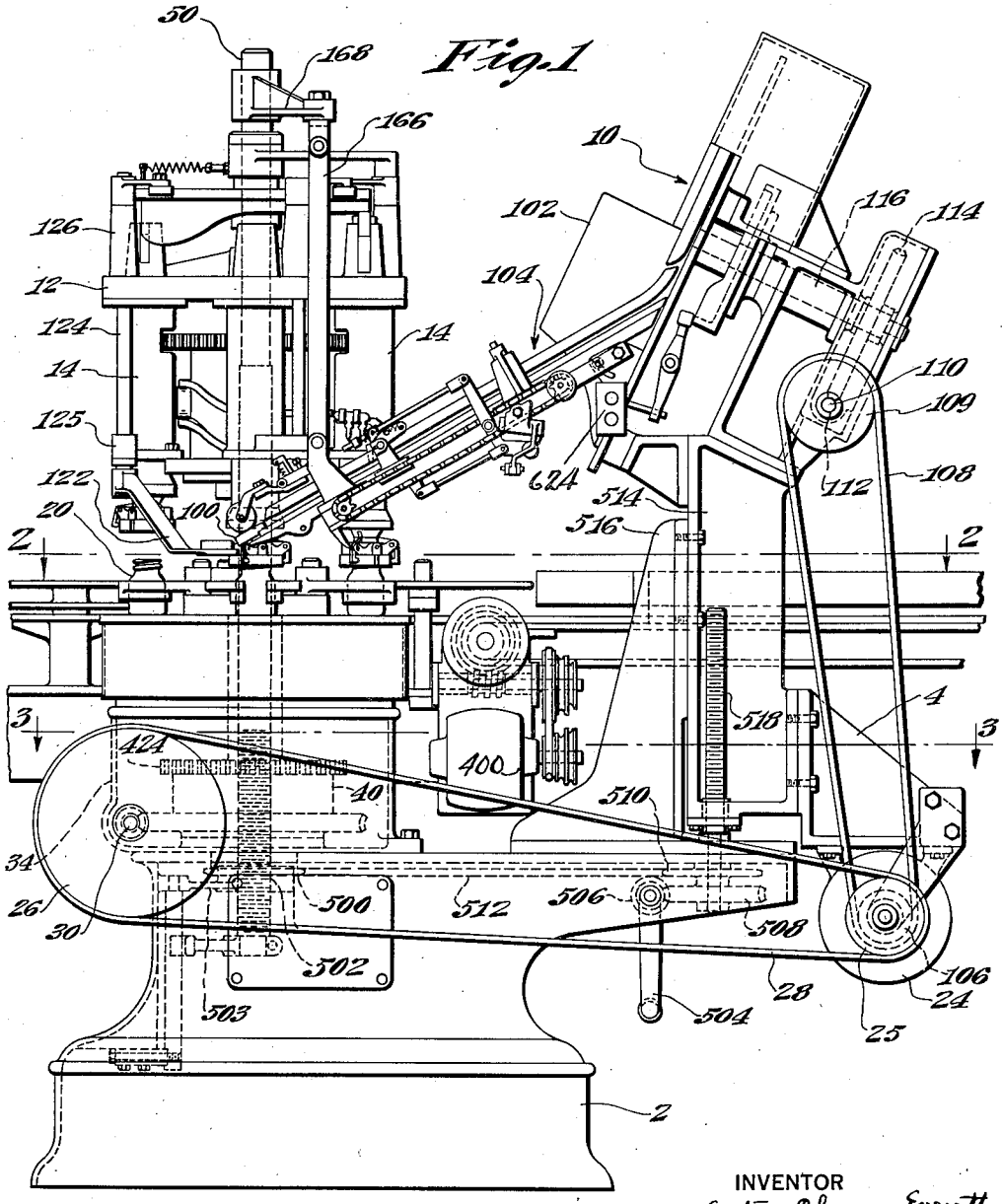
June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

Filed Aug. 11, 1933 10 Sheets-Sheet 1

Fig. 1



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June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

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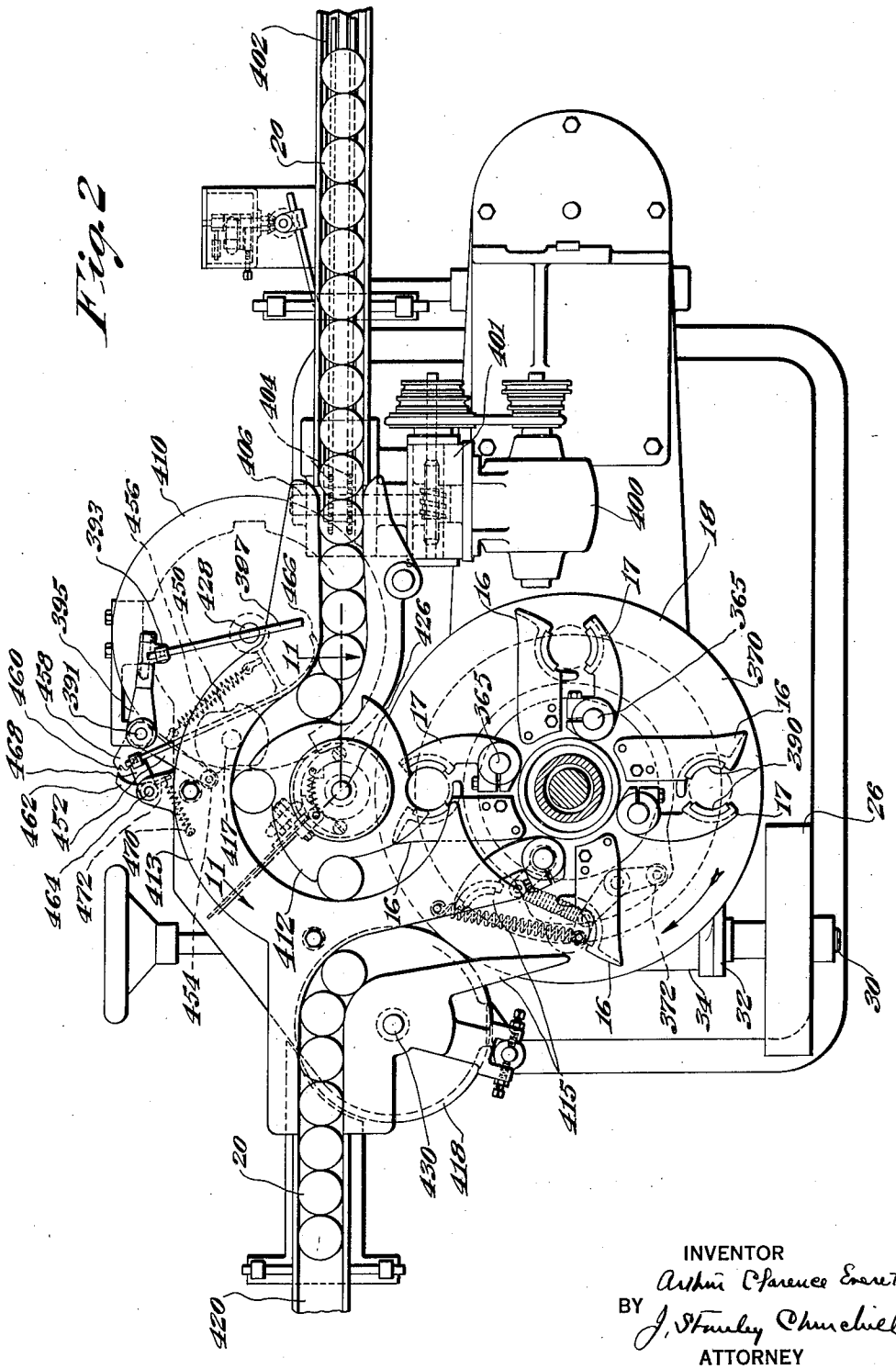
Fig. 2



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June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

