a relatively substantial flow velocity without undue irregular distortion of the liquid level in the cup 28.

The conduit 60 is connected to a source of alternating suction and pressure comprising a pump 80 direct-connected to its driving motor 81 mounted on a support 82 fixed on the base plate 11 to form a single-conduit pressure-suction air pump system. The pump may be of any rotary positive pressure type such as shown in Pat. No. 2,081,650 previously referred to, having intake and outlet conduits 84, 83 connected to a solenoid operated reversing valve such as shown in that patent, and having an air filter similarly associated therewith. For convenience, the valve device is herein illustrated as having a cylindrical valve casing 85 having a central valve stem 86

carrying axially spaced disc valves 87, 88. As shown, the valve unit is downwardly retracted by an external expansion coil spring 89 acting between the valve casing and a head on the valve stem, the valves 87, 88 being in such position that communication is established only between the conduit 60 and the pressure passage 83. When a solenoid 90, in an extension 90a of the valve casing, is energized, the valve unit is upwardly moved against the force of the spring 89, cutting off the conduit 60 from the pressure passage 83 and connecting it to the suction passage 84. In this pressure position of the valve unit, air may leak in around the upper part of the valve stem through the casing extension 90a which may have a bleeder hole or may be skeletonized to supply air for the pump and when the valve unit is in suction position, air pressure may leak out about the lower part of the valve stem to permit the suction to be maintained. The circuit for the solenoid is described hereinafter. In the conduit 60 there may be any suitable bleeder valve device 91 which may include a needle point valve (not shown) settable by a screw 92 to adjust a fine bleeder opening 93 whereby the maximum pressure and suction may be given an approximate adjustment. When filling of the cup 28 is to begin, the valve unit is in suction position, whereby the pump 80 creates a suction in the chamber 15. As soon as the cup has been filled, as determined for example, by the electrical capacitance means 63, the solenoid spring moves the valve unit to pressure condition, whereby the flow of milk instantly ceases, any surplus milk in conduit 47 being caused to return to the can 48, and as the front door 19 opens for removal of the cup, the pressure causes an outward cleansing puff of air. When the doors 19, 20 are closed, the air pressure flows through the conduit 47, 71 to bubble up through the liquid or milk in the can 48 for agitating the same and assuring an even distribution of particles or ingredients which tend to separate out. Such agitation may thus occur before or after a cup 28 is filled, and may also occur in both instances, while the chamber 15 remains closed. A single conduit is thus utilized for both suction filling and pressure agitation. The latter phase will be further discussed hereinafter.

The structure thus far described may operate according to different cycles which may be termed "intermittent" and "continuous." The intermittent cycle may be initiated manually by a simple or coin operated switch, with both doors 19, 20 closed and a cup 28 in operative position in the chamber 15. The latter is subject to suction and the cup is filled, whereupon the front door opens. Whenever the operator removes the cup, the rear door opens to receive another cup, and during or preferably before the rear door closes, the front door closes, completing the cycle. The continuous cycle is different in that the filling of the cup is initiated automatically and when the cup is full, the front door automatically opens. This condition of the apparatus marks the beginning of the continuous cycle, and the apparatus may remain in this condition as long as desired. Upon removal of the filled cup, the front door 19 closes, the rear door 20 opens to receive another cup, and then closes, and the cup is filled, whereupon the front door opens, completing the cycle. In the intermittent cycle, agitation of milk by the air pressure occurs automatically at regular intervals while the chamber is closed. In the continuous cycle, the agitation occurs during a frac-

tion of a minute after the cup has been filled and before the front door is opened for which reason the opening of the front door is suitably retarded. Since the continuous cycle contemplates a virtually continuous use of the apparatus, ample agitation will occur.

Certain devices and mechanism for causing the operations mentioned will now be described, followed by a description of the electrical circuit. The frame walls 13, 14 carry a main drive shaft 95 suitably journaled therein, and rotated by any suitable source of power such as an electrical motor indicated in the circuit drawing. The shaft has fixed thereon identical cams 96, one adjacent to each wall and outside of the frame. The cam rotates counter-clockwise and is shaped to cause rapid opening of the front door and to cause it to remain open, all in proper timed relation in the cycle, the door closing gravitationally, with its weight being continuously carried by the cam. Also journaled in the walls 13, 14 is countershaft 97 carrying identical telescopic arms 98 that support the front door 19. The shaft 97 may be stationary or rockable, and constitutes a pivotal support for the arms, the latter being disposed at opposite sides of the door for a well-balanced support thereof. Each arm 98 may include a main section 99 having a follower roller 100 for the cam 96. The latter may have a rapid rise 101 for opening the door, a dwell 102 to keep the door open, and a dwell 103 to support the door closed. Each arm 98 has a companion arm section 104 extending along and slidable with relation to the section 99 by the provision of pin 105, on the latter engaging in slots 107 of the slidable section. The latter carries a pin 108 connected by a tension coil spring 109 with the pin 105, thus tending to elongate the arm to move the front door 19 away from its seat at the opening 17 of the chamber 15. At its front end portion, the arm section is enlarged to provide a seating engagement with the door 19, including three open ended slots 110 for engaging corresponding pins spaced lengthwise of the door. One of these pins 111 is central to the door, and is engaged in the central slot and the other lateral pins 112 are engaged in the other slots. For releasably locking the door to the arm section 104, the latter may have a latch lever 113 centrally slotted at 114 to receive a pivot and guide pin 115 on the arm section 104 and having at its forward end an angular or bayonet slot 116 adapted to receive the pin 111. At its other end, the latch lever is engaged at 117 by a tension coil spring 118 connected at 119 to the arm section 104. Thus the spring 118 serves the dual purpose of holding the pin 111 securely engaged in the bayonet slot 116 to lock the door to the arm section 104 and to pull the door toward the latter with the pins 111, 112 snugly seated in slots 110 to maintain the door in substantially rigid relation to the arm section. The springs 118 have the additional purpose of permitting some yield when the door is seated on the chamber 15 to allow for any slight misalignment and permit uniform seating engagement. The door 19 may be removed by merely sliding the levers 113 frontward and swinging them out of the way. As arranged, the telescopic arms 98 clear the conduits 47 and 60, and lie at opposite edges of the rear door, in spaced relation thereto.

As previously indicated, when the front door 19 is in open or partially open position, it is spaced from the seat at the chamber opening 17 to avoid frictional war on the gasket 24. The telescopic arms 98 are then held expanded in length by the

springs 109. When the door is in closed, sealing position it has been moved radially inward, toward the chamber 15, to tightly engage the seat at the opening 17. To effect such radial movement, means such as identical bell crank lever 120 are provided on the walls 13, 14 pivoted thereon at 121.

Provided on the arm section 104 is a pin 122 movable into cooperation with the bell crank lever 120 when the arms 98 move downward into door closing position. In such position of the pin 122, the bell crank lever is movable clockwise to engage the pin 122 and move the arm section 104 rearward against the force of spring 109 for causing the front door 19 to move toward its seat at the opening 17 for air tight sealing of the chamber 15. For positive actuation of the bell crank lever, its arm 123 may carry a roller 123a engageable with a cam 124 rigid on the main shaft 95. A tension coil spring 125 interconnects the arm 123 with a point on an adjacent frame wall 13 or 14 to maintain the roller in engagement with its cam 124 and to retract the bell crank lever 120 out of the path of the pin 122 for purposes of clearance. The cam 124 may have a dwell 126 to permit the retraction to occur, and a dwell 127 for advancing the bell crank lever to engage the pin 122 and cause the movement of the arm section 104. After the front door has fully closed the cam face 127 engages the roller 123a and maintains such engagement until the suction filling of the cup 28 has been completed and the front door is ready to open. Then the cam face 127 releases the roller 123a whereupon the bell crank lever 120 is actuated by the spring 125 to release the pin 122, and the spring 109 acts to longitudinally expand the arm 98, spacing the front door from its seat at 17. The identical operations occur at both arms 98 to produce a fully balanced operation of the door 19.

For actuating the rear door 20, a spring expanded telescopic linkage 130 is provided pivotally connected thereto at 131. The linkage includes a main link 132 pivotally mounted at its rear end on the rod or countershaft 97 and having a roller 133 engaging a cam 134 fixed on the main shaft 95. Spaced from its front end, this link has a pin 135 engaging in the slot 136 of a companion link 137 pivoted to the door at 131. The pin 135 serves to hold the links 132, 137 together in side by side, relatively sliding relation to each other. A tension coil spring 138 interconnects the forward end of the link 132 with the rear end of the link 137 to cause expansion of the linkage 130 for pressing the rear door 20 into closed sealing relation to the chamber 15. When the door is thus closed, the links form a small angle with each other to facilitate instant downward breaking of the linkage for opening the door, and this action may be accelerated by the spring 139 which interconnects the link 137 with the base plate 11 in a downward and rearward direction. When the rear door is closed, cam dwell 140 engages the roller 133, and when the rear door is to be opened, the roller enters the cam recess 141. In the latter position, the spring 139 causes the linkage 130 to break downward, this being assisted by the spring 138 which is thus relieved of its tension. The slot 136 may have sufficient length to permit the rear door to open to an angle of about 45 degrees.

