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Gess

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[54] **APPARATUS FOR FILLING CONTAINERS**

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[52] **U.S. Cl.** **141/258;** 141/183

[51] **Int. Cl.** **B67c 3/12**

[58] **Field of Search** 23/253, 259; 141/98, 18, 141/165, 170, 171, 191, 130, 183–191, 258–262; 53/139.3

[56] **References Cited**

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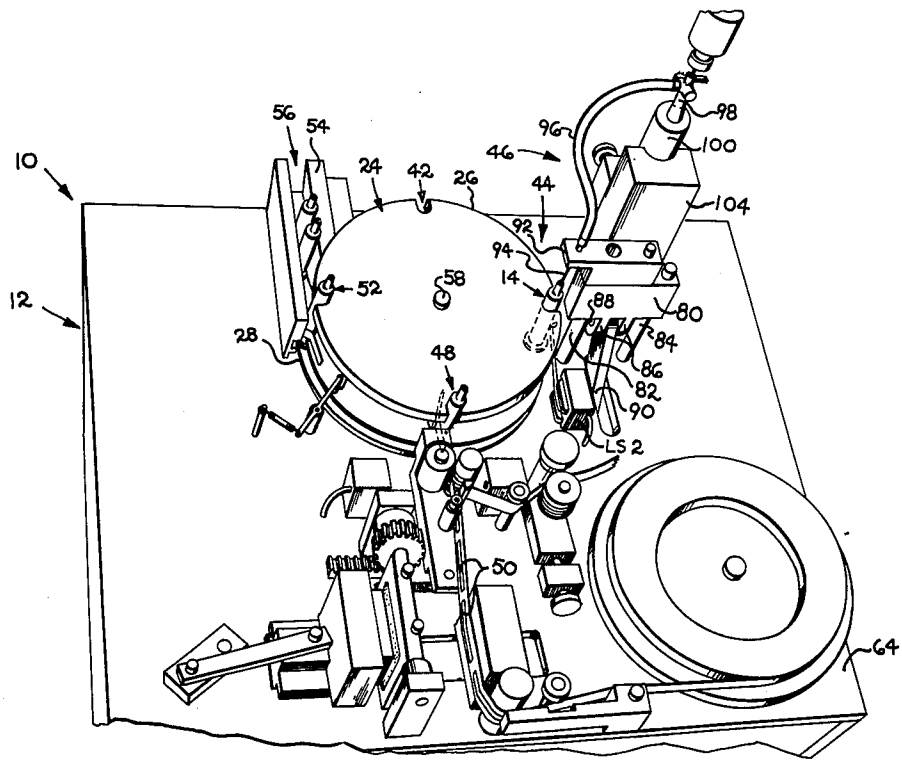
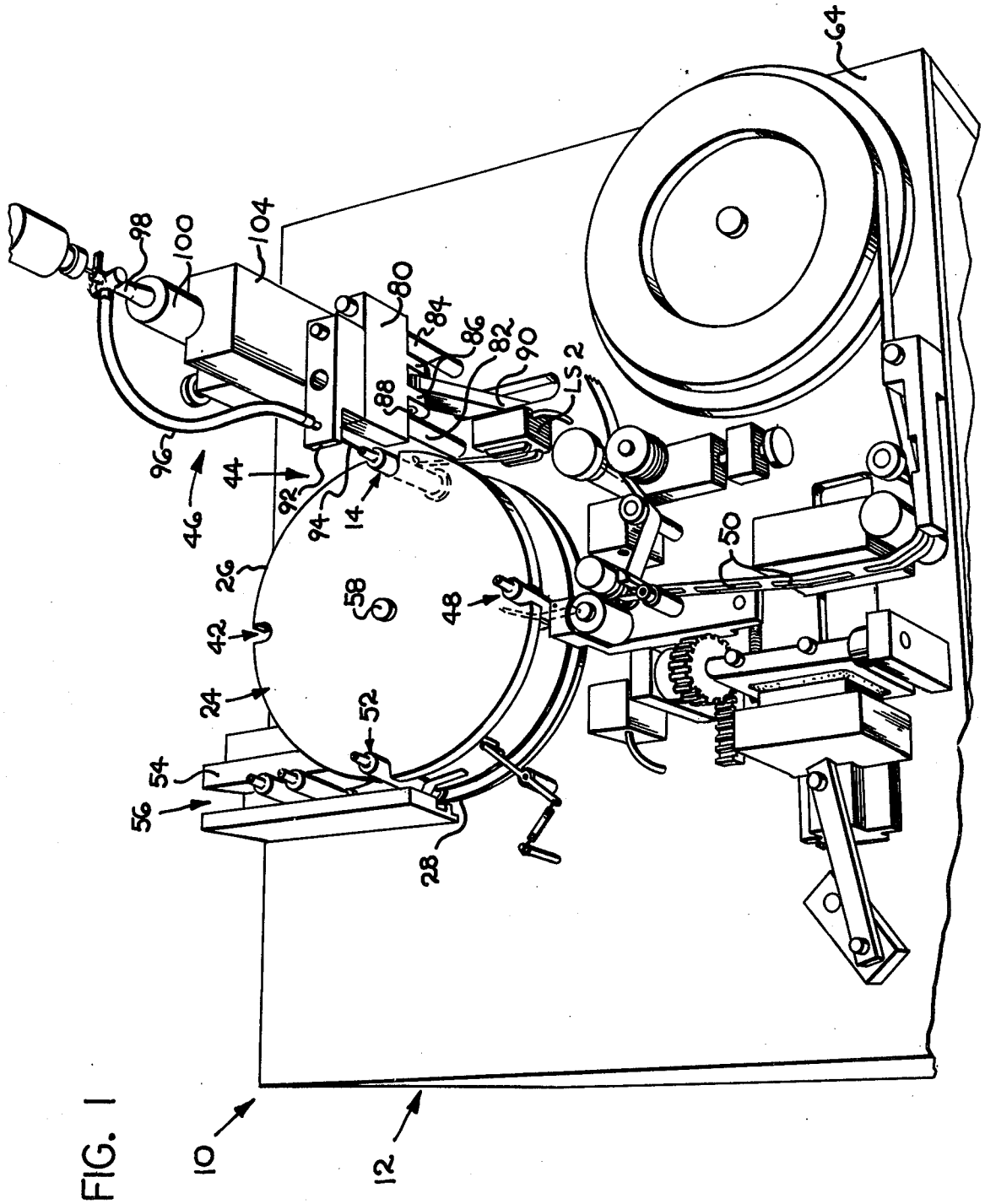
[57] **ABSTRACT**