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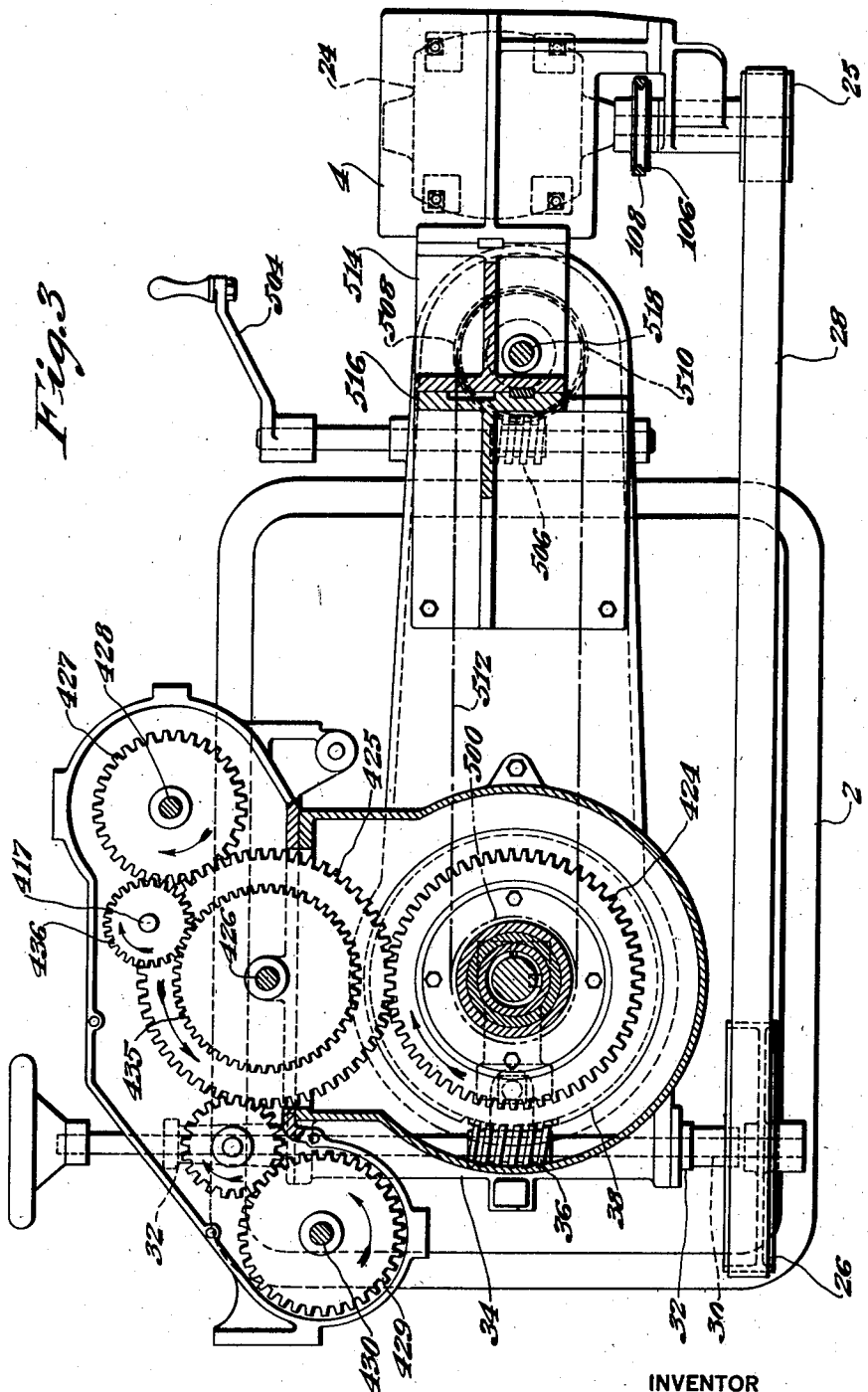
Fig. 3



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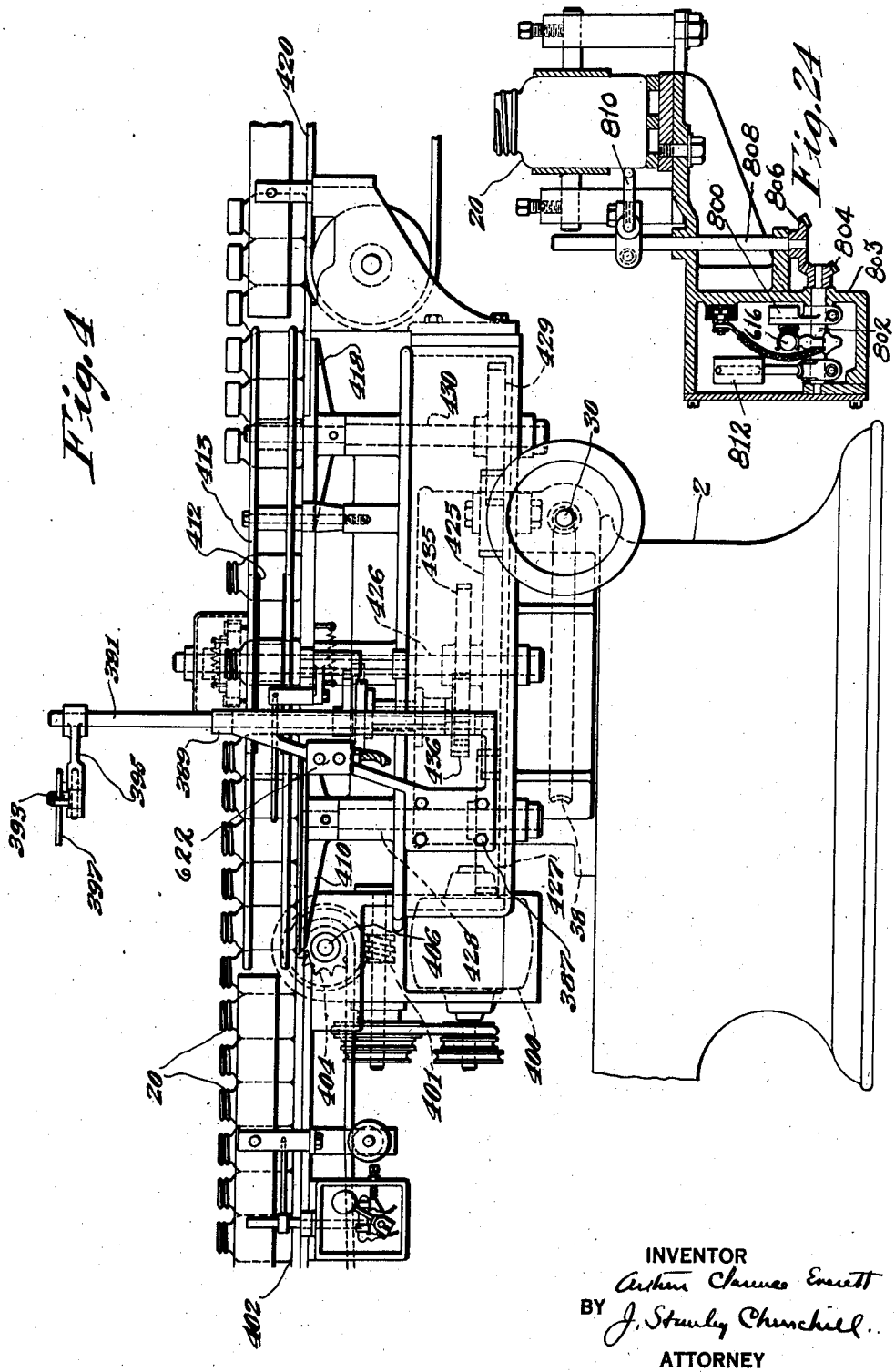
June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

