

Feb. 25, 1964

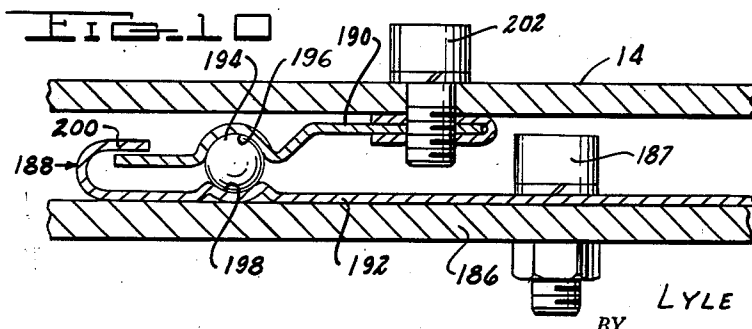
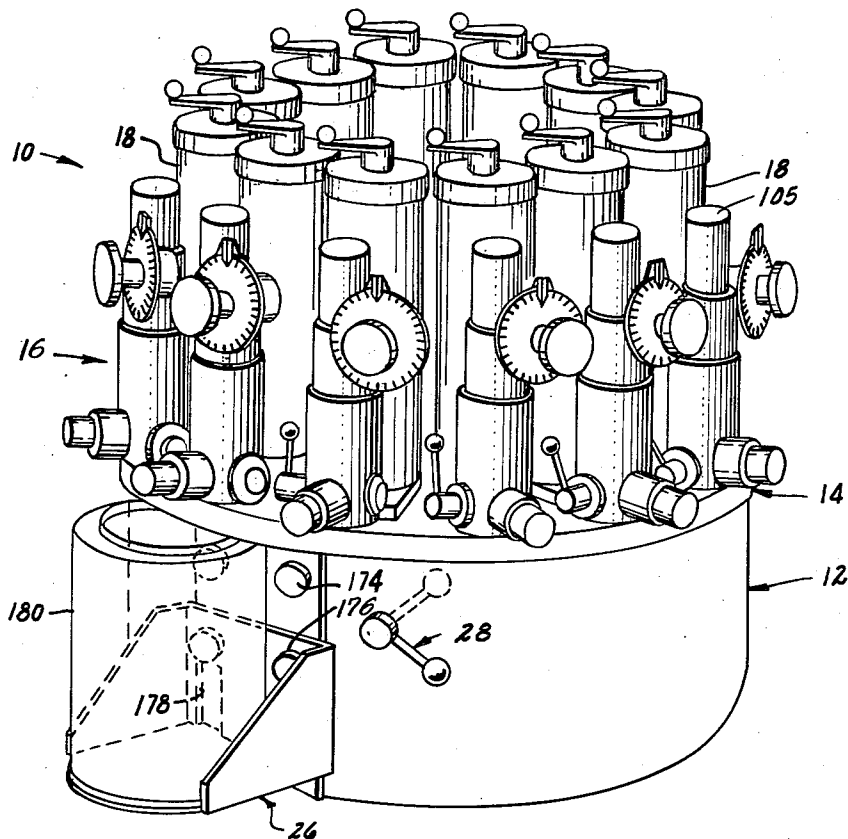
L. MARSH
FLUID DISPENSER

3,122,272

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9 Sheets-Sheet 1

FIG. 1



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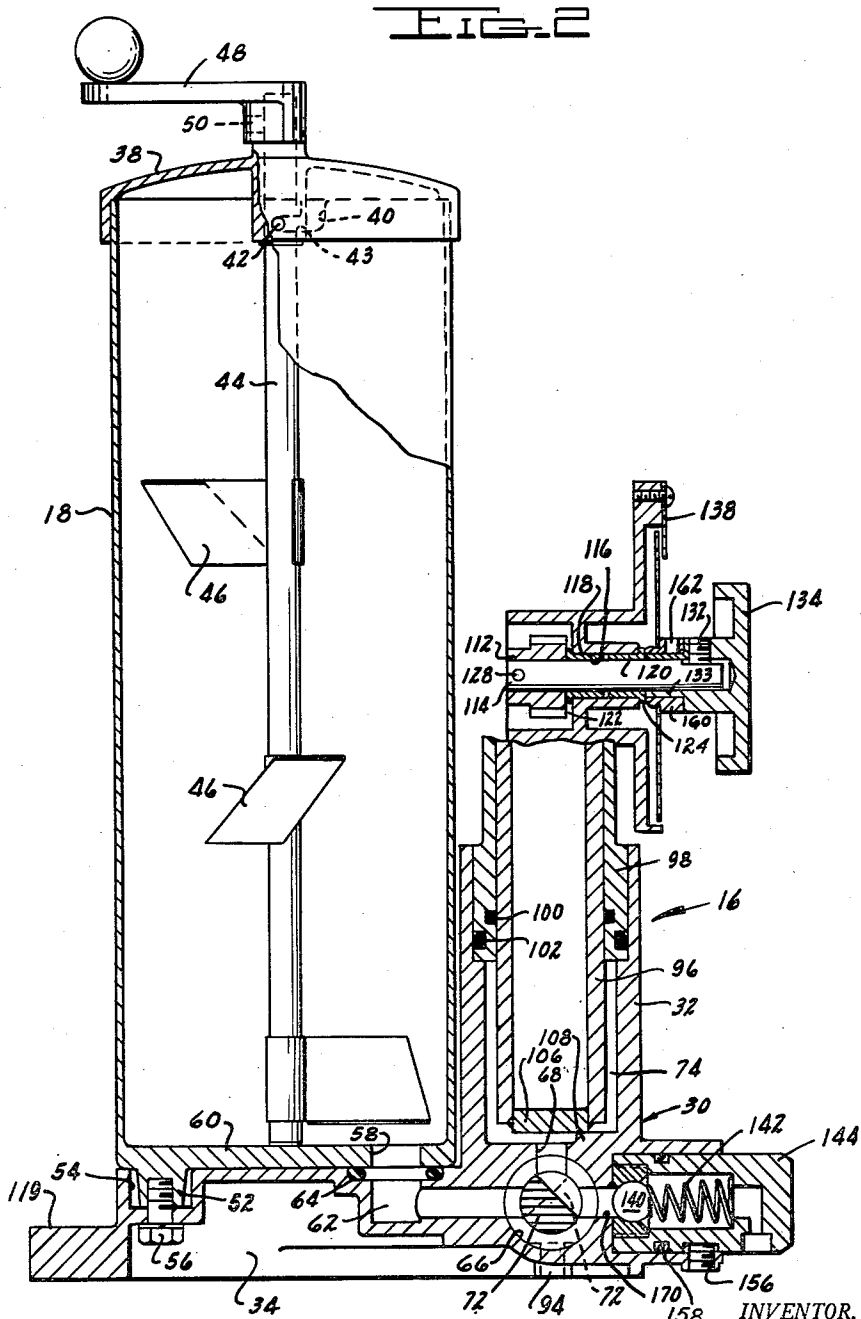
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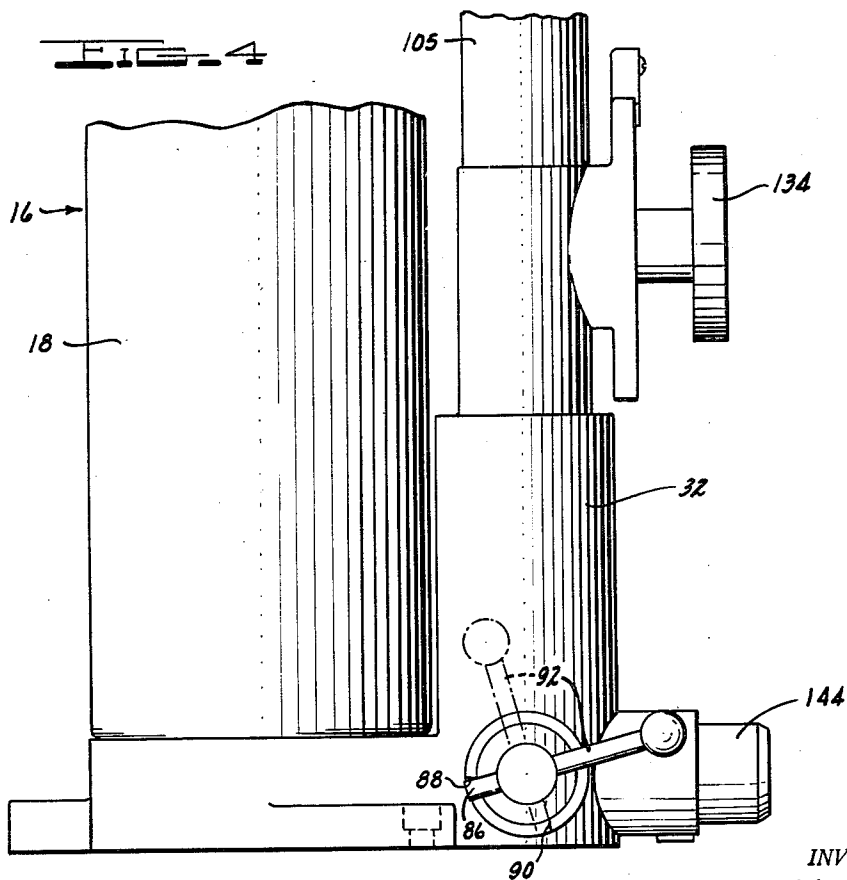
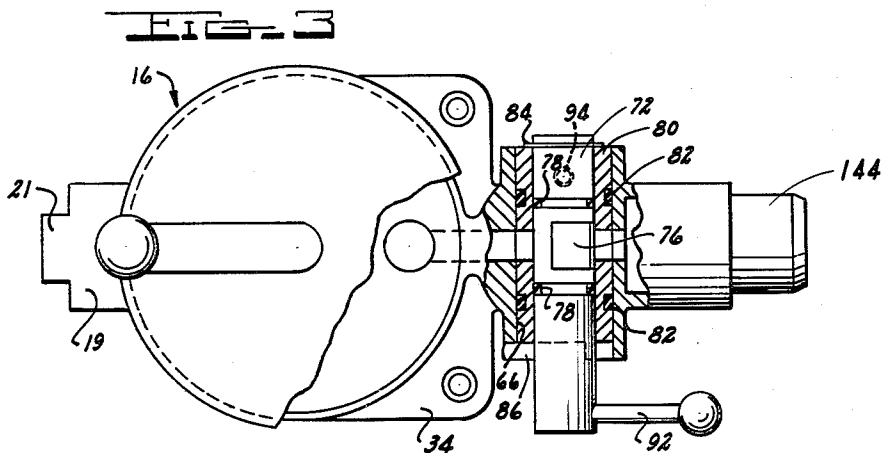
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FIG. 5

