July 23, 1957 A. COOK ET AL 2,799,983

CAPSULE CLOSING AND EJECTING MECHANISM

Filed Jan. 23, 1956 6 Sheets-Sheet 1

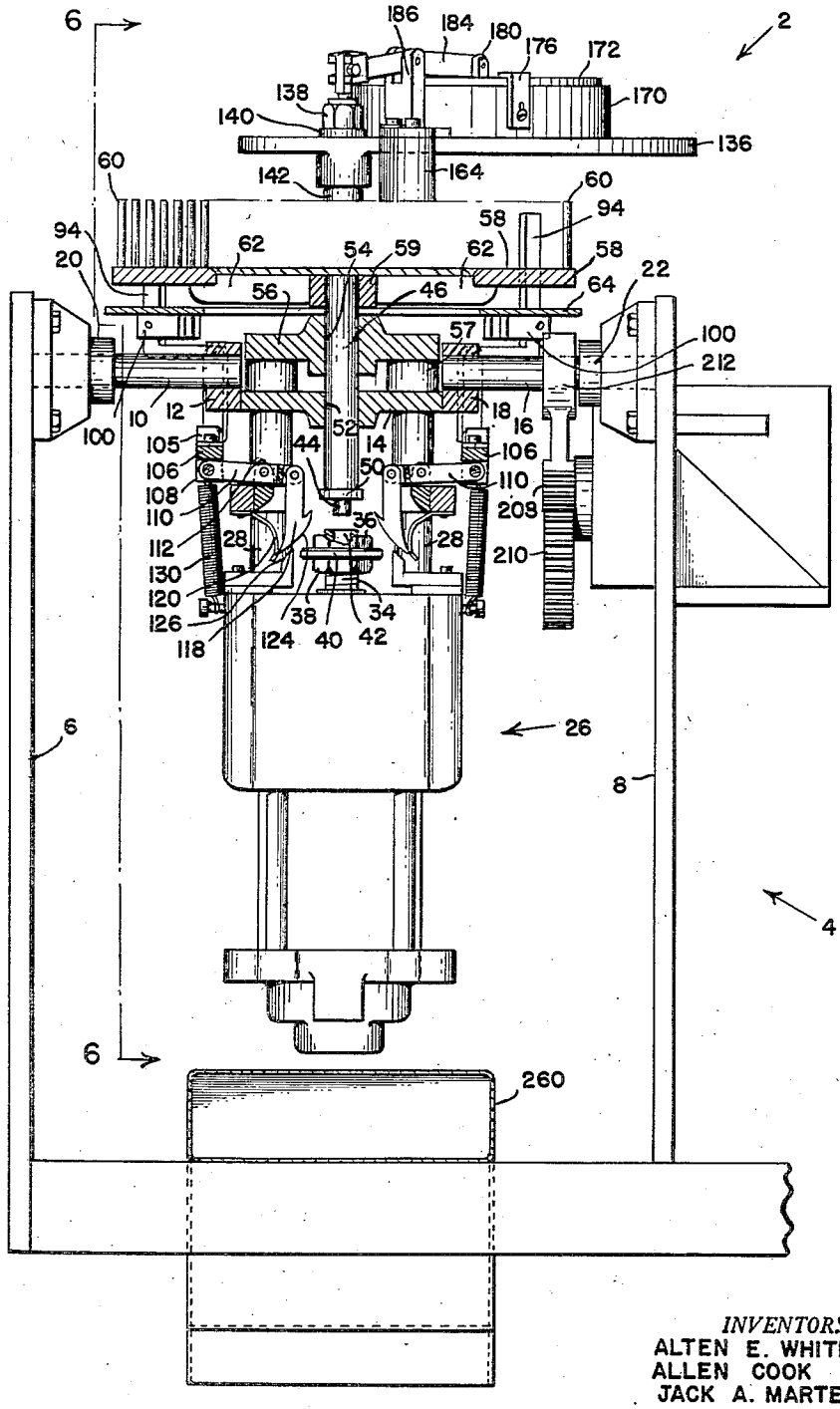


FIG. 1.

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CAPSULE CLOSING AND EJECTING MECHANISM

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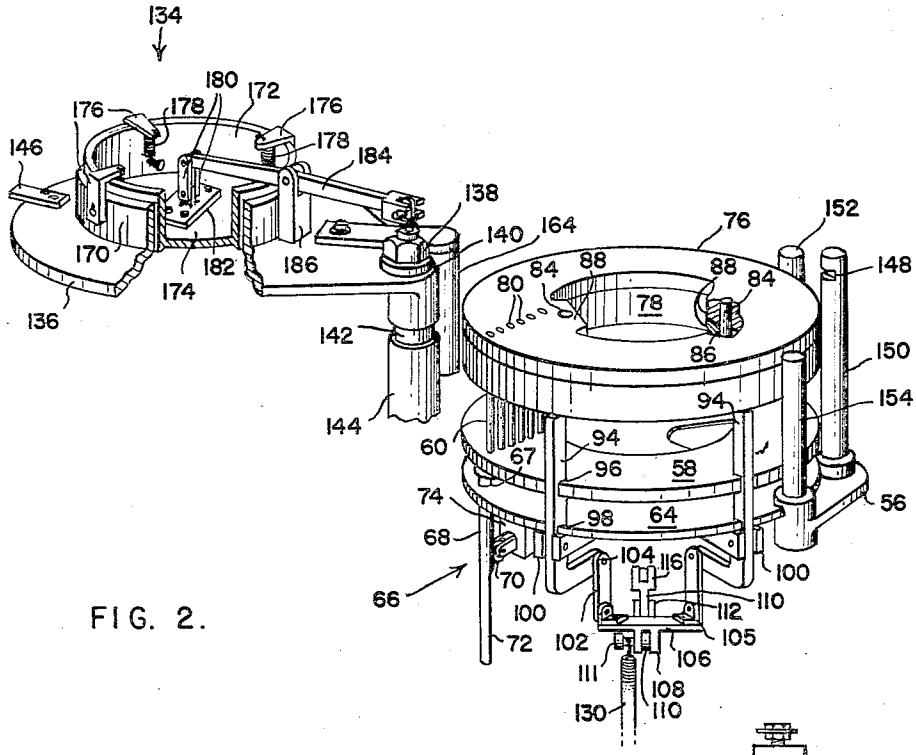