Filed Aug. 11, 1933 10 Sheets-Sheet 4



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CLOSURE APPLYING MACHINE

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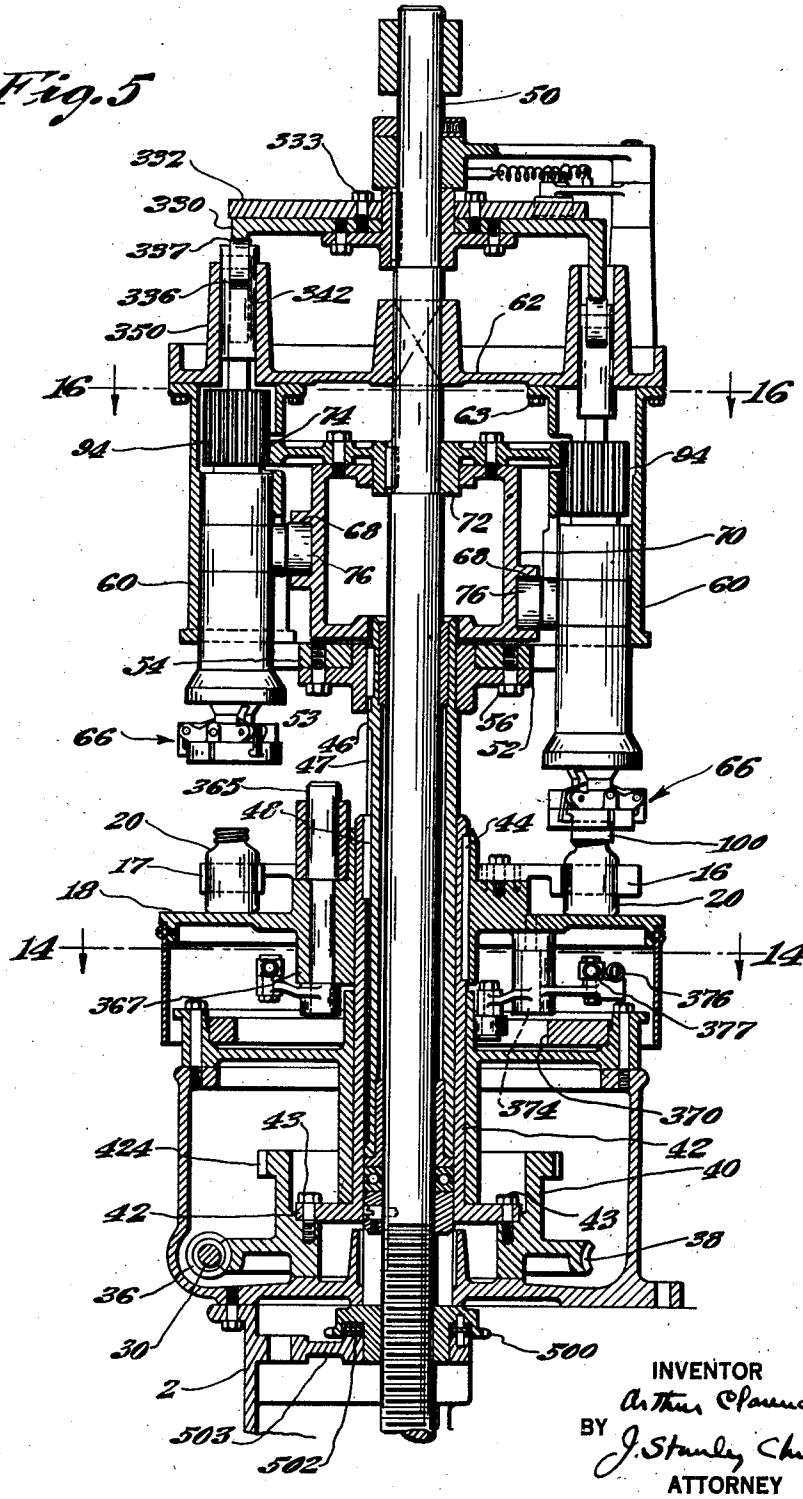
Fig. 5



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June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

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Fig. 6

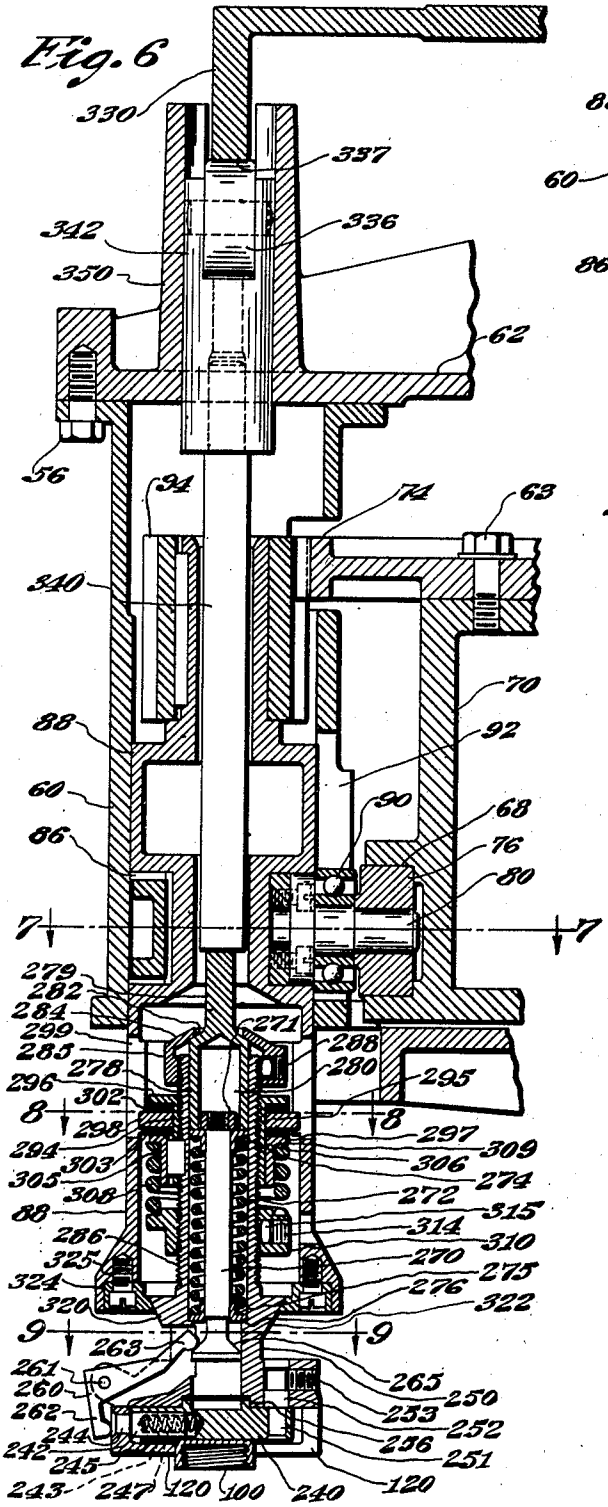


Fig. 7

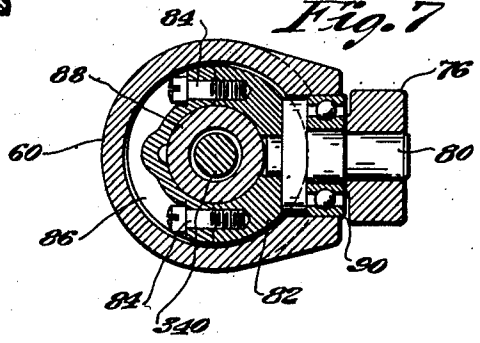


Fig. 8

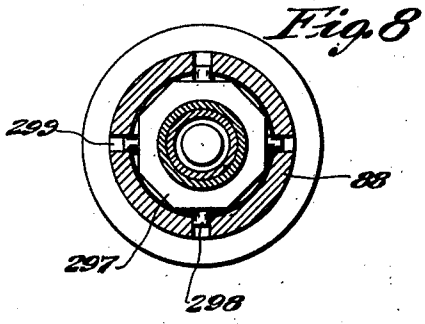


Fig. 9

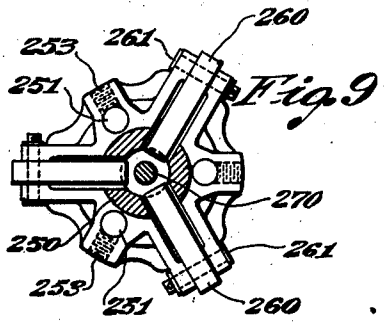
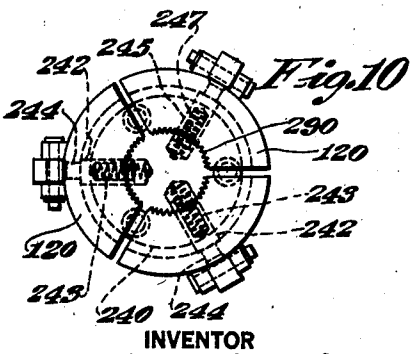