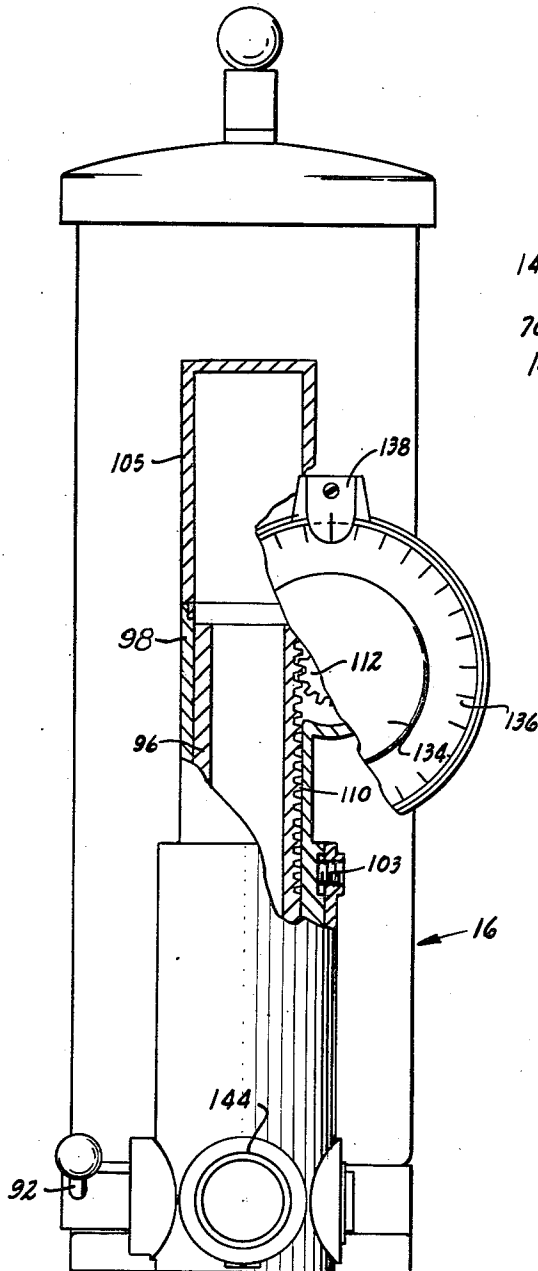
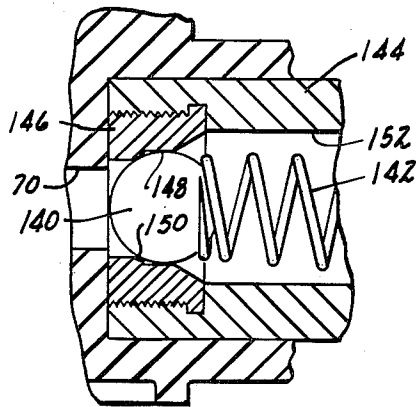