This invention relates to apparatus for filling medicinal syringes. The apparatus includes a pump arrangement for filling individual syringes automatically and includes a mechanical adjustment for easily changing the amount of medicinal liquid fed to each syringe. The individual syringes are then labeled with appropriate indicia showing the contents.

7 Claims, 3 Drawing Figures

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LS 2
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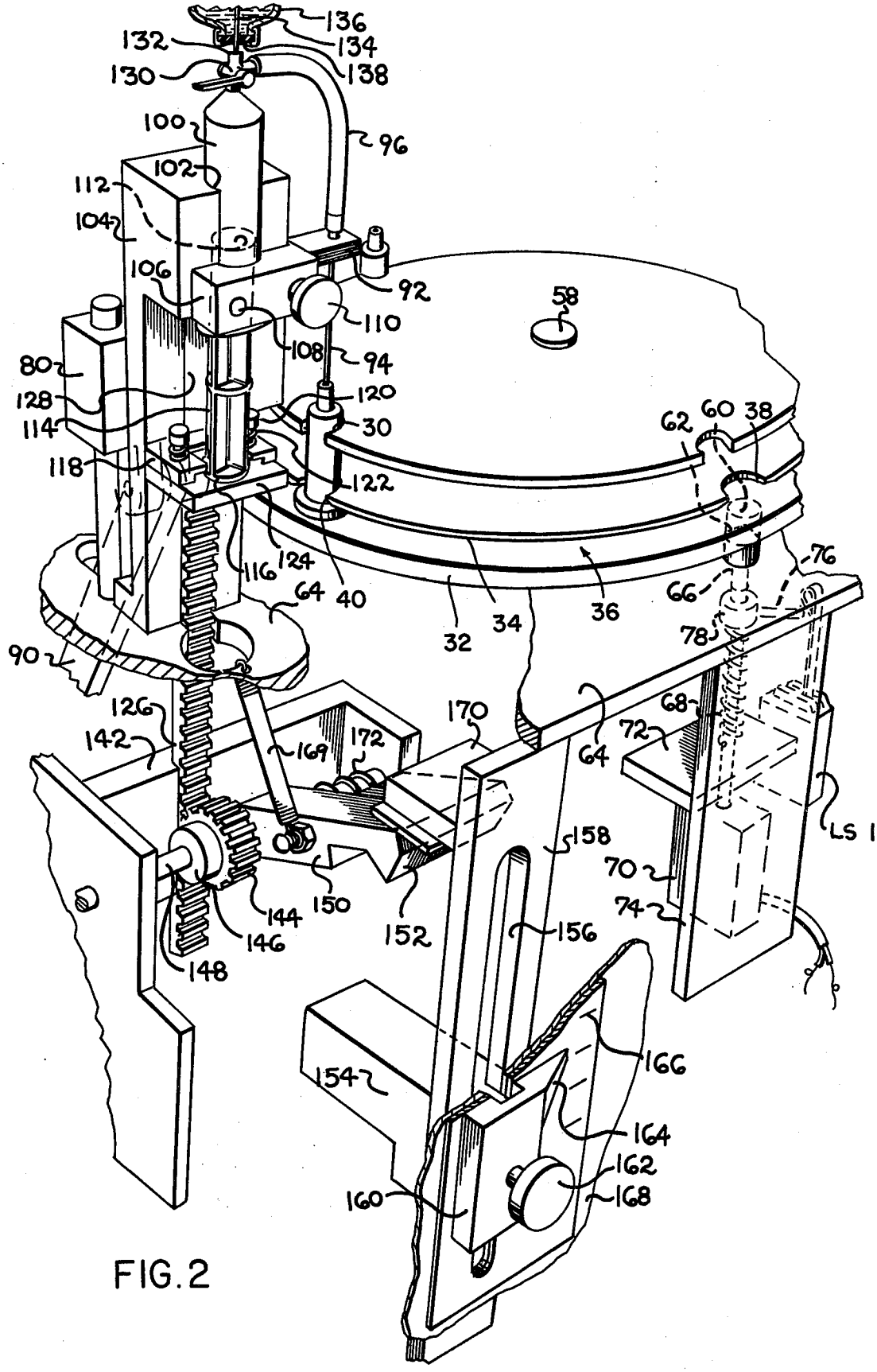
FIG. 1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142
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LS 1
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FIG. 2