Fig. 10



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CLOSURE APPLYING MACHINE

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Fig. 11

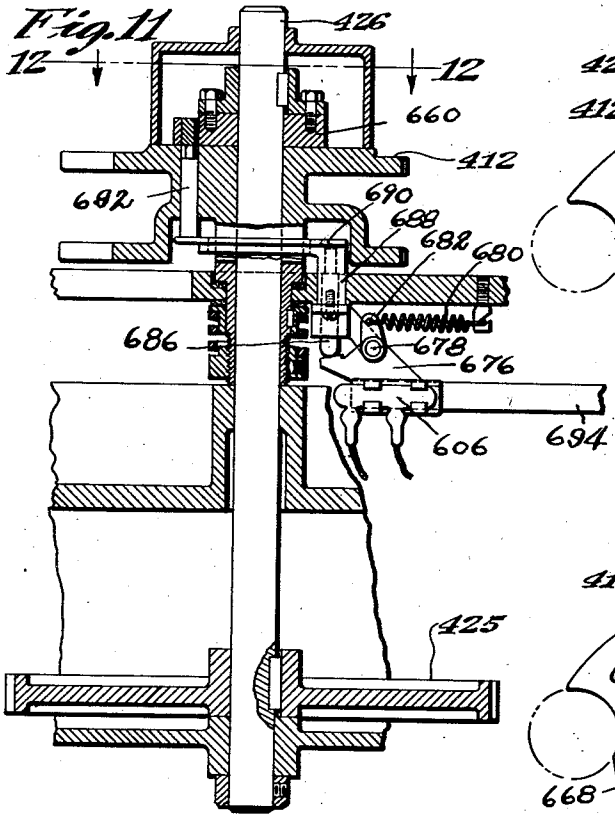

Fig. 12

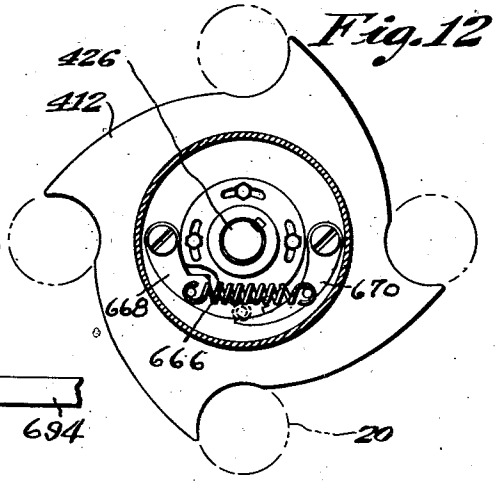

Fig. 13

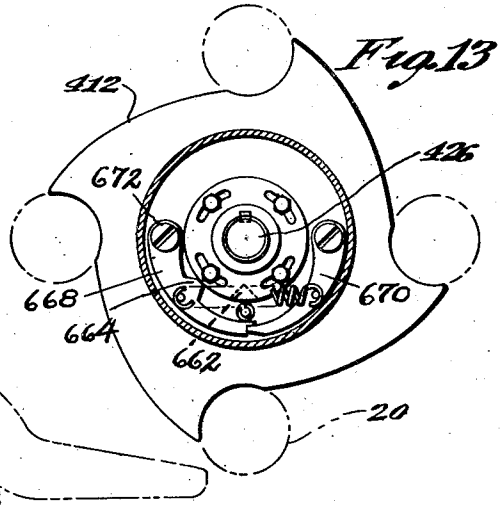

Fig. 14

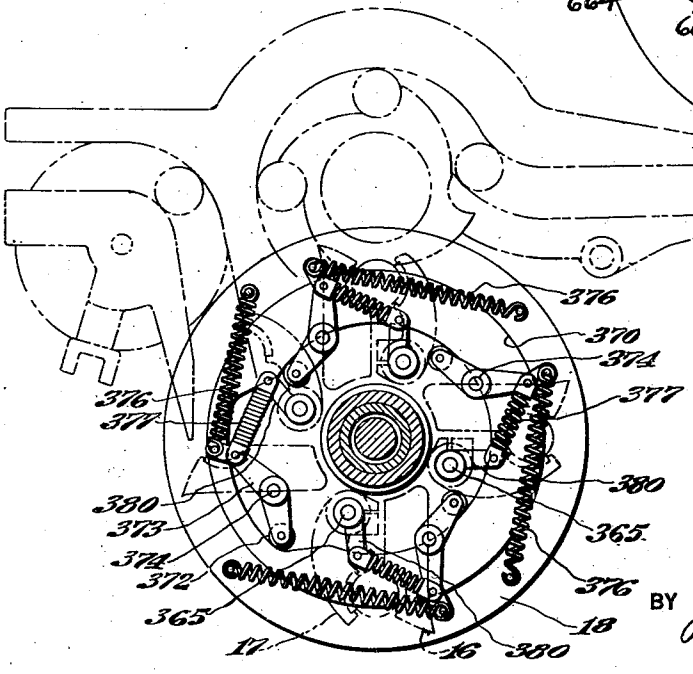

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Fig. 15

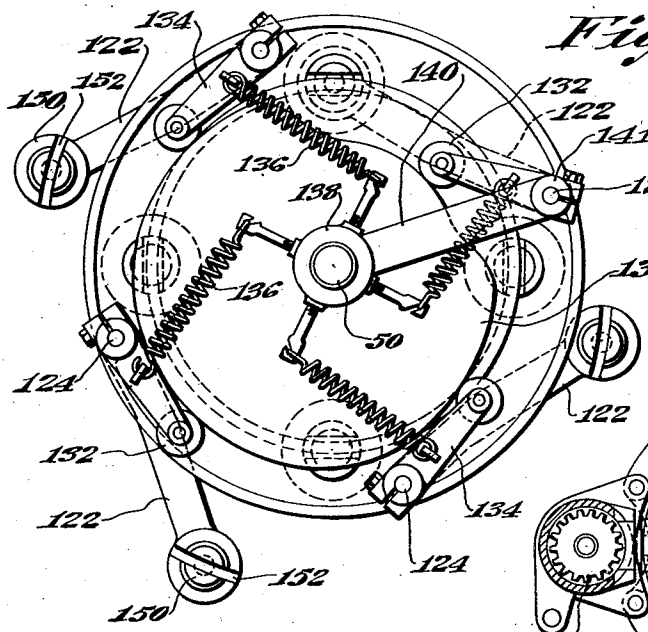


Fig. 16

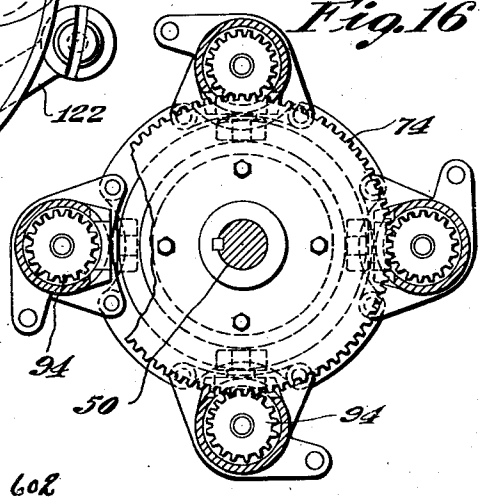
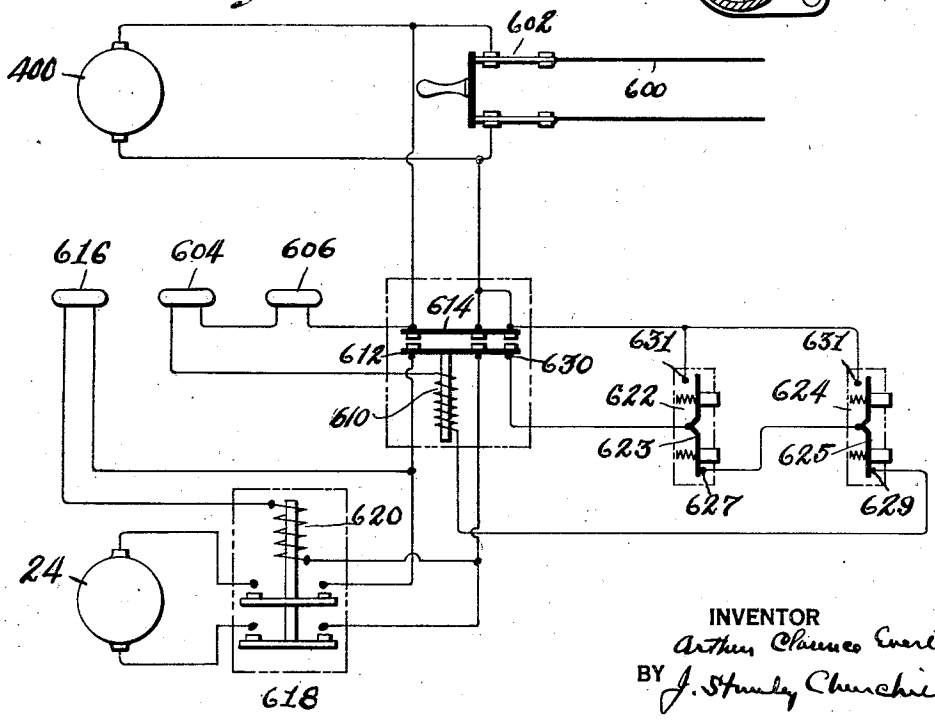