FIG. 6



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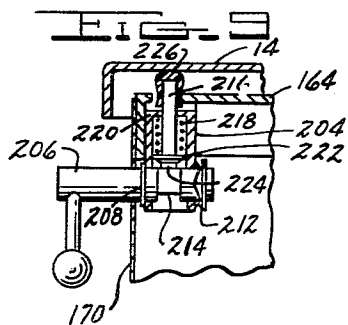
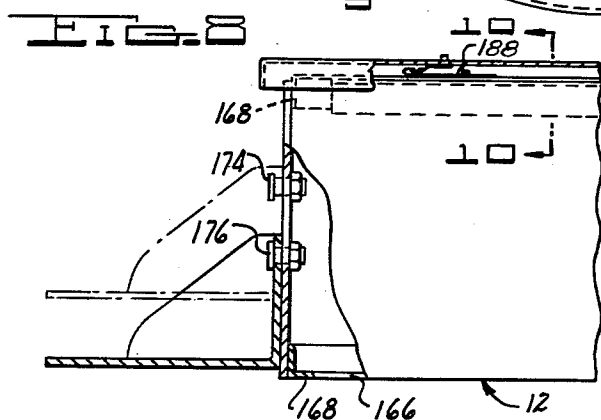
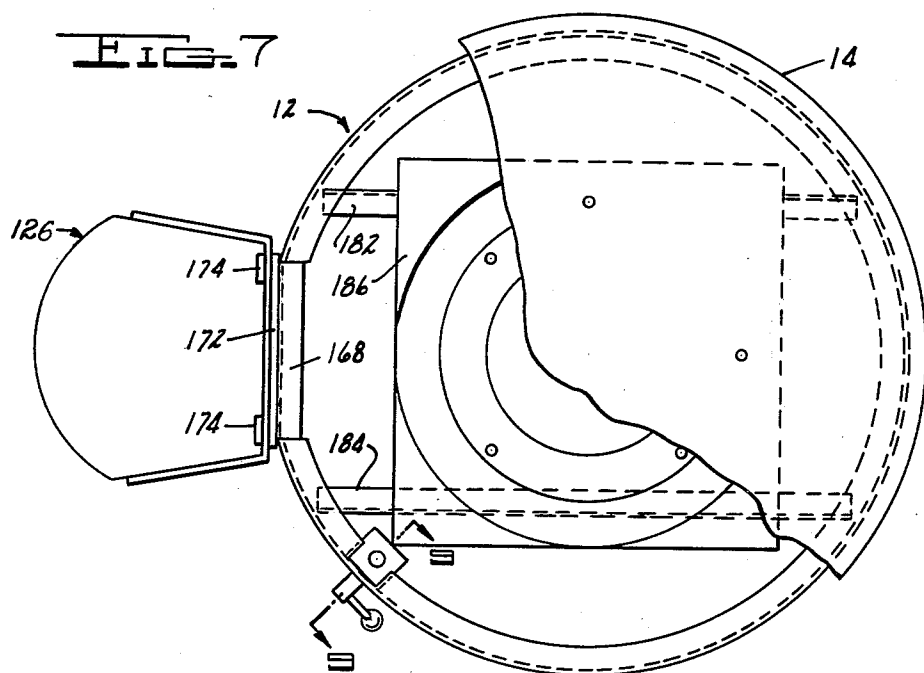
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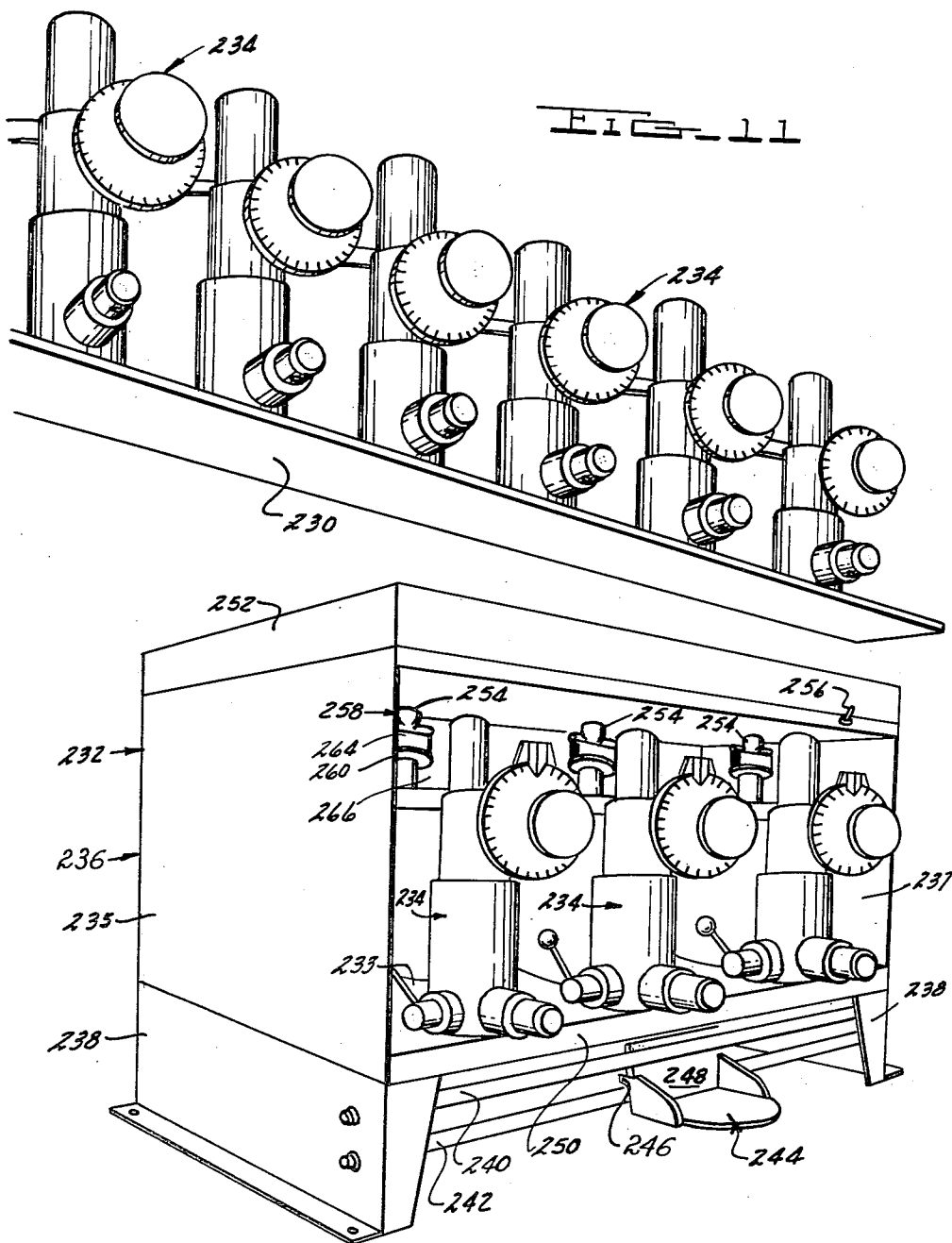
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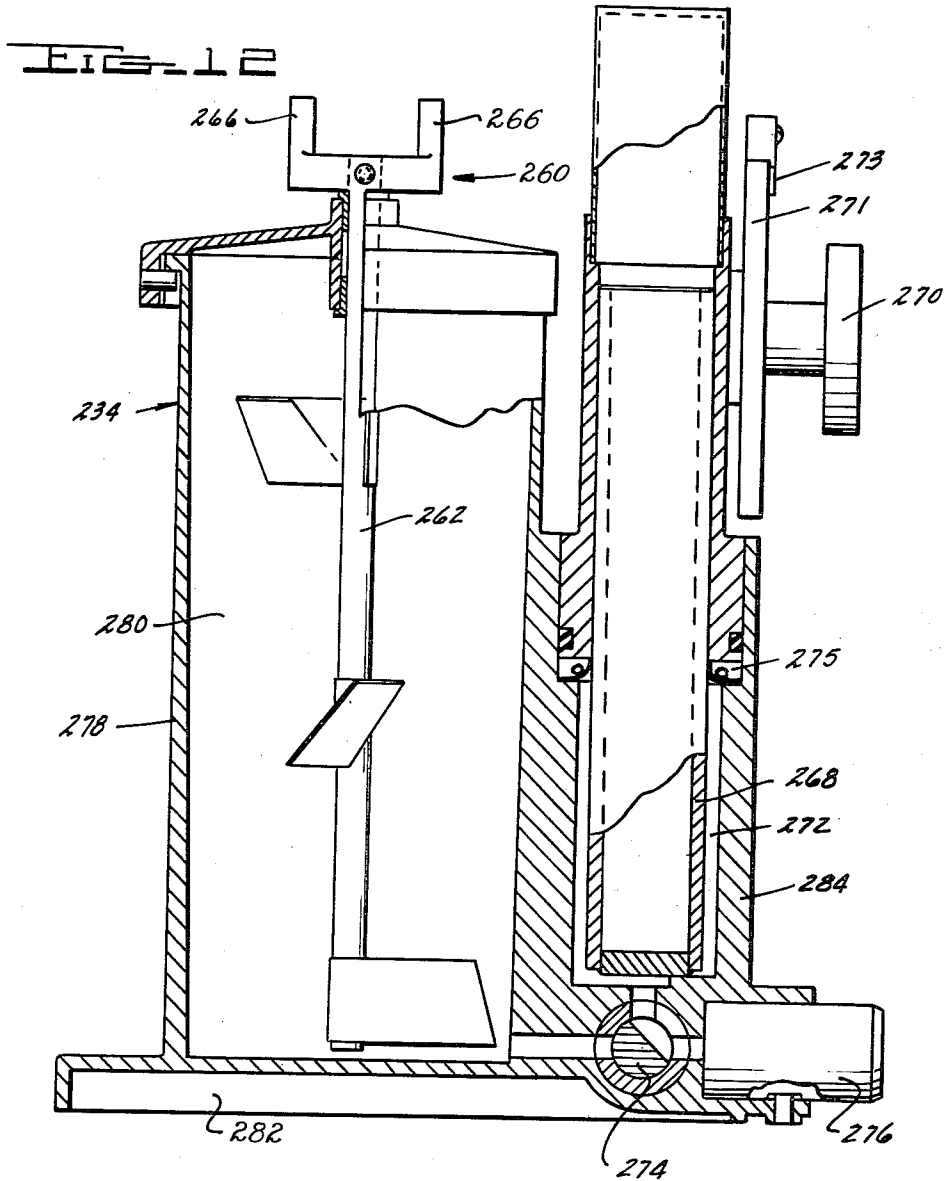
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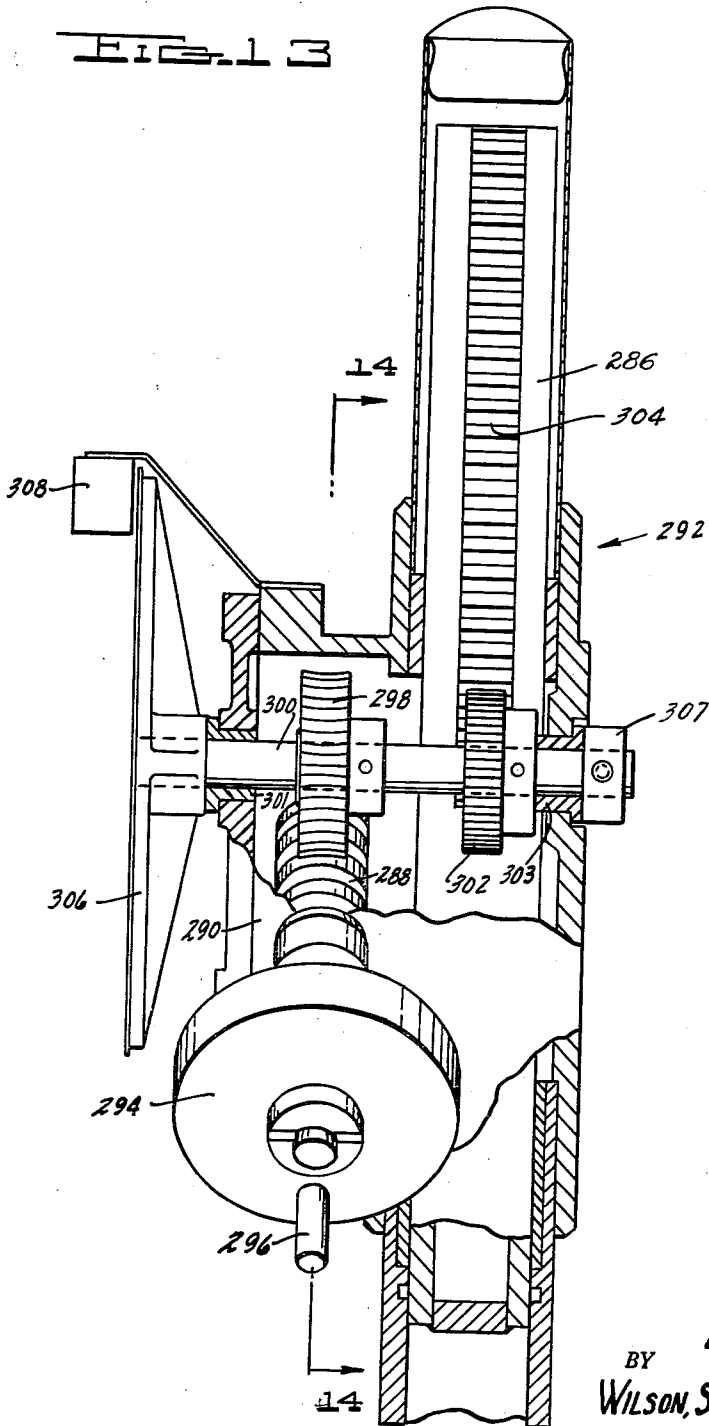
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FIG. 13