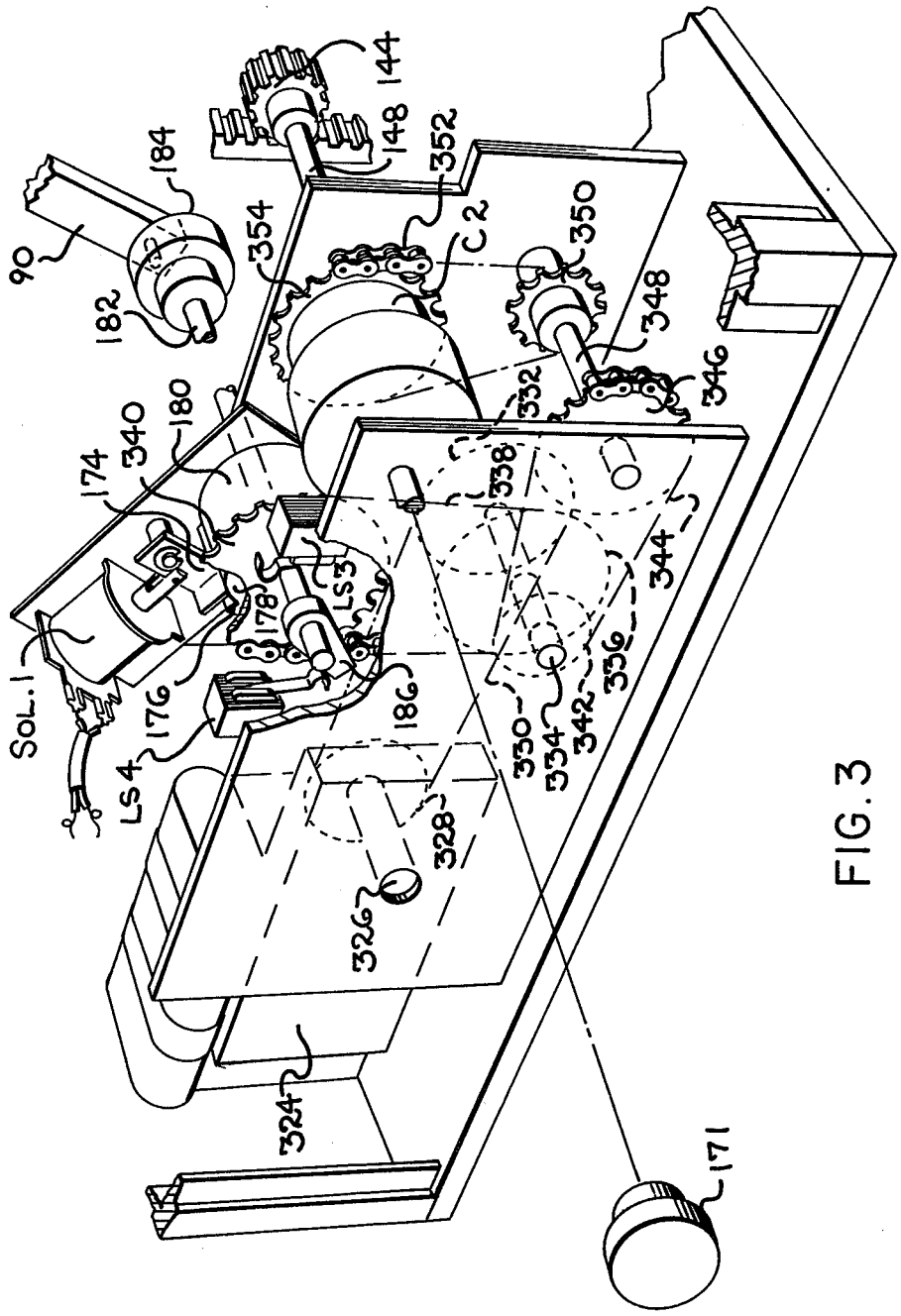
144
148
352
184
90
354
C2
350
182
348
346
332
180
340
174
338
344
178
LS3
336
SOL. 1
176
186
330
334
342
LS4
328
326
324
171

FIG. 3

APPARATUS FOR FILLING CONTAINERS

This is a division of application Ser. No. 190,210, now U.S. Pat. No. 3,835,897 filed Oct. 18, 1971.

This invention relates to apparatus for filling containers and specifically medicinal syringes.

Disposable syringes are more and more commonly used in hospitals, a principal advantage being the added assurance against infection. Commonly syringes are manually filled from a supply container having a rubber diaphragm through which the syringe needle is projected into the container. Such containers are relatively small, being capable of only supplying doses for eight or ten syringes. Otherwise, too many holes result in the diaphragm as the result of the needles, and the contents can be exposed to the air and contaminated. Additionally, the needles of the syringes have a greater chance of being contaminated by this supply technique. The relatively small supply containers are also uneconomical and present a handling and storage problem. Particularly in larger hospitals using large numbers of syringes daily, the manual filling of each represents many costly man-hours on the part of nurses or doctors who are already overworked.

The present invention provides a machine for filling a number of syringes automatically and for labeling them at the same time. This assures that the proper label is applied to the proper medicine to reduce the possibility of errors. Further, a larger container of the medicine can be used, if desired, for greater economy, as well as to reduce handling and storage problems. The syringes can be filled without the needles thereon with the needles being applied later, to further reduce the possibility of contamination.

The new machine is also compact, reliable, and can be used by an unskilled operator. It also employs relatively inexpensive and simplified mechanical components to reduce the overall cost and maintenance requirements.