When the rear door is thus opened, it is adapted to receive cups such as 28 manually or automatically, as by any conventional dispensing unit 145 for paper cups, well known in the art. This

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unit is adapted for use with a stack of nested cups, and discharges one at a time.

The cup dispenser unit may be arranged to discharge cups onto the track 29 of the open door 20. Preferably, a concaved guideway 146 is connected to said unit to assure that the cups will fall in accurate upright position. Automatic operation of the dispensing unit 145 may be had by a lever 148 having a fixed pivot 149 on the frame wall 14. At its lower end, this lever includes a roller 150 engaging a cam 151 fixed on the main shaft 95, and a tension coil spring 152 interconnecting the lever with a point 153 on the base 11 to hold the roller against the cam. At its upper end, the lever may have a slot 154 engaging a pin 155 on an arm or link 156 connected to the dispenser unit 145 or to an actuator thereof. The lever moves counterclockwise to prepare the actuator to discharge a cup and when the roller 150 enters the cam's recess 154, the lever swings rapidly clockwise to cause discharge of the cup, this occurring almost immediately upon full opening of the rear door.

Since the usual stack of cups is quickly exhausted, means is provided whereby a plurality of the stacks can be mounted simultaneously and automatically shifted to dispensing position as a previous stack becomes exhausted. Accordingly there is provided a cylindrical casing member 158 having therein three tubular equally angularly spaced sections 159 open at the top and being internally shouldered at 160 to slidably receive and seat vertical receptacles 161 having therein stacks of nested paper cups such as 28. When the receptacles 161 are inverted and mounted as shown, each communicates with its tubular section 159 to form therewith a relatively smooth continuous passage for the paper cups. Centrally formed in the casing 158 is a tubular hub 162 adapted to receive a shaft 163 about which the casing rotates. The lower ends or mouths of the tubular portions 159 terminate in a plate 164 affixed thereto and serving as a base for casing 158. This base rests slidably on a stationary plate 165 which serves as a support for the casing 158 and also as a closure for the sections 159 except at the opening 166 aligned with the dispenser unit 145 which may be affixed to the plate 165 as by brackets 167. The opening at 166 may be so shaped or lipped as to prevent the marginal lip of a cup from accidentally catching thereon. Thus cups 28 are discharged into the dispenser unit as consumed. Since the latter is spaced considerably below the plate 165 for a purpose hereinafter described, a coaxial tube 168 is affixed to the dispenser unit to bridge at least part of the gap. This tube 168 may have a slightly flared or beveled mouth to avoid catching the lip of a cup. The plate 165 is also provided with a central opening 169 sufficiently large to freely pass a ratchet wheel 170 that is rigid on the hub or bearing 162. With the plate 165 affixed to and resting on the frame walls, 13, 14, assembling is facilitated, and the casing 158 including the ratchet wheel 170 can be readily removed if desired. This ratchet wheel is utilized to rotate the casing 158 at selected times to shift a new stack of cups into feeding relation to the dispenser unit 145 as presently described.

Spaced below the top frame plate 165 and parallel thereto is a mechanism carrier plate 171 affixed to the frame members 13, 14. The stationary shaft 163 is undercut to rest on this carrier plate, its undercut portion 172 passing through a hole in the plate and being secured

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thereto by a fixed head 173 of any suitable character. Journalled on the portion 172 between the elements 171 and 173 is a lever 175 adapted to be oscillated to actuate the ratchet wheel. For this purpose a link 176 is connected to one end of the lever 175 at 177a and to an upright lever 177 at 178. This lever 177 has a fixed pivot 179 on the frame wall 14 and is pivotally connected at its lower end at 180 to a link 181 having a slot 182 for slidably receiving a pin 183 on the lever 148. At its other end, the lever 175 is provided with a pair of radially spaced pins 184, 185 extending upward through individual arcuate slots 186 in the carrier plate 171. The former of these pins carries a pawl 187 maintained in engagement with the ratchet wheel 170 by a tension coil spring 188 connected to the pawl and to a point or pin on the carrier plate 171. The opening 169 in plate 165 is made sufficiently large to clear the pins, the pawl and the spring thereof. Extending in the path of the other pin 185 is a longitudinally slidable strip element 190 having a plurality of slots 191 receiving headed pins 192 on the underside of the plate 165 whereby the element 190 is mounted to overlie the carrier plate 171. At its extreme outer end, the element 190 may have an upwardly bent finger piece 193, the plate 165 being cut away at 194 to provide clearance therefor. This finger 193 is engageable in any one of three equally angularly spaced notches 195 disposed along the periphery of the bottom plate 164 of the cup stack casing 158. These notches are cut at an angle to the tangent for proper engagement with the finger piece 193 and for easy release therefrom. A tension coil spring 196 interconnects the element 190 with a stationary part so as to move the element toward its actuator pin 185 with the finger 193 entering one of the notches 195 to thus lock the casing 158 against rotary movement except when the stack of cups has been exhausted. A tension coil spring 197 interconnects the lever 175 with a relatively stationary part to tend to retract the pawl 187 and to actuate the pin 185 in opposition to the spring 196, whereby pin 185 and the latch element 190 are always in contact with each other. However, the tension of spring 197 is superior to that of spring 196 and the action of the former is thus to normally maintain the pin 183 at the forward end of the slot 182.

In order to ascertain whether a stack of cups has been exhausted, a feeler finger 200 is mounted on a vertical pivot pin 201 on an extension 202 of the carrier plate 171. This feeler finger may be in part on the underside of the latter, but in general it is mounted to clear the rotary base 164 of the cup stack casing 158 and as closely as practical thereto. The elongated free end portion 200a of the feeler pin may be of increased thickness beveled or triangular in cross section so as to facilitate downward movement of the cup without forming an obstruction that might catch the rim lips thereof. The movement of this beveled portion is approximately radial to the downward path of the cups as the finger pivots in its horizontal path. A light tension coil spring 203 is connected to the finger and to an extension 204 of the wall 14. Thus the finger is constantly in contact with the side walls of descending cups. When the stack of cups is exhausted, the finger may move into the path thereof so that it can be readily seen in part through the opening 166 of the plate 165. At certain times the finger is fully retracted, and a clearance notch 205 may

be provided for it in the carrier plate 171. Such complete retraction may be caused by a lost motion wire link 206 engaging in a hole in the finger and in a hole in a downwardly extending lug 207 of the lever 175, the movement of the latter being considerably greater than that of the feeler finger. When the lever 175 swings counterclockwise, the finger 200 moves outwardly, the link 206 idling, and the outward movement of the finger in the absence of cups being limited as hereinafter described.

Resting on the carrier plate 171 and pivotally connected to the pin 201 of the feeler is an arm 210. A coil spring 211 extends around the pin 201 with one end engaging the feeler at 212 and the other end engaging a pin 213 on the arm 210 whereby the spring urges the elements 200 and 210 to move angularly away from each other. When the feeler 200 is fully retracted into the notch 205, the spring 211 serves to move the arm 210 counterclockwise against the stop pin 214 on the carrier plate 171. When the feeler moves outward beyond cup contacting position, in the absence of a stack of cups, it is required that the arm 210 shall move to a position against the stop pin 215 on the carrier plate 171. This is accomplished by the provision of a pin 216 on the feeler 200 adapted to laterally engage or abut an edge of the arm 210. The extension 203 is of course so cut away as to avoid interference with the pin 216. By means of this pin 216 the spring 203 is adapted to move the arm 210 against the stop pin 215, and the latter serves as a stop for outward movement of the feeler in the absence of a stack of cups. The range of angular movement of the arm 210 may be much less than that of the feeler 200 and hence retraction of the feeler by the wire link 206 may continue after the arm 210 has come to rest against the stop pin 214. Further the arm 210 is disposed against the stop pin 214 by the spring 211 when the feeler has moved partially outward to engage a stack of cups. It is only when the feeler is fully projected by spring 203 in the absence of a stack of cups that the arm 210 moves against the pin 215. Actually the feeler need not move inward beyond cup feeling position except that it may be desirable to have it yield for passage of the external rim of the cup; but further retraction may be desirable for increased tension of the spring 211 to assure movement of the arm 210 to its stop 214.

When the arm 210 lies against the stop 214 it lies in the path of an extension or lug 220 on the extreme upper end of the lever 177, projecting above the carrier plate 171. To prevent the arm 210 from springing upwardly away from the extension 220, a spacer pin 221 on the arm slidably contacts the bottom face of the plate 165. When the arm 210 lies at the stop 215, it clears the extension 220 to permit oscillation of the lever 177. This extension may be relatively narrow so that it may be cleared by a small angular movement of the arm 210.

When the arm 210 lies in position at the stop 214 to lock the lever 177, clockwise movement of the lever 148 will merely cause the pin 183 to ride in slot 182. In this locked position, a stack of cups is present, but as soon as the stack has been consumed, the feeler 200 moves outward and the locking lever 210 moves to unlocked position permitting free movement of the lever 177. In course of this free movement, the spring 197 moves both the pawl lever 175 and the lever 177 counterclockwise; the pawl 181 retracting and

lever 148 causes clockwise movement of both levers 175, 177 against the tension of the spring 197, the pawl 181 advancing; and in each case pin 183 is at the forward end of its slot 182. Each oscillation of the levers thus causes the pawl to advance the ratchet wheel 170 one tooth; and this occurs on each cycle of the machine, the operation being controlled by the main shaft 95.