FIG. 2.

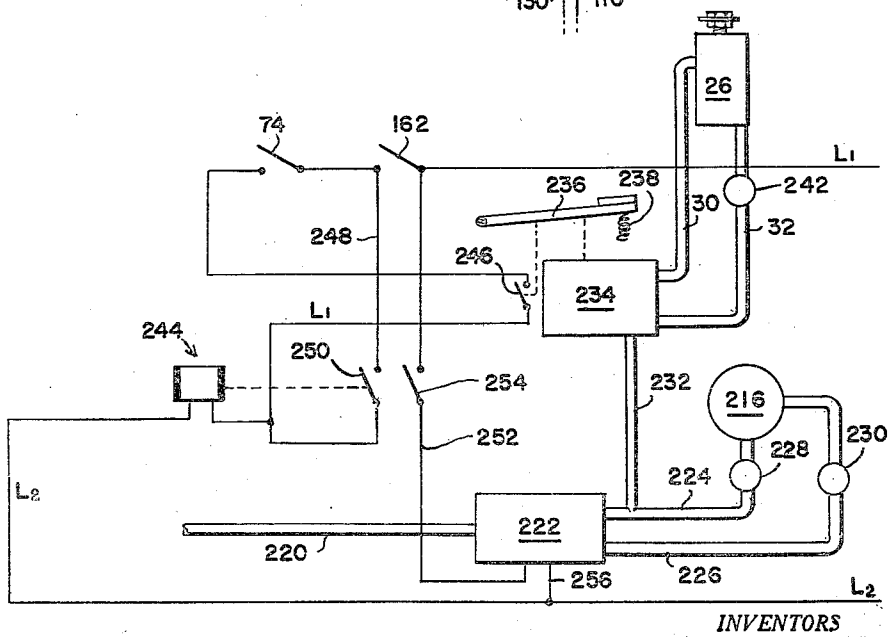


FIG. 3.

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CAPSULE CLOSING AND EJECTING MECHANISM

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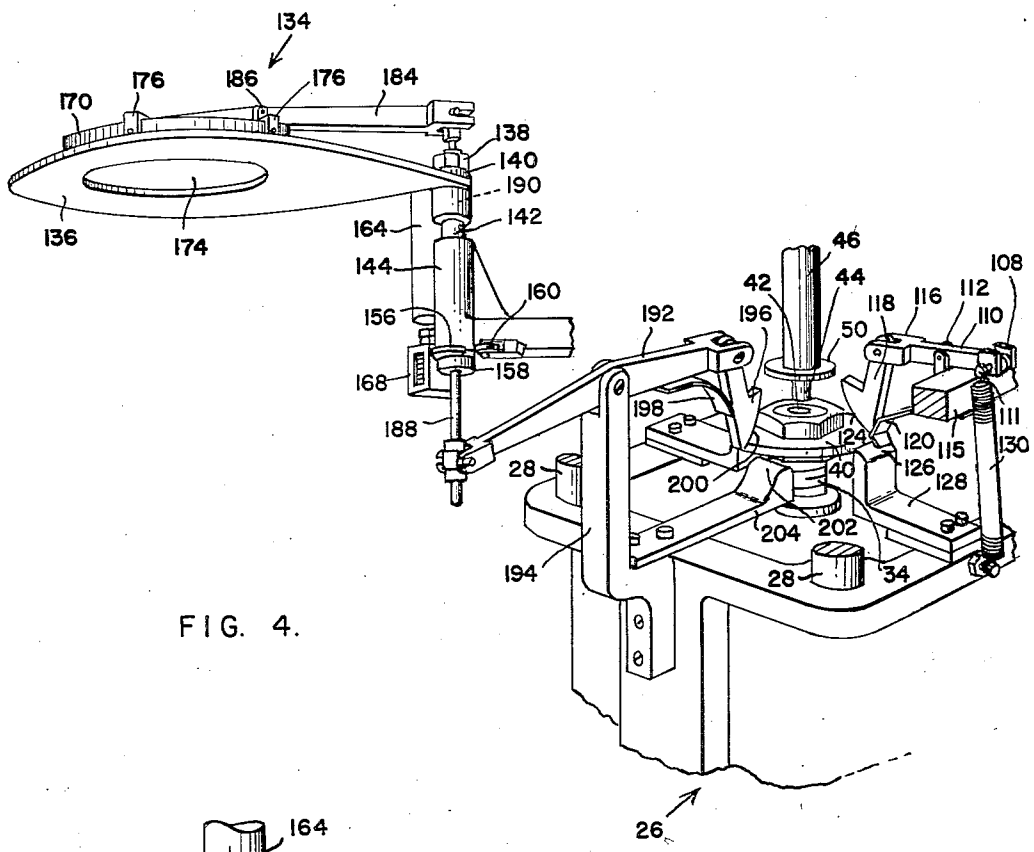


FIG. 4.