The new machine has a four-station indexing wheel or turntable. The syringe is fed by hand or by suitable automatic supply means to a first station of the turntable with a narrow neck to receive the needle extending upwardly. The lower end of the syringe has a plunger previously inserted into the barrel thereof to seal that end of the syringe. The syringe is then moved to a second station at which a predetermined amount of medicinal liquid is supplied through the narrow neck of the syringe in a predetermined, changeable amount. The syringe intercepts a printed label at the third station which wraps around the syringe barrel and is adhered together at the back. The syringe is then automatically removed from the indexing wheel to a discharge trough at the fourth station. A removable cap can then be placed over the narrow neck of the syringe and the filled syringe stored until ready for use. At that time, the cap can be removed and a sterilized needle applied to the narrow neck, with a plunger rod inserted into the plunger located in the syringe barrel.

Even with four stations, including the filling apparatus and the label printing and applying apparatus, the entire machine is very compact, being less than about 16 inches wide and 20 inches long.

It is, therefore, a principal object of the invention to provide a machine for automatically filling syringes.

Another object of the invention is to provide a machine for filling and labeling syringes which is compact in size, reliable, and low in cost.

Yet another object of the invention is to provide a container-filling machine with accurate and easily adjustable means for changing the quantity of medicinal liquid supplied to the container.

Many other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIG. **1** is an overall view in perspective from above of a machine for filling and labeling syringes according to the invention;

FIG. **2** is an enlarged view in perspective, taken from the opposite direction, of indexing means for a turntable and of apparatus for filling syringes with predetermined, changeable amounts of medicinal liquid; and

FIG. **3** is a view in perspective, with parts broken away and with parts in section, of drive means for certain components of the machine and particularly the filling apparatus.

Referring to the drawings, and particularly to FIG. **1**, an overall syringe filling and labeling machine embodying the invention is indicated at **10** and includes a base **12** containing the drive system and controls for the machine. The overall machine is compact, being only about 16 inches wide and 20 inches long so that space requirements are kept to a minimum. The machine is also relatively light in weight, less than about 100 pounds, to provide portability so that the machine can be positioned in the most efficient or needed location. However, the machine is commonly used in a sanitary hood which supplies filtered, germ-free air over the apparatus to prevent possible contamination by air-borne bacteria.

Syringes handled by the machine **10** are indicated at **14.** These preferably are of the disposable type which can be readily commercially obtained in several different styles. As shown in FIG. **2,** the syringe **14** includes a main barrel **16** containing the usual graduations and an upper neck **18** over which can be fitted a suitable cap when the syringe is filled. The cap can subsequently be removed and a needle placed on the neck **18.** At the lower end of the syringe **14** is an annular flange **20** for fingers, used in combination with the thumb on a plunger rod, to push the plunger rod into the syringe and move a plunger **22** through the barrel **16** toward the neck **18** to dispense the contents. The plunger **22** is placed in the barrel **16** before the syringe **14** is placed in the machine. Commonly, the syringes **14** including the plungers **22** are purchased assembled and in a sterilized condition from the manufacturer.

The syringes **14** are moved from a suitable supply source sequentially to an indexing wheel or turntable **24.** The turntable **24** includes an upper disc **26** and a spaced, lower disc **28** connected together by a central hub (not shown). Referring particularly to FIG. **3,** the upper disc **26** includes a notch **30** which positions an upper portion of the syringe barrel **16.** The lower disc **28** has a horizontally-extending peripheral lip **32,** above which is a thin metal plate **34** of smaller diameter, with a space indicated at **36** between the lower disc and the plate. A notch **38** is formed in the plate **34** to receive a lower portion of the barrel **16,** the notches **30** and **38** being in alignment, there being four of each of the notches for the four stations of the turntable **24.** A chamfer **40** is formed around the lower notch **38** at the bottom surface of the plate **34.** The flange **20** of the syringe **14** is inserted in the space **36** and is held between

the disc 28 and the plate 34, the latter being somewhat resilient to firmly engage the flange.