More specifically, assuming that a stack of cups is present, the feeler 200 is fully retracted on each cycle, but its advance is only partial being limited by the cups. Upon each such retracting movement, the locking arm 210 is in the path of lever 177 and upon occurrence of the partial advance, the locking arm remains in the path of the lever 177. During this partial movement of the feeler 200, the locking arm is held stationary against stop 214 by the spring 211. However, sufficient clearance is provided between the locking arm and the lever 177 so that the latter has a small range of movement toward and away from the locking arm 210, but this involves merely a matter of clearance between these parts. In consequence the pawl lever 175 oscillates a little but not sufficiently to permit its pawl to turn the ratchet wheel 170. In the absence of a stack of cups, the operation is the same as before, except that the feeler 200 now advances fully on each cycle, thereby moving the locking arm out of the path of the lever 177 at the appropriate time to permit full movement of the latter and of the pawl lever 175, with the pawl now moving through a sufficient range to move the ratchet wheel one tooth; and although the locking arm 210 moves momentarily into the path of the lever 177, it moves out of that path at the time when the pawl is due to be advanced by clockwise motion of levers 177 and 175. It may be added that the link 206 may begin to slacken as the feeler moves beyond its partially advanced to fully advanced position, with the link riding freely through the ear 207 on the lever 175, this involving the provision of suitable clearance. It will now be clear that in the absence of a stack of cups, all the associated parts have their full range of movement or oscillation upon each cycle of the apparatus.

Considering now in further detail the operation of the latch member 190, it is noted that when there is a stack of cups present, preventing full outward movement of the feeler 200 so that the ratchet wheel 170 is not turned, the stack casing 158 connected thereto remains stationary. To prevent a forcible attempt at manual turning of the casing 158 with consequent distortion or jamming of the cups, the finger 193 remains constantly engaged in one of the notches 195 at the base of that casing to prevent rotation thereof. The pawl lever 175 being relatively stationary as above described, and lying at an end of its clockwise movement, the pin 185 is at the front end of its arcuate path, thereby clearing the path of the latch 190 which is thus held in locking position by its spring 196. But when a stack of cups is absent, and the feeler 200 advances fully, permitting full oscillation of the pawl lever 175, the counterclockwise movement of the latter causes the pin 185 to move rearward to retract and release the latch member 190 from the notch 195 against the force of the spring 196. During the clockwise movement of pawl lever 175, the ratchet wheel 170 turns to angularly move the casing 158. Since the locking finger 193 and pawl 181 both advance forwardly, the retracted position of the

former must be sufficiently rearward to clear the notch 195 while the rotation is occurring to move the notch out of register with said finger. When the notch 195 has cleared finger 193 in the clockwise rotation of plate 164, the finger 193 may then ride along the arcuate edge of plate 164 until it comes into register with the next succeeding notch 195, when another cup compartment 159, 161 has moved into alignment with the dispenser unit 145, and since a stack of cups is now present, oscillation of the pawl lever 175 ceases and the latch member 190 remains in stationary locked position.

Because the particular mechanism disclosed provides for a rather small throw of the pawl lever 175, a multiplicity of teeth are required on the ratchet wheel 170. In this particular case, with three stacks of cups, the ratchet wheel has fifteen teeth. Since the stack casing 153 is moved one tooth on each cycle or cup filling operation of the machine, it requires five cycles of the machine for replacement of a stack of cups. Therefore a reserve of at least five cups must be provided for the interim, and the tubular section 163 affixed to the dispenser unit 145 is utilized for this purpose.

While the apparatus includes an electrical system including wiring and switches, it is considered to be sufficient to show these in the circuit diagram, except that it is instructive to show here certain switches which are operated by the main shaft 95. These include conventional switches 225, 226, and 227 fixedly mounted on the main base plate 11, having spring arms 223 carrying rollers 229 engageable with the respective cams 230, 231, 232 mounted on said main shaft. Of these, the switches 225 and 227 are single pole, single throw switches and the switch 226 is a single pole double throw switch. The switch 225 serves to cut out the circuit to the main shaft motor and to the pump motor 81 when the front door 19 is open. The switch 226 is normally closed at one of its poles for completing a circuit to a periodic agitator control switch when there is no filling of a cup in the chamber 15, and which opens said circuit and closes a circuit through its other pole for energizing said motors subject to switch 225. Switch 227 is a safety switch for opening a circuit to prevent an unlimited flow of liquid in the event that the level control means for the liquid in the cup 28 fails to operate; this switch is therefore a timing switch whose period of operation is somewhat greater than the maximum time for normally filling the cup and it closes just before the filling begins and opens a little after the filling ceases under the control of the level control means.

A structure 235 providing a periodic agitation control and a different liquid level control for the cup 28 will now be described. These controls are functionally independent except as coordinated in the system as a whole, but they are arranged and constructed as a compact unit. The device 235 includes parallel metal plates or walls 236, 237 interconnected at one end by a suitable insulator block 238 and by other means (not shown) to provide a rigid frame. An agitator control switch 239 includes generally horizontal vertically spaced spring arms 240, 241 mounted on the insulator panel 238. These arms are in laterally offset relation to each other, but include laterally projecting portions carrying insulated aligned contacts 242, 243. The latter are connected by wire coils 244 to the switch arm

mounting screws 245 which serves as terminals for connection into a circuit hereinafter described. Mounted on the wall 237 is a horizontal shaft 246 carrying spaced cams 247, 248 for the respective switch arms 240, 241 for controlling the switch 239. These cams rotate continuously counterclockwise. Each cam has a tooth-like portion 249 forming a sharp drop to a recess 250 leading onto a relatively long dwell 251. Both cams are identical except that one cam is angularly advanced through a certain small time angle with respect to the other. The switch arm 241 is formed with an upwardly bent finger 252 to engage its cam and to bring about a certain operation of the switch that will now be described. In the position shown, the contacts 242, 243 engage each other and the switch 239 is closed. From this position, when a small angular movement occurs, the cam 247 releases the switch arm 240 which springs upwardly separating the contacts 242, 243, the switch arm 241 maintaining its position or following slightly to a degree less than the movement of the arm 240. The latter now lies in the recess 250 of its cam 247, and as rotation continues, the high dwell 251 of cam 248 engages the finger 252 to spring the arm 241 downwardly to further separate the contacts 242, 243. Still further rotation causes the dwell 251 of cam 247 to engage the top switch arm 240 to spring it downwardly, but the switch remaining open until the lower switch arm 241 snaps off the tooth-like portion 249 of its cam 250 for again closing the switch in the position shown. It is thus clear that the switch 239 is closed during an angular movement of about 30 degrees and is open during the rest of the rotation. Hence if the shaft 246 makes a rotation in three minutes, the switch will be closed for only one-half a minute, during which agitation of liquid occurs by air pressure blown into the liquid. The shaft 246 may be rotated by any suitable clock or timing device such as any synchronous electrical motor 255 having a drive shaft 256 journaled in the frame wall 236 and carrying a pinion 257 engaging a gear 258 carried by a shaft 259 that is journaled in the walls 236, 237. Also carried by the shaft 259 is a pinion 260 engaging a gear 261 mounted on the cam shaft 246. Thus the motor 255 causes continuous rotation of the cam shaft for accurate timed operation of the switch.

Operating conjointly with the capacitance control indicated at 63, or as a substitute therefore is a liquid level control for the cup 28 which is responsive to the drop in liquid level in the can 48 upon each liquid dispensing operation, or to the increased time required for filling the cup due to the drop in head in the can 48. The timing liquid level control, namely time switch 265, hereinafter described, may be used without removing the capacitance plates 63 if the capacitance control is out of order or is not used, and in that case the plates 63 may serve as an anti-friction covering for the cup guide 29.

The time switch 265 may include an extension of the main constant speed shaft 95 journaled in the wall 237 and carrying a finger 266 rotated clockwise thereby. This finger engages a pin 267 of an arm 268 having a hub 269 journaled on the shaft 259 retained by a spacer collar 271 pinned or otherwise fixed to the shaft, and by an adjoining collar 259a, between which the hub 269 is freely rotatable. Journaled on the shaft 259 is a clutch plate 270. Between the plate 270 and the gear 258 is a centrally convexed spider

spring 272 thus creating a frictional resistance between the plate 270 and the pinned collar 271 and gear 258.