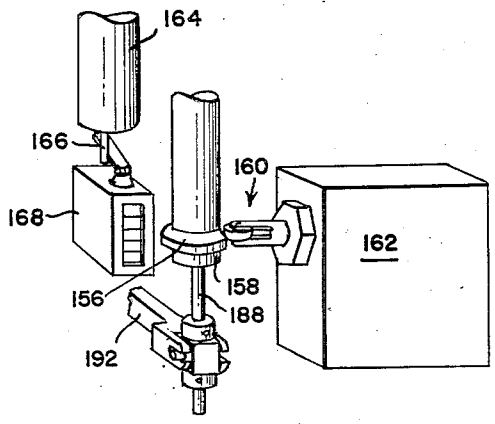


FIG. 5.

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CAPSULE CLOSING AND EJECTING MECHANISM

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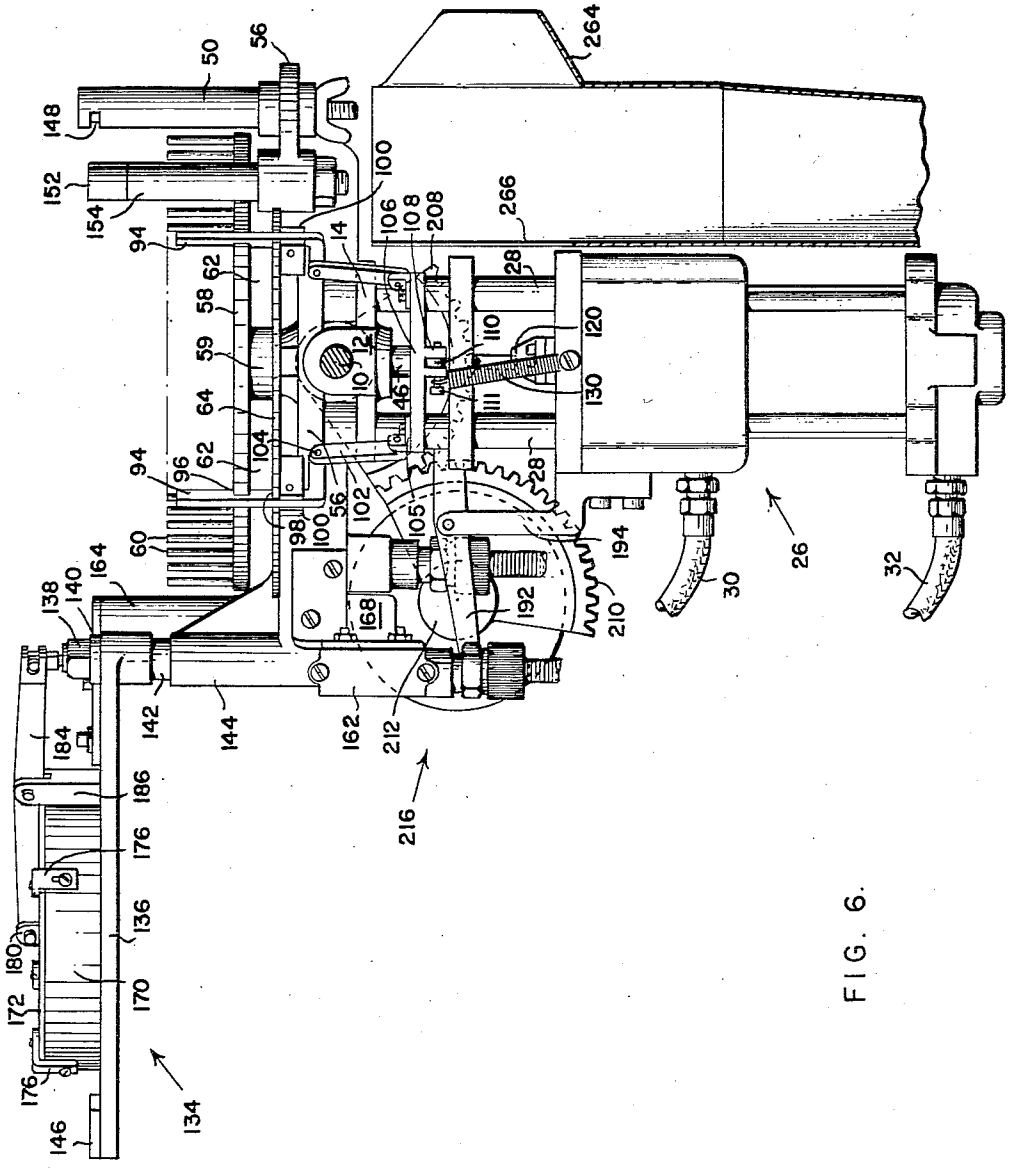


FIG. 6.