The syringes 14 are loaded at a first station indicated at 42 and are then carried by the turntable to a second station indicated at 44 when the turntable is indexed in a clockwise direction through 90° increments or steps. At the second station 44, the syringes 14 receive a predetermined quantity of a medicinal liquid from filling apparatus indicated at 46. The syringes 14 are then transferred to a third station, indicated at 48, where labels 50 carrying appropriate indicia designating the medicine in the syringes are applied. The syringes then move to a fourth station 52 and are stripped from the turntable and specifically from the notches 30 and 38 as they move beyond the station 52. This is accomplished by a side wall 54 of a discharge chute or trough indicated at 56, the side wall extending into the space between the discs 26 and 28 to engage and push outwardly that portion of the barrel 16 between the discs.

The turntable is driven through a central shaft 58 and an electromagnetic clutch C1 by means to be discussed subsequently. The table is precisely indexed to each of the four stations by means of four recesses 60 located on the lower surface of the lower disc 38 at the four notch positions of the turntable. A detent 62 (FIG. 2) extends upwardly through a platform 64 of the machine base 12 and has a downwardly-extending rod 66 therebelow which is spring-loaded in the upward direction by a coil spring 68. The rod 66 extends into a solenoid 70 and is pulled downwardly when the solenoid is actuated. The solenoid 70 is supported by a mounting plate 72 extending from a depending wall 74 of the base 12.

When a new syringe is placed at the first station 42 of the turntable 24, and the turntable is to be indexed, a start switch, whether hand- or foot-operated, is closed. A timer is then actuated which actuates the solenoid 70 to move the detent 62 out of the recess 60 for a very short period of time. The clutch Cl is also energized, enabling the turntable to be indexed to the next station. When the detent is released, the spring 68 moves it up against the lower surface of the disc 28 again where it can enter the next one of the recesses 60 when the turntable completes its 90° movement to the next station. When the detent has so indexed, and the detent 62 has moved into the next recess 60, an arm 76 extending outwardly from a collar 78 of the rod 66 operates a limit switch designated LSl which de-energizes the clutch Cl and stops the drive for the turntable.

Referring to FIGS. 1 and 2, the filling apparatus 46 at the second station 44 includes a vertically reciprocable member 80 slidably mounted on two vertical posts or guides 82 and 84. The member 80 has ears 86 pivotally connected by a pin 88 to a crank arm 90 which is driven in a manner to be subsequently discussed. The arm moves the member 80 with a vertical reciprocating motion over a predetermined distance. The member 80 also includes an outwardly extending flange 92 supporting a supply needle or elongate hollow member which extends downwardly and is in alignment with the neck 18 of the syringe 14 when at the second station 44.

The supply needle 94 is connected through a flexible supply tube 96 to a neck 98 of a pump cylinder 100. The cylinder 100 is held in a fixed position in a recess 102 of a stand 104 by means of a clamping bar 106 held in clamping engagement through a pin 108 and a thumbscrew 110. A pump plunger 112 is located within the cylinder 100 and is connected to a plunger rod 114 extending downwardly to an end flange 116, which is held by means of clamping plates 118, screws 120, and springs 122 on a back-up plate 124. The plate 124, in turn, is affixed to the upper end of a gear rack 126 which is reciprocably guided in a groove or gib 128 in the side of the stand 104.

When the rack 126 is moved up a predetermined distance, it moves the plunger 112 accordingly and dispenses a predetermined quantity of medicinal liquid from the cylinder 100 through the tube 96 and the needle 94 into the syringe 14. The cylinder 100 contains a relatively large amount of the medicinal liquid so that the plunger 112 can be moved upwardly incrementally a number of times to fill a corresponding number of the syringes 14 before the cylinder 100 is empty. When the cylinder is empty, it can be removed and replaced by a full one or it can be filled in place with the apparatus shown in FIG. 2. In this instance, when the cylinder 100 is empty, a three-way valve 130 is turned to enable the cylinder 100 to communicate with an upwardly-extending neck 132 of the valve 130 rather than with the line 96. The neck 132 is connected through a needle 134 with the interior of a medicinal supply container 136, the needle 134 projecting through a rubber diaphragm 138 on top of the container. When the rack 126 is then moved downwardly to retract the plunger 112, it draws a new supply of medicinal liquid from the container 136 into the cylinder 100 without removing the cylinder. The valve 130 can then be turned back to connect the cylinder with the line 96 and the operation can begin again. With the relatively small medicinal supply containers now commercially available, several may be needed to fill the cylinder 100. However, the machine according to the invention will make larger supply containers possible and practical since the diaphragm is pierced only once, by the needle 134, rather than by a multiplicity of syringe needles.