Fig. 17



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June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

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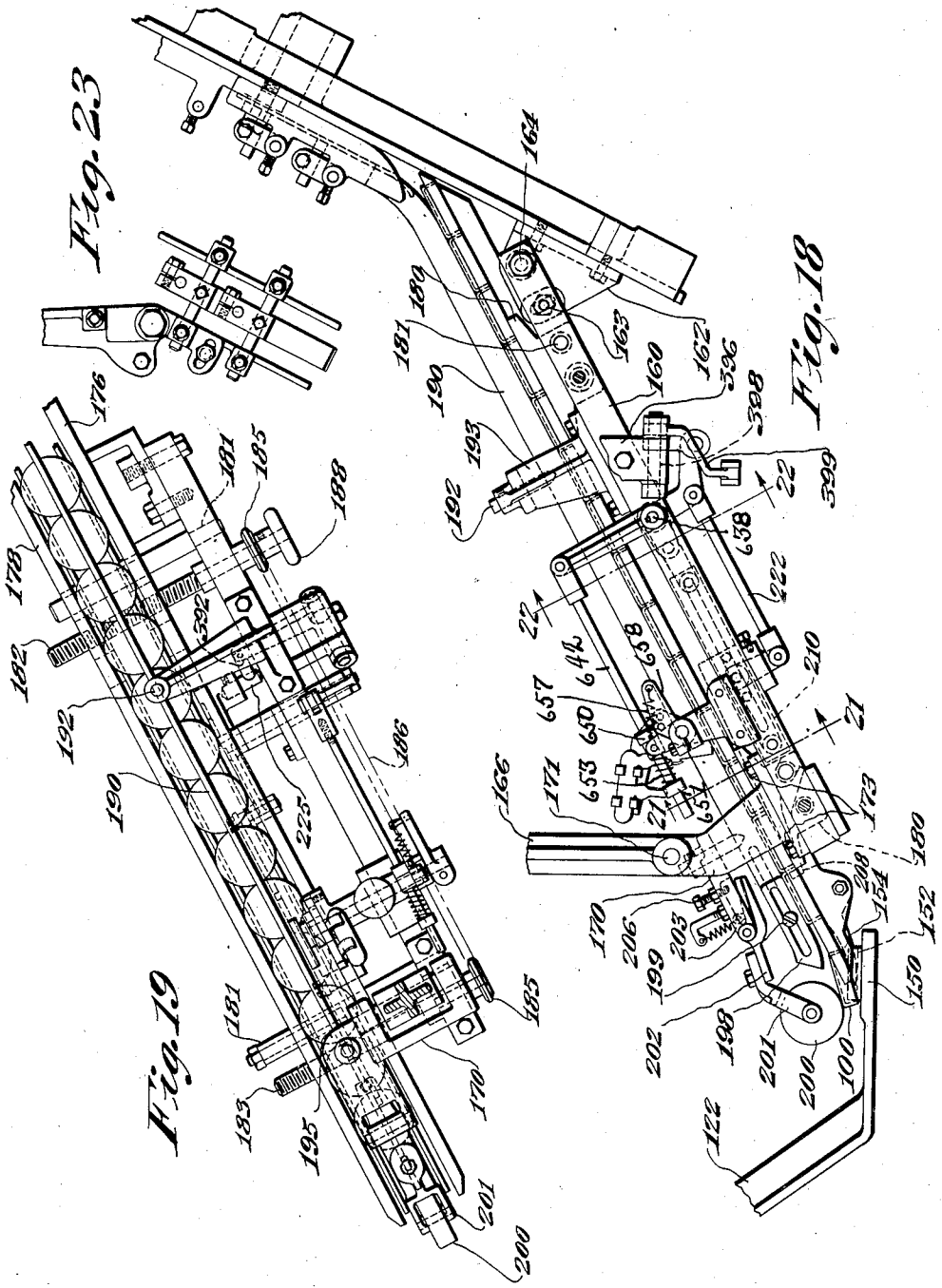

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June 1, 1937. A. C. EVERETT 2,082,048

CLOSURE APPLYING MACHINE

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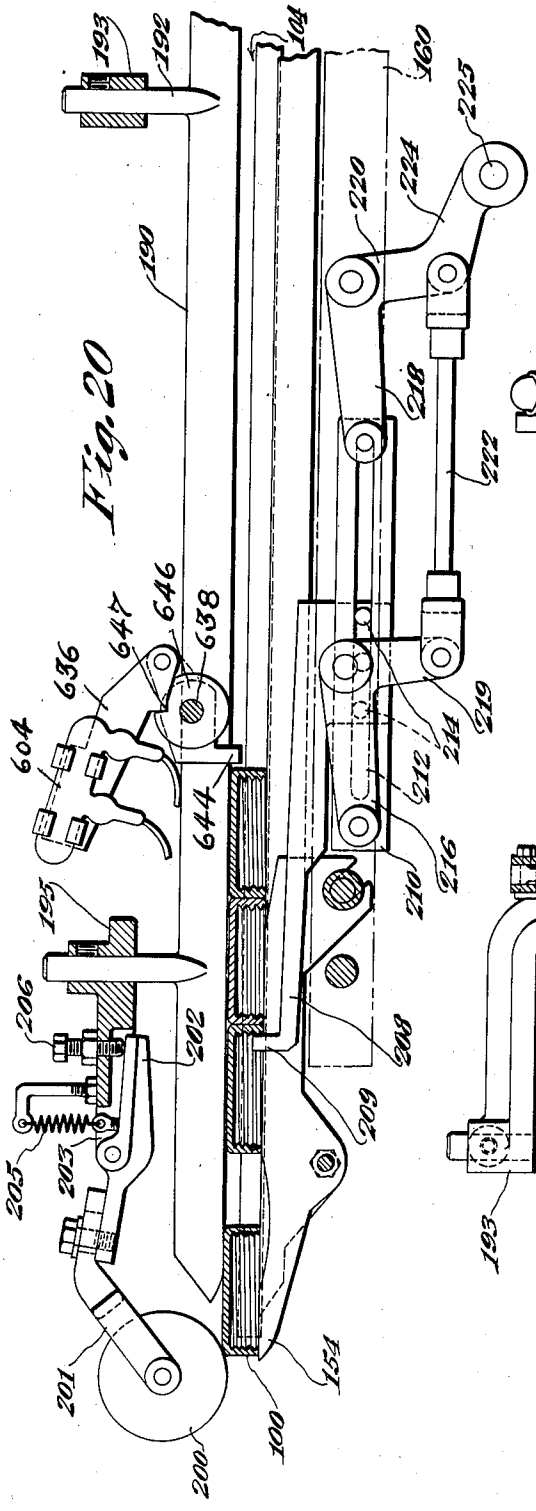

Fig. 20

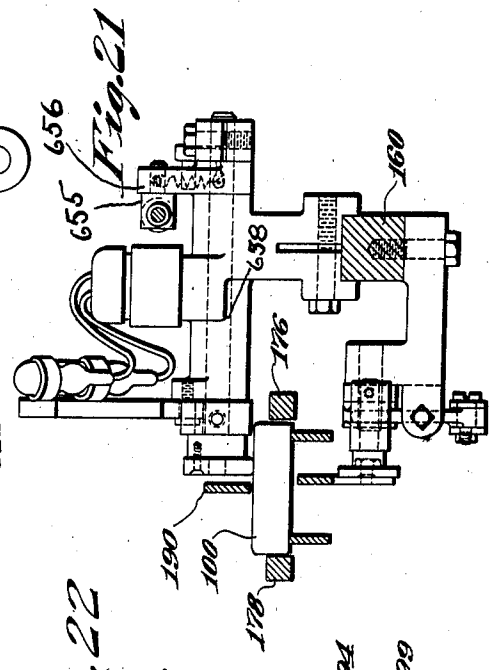

Fig. 21

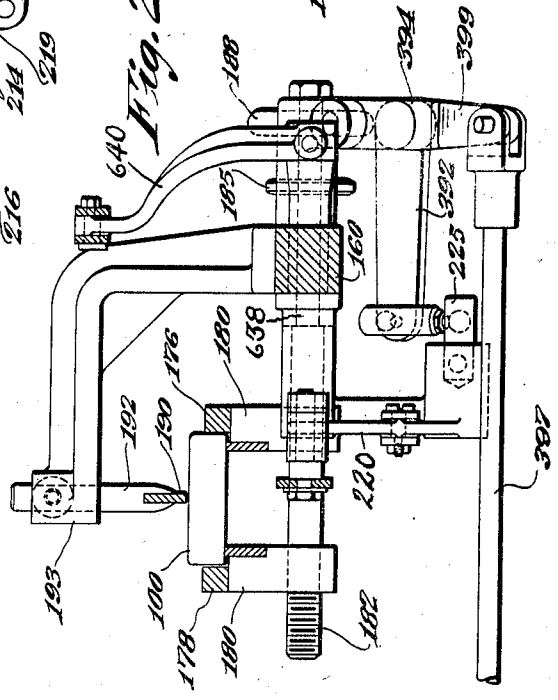

Fig. 22

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Patented June 1, 1937 2,082,048