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CAPSULE CLOSING AND EJECTING MECHANISM

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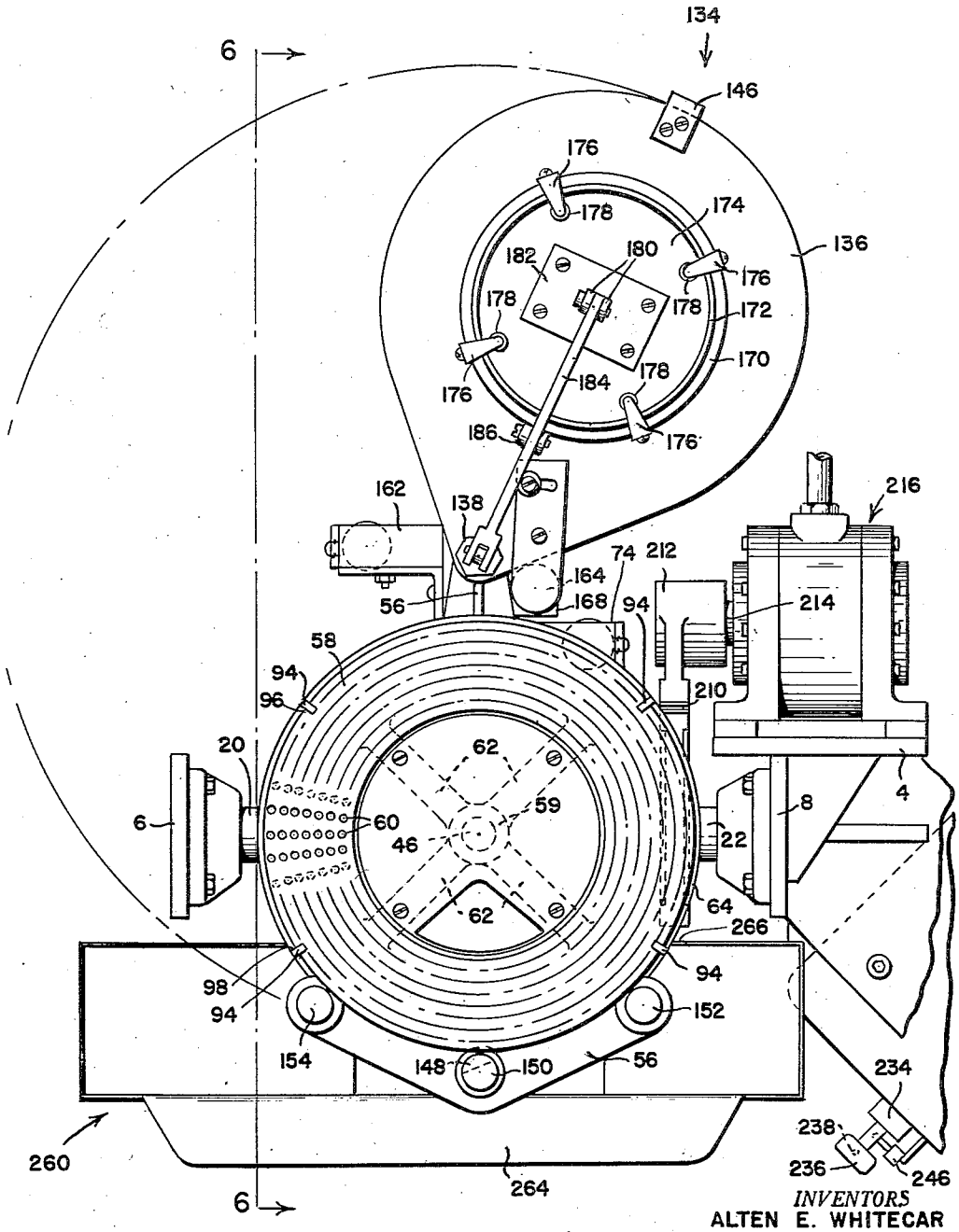


FIG. 7

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CAPSULE CLOSING AND EJECTING MECHANISM