The plunger 112 is moved incrementally upwardly in the cylinder 100 through a unique, variable drive arrangement. Accordingly, the rack 126 projects through an opening 140 in the platform 64 of the base 12 and is backed up by a lower wall 142. A pinion 144 meshes with the rack 126 and is connected through a commercially-available one-way clutch 146 with a drive shaft 148. The clutch 146 is designed so that when the shaft 148 rotates in a clockwise direction, as viewed in FIG. 3, it accordingly rotates the pinion 144 which moves the rack 126 and the plunger 112 upwardly. When the shaft 148 is moved in a counterclockwise direction, however, the pinion 144 remains stationary. Rather than the clutch 146, the shaft 148 can be in two parts and connected by an electromagnetically-operated clutch which can be selectively operated.

A travel arm 150 is affixed to the shaft 148 and moves in an arcuate manner as the shaft rotates in either direction. When the shaft 148 is driven, and the arm 150 is in the position shown in FIG. 2, the shaft rotates until the arm 150 moves downwardly to a position in which an end 152 engages a positive stop in the form of an adjusting block 154. The block 154, in turn, is connected through a slot 156 of a vertical bar 158 to an indicator block 160 by means of an adjusting thumbscrew 162. When the screw 162 is loosened, the indicator block 160 and the stop block 154 can be moved up and down to any predetermined position. The position

is shown by a pointer **164** on the block **160** associated with indicia indicated at **166** located on a side wall **168** of the base **12.** When the shaft **148** is disengaged from the drive, the arm **150** is then moved back to its original position by a spring **169** connected between the arm and the platform **64.** The original position of the arm **150** is determined by a fixed stop **170** extending inwardly from the bar **158.**

From the above, it will be seen that when the shaft **148** is driven in a clockwise direction, it similarly moves the plunger **144** and causes liquid to be dispensed from the cylinder **100** through the tube **96** to the syringe **14,** until the arm **150** moves into contact with the stop block **154.** When the drive for the shaft **148** is disengaged, the spring **169** returns the arm **150** to the upper position against the stop **170.** During this counterclockwise movement of the arm **150,** the shaft **148** is similarly rotated, but the pinion **144** remains stationary and so does the rack **126** and the plunger **112.** Consequently, through each reciprocatory motion of the arm **150** and each incremental drive of the shaft **148,** the plunger **112** moves upwardly a predetermined distance in the cylinder **100** and dispenses a predetermined amount of medicinal liquid to the syringe aligned with the needle **94.** The dispensing of the liquid through the needle **94** only occurs when the needle is in the syringe and the member **80** is in the lower position.

When the cylinder **100** is empty and is to be refilled, the plunger rod **114** is retracted to its lowest position to draw a fresh supply of liquid into the cylinder. To accomplish this, the shaft **148** is moved inwardly toward the right, as viewed in FIGS. **2** and **3,** to move the pinion **144** out of engagement with the rack **126** so that the rack can be pushed downwardly. This can be accomplished by a suitable handle **171** of FIG. **3** which is pushed in by the operator. When the handle is released, a spring **172** of FIG. **3** moves the shaft **148** and the pinion **144** back to the original position with the pinion and the rack **126** again engaged.