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FIG. 14

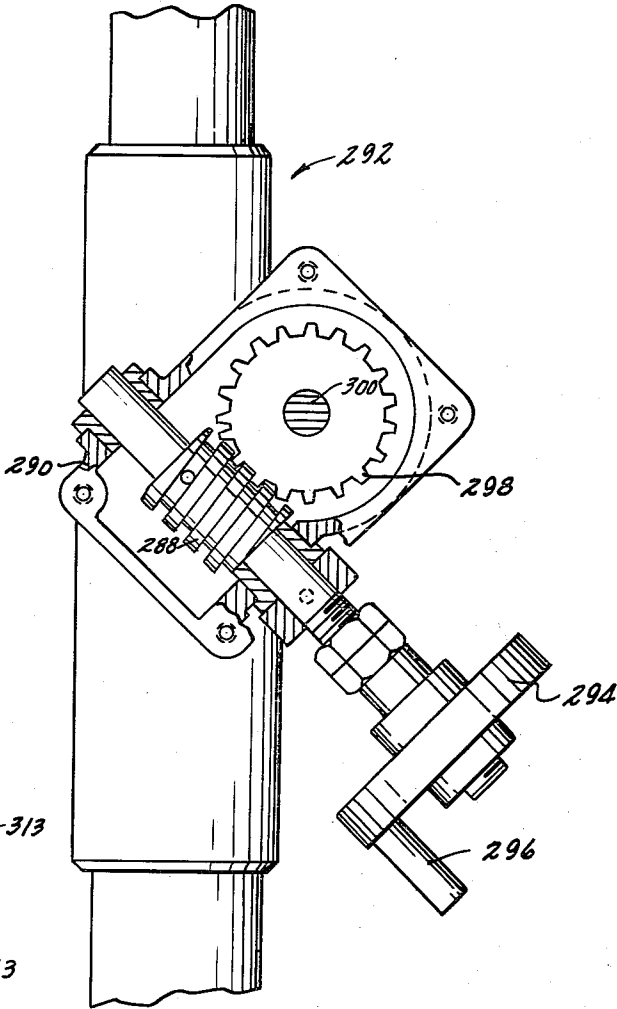
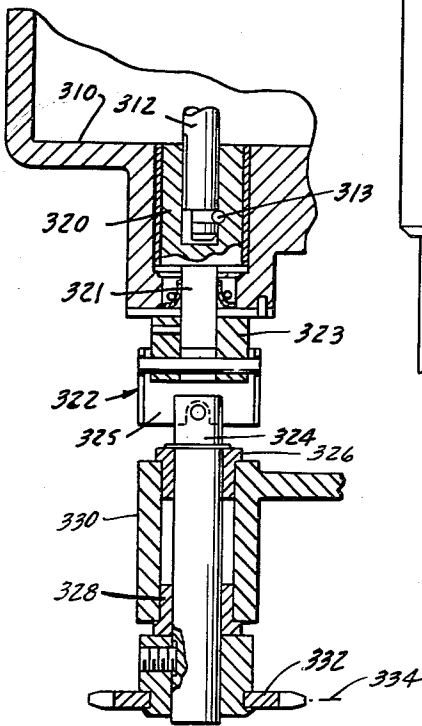


FIG. 15



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Filed Aug. 4, 1960, Ser. No. 47,488

12 Claims. (Cl. 222—26)

The present invention relates to manually operated liquid proportioning and dispensing apparatus, and more particularly to a device of this character in which an adjustable predetermined total quantity of liquid may be dispensed, the total quantity comprising different liquids individually dispensed in adjustable predetermined proportions.

The apparatus of the present invention is particularly adapted for use in dispensing the base colorants used in the preparation of mixed-to-order coating compositions. The base colorants used in such coating compositions consist of pigment mixed with sufficient liquid vehicle to form a flowable mass. The liquid mixture may be termed "viscous" or "semi-viscous." It should be noted at this point that while the dispenser is described in relation to the dispensing of base colorants, it will be appreciated that it is also operable to dispense a variety of liquids, such, for example, as liquid or semi-liquid food products, lubricating oils or various other products having a paste-like consistency.

Mixed-to-order paints are prepared on the spot by paint retailers to supply each customer's individual requirements. Mixed-to-order paints make available a wide variety of standardized and special colors and hues, in comparison to the limited range of pre-mixed colors available from paint manufacturers, and at the same time permit the retailer to inventory a small number of different base colorants. The advantages of this method of paint retailing have created a strong demand for devices capable of efficiently dispensing base colorants.