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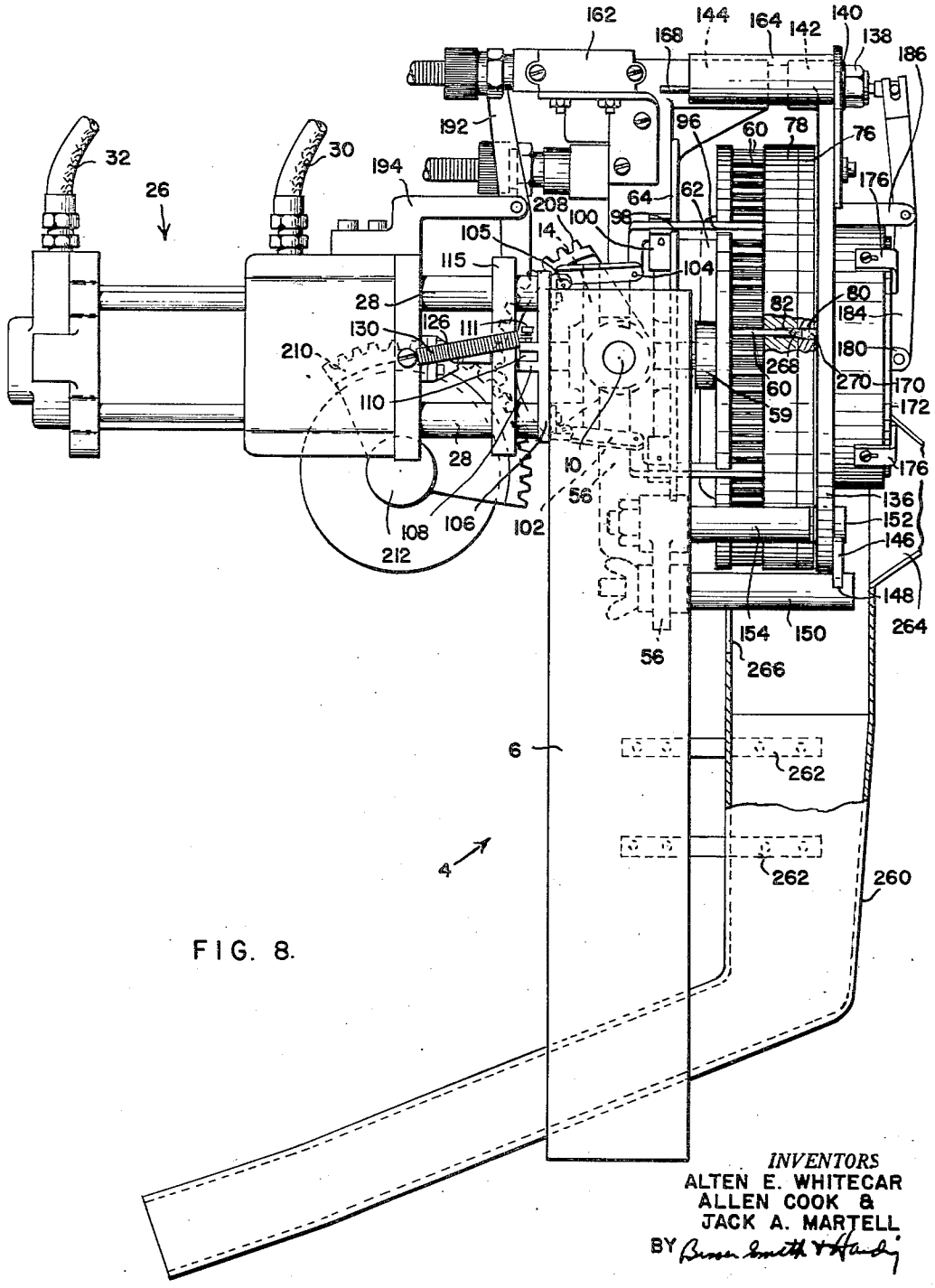


FIG. 8.

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United States Patent Office

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CAPSULE CLOSING AND EJECTING MECHANISM

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Application January 23, 1956, Serial No. 560,484

7 Claims. (Cl. 53—299)

This invention relates to mechanism for closing and ejecting capsules which may be, for example, hard gelatin capsules such as are conventionally used in the pharmaceutical industry.

The closing and ejecting of capsules has been accomplished heretofore. Although the previously known apparatus is satisfactory for some applications, it has been unsatisfactory where it is desired to quite fully fill the male portion of the capsule with material that does not pack firmly.

In accordance with this invention there is provided means for closing and ejecting capsules which can be rapidly and easily handled by the operator. Further, this invention provides means for closing and ejecting capsules which eliminates spilling from capsules well filled with material that does not pack firmly without any loss of efficiency in ejecting the capsules.

These and other advantages of this invention will become obvious on reading the following description in conjunction with the drawings in which:

Figure 1 is a front elevation partly broken away of a capsule closing and ejecting machine in accordance with this invention;

Figure 2 is a side perspective view partly broken away showing a pair of capsule rings mounted on the machine of Figure 1, showing the mechanism closely associated with the capsule rings;

Figure 3 is a schematic view of the controls for the machine of Figure 1;

Figure 4 is a rear perspective view showing mechanism closely associated with the air ram of the machine of Figure 1;

Figure 5 is a front perspective view of the control switch and closely associated mechanism operated by the lid of the machine of Figure 1;

Figure 6 is a section taken on the line 6—6 in Figure 1;

Figure 7 is a plan view of the machine of Figure 1;

Figure 8 is a side elevation of the machine of Figure 1 showing a 90° rotation of the closing and ejecting mechanism.

Referring to Figure 1, a capsule closing machine 2 in accordance with this invention has a supporting frame 4 with vertical support members 6 and 8. A shaft 10 is fixedly secured to a support member 12 which, in turn, is welded to plate 14. Similarly, a shaft 16 is fixedly secured to a support member 18 which is welded to plate 14. Shaft 10 is journaled in ball bearing 20 which is mounted on frame member 6 and shaft 16 similarly is journaled in ball bearing 22 which is bolted to upright frame member 8.

An air operated ram 26 is supported from plate 14 by a plurality of posts 28 which are respectively secured to plate 14 and ram 26. Ram 26 is provided with air lines 30 and 32 (Fig. 6). Piston rod 34 of ram 26 is threaded and carries a pair of nuts 36 and 38 between which a ring 40 is held. The terminal end of rod 34 has an opening 42 which is adapted to straddle screw 44 which is screwed to rod 46 to hold a hard steel impact washer 50 which

is adapted to be engaged by rod 34. Rod 46 passes through a central opening 52 in plate 14 and through an opening 54 in casting 56 which is mounted on plate 14 by posts 57. The outer end of rod 46 is secured to a circular plate 58 which carries a plurality of pins 60 which are adapted to be in registry with openings in capsule carrying rings as will be made apparent shortly. Rod 46 is secured to plate 58 by a hub 59 and spokes 62. Hub 59 rests on a circular ring plate 64 which is secured to casting 56.