UNITED STATES PATENT OFFICE

2,082,048

CLOSURE APPLYING MACHINE

Arthur Clarence Everett, Boston, Mass., assignor to Pneumatic Scale Corporation, Limited, Quincy, Mass., a corporation of Massachusetts

Application August 11, 1933, Serial No. 684,659

13 Claims. (Cl. 226—88.1)

This invention relates to a closure applying machine.

In general, the object of the invention is to provide a novel and improved closure applying machine capable of applying closures to successive containers in a rapid, efficient and economical manner.

A further and more specific object of the invention is to provide a novel and highly efficient machine for applying screw closures to containers and preferably to bottles, in a rapid and smooth manner adapted to minimize the spilling of the contents of the bottles or containers.

With these general objects in view and such others as may hereinafter appear, the invention consists in the closure applying machine and in the various structures, arrangements, and combinations of parts hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings the different features of the invention are illustrated as embodied in a machine for applying screw caps to bottles, wherein Fig. 1 is a front elevation of the machine; Fig. 2 is a sectional plan of the lower half of the machine shown in Fig. 1, taken on the line 2—2; Fig. 3 is a sectional plan taken on the line 3—3 of Fig. 1; Fig. 4 is a rear elevation of the lower half of the machine; Fig. 5 is a vertical section of the bottle supporting and closure applying mechanism; Fig. 6 is a vertical section of one of the closure applying mechanisms; Figs. 7, 8 and 9 are sectional views taken on the lines 7—7, 8—8 and 9—9, respectively, of Fig. 6; Fig. 10 is a bottom view of the closure holding member shown in Fig. 6; Fig. 11 is a vertical sectional view of the bottle feeding mechanism taken on the line 11—11 of Fig. 2; Fig. 12 is a sectional plan taken on the line 12—12 of Fig. 11; Fig. 13 is a similar view illustrating the clutch in a non-driving position; Fig. 14 is a sectional plan taken on the line 14—14 of Fig. 5, showing the bottle gripping mechanism; Fig. 15 is a plan view of the closure applying mechanism illustrated in Fig. 5; Fig. 16 is a sectional view taken on the line 16—16 of Fig. 5; Fig. 17 is a wiring diagram for control mechanism to be referred to; Fig. 18 is an elevation of the closure feeding device; Fig. 19 is a plan of the closure feeding device shown in Fig. 18; Fig. 20 is an enlarged sectional detail of the lower end of the closure feeding mechanism shown in Fig. 18; Fig. 21 is a sectional view taken on the line 21—21 of Fig. 18; Fig. 22 is a sectional view taken on the line 22—22 of Fig. 18; Fig. 23 is a detail in plan of the upper portion of the closure feeding mechanism shown in Fig. 18; and Fig. 24 is a sectional detail of control mechanism to be referred to.

The different features of the invention are embodied in a machine for applying screw closures to containers such as bottles, and in which the containers may be carried in succession into the machine by an incoming conveyor. Provision is made for transferring the containers in succession to successive gripping members forming a part of a revoluble closure applying mechanism having a plurality of closure applying devices adapted to effect the application of the closures to the containers held by the gripping members during the revoluble movement of both the gripping members and the closure applying devices. After the application of the closures to the containers, the latter are conveyed from the machine by a discharge conveyor. Provision is also made for controlling the operation of the machine in a novel and improved manner.

An important feature of the present invention resides in the provision of mechanism for transferring the closures to the revoluble closure applying devices in a manner such as to enable increased speed to be obtained in the application of the closures to the containers and to enable increased production to be obtained with the machine, and to this end provision is made for transferring the closures in succession from a closure feeding mechanism to said closure applying devices while the latter are revolved and preferably by mechanism arranged to move with said closure applying devices as the latter revolve so that the closure applying devices may be revolved at relatively high speed while ample opportunity is afforded for the successful transfer of the closures thereto. This feature of the invention enables the closure applying devices to be continuously revolved to impart smoothness to the operation of the machine.

Another feature of the invention resides in the provision of novel and superior mechanism for conveying successive containers into operative relation to the closure applying mechanism, which is designed to minimize the occurrence of interruption in the operation of the machine because of container breakage and also because of jams in the containers being thus fed into the machine. Other features of the invention will be hereinafter pointed out.

Referring now to the drawings and particularly to Figs. 1, 3 and 5, in general the illustrated machine is provided with a base 2 having mounted thereon a closure feeding mechanism generally

indicated at 10 and a revoluble head 12 upon which are mounted to revolve therewith a plurality of and, as herein shown, four individual closure applying devices 14. Each closure applying device is arranged to be individually rotated during the revolution of the head to effect the application of a closure 100 upon a container 20 held by the clamping members 16, 17 of a revoluble container supporting table 18. The clamping members are arranged to revolve with the closure applying devices, and provision is made for operating the clamping members to engage and release the containers at different stations in the revolution of the container supporting table, as will be described.

The revolution of the clamping jaws 16, 17 and the containers 20 held thereby, and also the revolution of the closure applying devices, is, as herein shown, effected by the driving motor 24 attached to a bracket 4 and arranged to drive a driving shaft 30 through pulleys 25, 26 and through a belt 28, as shown in Figs. 1 to 4. The driving shaft 30 is journalled in bearings 32 in a casing 34 secured to and supported by the base of the machine, and is provided with a worm 36 which cooperates with a worm wheel 38 formed on the lower portion of a cylindrical drum 40, see Fig. 5. A sleeve 42 is attached at its lower end to the inside of the cylindrical drum by the bolts 43, and at its upper end to a circular container supporting table 18 by a key 44. The clamping jaws 16, 17 above referred to for clamping the containers are mounted upon the revoluble table to rotate therewith. Provision is made for effecting the revolution of the cap applying devices 14 about a central supporting shaft 50 through connections between the cap applying devices and the sleeve 42, including, as shown in Fig. 5, an inner sleeve 46 having an elongated keyway 47 within which an elongated key 48 secured to the outer sleeve is slidably fitted whereby to effect rotation of the inner sleeve while permitting the vertical adjustment of the sleeve for the purpose of adjusting the vertical position of the closure applying devices to accommodate the machine to different heights of bottles or other closures.

The plurality of closure applying devices are mounted upon the top of the inner sleeve 46 by a supporting bracket 52 keyed by a key 53 to the upper end of the sleeve. The bracket 52 has attached to it a plate 54 which forms a supporting member for the individual capping head casings 60 and to which they are fastened at their lower ends by screws 56. The individual capping head casings 60 are at their upper ends secured to a ring 62 by screws 63 so that rotations of the inner sleeve are transmitted directly to the capping head casings and ring 62 to cause the casings to revolve about the stationary shaft 50, as will be apparent from an inspection of Fig. 5.

Each cap applying chuck indicated generally at 66 is mounted to slide vertically within a capping head casing 60 and a vertical motion is imparted to the individual chucks from a cam path 68 in a cylindrical drum 70, the upper end of which is fitted over a hub 72 of a gear 74 keyed to the stationary shaft 50, as illustrated in Fig. 5. Each capping chuck is provided with a cam roller 76 which rides in the cam path 68, and, as illustrated in Fig. 6, each cam roller 76 is rotatably mounted on a stud 80 secured in an annular split collar 82. The halves of the split collar 82 are held together by means of screws 84 in an annular groove 86 keyed in the chuck housing 88. An anti-friction bearing 90 on the stud 80 guides the stud in a vertical slot 92.