The filling operation of the syringe begins when one of the syringes **14** moves into the filling position at the station **44.** At that time, a feeler arm of a limit switch LS2 engages the syringe barrel **16** and closes the switch. The limit switch causes a pulse to be fed to a solenoid SOL.1 (FIG. **3**) which retracts a dog **174** from an offset **176** in a control disc **178.** The release of the dog **174** from the offset **176** causes a commercially-available wrap spring clutch **180** to engage and connect a drive shaft **182** with a drive train, to be discussed subsequently. The shaft **182** is then driven through an angle of 180° until the dog **174,** which was immediately released after being retracted, contacts another offset diametrically opposite the offset **176** in the control disc **178.** This accordingly stops the shaft **182.**

During this movement, the crank arm **90,** connected to a cam **184** on the shaft **182,** moves the reciprocable member **80** downwardly to move the needle **94** into the syringe **14** at the station **44.** In this position, a control arm **186** on the shaft **182** contacts a feeler arm of a limit switch LS3 which closes to energize an electromagnetic clutch C2 to engage the drive train with the shaft **148.** At the same time, the limit switch LS3 energizes a timer which, when timed out, de-energizes the clutch C2. The time that the clutch is energized, however, is sufficient for the shaft **148** to be driven to the extent that the arm **150** moves a distance sufficient for the end **152** to contact the stop block **154** where it remains until the timer times out and the clutch C2 is disengaged. At that time, the spring **169** returns the arm **150** and the shaft **148** to the original position, ready for the next reciprocatory filling motion.

When the timer which dis-engages the clutch C2 times out, it also pulses the solenoid SOL.1 again to temporarily retract the dog **174** and to enable the shaft **182** to again rotate 180° and raise the supply needle **94** from the syringe **14** at the station **44.** At this time, the control arm **186** contacts a fourth limit switch LS4 which readies the machine for another cycle. The turntable control is in series with the limit switch LS4 to prevent indexing unless the switch LS4 is closed. This prevents possible indexing when the supply needle **94** is in one of the syringes **14.**

The drive train for the filling apparatus **46** will now be discussed. Referring to FIG. **3,** a motor **324** has a drive shaft **326** which, through a drive sprocket **328,** a chain **330,** and a driven sprocket **332,** rotates an intermediate shaft **334.** This rotates an intermediate sprocket **336** which, through a chain **338,** drives a sprocket **340** which drives the shaft **182** through each of its 180° movements when the dog **174** is released and the clutch **180** is engaged.

A drive sprocket **342** on the intermediate shaft **334,** through a chain **344,** drives a sprocket **346** located on a second intermediate shaft **348.** A drive sprocket **350** affixed to the shaft **348** then drives, through a chain **352,** a sprocket **354** which is rotatably mounted on the shaft **148.** When the clutch C2 is engaged, the sprocket **354** drives the shaft **148** and the pinion **144** until the arm end **152** contacts the stop block **154.** The clutch C2 then simply slips until it is de-energized.

Various modifications of the above described embodiment of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if they are within the spirit and the tenor of the accompanying claims.

I claim:

1. Apparatus for filling medicinal containers comprising means for holding a medicinal container upright with an opening at the top thereof, a hollow member for directing liquid into the container opening, means for holding said hollow member above the container holding means with the hollow member directed toward the opening, a supply container, plunger means in said supply container, means connecting said supply container with said hollow member, and means for moving said plunger means incremental distances further into said supply container to move amounts of liquid from the supply container through the connecting means and the hollow member when medicinal containers are to be filled.

2. Apparatus according to claim **1** characterized by means for returning said plunger means toward the initial position in said supply container after said plunger means has been moved a number of incremental distances further into said supply container.

3. Apparatus according to claim **1** characterized by said moving means comprises a gear rack connected to said plunger means, a pinion gear, and means for rotating said pinion gear in one direction only through a predetermined angle to incrementally move said plunger means each time one of the medicinal containers is to be filled.

4. Apparatus according to claim 3 characterized by said latter means includes a shaft on which said pinion gear is mounted, an arm affixed to said shaft, and adjustable means for limiting the extent of angular movement of said pinion gear.

5. Apparatus according to claim 4 characterized by a one-way clutch mounting said pinion gear on said shaft to enable said pinion gear to rotate with said shaft in only one direction effective to move said gear rack toward the supply container and said plunger means further into said supply container.

6. Apparatus according to claim 4 characterized further by drive means including an electromagnetic clutch for rotating said shaft, and means for energizing said electromagnetic clutch for a predetermined period of time when one of the medicinal containers is to be filled.

7. Apparatus according to claim 1 characterized further by means for moving said hollow member downwardly into the medicinal container when the medicinal container is held in alignment with said hollow member by said holding means.

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