As viewed in Figure 2, plate 58 has secured thereto a downwardly extending rod 66 which passes freely through opening 67 in plate 64 and which has an upper portion 68 which engages a roller 70 of a microswitch 74 and a reduced lower portion 72 which permits the microswitch 74 to be spring biased outwardly.

As shown in Figures 2 and 8, conventional capsule retaining plates 76 and 78 (see Patent 1,819,936) are ring shaped and have capsule openings 80 and 82, respectively, which are maintained in registry by means of pins 84, which are secured by a pressed fit in plate 76 and pass downwardly into openings 86 in plate 78 located in inwardly projecting portions 88.

As viewed in Figure 2, plate 78 is supported by a plurality of bell crank support members 94. Each member 94 passes downwardly through a slot 96 in plate 58 and a slot 98 in plate 64. Each member 94 is fulcrumed on a bracket 100 secured to the bottom of plate 64 and is pivotally connected to a link 102 at 104. Each link 102 is pivotally secured to a bracket 105 which, in turn, is secured to a crossbar 106.

As best seen in Figure 4, each crossbar 106 is provided with a clevis 108 in which is pivotally secured a link 110 by a pin 111. Each link 110 is fulcrumed to a bracket 112 secured to support member 115 and has a clevis end 116 in which is pivotally secured a latch 118. Each latch 118 is biased inwardly by a spring strip 120 secured to support member 115. Latch 118 has a curved face 124 which is adapted to engage a cam face 126 on bracket 128 which is secured to ram 26. An extension coil spring 130 is secured to pin 111 and ram 26 and acts to bias latch 118 upwardly and crossbar 106 downwardly.

Referring now to Figures 2 and 4, a lid 134 has a plate member 136 which is fixedly secured by a nut 138 and a washer 140 to a threaded post 142 journaled in a bracket portion 144 of casting 56. As viewed in Figure 2, lid 134 is adapted to be rotated counterclockwise until its projection member 146 is engaged in a slot 148 in post 150 mounted on casting 56. An adjacent post 152 mounted on casting 56 acts as a limit stop to the rotation of lid 134 and acts along with a post 154 to assist in positioning rings 76 and 78.

A cam 156 (Figures 4 and 5) is secured to the bottom of post 142 by a threaded member 158 so that the cam 156 rotates with the post 142 and lid 134. A spring biased roller member 160 is adapted to follow cam 156 and actuate microswitch 162. A post 164, which is secured to lid 134, carries a pin 166 which actuates a counter 168.

The inner periphery of plate 136 has an upstanding flange 170 (Figure 2) within which is mounted an upstanding flange 172 of a plate 174. A plurality of right-angled brackets 176 are each secured to the exterior surface of flange 170 and each support an extension coil spring 178 which is secured to flange 172. The springs 178 act to bias flange 172 upwardly against the top of the brackets 176. A pair of links 180, 180 are pivotally secured to bracket 182 which, in turn, is secured to plate 174. Links 180, 180 are pivotally secured to lever 184 which, in turn, is fulcrumed on support member 186 and pivotally secured to rod 188 (Figure 4). Rod 188 passes downwardly through a bore 190 in post 142 and is pivotally connected at its lower end to a lever 192 which is fulcrumed on bracket 194 and which pivotally carries at its inner end, a

latch 196. Latch 196 is biased inwardly by a leaf spring 198 and has a curved face 200 which is adapted to engage a cam face 202 on bracket 204 which is secured to ram 26. Latch 196 is identical with latch 118 but lies a little lower as viewed in Figure 4 so as to be engaged slightly later by the downward movement of ring 40.

Referring to Figures 1 and 7, to provide the necessary rotation of the mechanism, a segment gear 208 is fixedly secured to shaft 16 and meshes with a segment gear 210 secured to a hub 212 mounted on drive shaft 214 of air motor 216 having a 90° arc of rotation. It will be understood, of course, that numerous other driving means can be substituted for air motor 216.

Referring now to the schematic showing of Figure 3 for a description of the control means for supplying air to ram 26 and motor 216, there is a compressed air line 220 connected to a source of compressed air (not shown). Air line 220 is secured to a valve 222 which is connected to air lines 224 and 226. Valve 222 is a solenoid controlled valve and provides for a flow of air into line 224 and out of line 226 or, alternatively, into line 226 and out of line 224. Lines 224, 226 are provided with flow regulator valves 228 and 230 which are adjusted to control the speed of operation of motor 216 to which lines 224, 226 are connected. Air line 224 has a branch 232 which acts to supply a valve 234 with compressed air. Valve 234 is operated by a foot pedal 236 which is upwardly biased by a spring 238. Valve 234 acts to provide a flow of air into line 30 and exhaust air through line 32 or, alternatively, into line 32 and exhausted through line 30. Lines 30 and 32 are connected to ram 26. A flow regulator valve 242 is placed in line 232 to provide means for adjusting the speed of return of the ram 26.