At 268a the arm 268 is offset to carry a pin 268b adapted to ride on a timer cam 275 fixed on a shaft 274 journaled in the walls 236, 237. This shaft 274 is moved through small equal successive angles in a manner hereinafter described. Connected to one end of shaft 274 there may be a spring wound motor 273a and carried by the shaft 274 at the other end thereof is a gear 273 engaging a pinion 274a on a shaft 274b journaled in the wall 236. Also carried by the shaft 274b is a ratchet wheel or gear 276, and a pawl lever 277. The latter carries a pawl 278 mounted thereon at 279 and connected to the lever by a tension coil spring 280 urging the pawl into engagement with the gear 276. A second pawl 281 is pivotally mounted on a pin 282 secured to the wall 236 and urged into engagement with the gear 276 by a leaf spring 283 mounted on a bracket 284 secured to the wall 236. Adjacent to its upper end, the downwardly inclined pawl lever 277 is enlarged in width to form a head or finger piece 285 carrying a cam portion 286 of like width engageable by a finger 287 carried by the shaft 95. The pawl lever 277 is held upward by a tension coil spring 288 interconnecting the head 285 with a point on the wall 236 at a cut out 289 which allows room for the spring. This upward movement of the lever under the influence of the spring 288 is limited by a stop pin 290 fixed on the front wall 236 and engaging the lever in a recess thereof, whereby the cam 286 and the finger 287 are maintained in operative relation to each other. In this operative relation, the pawls 278, 281 serve as a pawl actuated spring motor wind as well as an escapement-like means for the gear 276 to actuate the latter and to prevent the spring motor 273a from suddenly unwinding. This pawl actuated spring motor wind is operated once whenever the main shaft 95 makes a rotation, the finger 287 engaging the cam 286 to cause oscillation of the lever 277 against the force of the spring 288 just enough to cause the pawls 278, 281 to advance one tooth of the gear 276. Since the latter is connected to the timing cam 275 by the gear train 273, 274a, the cam 275 is caused to have precisely equal angular movements upon each cycle of the machine as exemplified by the rotation of the main shaft 95. Because the timing cam 275 should turn clockwise, the movement of the gear 276 under the control of the escapement should be counterclockwise.

If a quick re-setting of the timing cam mechanism is desired, it should be possible to easily release the escapement to return the timing cam 275 to an initial position. For this purpose a pin 291 is affixed to the front wall 236 in the path of the cam shaped tail 292 of the pawl 278; and on the pawl 281 there is fixed a pin 293 engageable with the cam end face 294 of the pawl lever 277. Now when the operator depresses the finger piece 285, the lever 277 is moved clockwise against the force of spring 288 and the cam portions 292 and 294 engage their respective pins 291 and 293 to angularly move the corresponding pawls 278 and 281 out of engagement with the gear 276, whereby the gearing spins freely under the influence of the motor 273a until the timing cam 275 arrives at a desired position, whereupon the pawl lever 277 is released. It will be understood that the spring motor was wound up when

the escapement rotated the gear 276 and hence the cam shaft 274.

For the purpose of setting the timer cam 275 to a desired initial position, an arm 295 is provided, freely journaled on the cam shaft 274 and having an angular section 296 formed with a slot 296a concentric with said shaft. A headed screw 297 is threadedly connected into a boss 298 of the wall 236. A stop pin 299 fixed on the gear 273 lies in the path of the arm 295. The latter may be set at any desired position or angle by means of the set screw 297 which clamps the arm 295 against the adjacent wall 236. When the finger piece 285 is depressed to release the escapement, the spring motor causes rotation until the stop pin 299 engages the arm 295. Such rotation involves counterclockwise movement of the timer cam 275 for resetting the same to a desired initial position. Thus any desired portion of the timer cam 275 may be used according to the head of liquid in the can 48 and the elevation thereof relative to the liquid discharge outlet of the dispensing chamber 15. For instance, if the chamber 15 is higher at one installation than at another, relatively to the can 48, where the difference in head is greater, the timer cam 275 is set to afford a correspondingly greater period of time for the constant pressure pump 80 to fill the cup 28.

The timer switch includes any conventional normally closed spring switch 300 fixedly mounted on extension 301 of the clutch plate 270. To clearly show the operation, the switch 300 may include a casing 302 having a strip spring switch arm 303 connected at one end therein and serving to normally close the switch contacts 304. For opening the switch, a rod or plunger 305 is slidably mounted in any suitable manner in the path of the spring arm 303, for example, in a hole in the bottom wall of the casing 302. The plunger 305 is urged downward by the switch spring 303, so as not to interfere with the normal interengagement of the contacts at 304, and there may be suitable means such as a collar on the plunger to prevent it from falling out of the casing. The plunger lies in the path of the arm 268 so that the latter is adapted to press on the plunger and upwardly deflect the spring arm 303 to open the contacts 304. The switch 300 may include any suitable insulation, and the parts 302 and 305 may consist of insulator material.

Since the shaft 259 turns clockwise, the clutch plate 270 acts to constantly urge the switch 300 clockwise, so that the plunger 305 engages the arm 268 to keep the switch 300 open. When the finger 266, turning clockwise swings the arm 268 upwardly, it pushes the switch 300 counterclockwise to an upraised position. Because the speed of the main shaft 95 is substantially greater than that of the shaft 259, the finger 266 quickly releases the arm 268 and the latter quickly drops, disengaging the plunger 305, whereupon the switch 300 is in normally closed position while it relatively slowly descends until the plunger 305 again engages the arm 268 to open the switch 300. The clutch plate yields easily under the force of the arm 268, but is held sufficiently tightly frictionally to overcome the spring arm 303.

In the cycle of the machine as hereinafter described in connection with the circuit, it is noteworthy that the timer switch 265 causes the switch 300 to be open at the end of each cycle, at which times the pump 80 is adapted to apply pressure. The switch 300 is closed at an intermediate point in each cycle during which the

valve device 85 is in position to cause the pump to create a suction for filling a cup 28. As soon as the latter is filled, the switch 300 is opened. While the switch 300 is closed, the solenoid 90 is energized to hold the valve device 85 in suction position. When the switch 300 opens, it cuts off the current to the solenoid, whereupon the valve discs 87, 88 are shifted to pressure position by the spring 89 to thus cut off the flow of liquid.

The key to the structure 265 is the timer cam 275. The latter is designed according to the cylindrical can 48 that is used, and related conditions. Where the amounts of liquid to be dispensed are uniform, and the container 48 is of any suitable design, such that it suffers an equal drop in head upon each dispensing operation, the number of such equal quantities of liquid to be dispensed to empty the can 48 is computed. Assume that 100 cups 28 can be filled from one can 48. This involves 100 cycles of the machine and hence 100 operations of the train of elements 95, 287, 277, 278, and 281 causing the gear 276 to advance 100 teeth and the timer cam 275 to have 100 successive equal movements. The operative cam surface of the cam 275 is provided with a uniform slope, so that its radius changes by an equal amount upon each of the 100 movements. As the liquid level in the can 48 drops, and because the pump 80 creates a uniform suction, the time required for pumping out the same amount of liquid increases. We have discovered that this increment of time is directly and precisely proportional to the change in liquid head. Thus there are 100 equal increments in time in filling 100 cups. The slope of the timer cam varies in relation to a switch such as 300 to produce 100 increments in the time during which the switch is closed. In other words, as the liquid level in can 48 drops, the point of time at which the switch opens to deenergize the solenoid 90 and cause the liquid filling suction to be cut off, is advanced.

More specifically, if an empty cup 28 is in proper position in the sealed chamber 15, and a cycle is initiated, the main shaft 95 begins to turn. Initially the switch 300 was in downward position in engagement with and held open by the arm 268. Now the finger 266 on the main shaft causes the arm 268 and switch 300 to swing upward, with the switch elevated always to the same point, the arm 268 quickly dropping, whereupon the switch 300 is closed and descends slowly. The closing of the latter initiates the filling of the cup 28. The point to which the arm 268 dropped is determined by the position of the timer cam 275, and as the radius of the point of contact therewith diminishes upon successive filling cycles, the distance between the arm 268 and the cam 275 for the fall of switch 300 increases; in the example given, there are 100 such increments. With the timer motor 255 turning the shaft 259 at constant speed, the time for engagement of the switch 300 with the arm 268 for opening of the switch thus reflects the design and position of the cam 275. The switch now remains in this open position until the next cycle.

The operating surface of the cam 275 is made considerably longer than a particular can 48 may require. If the latter is normally positioned lower relatively to the chamber 15 at one installation than at another, a lower section of the cam 275 is utilized to allow for the increased time consumed in dispensing the liquid. This can be ascertained by calculation or by calibration of the stop arm 295. With the finger piece 285 depressed

to release the escapement, the spring motor 273a moves the gear 273, rapidly counterclockwise until the pin 299 abuts the arm 295, and the thumb screw is utilized to secure the arm 295 in set position, the follower pin 268b being at a relatively high point of the timer cam, which thus becomes the constant starting point for the particular installation. Whenever a can 48 is empty and is replaced, the finger piece 285 is depressed to reset the timer cam to the position determined by the arm 295.

It will be appreciated that the liquid level control means may also be coordinated in principle with a condition which is not constant but which varies with the liquid head in the can 48. Thus the degree of suction may be varied by varying the speed of the pump or by bleeding the suction line or by varying the pump outlet to thus change the suction so that the time for the cup filling operation may be constant or may vary according to the control used. With the time constant, the suction would be increased by equal increments upon each cycle, as the liquid head in the can 48 drops. For this purpose the cam 275 may be regarded as an energy control valve for controlling the flow of air as well as of electrical current; and it may constitute a valve disc for controlling an air inlet or outlet port. However, the control is more difficult to realize if used directly on the air flow than if a constant air pressure is utilized as herein described.