Various attempts have heretofore been made to provide a dispensing apparatus suitable for use in retail outlets. Several problems have been encountered in the provision of such devices, such as extreme complexity of the units, cumbersomeness, and cost. In addition, there have been certain problems inherent in paint mixing which have been difficult to overcome. For example, in order to produce and reproduce the exact hues desired, it is necessary that the dispensing device be extremely accurate. A small error in the amount of colorant dispensed may result in an appreciable deviation between the actual paint mixed and the color desired. Dispensing apparatus should be adjustable to dispense either a small or a large amount of a specific colorant. For example, the device should be able to dispense as little as $\frac{1}{500}$ of an ounce or as much as 8 ounces, depending upon the requirements of the particular paint being formulated. Additionally, the dispenser should be of rugged and long-lasting construction and should be inexpensive to manufacture. It is also desirable that the dispenser not have objectionable dripping of colorant after the dispensing operation which would create a clean-up problem.

Accordingly, it is an object of this invention to provide a liquid dispensing apparatus of the proportioning type.

Another object of the invention is to provide a dispensing apparatus which is adjustable to permit dispensing of a number of different liquids individually in predetermined amounts to produce a total predetermined quantity of dispensed liquid.

A further object of the invention is to provide a novel liquid dispensing pump for the dispensing apparatus which will accurately dispense a predetermined amount of liquid upon actuation thereof.

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Another object of the invention is to provide a dispensing pump which is actuated manually thereby eliminating the necessity for a pump motor and the associated control mechanism, thus considerably reducing the cost of the dispenser unit.

Another object of the invention is to provide means for varying the amounts dispensed from the pump in accordance with the requirements of the particular paint formulation.

A still further object of the invention is to provide a pump for the dispensing apparatus which is "drip-free" after each dispensing operation.

Another object of the invention is to provide storage means to carry a quantity of liquids for each pump and to provide agitator means to keep the stored liquids in a well-mixed condition.

Another object of the invention is to provide, in one embodiment, a plurality of such pumps mounted on a rotatable turntable provided with locking means whereby the different pumps carrying the various liquids may each be selectively positioned in dispensing relation to a container, and may then be adjusted for dispensing the desired amount of liquid in accordance with the need for that particular material.

A further object of the invention is to provide, in another embodiment, a plurality of pumps each individually mountable in an apparatus for power mixing the contents of the pump reservoir and also provided with means for positioning a container in dispensing relationship to the pump.

Another object of the invention is to provide a liquid dispensing pump which includes a novel hand-operated gear operated drive mechanism to actuate the pump piston and which permits simple and accurate determination of the amount of liquid dispensed.

A still further object of the invention is to provide such a pump, in one embodiment, having worm gear means to assist in gaining a mechanical advantage for dispensing large amounts of liquids.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIG. 1 is a perspective view showing a plurality of the liquid dispensing pumps of the present invention mounted on a rotatable turntable to form a complete dispensing unit;

FIG. 2 is a side elevational view in section of one of the pumps shown in FIG. 1 with parts broken away for the purpose of clarity;

FIG. 3 is a top plan view of the pump shown in FIG. 2 with parts broken away;

FIG. 4 is a partial side elevational view of the pump of FIG. 2;

FIG. 5 is a front elevational view of the FIG. 2 pump with portions broken away for the purpose of clarity;

FIG. 6 is an enlarged sectional view of the nozzle and valve means for the FIG. 2 pump;

FIG. 7 is a top plan view of the base and turntable structure of the apparatus shown in FIG. 1;

FIG. 8 is a side elevational view of a portion of the base of FIG. 7 showing the adjustable shelf and structure of the rotatable turntable;

FIG. 9 is a sectional view taken substantially along line 9—9 in FIG. 7 looking in the direction of the arrows showing the frictional stop means for the turntable;

FIG. 10 is an enlarged sectional view taken substantially along line 10—10 of FIG. 8 looking in the direction of the arrows to show the turntable bearing means;

FIG. 11 is a perspective view of another embodiment

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of the invention showing power mixing means and storage means for a modified version of the pump;

FIG. 12 is a side elevational view in section of the modified dispensing pump utilized in the FIG. 10 embodiment;

FIG. 13 is a front elevational view showing a worm gear drive for the dispensing pump with parts broken away for the purpose of clarity;

FIG. 14 is a partial side elevational view of the FIG. 13 pump embodiment taken substantially along the line 14—14 of FIG. 13 looking in the direction of the arrows; and

FIG. 15 illustrates structure for automatically stirring one of the pump reservoirs from the bottom.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

One embodiment of the invention is shown in FIGS. 1 through 10. As may be seen in FIG. 1, the dispensing apparatus 10 comprises a base 12 upon which is mounted a rotatable turntable 14. The turntable 14 carries a plurality of dispensing pumps 16 each of which has a liquid storage reservoir 18. The base 12 is provided with an adjustable shelf 26 to accommodate different sized containers to collect the material dispensed from the pumps. Lock means 28 are provided on the base 12 to hold the turntable in a selected position for dispensing. The lock may be released when it is desired to position a different pump in the dispensing position.

In operation of the dispensing apparatus 10, the turntable 14 is first manually rotated to position the desired pump 16 over the adjustable shelf 26. The lock 28 is then actuated to hold the turntable in this position. When the turntable has been so positioned, the pump is actuated to dispense the proper amount of colorant. If several colorants are to be dispensed this process may be repeated until all of the desired colorants have been dispensed.

The structure of the pump 16 is illustrated in FIGS. 2 through 6. The pump comprises a housing 30 having a hollow upstanding cylindrical portion 32 which defines a metering chamber 74. Projecting outwardly from the hollow cylindrical portion 32 is a base portion 34 which forms a shelf or mounting platform for the fluid reservoir cannister 18. A projection 19 having a tongue 21 is provided on portion 34 for insertion into a slot to prevent rotation of the pump when mounted in a structure where it is not fastened to a base, such as the power mixing apparatus 232 described in connection with another embodiment of the invention.

The cannister 18 has a cover 38 which is removable to permit filling. A pair of bayonet slots 40 are provided in the upper end of the cannister to engage pins 42 provided on the cover. The cover may be removed or installed by rotating it until the pins 42 disengage or engage the interturned slot portions 43. Extending downwardly into the cannister through an opening in the cover 38 is an agitator shaft 44. The shaft 44 carries a plurality of vertically spaced blades 46 to mix the fluid contents of the cannister. A handle 48 is secured to the upper end of the shaft 44 by means of a setscrew 50 to provide for manual rotation of the blades.

The cannister is provided with downwardly projecting bosses 52 which are received in recesses 54 provided in the base portion 34. Screws 56 project through openings in the recesses and into threading engagement with threaded openings in the bosses 52 to firmly secure the cannister to the base.

An outlet opening 58 is provided in the bottom wall 60 of the cannister and registers with passageway 62 provided in the base. This opening is sealed by means of

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an O-ring 64. The passageway 62 extends into communication with a bore 66 which is provided in the base beneath the cylindrical portion 32.

A passageway 68 extends from the bore 66 at substantially right angles to the passageway 62. A third passageway 70 extends from the bore 66 substantially in line with the passageway 62. A valve element 72 is provided in the bore 66 to direct flow of fluid from the cannister 18 through passageways 62, 68 and into the metering chamber 74 and to simultaneously close off the outlet passageway 70. The valve element 72 has an alternate position, shown in dotted lines, in which it directs the flow of fluid from the chamber 74 into the outlet passageway 70 simultaneously closing off the inlet passageway 62.

The valve element 72 comprises a cylindrical member having a notch 76 for fluid flow provided in the surface thereof. As best seen in FIG. 3, sealing rings 78 are provided to seal the valve element 72 and a sleeve member 80 which lines the bore 66. The sleeve member 80 is fabricated from a hard metal and prevents wear of the bore. It is secured in place by a setscrew 94. The housing 30 is preferably fabricated from a metal such as aluminum which would wear rapidly if subjected to abrasion. The sleeve 80 is sealed within the bore 66 by means of sealing rings 82. The valve element is prevented from axial movement in the sleeve by means of a ring 84 provided on one end and a pin 86 provided on the other end. The pin 86 additionally acts as a stop element to selectively position the flow notch 76. As will be noted, a cut-out portion is provided in the casing forming bore 66 to form shoulders 88, 90. The pin 86 abuts against one shoulder to hold the valve element in the position shown in FIG. 2 to permit dispensing from the pump. When the valve handle 92 is rotated in the counter-clockwise direction as shown in FIG. 4 in dotted lines, the pin abuts against the second shoulder 90 to position the valve element as shown in FIG. 2 to permit flow of fluid from the cannister 18 into the metering chamber 74. Dispensing from the pump is accomplished by means of a piston 96 slidably mounted into sleeve 98 which is positioned in the metering chamber 74. Sealing ring 100 is provided between the piston and sleeve, and sealing ring 102 is provided between the sleeve and the metering chamber side wall. The sleeve is held in place by setscrew 103.