Referring now to electrical components of the control means as shown in Figure 3, power supply lines L_1 and L_2 are connected to a relay 244. Line L_1 contains switches 162 and 74 which are operated respectively by the movement of lid 134 and the movement of plate 58 and rod 66. In addition, line L_1 contains a switch 246 which is operated by foot pedal 236. Line L_1 is also connected to relay 244 by line 248 which acts as a holding circuit, line 248 having a contact 250 which is closed when the relay is energized. Line L_1 is connected to solenoid valve 222 by line 252 which contains a contact 254, the contact 254 being closed when the relay 244 is energized. Line L_2 is connected to solenoid valve 222 by a line 256.

Referring particularly to Figures 7 and 8, a chute 260 is secured to frame 4 by a plurality of brackets 262. Chute 260 is adapted to convey the capsules to a desired location after they are discharged from the closing mechanism. Chute 260 has an enlarged upper end 264 adapted to permit the entry of the rings, lid and associated elements. The left hand face of the chute, as viewed in Figure 8, is cut away as shown at 266 to accommodate the mechanism as it is rotated.

Operation

The first step in the operation of the above described mechanism is to mount capsule retaining plates 76 and 78 on support members 94 with pins 60 started in openings 82. Plate 78, in the conventional manner, will contain a plurality of filled capsule bodies 268 and plate 76 will contain capsule caps 270. At this stage of the operation, the mechanism will be in an upright position, that is, with the pins 60 standing substantially vertically and correspondingly with the capsule bodies and capsule caps being substantially vertical. In this position the valve 222 (Figure 3) is supplying air to line 226 which acts to urge motor 216 to maintain the mechanism in the upright position.

The operator now grasps lid 134 and rotates it counterclockwise as viewed in Figure 7 so as to bring projection member 146 into slot 148 and plate 136 into contact with post 152. This action acts to rotate cam 156 (Figure 5) which acts to close switch 162 in an early stage of the rotation of the cam. When this operation has been completed, the operator inserts his fingers under plate 58 and urges it upwardly to urge pins 60 against capsule bodies 268 and start the joinder of the bodies with the caps 270. Simultaneously rod 66 (Figure 2) is raised sufficiently so as to bring the reduced portion 72 opposite roller 70 which causes switch 74 to operate into the closed position.

The operator then presses downwardly on foot pedal 236 which closes switch 246, energizing relay 244 to close contacts 250 and 254. The closing of contact 254 actuates solneoid valve 222 to reverse the flow of air in lines 224 and 226 which causes motor 216 to operate in the reverse direction. As viewed in Figure 6, the operation of motor 216 causes segment gear 210 to rotate counterclockwise which results in the clockwise rotation of segment gear 208 which in turn causes the supporting structure for rings 76 and 78 to rotate clockwise. This rotation continues until the rings 76 and 78 have been rotated 90° to the position shown in Figure 8.

Simultaneously with the reversal of flow of air to motor 216, air under pressure is supplied from line 224 to line 232 and hence to valve 234. The depression of the foot pedal 236 actuates valve 234 so as to introduce compressed air into line 32 causing rod 34 to move upwardly, as viewed in Figure 1, to engage rod 46 and force plate 58 and pins 60 upwardly into openings 82. This action forces the capsule bodies snugly into the capsule caps. It will be noted that this action takes place before tilting of retaining plates 76 and 78 and hence eliminates the spilling of any of the contents of the capsule bodies. Plate 136 acts to back up the capsule caps.

When retaining plates 76 and 78 have been carried around so as to be substantially vertical, the foot pedal is released resulting in actuation of valve 234 to reverse the flow of air to ram 26, air now being supplied in line 30 and exhausted through line 32. As best seen in Figure 4, the reverse movement of rod 34 causes ring 40 to first engage latches 118 and then latch 196. Latches 118 are engaged by ring 40 slightly before ring 40 engages latch 196. Latches 118 are moved towards brackets 126 causing levers 110 to pivot and move crossbars 106 towards rings 76 and 78 (Figure 2). This, in turn, causes links 102 to move towards retaining plates 76 and 78 and, in turn, pivots support members 94 so that the portions supporting retaining plates 76 and 78 move radially clear of retaining plate 78.

The engagement of latch 196 by ring 40 causes lever 192 to be pivoted and move rod 188 so as to pivot lever 184 and cause plate 174 to move towards plate 76. Plate 174 engages the inwardly projecting portions 88 and inner margin of plate 76 and forces plates 76 and 78 towards plate 58. This causes the pins 60 to eject the capsules from plates 76 and 78.

As latches 118 and 196 are carried downwardly still further, their curved faces 124 and 200 respectively come into contact with cam surfaces 126 and 202. This results in the camming of the latches away from and out of engagement with ring 40. Springs 120 and 198 then return latches 118 and 196 to their original position towards the axis of ram 26. At the same time, springs 178 retract plate 174 from capsule plate 76 in sufficient time to permit the capsules falling from the upper part of the ring to fall clear of plate 174.

As the capsules are ejected, they fall directly downwardly between plate 76 and lid 134 and are caught by chute 260 which conveys them to the desired location.