Electrical circuit

The electrical circuit of the machine will now be described, from which the coordination of various parts will be further apparent. The main line from any suitable source of current is indicated at 310, and the return line at 311. Current is fed to a panel terminal 312 and thence along a line 313 to the cup test switch 33 and along a line 314 to a double pole, double throw toggle switch 315 and to a push button or coin operated switch 316, the latter being used for the intermittent as distinguished from the continuous operation of the machine. As shown in full lines the switch arms 317, 318, and 319 are set for the intermittent operation (the fourth arm of the switch is not used). In the intermittent operation, the cycle begins with the chamber 15 closed and the cup 28 in operative filling position whereby the cup test switch is closed at contacts 39, 41, closing a circuit 320 to a panel terminal 321 and thence at 322 to the normally closed liquid level switch 265 or 300 which is held open by the arm 268, breaking the circuit. In series with the switch 300 is the normally open switch 227. The lead 314 includes a section 323 connected to a switch terminal 324, and by switch arm 319 to a terminal 325 from which a line 326 is connected to the switch 316; a return line 327 from the latter is connected to switch terminal 328, whence the circuit is made to the switch terminals 329, 330 by the arms 318, 317. From the terminal 330 a lead 331 extends to normally open switch 225 which is closed by its cam 230 timed with the front door 18. From the switch 225, a lead 332 connects to the panel terminal 333. From the latter extends a lead 334 to the contact 40 which is open; also a lead 335 to the main motor 336 which rotates the drive shaft 55; a third lead 337 from terminal 333 extends to a switch 338 of which the contacts 339, 340 are normally closed, and the contact 341 open. From the contact 339 extends a lead 342 to the pump motor. Because the push button switch 316 is open the

motors 336 and 81 are normally deenergized, but while that switch remains open, current will flow along a circuit 343 from switch terminal 325 to the switch 226. The latter has contacts 344, 345 and 346, of which the contacts 344, 345 are normally closed while the contact 346 is open. From the contact 345, a lead 347 extends to the agitator switch 239 which is open most of the time but which closes at regular intervals for causing agitation of the liquid in can 48. From the agitator switch 239 extends a lead 348 to a panel terminal 350, whence a lead 351 connects to a relay 352 that controls the switch arm 339 to move the same to release contact 340 and engage contact 341, thus opening the line 337. However, current from the terminal 350 will flow through the lead 355 to the contact 341 and thence through the line 342 to energize the pump motor 81 while the main motor 336 remains idle. The solenoid 90 being deenergized, the valve device 85 is in position so that the pump blows air into the liquid to agitate the same whenever the agitator switch is closed. When that switch is open, the pump motor 81 and relay 352 are deenergized.

In the intermittent operation, it is now desired to start a cycle of the machine. Accordingly, the push button switch is closed momentarily to start the main motor until the cam 231 closes contacts 344, 345 of the switch 226, whereupon the switch 315 may be released and the operation will continue to complete the cycle. When switch 315 is closed, the current from terminal 312 has a circuit through the switch 225 to terminal 333 and thence by parallel circuits to the main motor 336 and to the pump motor 81 as described. The agitator switch circuit 347 is now open, and the relay 352 deenergized. Current from terminal 312 flows through a circuit 314, 324, 319, 325, 343, 344, 346, and thence through a line 356 connected to the terminal 328, then by way of 328, 329, 330, and 331 to the closed switch 225, and along lead 332 to the panel terminal 333 which is the supply source for the motors 81 and 336.

As the main shaft 95 moves through a certain small angle, it causes closing of the liquid level switch 300. Current from terminal 312 now flows through circuit elements 313, 41, 39, 320, panel terminal 321, and elements 322, 227 through a line 359 and a normally closed switch 360 to the solenoid 90 causing the valve device 85 to reverse so that the pump 80 now exerts suction for liquid filling of a cup. This continues until the timer cam 275 opens the switch 300, whereupon the solenoid is deenergized, the valve device now serving to feed pressure into the chamber 15. It is noted that the switch 227 closes just before the timer switch 300, and opens after the latter has opened. The cam 232 is designed to keep the switch 227 closed for a time period a little greater than the maximum time during which the timer switch may be expected to remain closed. Should the timer switch fail to operate for any reason, the switch 227 assures a cut off of the liquid flow to prevent a substantial overflow and loss of the liquid. This is further guarded against by the switch 360, the latter having the added function of opening when a film of liquid for any cause deposits on the floor of the chamber and creates an unsanitary condition. Such a film bridges the electrodes 31, which are in a low voltage circuit 361 supplied by a step down transformer 362 that is in a circuit 363 which may be connected to the line 310, 311. In the circuit 361 is a relay 364 which opens the switch 360 when energized, and which is deenergized when the film

of liquid is removed. By opening the switch 360 the pump 80 immediately supplies pressure instead of suction, so that the flow of liquid ceases.

The cup 23 having been filled, the motor 336 continues to turn the main drive shaft 95 to open the front door 19 for removal of the cup at any time. Now the switch 225 has opened cutting off the flow of current to the terminal 333 and thus causing the main motor 336 and the pump motor 81 to cease operation. While the contacts 344 and 346 of switch 226 remain closed, this is immaterial as they are subject to switch 225. The cup test switch contacts 39, 41 remain closed, but the agitator switch 239 is cut out at contact 345 of switch 226, and the liquid level switch 300 is open.

Upon removal of the filled cup 23, the cup test switch 33 closes at its contacts 40, 41, contact 39 being open, whereby current from panel terminal 312 flows to panel terminal 333, supplying the motors 81 and 336, the current to motor 81 passing through contacts 339, 340 of switch 338. Next, a new cup is being supplied at the rear door 20, and the front door closes whereupon the switch 226 is actuated to cause opening of the contacts 344 and 346 and closing of contacts 344, 345, to supply current to the agitator switch 239. When the rear door closes, the cup test switch 33 opens its contact 40 and closes its contacts 39, 41 so as to place the liquid level switch 300 in circuit, but the latter is open due to the position of the arm 268. The main motor 336 is now idle while the pump motor 81 is periodically operated by current from the agitator switch to the relay 352 and through contacts 339, 341 as previously described.

If the liquid level switch 300 be responsive to changes in capacitance between the condenser plates 63, the operation will be the same as described.

The circuits may be completed by any suitable return lines 366 to 369 inclusive leading respectively from the pump motor 81, solenoid 90, relay 352, and the main motor 336 to a panel terminal 370 connected to the line wire 311.

For the continuous operation of the machine, it will be recalled that the cycle begins and ends with the front door 19 of chamber 15 open, ready for the removal of a filled cup 23. For this cycle, the toggle switch 315 is shifted to merely bridge the contacts 324, 330 as shown in dotted lines at 371. Now current from panel terminal 312 will flow along a circuit 314, 323, 371, 331 to switch 225 which is open when the front door is open, thus breaking the circuit to the main motor 336 and the pump motor 81. Cup test switch contacts 39, 41 being closed, the liquid level switch 300 is connected, but is open. Upon removal of the filled cup, switch contacts 40, 41 close, supplying current to the panel terminal 333 and thus to the main and pump motors, initiating closing of the front door which may be retarded by the design of its cam 96 to afford time for the cup to clear the door. When the front door is closed, current from terminal 312 also flows through circuit 314, 323, 324, 371, 330, 331 and switch 225 to panel terminal 333, so that there are now two circuits feeding the motors 81 and 336. A new cup being in place, with the rear door closed, the cup test switch terminal 40 is open, cutting out the supply circuit 334, and closing contacts 39, 41, to close the circuit 320, 321, 322 to the liquid level switch 300. The operation of the latter is the same as before; it is initially open, and when it closes, the solenoid 90 is energized to cause suction filling,

after which the switch 300 opens. Now the pump 80 supplies pressure to the chamber 15 causing agitation of the liquid in the container 48 during the few seconds before the front door opens to complete the cycle.

Operation

The operation of the machine will now be briefly described. The milk or other liquid container 48 and its associated parts are assembled at a milk or other liquid plant, in sterile condition. Each can is supplied with a new, discardable telescopic conduit 47, 71 of paper-like material, interconnected by the rubber coupling tube 72, which with the conduit section 71 is within the can, while the upper section 47 is sealingly engaged in the rubber bushing 70. With the conduit collapsed and the cover 66 locked to the can, the goose-neck curve 73 of the conduit 47, with its grommet 49, lies enclosed in a sanitary manner in the cover chamber 67, which is closed by the auxiliary cover 75. The water-proofing coating of the conduit will not be affected by prolonged contact with the liquid. In this condition, the can 48 is shipped.

On arriving at its destination, the can 48 is placed in a refrigerator (not shown), the cover 75 is removed, and the conduit section 47 is moved upwardly, sliding through the elements 70 and 72, for attachment of the curved portion to the chamber 15 at its discharge port 46. Such attachment is effected by the locking device 52 whose lever is swung about its vertical axis to engage around the conduit, the cam 57 being then moved to tilt the lever relative to the horizontal at its loose fitting pivot, whereby the ear portion 54 bears down on the flange 49 so that the packing 50 effects a tight seal.

If it be attempted to adulterate the liquid, this is rendered difficult by the raised boss 63 and by the sealing bushing 70. If the conduit section 47 were completely removed, it could not be re-entered into the contractile coupling 72 which would tend to tilt aside in the hollow boss or within the main body of the can 48.