During the revolution of the cap applying chuck 66 about the shaft 50, each cap applying chuck is caused to rotate about its own axis in order to effect the application of the caps or closures to the containers, and as herein shown each cap applying chuck is provided with a pinion 94 keyed to the top of the chuck housing 88 and each pinion 94 meshes with a gear 74 on the shaft 50. The pinion 94 is made of sufficient length to permit the gear and pinion to remain in mesh in the various vertical positions into which the pinion and chuck housing are moved during the operation of the machine.

Referring now to Fig. 1, the cap feeding mechanism 10 in the illustrated machine may comprise any suitable or known form of cap feeding mechanism, and as herein shown includes a hopper 102 for storing a bulk supply of the caps 100 and from which successive caps are selected and delivered right side up through a feed chute 104, and the operating mechanism for selecting and delivering successive caps into the feed chute 104 may comprise that illustrated in the patent to R. N. Doble No. 1,801,721, to which reference may be made for a complete description thereof. Inasmuch as the details of the cap feeding mechanism and its mode of operation, except as may be hereinafter pointed out, comprise of themselves no part of the present invention, it is believed to be sufficient to state that the cap feeding mechanism is driven from a driving pulley 106 fast on the shaft of the motor 24 through a belt 108 and pulley 109 fast on a counter shaft 110. The counter shaft 110 is provided with a worm 112 which meshes with a worm wheel 114 secured upon the main operating shaft 116 of the cap feeding mechanism, so that during the operation of the machine successive caps are withdrawn from the supply hopper 102 and delivered into the chute 104 where they are transported by gravity to the delivery end of the chute in readiness to be picked off by a transferring device and conveyed to the individual chucks of the plurality of cap applying devices.

Provision is made as has been described for operating the clamping members of the revoluble container supporting table to engage and release the containers at the different stations in the revolution of the container supporting table, and as herein shown each set of clamping members comprises a stationary jaw 16 and a movable jaw 17. The stationary jaw is secured directly to the table and the movable jaw is fastened to the shaft 365 extending through a bearing 367 in the table. The movable jaw is arranged to be moved by a cam 370 through a cam roller 372 on a cam lever 373 pivoted on a pin 374 supported by the table 18. The cam lever is connected to the table 18 by a spring 376 and also by a yielding connecting rod 377 to an arm 380 secured on the lower end of the shaft 365. It will thus be seen that as the table 18 revolves, the cam roller 372 acting on the cam 370 causes the movable gripping jaw 17 to close and yieldingly hold the bottle in position to permit the closure applying operation to be performed during one portion of the revolution of the table and to release the bottles so that they may be discharged during another portion of the revolution of the table. Both the stationary jaw 16 and the movable jaw 17 are provided with yieldable clamping surfaces 200 of rubber or similar material to as-

sist in holding the bottle firmly during the closure applying operation.

Provision is made in the illustrated machine for transferring the caps 100 from the cap feeding mechanism to the jaws 120 of the cap applying devices while the latter are revolving in order that maximum production and speed may be obtained in the operation of the machine. Referring now to Figs. 1, 15 and 16, each closure applying device is provided with an oscillatory transferring arm 122 mounted to revolve about the central shaft 50 with the closure applying devices as the latter revolve in the manner above described, and provision is made for effecting the oscillations of the closure transferring arms at such a point in the revolution of the closure applying devices about the shaft 50 as to enable the successive caps or closures to be withdrawn from the end of the closure feeding chute 104 and to be transferred to a position where the closures may be engaged by the closure applying devices, as will be described. As herein shown, each transferring arm is secured upon the lower end of the shaft 124 having a lower bearing 125, and an upper bearing 126 formed on the ring 62. Each shaft is arranged to be oscillated by a cam 130 having cooperating with the face thereof cam rollers 132 upon levers secured to the upper end of the shafts 124, the cam rollers being held in contact with the cam face by means of the springs 136, as illustrated in Fig. 15. The springs 136 are connected to a hub 138 supported upon and free to rotate about the shaft 50 and having an integral arm 140 connected to the upper end of one of the shafts 124 by a free bearing 141, thus insuring the revoluble movement of the hub and springs with the revolution of the closure applying mechanism about the shaft 50 and enabling the transferring arms to be successively oscillated by the active portions of the cam to effect the transferring operation, as will be described, without interfering with the continuous revolution of the closure applying devices.

As herein shown, each transferring arm is provided with a hub 150 having a slot 152 therein. As the transferring arm is oscillated by the cam at the proper time in the revolution of the closure applying devices, the hub 150 upon the arm is caused to pass under the endmost cap in the manner illustrated in Fig. 18 to deposit the cap 100 upon the hub 150, and during this operation a supporting finger 154 forming a part of the cap feeding mechanism passes through the slot in the hub to assist in depositing the cap upon the hub. After the cap has been thus deposited, and as the revolution of the transferring arm continues about the shaft 50, the operating cam 130 permits the springs 136 to swing the transferring arm radially inwardly to a position directly beneath and in alignment with the chuck 66.

In this manner the transfer of successive closures or caps to the revoluble closure applying devices is effected during the revolution of the latter, enabling the machine to operate at much higher speeds and with more smoothness and continuity of operation than has heretofore been possible with machines of the intermittent type.

Referring now to Figs. 1, 18, 19, 20 and 23, the cap feeding chute 132 and associated parts of the cap feeding mechanism may, as above stated, comprise those illustrated in the patent to R. N. Doble above referred to and to which reference may be made. The chute 104 is supported upon a bar 160, one end of which is attached to the frame of the cap feeding device by means of a bracket 162 and clamping screws 163, 164. The lower end of the bar 160 is supported by an arm 166, the top end of which is fastened at the outer end of an arm 168 secured on the top of the shaft 50. The lower end of the arm 166 is attached to a bracket 170 by a pin 171, and the bracket 170 is attached to the bar 160 by screws 173, as shown in Fig. 18. The closures are guided in their movement down the chute between an inner rail 176 and an outer rail 178 supported on brackets 180, and the latter are slidably supported on pins 181 and screws 182, 183 having right and left threads. The screws 182, 183 are provided with sprockets 185 connected by a chain 186, and the screws 182, 183 are further provided with a hand wheel 188 for simultaneously turning both screws to maintain the guide rails in parallel relation during adjustment. The chute is also provided with a top guide rail 190 positioned centrally over the top of the caps or closures to keep them from lifting. The top of the guide rail is supported to be capable of adjustment for different heights of caps by a pin 192 supported by a bracket 193 secured to the bar 160. The second end of the top guide rail 190 is supported by a laterally projecting arm 195 extending from the bracket 170. On the lower end of the top guide rail 190 there is provided an adjustable extension 198 secured by a screw 199 to enable the lower end of the rail to be lengthened or shortened for different types of caps or closures.

In order to hold the cap or closure during its transfer from the end of the chute 104 to the transferring arm 122, a roller 200 is provided to engage the top of the endmost cap in the manner illustrated in Fig. 18. As herein shown, the roller 200 is mounted in a fork 201 attached to a rocking lever 202 pivotally mounted on an arm 203 on the bracket 170. The roller 200 is urged downwardly with a slight pressure by a spring 205 and a suitable stop screw 206 is provided to adjustably limit the downward movement of the roller 200.

In the operation of the machine, as the caps or closures 100 slide down the chute 104, provision is made for holding the same in readiness to be delivered in timed relation to the remaining operations of the machine and, as herein shown, a finger 208 having an upturned end 209 is arranged to be extended up into the end cap of the line, as shown in Fig. 20, to hold the same from sliding down the chute. The finger 208 is adjustably fastened to a link 210 through a slot 212 in the link and screws 214 extended through the slot, to enable the finger to be properly positioned for any desired size of cap. The link 210 is mounted to have a motion such that the finger 208 moves with substantially a straight line motion and, as herein shown, the link is pivotally supported at its ends by arms 216, 218 of the bell crank levers 219, 220. The second arms of these bell crank levers are pivotally connected together by a connecting rod 222. An extension 224 of the bell crank arm 220 is connected by a swivel connection 225 to one arm 392 of a bell crank 394 pivotally mounted in the bracket 396 fast on the bar 160 by means of the pin 398. The second arm 399 of the bell crank is pivotally connected by means of a connecting rod 397 to the end of an arm 395 by a swivel connection 393, as best shown in Fig. 4. The arm 395 is fast on a vertical rod 391 which is mounted in the bracket 389 fastened to a portion of the frame of the machine by screws 387. A rod 391 is normally rocked by a cam 450 fast on the shaft 417 through the arm 452 which is

fast on the rod 391 and is provided on its outer end with a roll 454 cooperating with the cam 450. A spring 456 fastened at one end to the frame of the machine, and at the other end to the arm 452, yieldingly holds the cam roll 454 against the cam 450. A latching arm 458 fast on the rod 391 is provided with a notch 460 and cooperates with a pawl 462 fast on the rod 464 and is normally held out of engagement with the latch 458 when the containers are being normally fed to the machine. Any failure in the feeding of the containers to the machine causes the pawl 462 to engage the latch member 458 and prevent the feeding of a cap by the cap feed mechanism.