The piston 96 is formed from a tubular element which is enclosed at the bottom by means of a plug 106. The plug 106 extends outwardly a short distance from the bottom of the piston and acts as a stop element on the downward stroke, abutting against a boss 108 provided within the metering chamber. A hollow cap 105 is detachably mounted on the upper end of sleeve 98 to enclose the piston during its upward stroke.

As will be noted in FIG. 5 vertically aligned gear teeth 110 are provided on one side of the piston 96 to form a gear rack. A pinion 112 is provided to mesh with the teeth 110. The gear 112 and teeth 110 provide the means for raising and lowering the piston. The gear 112 is carried on a shaft 114 which extends through an opening 116 provided in the sleeve 98. As will be seen in FIG. 2, the shaft 114 is carried in bearings 118, 120 having flanges 122, 124 which abut against the end of member 126. The shaft assembly is held against axial movement at one end by the pinion 112 which is secured thereto by setscrew 128 and is held against axial movement at the other end by means of the reduced end portion of handwheel hub 133. The handwheel 134 is secured to the shaft by a setscrew 132.

As will be appreciated, the piston 96 is moved up and down by rotating the handwheel 134 to turn the pinion which engages the teeth provided on the piston. As best seen in FIG. 5, the handwheel is provided with a dial plate 136 which cooperates with a pointer 138 provided on the sleeve 98. The plate 136 is provided with indicia on its face to permit measuring the amount

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of material dispensed as will be hereinafter more fully explained.

In operation of the pump, the valve member 72 is turned to the dotted line position as shown in FIG. 2 thus blocking the output passageway 70 and establishing communication between the metering chamber 74 and the reservoir 19. The piston 96 is raised by means of the handwheel 134, causing a vacuum to develop in the metering chamber. The vacuum draws material from the reservoir into the metering chamber. The amount of material drawn from the reservoir will depend upon how high the piston is raised. While it is desirable to have the valve element 72 block the output passageway during the filling of the metering chamber, it will be appreciated that this is not critical because this outlet is also blocked by check valve element 140. When the piston has been raised a predetermined distance to fill the metering chamber to the desired point, the valve element 72 is rotated off the passageway 62 and establishing communication between the metering chamber and the outlet passageway 70.

The handwheel is then turned to move the piston downwardly to force the fluid trapped in the metering chamber out through the passageways 68, 70. As will be noted, the passageway 70 is normally blocked by a check valve assembly comprising a ball valve element 140 and spring 142. Upon the application of fluid pressure by downward movement of the piston, the ball will overcome the spring force and move to open the outlet of the pump. The fluid will then pass through the nozzle 144 and be dispensed into a suitable container.

The nozzle 144 is constructed to prevent dripping of fluid after a dispensing operation. As will be noted in FIG. 6, a seat 145 is provided in the inner end of the nozzle. The anti-drip feature is accomplished by means of the suction which the ball element 140 creates as it moves to close the outlet opening after the piston has reached the end of its stroke. The valve seat 145 is provided with a short passageway 143 adjacent the annular seating surface 150, for the reception of the ball 140. The diameter of the passageway 143 is substantially equal to the major diameter of the ball, there being a slight clearance to permit ball movement. Movement of the ball through the passageway 143, towards the surface 150, creates the aforementioned suction. The suction is of sufficient magnitude to draw liquid remaining in the passageway 152 towards the seat 150, thus providing a quick shut-off flow from the pump. It is also important to have the liquid drawn back a short distance from the outlet spout in order to compensate for variations in room temperature which may cause thermal expansion with the consequent dripping of the trapped fluid after the dispensing operation. The distance which the liquid is withdrawn may be varied as desired by varying the length of the passageway 143 or the diameter of passageway 143 and ball 140. Rapid movement of ball 140 to close the nozzle opening and create the aforementioned suction may be aided by raising the piston a short distance after dispensing. This will create a suction in the metering chamber tending to draw the ball to the closed position more rapidly. The piston may be raised by a reverse turn on the handwheel or it may be allowed to bounce off boss 103 by releasing the handwheel at the end of the downstroke.

The fluid is retained in the nozzle during non-dispensing periods either by the surface tension of the fluid or the differential pressure created by the suction. Due to the high viscosity and the impermeability of most of the liquids dispensed from the pump, there is a high surface tension within the fluid and also a considerable length of time before enough air passes therethrough to equalize the pressure on both sides of the entrapped fluid. In the event that the pump is to be used for a thin liquid, the

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spout may be inclined at a slight upward angle to retain fluid trapped therein.

The nozzle 144 is secured in opening 154 by means of a setscrew 156. A sealing ring 158 is provided to seal the nozzle and pump opening.

The dial plate 136 is set at the zero point during manufacture of the pump by first lowering the piston 96 to a point where the plug 106 touches boss 108. There will normally be some fluid in the metering chamber 74 with the piston in this position, however this fluid is never dispensed because there is no dispensing pressure available. Therefore, the metering chamber may be considered to be empty when the piston is lowered. The dial plate, which is carried in hub member 160, may then be rotated on the handwheel hub to the zero position with reference to the pointer 138. This is accomplished by loosening setscrew 162 to permit rotation of the hub 160 about the reduced portion of the handwheel hub. When the dial plate has been set to zero, the setscrew 162 is tightened and the instrument is ready for use. An advantage of this means of setting the dial plate is that the tolerance of the piston (length and exact location of teeth) does not have to be to a high degree of accuracy.

After the dial plate and piston are set to the zero position, the amount of material dispensed is controlled by the distance the piston is raised during the filling of the chamber 74. The dial plate may be divided into desired units, such as ounces and fractions thereof, permitting a simple method of measuring the amount of material dispensed.

As previously mentioned, a plurality of pumps are mounted on the structure shown in FIG. 1. This structure is best seen in FIGS. 7 through 10. The base 12 comprises a pair of vertically spaced curved angle iron supports 164, 166. The supports 164, 166 do not form a complete circle and are joined together by two short lengths of straight angle iron 168. The supports 164, 166 are spaced apart by a sheet metal wall 170 which wraps entirely therearound and up to the straight supports 168. A plate 172 is secured between the straight support members to complete the base.

An adjustable shelf 26 is detachably mounted on the plate 172 by means of either the upper bolts 174 or the lower bolts 176. The heads of the bolts fit into slots 178 provided in the shelf 26. The shelf is mounted on either the upper or lower bolts depending upon the size of the container to be filled. As shown in FIG. 1, the shelf is positioned on the lower set of bolts to hold a large container 180. The shelf may be moved to the upper set of bolts as shown in dotted lines in FIG. 8 if a smaller container is to be filled.

The rotatable turntable 14 is mounted on the base 12 as best seen in FIGS. 7, 8 and 10. A turntable support is provided within the base 12. The support comprises a pair of spaced support member angle irons 182, 184 which extend across the base and are secured to the underside of the upper circular support member 164 as by welding. A plate 186 is then secured to and supported on the support members 182, 184. A bearing assembly rotatably supports the turntable 14. As shown in FIG. 10, bearing assembly 188 comprises an upper plate 190, a lower plate 192 and ball bearings 194 provided in annular grooves 196, 198 of the plates 190, 192 to give a frictionless rotation to the bearing structure. The lower plate 192 has an intumed lip portion 200 to hold the assembly together. The lower plate 190 is fixedly secured to the support plate 186 by means of screws 187. The upper plate is secured to the underside of the turntable 14 by means of the screws 202. As will be appreciated, the turntable may consequently be rotated about an axis through the center of the base 12.