With a cup 28 in place in the chamber 15 in central relation to the conduit outlet, the liquid, without touching any part of the chamber, flows in a rapid stream into the cup, without uneven swirling, so that the liquid level rises relatively uniformly circularly of the cup; this is assisted by the smooth coated surface of the conduit, reducing eddying. Thus the rising liquid affects the capacitance of a condenser device, including plates 63 to cut off the liquid flow at a predetermined level. Alternatively, a switch device 265 responsive to the uniform drop in head in the cylindrical can 48 upon successive dispensing operations serves to measure the amount of liquid in the cup 28. The switch device 265 is based upon the principle of supplying increased pumping energy proportional to the increased resistance caused by the drop in head, and such increased pumping energy may take the form of a changing pump pressure but preferably it involves the use of constant pump pressure for an increasing time period for which the timer cam 275 is designed. Thus a normally closed switch is maintained open by the pressure of a switch arm 268 against which it is held by a clutch plate 270 driven by a relatively slow, constant speed shaft 259. On each cycle the arm 265 is caused to rapidly push the switch away to a uniform position from which the clutch plate moves the switch to again engage the arm 268, the inter-

vening space being increased on each cycle by the timer cam effecting the return position of the arm 268. During the return travel of the switch 300, the same is closed, and at the end of that travel it is open to cut off the liquid flow.

While the liquid flow may be caused by any suitable pressure, preferably an air pump 80 is used because with a reversing valve 95, it can supply pressure for agitation as well as suction for pumping out the liquid, through the simple one conduit means 47, 71. This agitation is caused by air bubbling up through the liquid thereby thoroughly mixing the elements in liquid food and other mixtures, such as chocolate milk, tomato and fruit juices, etc., and aerating the liquid to substantially reduce its bacterial count and to increase the palatability of the liquid. The last two features afford striking advantages with milk, including homogenized milk. The air for agitation may be suitably filtered and may be taken from the refrigerator to maintain the liquid in cool condition. The agitation may be effected at regular intervals except as interrupted by the filling of the cup. In the case of milk, the agitation may occur for one-half minute in every three minute period without producing excessive butter fat. Such agitation may be controlled by an agitator switch 239 operated by the constant speed means used for the liquid level control switch 300.

The chamber 15 is so constructed that when a cup 28 is properly seated therein, its upper portion is out of contact with all parts of the chamber for sanitary reasons. Its mouth is well below the liquid discharge and suction ports so that they will not obstruct removal of the cup and so that any froth on the liquid shall not be drawn into the suction port. When the suction is replaced by pressure, this is done before the chamber 15 is opened, so that any liquid in the conduit curve 73 is blown back into the can 48, and so that there is a puff of pressure when the chamber opens, tending to blow out any flies that may be present therein. In the so-called intermittent operation, the cup remains empty in the sealed chamber 15 and agitation occurs, until a cycle is started, whereupon fresh cold liquid is discharged. In the so-called continuous operation, intended for very busy restaurants and the like, the cycle ends with a filled cup and the chamber 15 open, and is again started by removal of the cup. In this cycle, the agitation occurs after the cup has been filled and just before the chamber opens. The agitation, though for a very short time, is sufficient because the machine is almost constantly in use. To maintain sanitary conditions, if a film of liquid forms on the bottom of the chamber, such as may attract flies, the electrodes 31 will prevent filling of the cups until wiped off. A low voltage is employed on these electrodes to prevent possible short-circuiting, and hence the relay 364 is used to open switch 360.

While cups 28 may be supplied to the chamber 15 manually, this is preferably done automatically for sanitary reasons. To assure a compact, continuous operation, the chamber is provided with a rear door 20 for receiving the empty cup, and a front door 19 for removal of the filled cup, the chamber being otherwise stationary. Such a chamber is simple and highly advantageous for rapid dispensing operations, and is desirable for sanitary reasons even if suction filling be not used. The sanitary code especially in con-

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nection with the machine dispensing of loose milk is very rigid and circumspect.

To supply cups 28 to the chamber 15, any standard dispenser including a dispensing unit 145 may be used. The latter may be to the rear of the chamber, discharging onto a stationary inclined guide 146 which in turn discharges onto a track or groove 29 on the rear door 20 and thence onto a ring seat 27 that swings therewith. When the rear door closes, the seat 27 is horizontal. Before the rear door closes, the front door 19 has closed. A single drive shaft 95 operates both doors by means of extensible arms 98 for the front door and by means of an extensible linkage 130 for the rear door. Because the front door 19 slides along its seat, the arms 98 hold it away from its seat except when the chamber is to be sealed air-tight.

The chamber 15 permits suction filling of paper cups without collapsing the latter. Because of the pliability of these cups, the provision of a suitable feeler switch 38 is solved by engaging the same laterally with the cup near the reinforcing base thereof and buttressing the adjacent part of the cup by receiving the same in the relatively snugly fitting ring seat 27. The feeler switch operates to prevent the flow of liquid if a properly seated cup is lacking.

Since a single stack of cups 28 will not last long, there is provided a dispenser head or casing 158 for mounting a plurality of equally angularly spaced stacks in side by side relation to each other. One of these stacks is always in alignment with the dispenser unit 145, while the others rest on a plate 165 that supports the casing 158. A feeler 200 lies in the path of the feeding stack, and when the latter is exhausted, the feeler advances so that mechanism operated by the main shaft 95 on each cup filling cycle, causes the casing 158 to rotate until another stack is in feeding position. Since a number of cycles is required to effect this change, a reserve of cups for the interim is carried by the dispenser unit 145. As soon as a new stack is in place, the feeler 200 causes locking of the casing 158 not only against mechanically actuated movement, but also against manual movement.

In the so-called continuous operation, when the filled cup is removed, with the front door 19 open, the drive shaft 95 and pump 80 are at rest. Upon removal of the cup, the cup test switch 38 causes operation of the drive shaft and pump, closing the front door, causing replacement of the cup and closing of the rear door, the cup test switch now routing the current to the liquid level switch 300. When the latter closes, the solenoid 90 is energized for suction filling of a cup, and then opens to de-energize the solenoid, causing cutting off the suction to cause the flow to cease and supplying pressure to chamber 15. When the front door opens, the switch 225 opens cutting off the current to the motors for the main shaft and the pump.

In the so-called intermittent operation, the toggle switch 315 is set so that a cycle is started by closing manual switch 316, the initial position being that the chamber 15 is sealed with an empty cup therein. On closing switch 316, the pump 80 and drive shaft 95 begin to operate, whereupon cam 231 sets switch 226 to supply current through switch 225 to the motor and drive shaft, so that switch 316 is shorted and may be released. When the main shaft causes clos-

ing of the liquid level switch 300, current flows therethrough from the cup test switch 38 to energize solenoid 90 and reverse the valve device 85 for suction filling with the switch 300 opening when the cup is full, thus deenergizing the solenoid and causing the valve to return to initial position to cut off the liquid flow by supplying pressure to the chamber 15. The front door 19 then opens, and the filled cup is removed, whereupon the cup test which supplies current to the motors for the main shaft and pump, but before such removal the main shaft and pump are idle. Then a new cup is seated and the chamber 15 is closed. Now the liquid level switch 300 is open, and the motor for the main shaft is idle because of a change in position of switch 226 which now routes current to the agitator switch 239 so that only the pump periodically operates under the control of relay 352 which is subject to the agitator switch. In both continuous and intermittent operation, if the liquid level controls such as 63 or 265 with its switch 300 fail to operate, a flood of liquid may be dispensed. To avoid this a safety cut off is provided by switch 227 which is timed to remain closed only during the maximum range of operation of the liquid level controls and slightly before and desirably after such maximum range.

Illustrative of circuits suitable for the capacitance 63 are those of U. S. Pats. Nos. 1,658,953, 1,701,975, 1,708,073, and 2,094,351.

Distant indication

Where many of the automatic dispensers herein are dispersed in large factories, distant indication is desirable to show when a milk can 48 is empty and when the cups 28 have been completely consumed. This may be accomplished by the indication of only one of these mutually dependent factors since the milk and the cups may become depleted simultaneously. Any suitable aural or visual indicator may be responsive to a movable part of the machine and may include a switch and a counter for operating the same or a switch alone. In Figs. 19 and 20, an indicator of the latter type is shown at 375 connected to the timing cam shaft 274 of the spring motor 273a, or an indicator with a counter and switch shown at 376 in the same figures may be connected to the main shaft 95 to be actuated by a finger 377 of the latter. In the case of the indicator 375 the same may be set to be responsive only to a position of the cam 275 at which all the milk has been depleted. The device 376, however is actuated upon each cycle of the machine, and when the counter reaches a certain predetermined position it indicates that the milk has been depleted or that the cups have been consumed, or both of these conditions, since the main shaft 95 operates the cup dispersive device. If desired, both indicators may be used, that at 375 for the milk, and that at 376 for the cups.

We claim:

1. In a device for dispensing liquids from a storage container into a drinking receptacle, including means for creating gaseous suction condition in the container to cause liquid to flow therefrom into the receptacle, comprising a suction chamber for removably receiving the receptacle, said chamber having a side vertical door when in normally closed position, means swingably mounting the door for movement to an open inclined position for guiding a receptacle into the chamber, and power operated means for swinging said door from open to closed positions

in timed relation with operation of said suction creating means.