In order to restore the remainder of the mechanism to its original position, the operator rotates lid 134 to its original fully opened position. Just before lid 134 reaches this position, cam 156 permits switch 162 to open. This deenergizes holding circuit 248 and hence relay 244 causing contacts 250 and 254 to open. This, in turn, results in deenergizing solenoid valve 222 which causes the flow of air to motor 216 to reverse. Motor

216 now operates to return the structure to its upright position causing plate 58, hub 59 and rod 46 to move downwardly by gravity until hub 59 rests on plate 64, where the operation of the motor ceases due to the fact that it has only a 90° rotation. Retaining plates 76 and 78 are removed anytime after the lid 134 is clear of them. This permits springs 130 to pivot members 94 through their associated linkages back into position to support the next retaining plate 78.

It is not desired to be limited except as set forth in the following claims.

What is claimed is:

1. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, pin means adapted to engage capsule bodies held in said body retaining plate, removable cover means adapted to be opposite the exposed face of said capsule cap retaining plate, releasable support means adapted to support said capsule body retaining plate in a substantially horizontal position, rotatable support means carrying said releasable support means, means mounted on said rotatable support means for advancing said pin means in the direction of said capsule bodies for closing the capsules, means for rotating said rotatable support means to tilt said capsule retaining plates, means to move said releasable support means out of engagement with the capsule body retaining plate and means to advance the capsule retaining plates away from the cover means to cause the pins to eject the capsules.

2. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, pin means adapted to engage capsule bodies held in said body retaining plate, removable cover means adapted to be opposite the exposed face of said capsule cap retaining plate, releasable support means adapted to support said capsule body retaining plate in a substantially horizontal position, rotatable support means carrying said releasable support means, means mounted on said rotatable support means for advancing said pin means in the direction of said capsule bodies for closing the capsules, means for rotating said rotatable support means to tilt said capsule retaining plates into a substantially vertical position, means to move said releasable support means out of engagement with the capsule body retaining plate and means to advance the capsule retaining plates away from the cover means to cause the pins to eject the capsules.

3. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, pin means adapted to engage capsule bodies held in said body retaining plate, removable cover means adapted to be opposite the exposed face of said capsule cap retaining plate, releasable support means adapted to support said capsule body retaining plate in a substantially horizontal position, rotatable support means carrying said releasable support means, means for rotating said rotatable support means to tilt said capsule retaining plates, a ram mounted on said rotatable support means and adapted to move said pin means in the direction of said capsule bodies for closing the capsules on its outward stroke and to engage on the return stroke said releasable support means to move said releasable support means out of engagement with the capsule body retaining plate and means to advance the capsule retaining plates away from the cover means to cause the pin means to eject the capsules, said means being actuated by engagement with said ram on its return stroke.

4. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, rotatable support means, a ram mounted on said rotatable support means, pin means adapted to be engaged by said ram on its outward stroke to move in the direction of said capsule bodies for closing the capsules, releasable support means adapted to support said capsule body retaining plate in a substantially horizontal position, said ram engaging said support means on its return stroke to move the releasable support means out of engagement with the capsule body retaining plate and means to advance the capsule retaining plates away from the cover means to cause the pin means to eject the capsules, said means to advance the capsule retaining plates being releasably engaged by the ram on its return stroke.

5. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, rotatable support means, a ram mounted on said rotatable support means, pin means adapted to be engaged by said ram on its outward stroke to move in the direction of said capsule bodies for closing the capsules, a releasable support adapted to support said capsules body retaining plate in a substantially horizontal position, said releasable support being linked to a latch which is adapted to be engaged by the ram on its return stroke for the release of said support, a cam adjacent said latch and adapted to cam said latch out of engagement with the ram, spring means biasing said latch to its non-operative position and means to advance the capsule retaining plates away from the cover means to cause the pin means to eject the capsules, said means to advance the capsule retaining plates being releasably engaged by the ram on its return stroke.

6. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, rotatable support means, a ram mounted on said rotatable support means, pin means adapted to be engaged by said ram on its outward stroke to move in the direction of said capsule bodies for closing the capsules, releasable support means adapted to support said capsule body retaining plate in a substantially horizontal position, said ram engaging said support means on its return stroke to move the releasable support means out of engagement with the capsule body retaining plate, a plate adapted to engage the capsule cap retaining plate at a point clear of the caps in said capsule retaining plate, means linking said plate to a latch adapted to be engaged on the return stroke of said ram, cam means adjacent said latch and adapted to cam said latch out of engagement with said ram and spring means adapted to move said latch back to its original non-operative position.

7. Capsule closing and ejecting apparatus comprising: a capsule body retaining plate, a capsule cap retaining plate mounted on said capsule body retaining plate, rotatable support means, a ram mounted on said rotatable support means, pin means adapted to be engaged by said ram on its outward stroke to move in the direction of said capsule bodies for closing the capsules, a releasable support adapted to support said capsule body retaining plate in a substantially horizontal position, said releasable support being linked to a latch which is adapted to be engaged by the ram on its return stroke for the release of said support, a cam adjacent said latch and adapted to cam said latch out of engagement with the ram, spring means biasing said latch to its non-operative position, a plate adapted to engage the capsule cap retaining plate at a point clear of the caps in said capsule retaining plate, means linking said plate to a latch adapted to be engaged on the return stroke of said ram, cam means adjacent said latch and adapted to cam said second mentioned latch out of engagement with said ram and spring means adapted to move said second mentioned latch back to its original non-operative position.

No references cited.