The turntable is locked in the desired position by means of the locking structure 28 shown in FIG. 9. The structure 28 comprises a hollow housing member 204 which is secured to the upper circular support 164 as by welding. Openings are provided adjacent the lower end of the

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housing 204 and also in the side wall 170 of the base to rotatably receive cylindrical member 206. This member is supported by the housing 204 and is locked against axial movement by means of rings 208, 210. A spring 212 is provided between the ring 210 and the housing 204 to permit a limited amount of axial movement of the member 206. An eccentric groove 214 is provided in the periphery of the member 206 within the housing 204 and acts as a cam. Abutting against the grooved portion is a rod 216 which extends upwardly through an opening in the support member 164. The rod 216 is urged into abutment with the groove 214 by means of a spring 218 which is retained between the upper wall 220 of the housing and a washer 222. The washer 222 is held in position by means of a ring 224 which is secured to the rod 216. The upper end of the rod 216 is provided with a rubber cap 226 which acts as a stop member.

The rotatable member 206 has two operative positions. It may be turned by means of handle 228 to position the rod 216 so that the cap 226 will abut against the underside of the turntable 14 as shown, or the member 206 may be rotated to permit the rod 216 to be moved downwardly by spring 218 to the end that the cap 226 will be out of engagement with the turntable. As will be appreciated, when the cap 226 engages the underside of the turntable, it will frictionally hold the turntable against rotation. Conversely, when the cap 226 does not engage the turntable, the turntable is freely rotatable.

In operation, when it is desired to dispense colorant from the apparatus 10, the operator checks the formula of the desired paint to determine what colors and quantities are to be dispensed. Upon making this determination, he inserts the proper sized container on the shelf 26 which is adjusted to a position suitable to the container size. The lock 28 is then released permitting the turntable 14 to be rotated. The turntable is rotated until the desired colorant is positioned over the container. At this point, lock 28 is actuated to hold the turntable in place. The valve 72 is turned by means of handle 92 to close outlet passageway 70 and provide communication between the pump metering chamber and the pump reservoir. The handwheel 134 is then turned until the pointer 138 is aligned with the amount of fluid to be dispensed as indicated on dial plate 136. The valve 72 is then rotated to the second position, closing the reservoir passageway 62 and providing communication between the metering chamber and the outlet passageway 70. The handwheel is then rotated in the reverse direction, moving the piston 96 downwardly to expel the metered amount of fluid into the container. This process is repeated with each successive colorant to be dispensed until all of the necessary colorants have been dispensed whereupon the correctly formulated paint is provided.

A second embodiment of the invention is illustrated in FIGS. 11 and 12. As there shown, the base and turntable structure for mounting the dispensers has been replaced with a shelf 230 for storing the dispensers during periods of non-use and power mixing apparatus 232 for mixing the contents of the dispensers just prior to the dispensing operation. The dispensers 234 operate in substantially the same manner as the previously described dispenser 16 but are modified structurally.

As will be noted in FIG. 11, a plurality of dispensers 234 are removably positioned on the shelf 230. The shelf may be secured to any suitable support, such as a wall and at a conveniently accessible height. When it is desired to dispense liquid from one of the dispensers, the desired dispenser is removed from the shelf and placed in the power mixing apparatus 232. As shown, the mixing apparatus is capable of accommodating three dispensers simultaneously. The mixing apparatus can be designed, however, to accommodate any desired number of dispensers.

The mixing apparatus 232 comprises a casing 236 for the dispenser having a bottom shelf 233, side and back

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walls 235, 237, 239 and top 252. The casing is supported by means of risers 238 provided at either end thereof. A pair of vertically spaced rods 240, 242 are secured between the risers and positioned beneath the open front of the casing 236. A movable shelf 244 is carried on the rods 240, 242. The shelf 244 is provided with a pair of projecting ears 246 extending rearwardly from shelf back plate 248. The plate 248 is insertable between the rods 240, 242 with the ears 246 resting on the lower rod and the plate 248 abutting against the upper rod. As will be appreciated, the shelf 244 may be moved along the rods 240, 242 and be positioned under any one of the dispensers 234. A flange or lip 250 is provided on the underside of the casing 236 to permit the shelf 244 to be positioned between the upper rod 240 and the lip 250. This permits raising or lowering of the shelf to facilitate differently sized containers.

Extending downwardly from the top wall 252 of the casing are longitudinally spaced shafts 254. The shafts 254 are power driven by a mechanism provided within the casing (not shown). Any suitable drive mechanism may be employed, however, a preferred crank-drive system utilizing a single prime mover is illustrated in my copending patent application, Serial No. 862,875, filed December 30, 1959. Partition walls may be provided in the casing 236 to divide the space between the drive shaft 254 and thus provide individual compartments for the dispensers. A switch 256 is provided to turn the drive mechanism on and off.

A connector element 258 is provided on the end of each shaft 254 to mesh with connector element 260 provided on the upper end of the dispenser agitator shaft 262. In operation, a hinged plate 264 of the shaft connector 258 is inserted between upstanding lugs 266 provided on the agitator shaft connector. Rotation of the drive shaft 254 causes the plate 264 to engage the lugs 266 and drive the agitator shaft.

The modified dispenser 234 is illustrated in FIG. 12. As mentioned, operation of the dispenser 234 is substantially the same as the previously described dispenser 16. Piston 268 is driven by a gear which is manually rotatable by handwheel 270. A spring-operated neoprene seal 275 is provided to seal the piston and piston cylinder. Index plate 271 and pointer 273 are provided to permit measuring of the amount of liquid dispensed. Filling of the metering chamber 272 is controlled by manually rotatable valve element 274 and dispensing from the metering chamber is through the nozzle 276 which is provided with a check valve (not shown).

In addition to the provision of means for power mixing, the dispenser 234 differs in other respects from the previously described dispenser. As will be noted, the casing 278 which defines fluid reservoir 280 is shorter and of larger diameter than the canister for the dispenser 16. This construction permits the reservoir to be made integrally with the base 282 and piston housing 284. As a consequence, the entire unit may be cast from a single mold. This results in a more rugged construction and reduced manufacturing costs.

Another embodiment of the invention is illustrated in FIGS. 13 and 14. This embodiment is intended for use where it is desired to dispense larger quantities of fluid than in the previous embodiments. In order to facilitate dispensing of larger quantities, a mechanical advantage is provided to drive the piston 286.

As will be noted, a worm 288 is rotatably mounted in casing 290 of the dispenser 292. The worm 288 is manually rotated by means of handwheel 294 which has a hand grip member 296. The worm 288 meshes with gear 298 mounted on shaft 300 which is rotatably mounted in bearings 301, 303. The shaft 300 also carries gear 302 which meshes with the teeth 304 forming a gear rack on the piston 286. The gear reduction provided by the worm gear drive permits the piston to be

driven up and down with the application of only a small force on the handwheel.

It will also be noted that a dial plate 306 is mounted on the shaft 300 to provide for dispensing measured amounts of liquid. A magnifying lens 308 is provided to permit easy reading of the dial plate. The plate 306 and a collar 307 secure the shaft 300 in place.

FIG. 15 is another embodiment of drive means for the agitator shaft to mix the contents of the fluid reservoir 310. This embodiment illustrates means for power driving of the agitator shaft 312 from beneath the reservoir. In the construction shown, the lower end of the agitator shaft 312 is secured to connector 320 by means of pin 313. The connector shaft 321 is in turn fixed to element 323 of flexible coupling 322. The second element 325 of the flexible coupling is secured to the end of drive shaft 324. The shaft 324 is rotatably mounted in bearings 326, 328 which are supported in a housing 330. A sprocket 332 is carried on the lower end of the shaft 324 and is driven by a chain 334. The chain 334 may be driven by any suitable power means and may be interconnected to a number of different drive sprockets to simultaneously drive a series of dispensers. This drive construction may be conveniently used in the turntable structure shown in FIG. 1.