2. In a device according to claim 1 including a seat extending at right angles to the door swingable therewith, and serving to seat the base of the receptacle, and guide means extending from the seat to adjacent an upper portion of the door cooperating with the seat to guide the receptacle thereto, the seat supporting the receptacle in vertical position when the door is closed.

3. In a device for dispensing liquids from a storage container into a drinking receptacle, including means for creating a gaseous suction condition in the container to cause liquid to flow therefrom into the receptacle, comprising a suction chamber for removably receiving the receptacle, control means for causing operation of said suction creating means, the chamber having an openable door for receiving the receptacle, seating means for the receptacle within the chamber to position the same in predetermined relation to the control means, the door and control means cooperating with a receptacle positioned on said seating means to cause operation of said suction creating means when the door is closed, said control means being idle in the absence of a receptacle on the seating means and when the door is open.

4. In a device according to claim 3, the control means including a feeler finger adapted to have lateral stop abutment with the receptacle for setting the control means in operative position, and the control means including yielding means responsive to movement of the door toward closing position to cause actuation of the feeler finger into an operative position with respect to said seating means.

5. In a device for dispensing liquids from a storage container into a drinking receptacle, including means for creating a gaseous suction condition in the container to cause liquid to flow therefrom into the receptacle, comprising a suction chamber having a door pivotally mounted for swinging to open and closed position whereby the chamber removably receives the receptacle, the door having curved surface seating engagement generally about the pivot as a center to thus seal the chamber in a gas-tight manner, means for swinging the door with the door free of the seating surface, means for moving the door radially for seating engagement in a gas-tight manner when the door is swung to closing position, and means for opening and closing said door in a predetermined timed relation with respect to operation of said gaseous suction creating means.

6. In a device for dispensing liquids from a storage container into a drinking receptacle, including means for creating a gaseous suction condition in the container to cause liquid to flow therefrom into the receptacle, comprising a suction chamber for removably receiving the receptacle, the chamber having a front door and a rear door, seating means for the base of the receptacle movable with the rear door, said rear door being movable to open position with the seating means positioned to receive a receptacle and to operatively support the same in the chamber when the rear door is closed, said seating means including control means actuating said gaseous suction creating means for discharging liquid into the receptacle in the operative position of the latter, the front door being openable for removal of the filled receptacle, and actuator means for opening the doors and for closing the

doors in predetermined timed relation so that the front door is open while the rear door is closed, for removal of the receptacle without affecting the position of the seating means thereof.

7. In a device for dispensing liquids from a storage container into a drinking receptacle, including means for creating a gaseous suction condition in the container to cause liquid to flow therefrom into the receptacle, comprising a suction chamber having a door whereby the chamber removably receives the receptacle, said means having a discharge port for filling the liquid into the receptacle, means for seating the receptacle within the chamber in liquid receiving relation to the port, and control means cooperating with said seating means and carried by said door simultaneously responsive to the receptacle when seated in operative position and to the door when in closed position to cause operation of the first mentioned means, whereby operation of the latter is prevented if the receptacle is improperly seated.

8. A device having means for dispensing liquids from a storage container into a drinking receptacle, a chamber for receiving the receptacle, a discharge port within the chamber, seating means within the chamber for supporting the receptacle in liquid receiving relation to the port, including lateral annular restraining means for the lower portion of the receptacle, and control means for the first mentioned means including an element bearing laterally, yieldably on the base portion of the receptacle against the resistance caused by the lateral annular means.

9. In a device for dispensing liquids from a storage container into a drinking receptacle, including means for creating a gaseous suction condition in the container for causing a flow of liquid into the receptacle, comprising a suction chamber for receiving the receptacle, a replaceably discardable liquid discharge tube of non-metallic material adapted to extend into the container and having a goose-neck curved end portion overlying the chamber, a top wall of said chamber having an opening receiving the free end of the curved portion for discharging liquid into the receptacle, a grommet-like element sleeved around the curved portion at the free end thereof and sealed to the said curved portion, said element having an annular flange, a packing member between the element and top wall, and movable means carried by said wall and coacting therewith for releasably pressing the flange against the packing member to form a gas-tight seal between the top wall and the tube.

10. In a device according to claim 9, the movable means including a latch lever pivotally mounted to swing toward and away from the grommet-like element and having an end open ring portion for receiving the latter above the flange, means affording an upright pivotal axis for mounting the latch lever on said wall to pivot in a substantially horizontal plane and providing lost motion for angular movement of the latch lever about its mounting means out of said horizontal plane, and a cam carried by the latch lever at the other end thereof for engaging the top wall to move the latch lever out of said horizontal plane for bearing said open ring portion down on said flange to form said gas-tight seal.

11. A device including gaseous suction means for dispensing a liquid from a storage container into a drinking receptacle, including a suction chamber for receiving the receptacle, an upper replaceably discardable liquid discharge tube of

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helically wound paper having a waterproof coating providing a smooth flow passage, said tube having a goose-neck curved portion, an annular metallic flanged ring sleeved on the curved portion adjacent to the end thereof and being sealed to the wall of the tube by said coating, the curved portion overlying the chamber, a top wall of said chamber having an opening for receiving the free end of the curved portion, means carried by said top wall for releasably engaging the flange of the ring for securing the tube to the chamber in a gas-tight manner, a second lower tube of helically wound paper having a waterproof coating providing a smooth flow passage, said tubes being telescopically related, and a rubber-like sleeve element forming an external joint between the tubes at the point where one enters the other, the inner tube being snugly frictionally engaged by the sleeve element but slidable therethrough without readily disengaging the sleeve element from the outer tube.

12. A device according to claim 11 including a perforated cover for the storage container having affixed thereto a rubber-like ring element in which the upper tube is snugly, frictionally engaged in slidable relation thereto.

13. A device according to claim 11, including a cover for the storage container depressed to receive the goose-neck portion in the collapsed telescopic relation of the tubes, the cover having a hollow upraised perforated portion in the depression, and means slidably sealingly engaging the upper of said tubes with the upraised portion at the perforation, with the other tube and the sleeve element lying below the cover and the said sealing means, the lower tube being adapted to shift out of register with the perforation upon withdrawal of the upper tube from the sleeve element.

14. A device including means for dispensing liquids from a storage container into a drinking receptacle, comprising a chamber for receiving the receptacle, the chamber having a top wall having an opening for the discharge of liquid into the receptacle, a discardable telescopic tube of sufficient length to interconnect the chamber with the container at the lower region of the latter with the tube passing through a hole in a cover for the container, the tube comprising a first section and a second section, an elastic sleeve element on the sections slidably interengaging the same to seal the tube in a gas-tight manner, the first tube having an integral goose-neck curved portion overlying the chamber top wall, an annular flange portion on the curved portion, the end of the latter being engaged in the discharge port, means cooperating with the flange to provide a snug connection between the chamber and the first tube, and an elastic sealing ring on the first section for engaging the cover and being located above the sleeve element whereby the latter and the second tube are adapted to lie in the container.

15. A device for dispensing a liquid to a drinking receptacle comprising a liquid storage container having a removable cover seal-locked thereon, the cover having a perforation, a liquid discharge tube of a discardable character comprising a plurality of telescopically interengaged sections, one section lying wholly in the container, the other section being mainly external of the container and being adapted to discharge the liquid into the receptacle, the last named section having an end portion extending through said perforation into the container, an elastic

ring portion sealing the perforation and slidably engaging the outer section, and an elastic sealing sleeve portion slidably interengaging said end portion with the upper end portion of the inner section, whereby the outer section can be extended as desired and removed and discarded, and means for causing liquid to be upwardly discharged from the container through said tube.

16. A device for a container for the bulk shipment of milk and adapted for use with a dispensing machine including a cover for the container, a discardable telescopic tube of paper-like material having a first section located wholly within the container and a second section extending partly within the container and partly externally thereof, the external portion having an integral curved portion adapted to lie in a depression in the cover, and being adapted for connection to the machine, a sleeve of rubber-like material on the sections and serving to form a liquid tight connection therebetween at the upper end of the first section, and the cover having an opening having a bushing of rubber-like material engaged therein, the second section being slidably engaged in a liquid-tight manner in the bushing, and the latter lying above the tube.

17. A device according to claim 16 wherein the second section is of smaller diameter than the first section with the sleeve being of substantially larger diameter than the opening in the bushing, as and for the purpose set forth.

18. A device including means for feeding agitated liquid from a storage container to drink-tated receptacles, comprising a single-conduit pressure-suction air pump system for alternately blowing air through the liquid in the container and for exerting a suction to withdraw liquid from the container, a suction chamber for the receptacle having door means, and means for feeding receptacles successively into the chamber in seated filling relation therein; and means responsive to a receptacle seated in the chamber for causing operation of the liquid and receptacle feeding means upon removal of the receptacle from seated position in the chamber, for causing a continuous operation of the device, including means whereby the air pump system is in suction condition while the door means is closed and is changed to a pressure condition after the receptacle is filled and before the door means open to cause a momentary agitation of the liquid in the container.

19. A device including means for dispensing liquids to a receptacle, a seat for the receptacle in operative liquid receiving relation to the dispensing means, guiding means for feeding the receptacle onto said seat, said guiding means holding the receptacle against movement in one direction from its seated relation, a movable feeler element adapted to engage the seated receptacle in said direction, and control means for actuating the feeler element only after the receptacle has been caused to be seated by said guiding means in the operative liquid receiving relation, the control means having means for controlling the liquid dispensing means to cause a flow of liquid only in the presence of an operatively seated receptacle, the feeler element being movable to extend across the seat to obstruct the same and cause the control means to render the dispensing means inoperative in the absence of a properly seated receptacle.

20. A dispensing device for dispensing fluid material in measured equal volume quantities in

intermittent succession from a container to a receptacle, including means for selectively applying suction and air pressure to the container to respectively cause the flow of material from the container and to cause agitation of the material therein, including a single conduit for the suction and pressure, means for measuring the flow of material from the container to the receptacle, means controlling the first mentioned means to cause the suction condition to be changed to a pressure condition when the predetermined amount of material has been dispensed, and a supplemental means in series with the measuring means and operative for a time range approximately equal to the maximum time required to dispense the measured amount of material and serving thereafter to cause the first mentioned means to change from the suction to the pressure condition to serve as a safety guard if the measuring means fails to function.

21. A device for discharging a liquid into a receptacle positioned within a chamber, comprising means for discharging the liquid from a container through a port in a top wall of said chamber, a side door for said chamber, means mounting the side door to swing between an open inclined receptacle guiding position and a closed vertical position; a seat for the receptacle mounted on the side door within the chamber when in closed position, said seat being horizontal when the side door is in said closed vertical position, and a guide means carried by the door for feeding the receptacle into the chamber and on to the seat when the door is in open inclined guiding position, the side door guide means and seat being so constructed and arranged to position the receptacle for remaining properly seated upon movement of the door to said closed position with the seat horizontal and in alignment beneath the port, the guide means being lateral to the port.

22. A device according to claim 21 including control means actuated by said side door when the latter moves to said vertical position, said control means having a feeler portion carried by the side door and being so coordinated with the seat that the feeler portion is yieldingly urged transversely of the seat to a first position in abutment with the receptacle and to a second position beyond the first position in the absence of a properly seated receptacle, the control means rendering the liquid discharging means operative or inoperative according as the feeler portion is in the first or in the second position.

23. In a device for dispensing liquids from a storage container into a drinking receptacle having a base, a suction chamber for removably receiving the receptacle, means for creating a gaseous suction condition within the chamber to dispense liquid from the container into the receptacle, said chamber having front and rear vertical doors, pivotal mounting means for swinging the rear door from a vertical closed to an inclined open position, movable seating means for the receptacle carried with said rear door to extend into the chamber on which an unfilled receptacle is placed when the door is in an open position and on which the receptacle is supported in a liquid receiving position when said door is closed; control means cooperating with the receptacle base and the rear door for activating said gaseous suction creating means to discharge the liquid into the receptacle when the rear door is closed and the receptacle is in liquid receiving position on the seating means, and means for opening and

closing the front and rear doors in timed relation with each other so that on opening the front door the rear door remains closed for removal of a filled receptacle.

24. In a device for dispensing liquids from a storage container into a drinking receptacle, a chamber having a seating portion for the receptacle and a port for discharging liquids into the receptacle in the chamber, the chamber having a rear door openable for receiving the receptacle and an opposite front door for removal of the filled receptacle, means for pivotally mounting the rear door at its lower end for swinging to an open inclined position, and guide means mounted on said rear door for receiving and feeding the receptacle into the chamber when the rear door is in said open position, said seating portion being mounted to swing with the rear door to engage the receptacle as the latter moves down said guide means, the seating portion operatively supporting the receptacle when the rear door is closed.

25. A device for dispensing a liquid into a receptacle comprising a chamber for receiving the receptacle in a predetermined position in relation to a liquid discharge port, the chamber having a door opening for removal of the receptacle, an exterior door for air-tight sealing of said opening, extensible telescopic arms pivotally mounting the door for swinging movement in and out of register with said opening and against and away from the chamber by telescopic action when in registered position into air-tight sealing engagement over the opening, and means for actuating the telescoping arms both pivotally and telescopically.

26. A device for dispensing liquid in measured equal volume quantities in intermittent succession from a container whose liquid head suffers a uniform drop upon dispensing each of said volume quantities comprising means for creating a suction in the container for dispensing said liquid, a first control means operating said suction creating means to provide predetermined effective suctions at intermittent intervals for dispensing said successive volume quantities of liquid, and a second control means responsive to each dispensing operation and coacting with said first control means for progressively increasing said effective suction by uniform increments each corresponding to a drop in liquid head in the container to maintain successive volume quantities of liquid dispensed uniformly equal.

27. A device for dispensing liquid in measured equal volume quantities in intermittent succession from a container whose liquid head suffers a uniform drop upon dispensing each of said volume quantities, comprising means for creating a suction in the container for dispensing said liquid, a first control means operating said suction creating means at a constant suction level for predetermined intermittent time intervals for dispensing said successive volume quantities of liquid, and a second control means responsive to each dispensing operation and coacting with said first control means to progressively increase said time intervals by uniform increments corresponding to the drop in liquid head in the container to maintain each successive volume quantity of liquid dispensed uniformly equal.

28. The device as defined in claim 27 in which said second control means includes a cam having an operating radius which slopes uniformly to correspond to said uniform drop in head of the liquid.

29. The device as defined in claim 26 including selective setting means for said first control means to initially operate the suction creating means at a desired effective suction level.

30. A device for dispensing liquids from a storage container into a drinking receptacle; means for creating a gaseous suction condition in the container causing a flow of liquid into the receptacle including a suction chamber having a liquid discharge port and a seat therein for removably receiving the receptacle; said chamber having a rear door swingably mounted to open for receiving the receptacle and a front door swingably mounted for removal of the receptacle; the bottom, side and top walls of said chamber being relatively stationary; a receptacle dispensing means for feeding receptacles through said rear door when open into the chamber; control means for permitting operation of said suction creating means only when a receptacle is seated on said seat; power operated means for swinging said rear door to open position, for actuating said dispensing means to seat a receptacle in said chamber, for closing said rear door, for creating said gaseous suction condition to fill the receptacle, and for opening the front door for removal of the receptacle, all in timed relation to each other.

31. The device defined in claim 30 including means electrically responsive to a film of liquid on the floor of the chamber rendering said suction creating means inoperative.

32. The device defined in claim 30 in which said power operated means includes a cam for opening and closing each of said doors, a cam for actuating the receptacle dispensing means, and a common shaft for said cams.

33. A device comprising a cup dispensing means for discharging cups one by one from a nested stack, storage means vertically spaced above said dispensing means having a plurality of compartments for additional stacks, means for moving said storage means by a predetermined number of advancing steps for successively positioning each of said compartments in vertical alignment above said dispensing means for feeding cups thereto when the preceding compartment has become exhausted, a feeding compartment between the aligned storage compartment and the dispensing means, actuating means for said moving means engaged with the dispensing means to operate therewith and advance said storage means one of said steps with each dispensing of a cup, a feeler responsive to a cup in feeding position, locking means operated by said feeler to render the actuating means inoperative to advance said storage means when a cup is in said feeding position, said feeler releasing said locking means for operation of said actuating means in the absence of a cup in said feeding position when the supply of cups in the storage compartment above the dispensing means is exhausted, said feeding compartment and feeler being so constructed and arranged to provide an interim supply of cups at least equal to said predetermined number of steps to be dispensed during the period while an exhausted compartment is being displaced by a filled compartment.

34. The device defined in claim 33 including a latch element releasably retaining the storage means for maintaining one of said storage compartments in a stationary position in said align-

ment with the dispensing means while feeding articles thereto, said locking means coacting with the latch element to release the storing means for said advancing movement when released by said feeler in the absence of said cup.

35. A device comprising means for dispensing articles, means having a plurality of article storing compartments successively movable into a position for feeding articles to the dispensing means, actuating means for the storing means operative when a compartment has become exhausted to cause another compartment to move into feeding position, a feeding compartment for said dispensing means, an element responsive to the presence of articles in the feeding compartment to render the actuating means normally inoperative, said element being movable in the absence of such feeding articles to render the actuating means operative, and means responsive to the element cooperating with the actuating means to releasably lock the storing means against movement by the actuating means in the presence of articles in said feeding compartment.

36. In a device for dispensing liquids in measured quantities from a storage container into a drinking receptacle, means for creating a gaseous suction condition in the container to cause liquid to flow therefrom into the receptacle, a suction chamber having a door whereby the chamber removably receives the receptacle, a seating member for receiving the receptacles one at a time within said chamber in position for filling, means for feeding the receptacles from a storage compartment through the door onto said seating member in said position for filling, means for intermittently actuating said suction creating means for dispensing the liquid from the storage container into the seated receptacle, actuating means on the seating member responsive to removal of a filled receptacle therefrom causing operation of the receptacle feeding means to feed another receptacle into position and initiating the suction actuating means to dispense the liquid and fill the seated receptacle.

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