Having thus described my invention, I claim:

1. Mixing and dispensing apparatus comprising a plurality of liquid dispensers; means for positioning a selected one of the dispensers in dispensing relationship to a container; each of said liquid dispensers including liquid storage means; means defining a liquid metering chamber in fluid communication with said storage means; an outlet for said metering chamber; a piston inlet for said metering chamber, a piston slidably extending through said piston inlet, sealing means in said piston inlet in sealing engagement with the piston to seal the piston inlet during piston movement, said piston being spaced from the surface of the metering chamber; a gear rack operatively connected to the piston; manually rotatable gear means in engagement with the gear rack to reciprocate the piston; index means including an indicator element connected to the gear means for rotation therewith to indicate the amount of liquid to be dispensed from the metering chamber to permit the dispensing of a selected amount of liquid; the piston being operable on one stroke to draw a selected amount of liquid into the liquid metering chamber from the liquid storage means and operable on the reverse stroke to dispense the selected amount of liquid from the metering chamber through the metering chamber outlet; and valve means to close the metering chamber outlet during filling of the metering chamber and operable to block communication between the metering chamber and storage means during dispensing from the metering chamber.

2. Mixing and dispensing apparatus comprising a plurality of liquid dispensers; means for positioning a selected one of the dispensers in dispensing relationship to a container; each of said liquid dispensers including liquid storage means; means defining a liquid metering chamber in fluid communication with said storage means; an outlet for said metering chamber; check valve means releasably closing said outlet; a piston inlet for said metering chamber, a piston slidably extending through said piston inlet, sealing means in said piston inlet in sealing engagement with the piston to seal the piston inlet during piston movement, said piston being spaced from the surface of the metering chamber; a gear rack operatively connected to the piston; manually rotatable gear means in engagement with the gear rack to reciprocate the piston; index means including an indicator element connected to the gear means for rotation therewith to indicate the amount of liquid to be dispensed from the metering chamber to permit the dispensing of a selected amount of liquid; the piston being operable on one stroke to draw a selected amount of liquid into the metering chamber from the

liquid storage means and operable on the reverse stroke to dispense the selected amount of liquid from the metering chamber and under a pressure sufficient to open the outlet check valve means to pass thereby and through the metering chamber outlet; and valve means to block communication between the metering chamber and storage means during dispensing from the metering chamber.

3. Mixing and dispensing apparatus comprising a base; a turntable rotatably mounted on the base; a plurality of liquid dispensers carried on the turntable; stop means for holding the turntable against rotation; said stop means being releasable to permit rotation of the turntable for positioning a selected one of the dispensers in dispensing relationship to a container; each of the liquid dispensers including liquid storage means; means defining a liquid metering chamber in fluid communication with said storage means; an outlet for said metering chamber; a piston inlet for said metering chamber, a piston slidably extending through said piston inlet, sealing means in said piston inlet in sealing engagement with the piston to seal the piston inlet during piston movement, said piston being spaced from the surface of the metering chamber; a gear rack operatively connected to the piston; manually rotatable gear means in engagement with the gear rack to reciprocate the piston; index means including an indicator element connected to the gear means for rotation therewith to indicate the amount of liquid to be dispensed from the metering chamber to permit the dispensing of a selected amount of liquid; the piston being operable on one stroke to draw a selected amount of liquid into the liquid metering chamber from the liquid storage means and operable on the reverse stroke to dispense the selected amount of liquid from the metering chamber through the metering chamber outlet; and valve means to close the metering chamber outlet during filling of the metering chamber and operable to block communication between the metering chamber and storage means during dispensing from the metering chamber.

4. Apparatus as claimed in claim 3 and further characterized in that the stop means for the turntable comprises a reciprocal member operable to frictionally engage the turntable; spring means urging said reciprocal member out of engagement with the turntable; and manually operable means for selectively moving the reciprocal member into engagement with the turntable.

5. A liquid dispenser comprising liquid storage means; means defining a liquid metering chamber in fluid communication with said storage means; an outlet for said metering chamber; a piston inlet for said metering chamber, a piston slidably extending through said piston inlet, sealing means in said piston inlet in sealing engagement with the piston to seal the piston inlet during piston movement, said piston being spaced from the surface of the metering chamber; a gear rack operatively connected to the piston; manually rotatable gear means in engagement with the gear rack to reciprocate the piston; index means including an indicator element connected to the gear means for rotation therewith to indicate the amount of liquid to be dispensed from the metering chamber to permit the dispensing of a selected amount of liquid; the piston being operable on one stroke to draw a selected amount of liquid into the metering chamber from the liquid storage means and operable on the reverse stroke to dispense the selected amount of liquid from the metering chamber through the metering chamber outlet; and valve means to close the metering chamber outlet during filling of the metering chamber and operable to block communication between the metering chamber and storage means during dispensing from the metering chamber.

6. A liquid dispenser comprising liquid storage means; means defining a liquid metering chamber in fluid communication with said storage means; an outlet for said metering chamber; check valve means in said outlet; a piston inlet for said metering chamber, a piston slidably extending through said piston inlet, sealing means in said

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piston inlet in sealing engagement with the piston to seal the piston inlet during piston movement, said piston being spaced from the surface of the metering chamber; a gear rack operatively connected to the piston; manually rotatable gear means in engagement with the gear rack to reciprocate the piston; index means including an indicator element connected to the gear means for rotation therewith to indicate the amount of liquid to be dispensed from the metering chamber to permit the dispensing of a selected amount of liquid; the piston being operable on one stroke to draw a selected amount of liquid into the metering chamber from the liquid storage means and operable on the reverse stroke to dispense the selected amount of liquid from the metering chamber under sufficient pressure to open the check valve and pass through the metering chamber outlet; and valve means to block communication between the metering chamber and storage means during the dispensing from the metering chamber.

7. A device as claimed in claim 6 and further characterized in that the gear rack is an integral part of the piston.

8. A dispenser as claimed in claim 6 and further characterized in that said manually rotatable gear means includes a shaft carrying a gear in engagement with the gear rack; and manually rotatable worm gear drive means to rotate said shaft.

9. A dispenser as claimed in claim 6 and further characterized in that said manually rotatable gear means includes a shaft carrying a gear in engagement with the gear rack; said index means comprising an index plate releasably secured to the shaft to normally rotate therewith; a fixed pointer to register with the index plate; said index plate being releasable at the termination of a dispensing stroke of the piston to establish a zero reference point in relation to the pointer.

10. Mixing and dispensing apparatus comprising a plurality of liquid dispensers; storage means for removably storing said dispensers; a support structure for positioning a selected one of the dispensers in dispensing relationship to a container; said support means including power mixing means; each of said liquid dispensers including liquid storage means; agitator means in the storage means; and connector means for removably securing the agitator means to the power mixing means of the support structure; means defining a liquid metering chamber in fluid communication with said storage means; an outlet for said metering chamber; a piston inlet for said metering chamber, a piston slidably extending through said piston inlet,

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sealing means in said piston inlet in sealing engagement with the piston to seal the piston inlet during piston movement, said piston being spaced from the surface of the metering chamber; a gear rack operatively connected to the piston; manually rotatable gear means in engagement with the gear rack to reciprocate the piston; index means including an indicator element connected to the gear means for rotation therewith to indicate the amount of liquid to be dispensed from the metering chamber to permit the dispensing of a selected amount of liquid; the piston being operable on one stroke to draw a selected amount of liquid into the liquid metering chamber from the liquid storage means and operable on the reverse stroke to dispense the selected amounts of liquid from the metering chamber through the metering chamber outlet; and valve means to close the metering chamber outlet during the filling of the metering chamber and operable to block communication between the metering chamber and storage means during dispensing from the metering chamber.

11. A device as claimed in claim 10 and further characterized in that said support structure includes means for mounting a plurality of dispensers therein; and an adjustable shelf structure positionable beneath each dispenser mounted therein to hold a container for receiving liquid dispensed from the dispenser.

12. A device as claimed in claim 10 and further characterized in that said casing structure includes means for simultaneously mounting a plurality of dispensers therein; said power mixing means comprising a plurality of power driven shafts; an agitator shaft extending outwardly from each dispenser; and each of the power driven shafts and agitator shafts having mutually engageable connector elements for releasably connecting a power driven shaft to an agitator shaft.

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