A finger 466, adjustably attached to the end of the arm 468 which is fast to the rod 464, is held against the incoming containers, as shown in Fig. 2, by the spring 470. One end of the spring is fast to the framework of the machine and the other end attached to the arm 468 by the pin 472. It will thus be observed that if there is no container in position to be picked up by the spider 412, the feeler finger 466 will swing inwardly and cause the pawl 462 to latch with the latch member 458, preventing the feeding of a cap.

The cam 450 is mounted on the shaft 417 and is arranged to rotate in timed relation to the container feeding table 18 through the gear train 424, 425, 435, and 436 (see Fig. 3). The gears 435 and 436 preferably have a ratio of 2 to 1, and, as illustrated, the cam 450 is provided with two low spots so that for each ¼ revolution of the table 18, the rod 391 is rocked to release one cap.

Referring to Figs. 6, 8, 9, and 10, the gripping chuck of each closure applying device comprises a chuck housing 88 having cap gripping mechanism supported thereon at its lower end and having provision for opening and closing the jaws of the chuck to receive a cap and screw it on to the threaded neck of a bottle or other container. The cap is gripped by jaws 120 mounted to slide radially of a disc 240, each jaw being provided with a pin 242 having a drilled out portion 243 in one end, and having the other end riveted to the jaw as at 244. The pin 242 slidably fits in a hole 245 bored radially in the disc 240 and a spring 247 normally tends to keep the jaws 120 in open position. One end of the spring bears in the bottom of the hole of the pin 242 and the other end in the bottom of the hole in the disc 240. The disc 240 is attached to the bottom of a spindle 250 by means of pins 251, one end of the pins being rigidly fastened to the disc 240 and the other end projecting through holes 252 and held in position by set screws 253. A circular shoulder 256 is provided on the disc 240 which fits snugly in a recess bored in the spindle 250 and centralizes the disc on the end of the spindle. By this arrangement, the jaws are made readily changeable for varying diameters of caps or closures by merely loosening the set screws 253, removing the disc 240 with the jaws thereon, and replacing the jaws 120 for any desired size of cap.

A plurality of clutch fingers 260 are pivotally mounted on the lower enlarged portion of the spindle 250 by means of pins 261, as best shown in Fig. 9. The lower arm 262 of each clutch finger 260 bears against the outside of one of the jaws 120 and the other arm 263 bears on a conical surface 265 of the spindle 270. The upward movement of the spindle 270 operates to move the jaws 120 inwardly to grip and hold the closure or cap, while the downward movement of the spindle 270 allows the spring 247 to open the jaws 120. The upper end of the spindle 270 is threaded and provided with a nut 271 for holding a spring 272 under compression. A spring collar 274 is provided between the nut 271 and the top of the spring 272 to centralize the spring and act as a washer for the nut 271. A similar collar 275 is provided at the lower end and rests upon a shoulder 276 in the spindle 250, so that the spring 272 normally has a tendency to raise the spindle 270. The height to which the spindle 270 can be raised is determined by a spindle comprising a large diameter 278 and a small diameter 279, and the large diameter 278 is provided with a hole 280 in which the nut 271 and spindle 270 may be free to move up and down.

A tapered shoulder portion 282 is provided against which the flange 284 of a threaded collar 285 bears and the latter is screwed onto the threads 286 of the spindle 250. A set screw 288 is provided to hold the collar 285 in the desired position of adjustment. The adjustment of the nut 271 determines the vertical position of the spindle 270 and particularly the conical surface 265 and hence limits the inward position of the chuck jaws 120. It will therefore be observed that if for any reason a closure or cap is not fed to the capping chuck, the serrated teeth 290 of the jaws 120 would, unless prevented by the mechanism described, close up to such a small diameter as to break particles of glass from the bottle top or to break the bottle itself, thus scattering broken glass and the contents of the bottle throughout the machine and interfering with the operation thereof.

The cap gripping portion of the chuck is driven through an adjustable friction device capable of being adjusted to slip when the cap has been screwed on the bottle with any desired degree of tightness and comprises a flanged nut 294 having threads 295 which cooperate with threads 286 on the spindle 250 to hold it in proper position. A collar 297 having pins 298 fastened therein projecting into elongated slots 299 in the chuck housing 88 forms the positive driving element of the friction drive for the chuck. The pins 298 are free to slide vertically in the elongated slots 299 but cause the collar 297 to be rotated with the chuck housing 88. A friction washer 302 made of fibrous frictional material is provided between the collar 297 and the flange 296 of the flanged nut 294. A similar friction washer 303 is provided between the collar 297 and a flanged collar 305. The flanged collar 305 together with the friction washers and collar 297 are slidably mounted on the hub 306 of the flanged collar 294. A compression spring 308, one end of which encircles the flanged collar 305, bears against the flange 309 and the other end of the spring is supported by an adjustable nut 310 screwed onto the threaded portion 286 of the spindle 250. A set screw 314 is provided to lock a plug 315 in position when adjustment is made to give the proper friction between the frictional washers 302, 303 and the collar 297. It will thus be seen that by adjusting the nut 310, the caps may be screwed on the bottle with any desired degree of tightness.

During the operation of the machine when the top of a bottle comes in contact with a cap held in the jaws of the chuck, provision is made for permitting the gripping mechanism to move vertically in the chuck housing 88 so that this

portion of the chuck will have a universal floating centralizing action to more readily apply the cap to the bottle, particularly where there is any irregularity either in the cap or in the bottle, which would otherwise tend to throw the center of the cap out of line with the center of the neck of the bottle. This is accomplished by providing a conical surface 320 on the spindle 250 normally supported by a corresponding conical surface 322 on a collar 324 fastened to the bottom of the chuck housing 88 by the screws 325, as shown in Fig. 6.

To open and close the chuck jaws, a stationary circular cam 330 is fastened to the disc 332 by screws 333, which disc is keyed to the stationary vertical shaft 50. A cam roller 336 cooperates with the face 337 of the cam 330 as the cap head casings 60 revolve about the shaft 50, thus imparting a vertical motion to the spindle 340. The lower end of the spindle 340 is slidably guided in a hole drilled centrally in the chuck housing 88, and the upper end is rigidly fastened to a cylindrical member 342 which supports the cam roll 336 and is free to slide in the bearing 350 formed on the ring 62. As the caping heads revolve about the shaft 50, the cam roller 336 cooperating with the cam face 337 operates to press down the spindle 279, compressing the spring 272 and thus lowering the conical surface 265 allowing the chuck jaws 120 to open to release the cap after it has been screwed onto the bottle. When the capping head reaches the cap receiving position, the spindle 340 is raised and allows the chuck jaws 120 to grip and hold the cap.

In the illustrated machine the bottles or other containers are carried into the machine on a conveyor 402 herein shown as comprising parallel chains running over suitable sprockets including the driven sprockets 404 on a shaft 406 driven by a motor 400 through a speed reducing device 401 of any usual or preferred construction. As the containers leave the incoming conveyor 402, provision is made for delivering the containers to the clamping jaws 16, 17 as the latter are moved into a receiving position such as is illustrated in Fig. 2. As herein shown, the containers are delivered onto a rotating disc 410 and thence conveyed by a toothed rotary member 412 to a position to be delivered into the clamping jaws, as shown. The rotating disc 410 is arranged to be rotated at a higher speed than either the incoming conveyor or the toothed rotary member 412 so as to accelerate the movement of the first few containers in the line of containers being fed by the incoming conveyor, to thereby insure that the first container in the line will have been advanced into a position to be properly engaged by the advancing tooth of the toothed member 412 and to minimize the tendency of the tooth striking the container before the latter has been properly advanced, thereby preventing a jam which might otherwise occur. After the toothed member has properly engaged the end container, the latter is carried around with the toothed member and between it and the guide rail 413 into a position where it is delivered to the clamping jaws which have previously been opened ready to receive it. The clamping jaws 16, 17 are then arranged to be closed as above described and the container is moved through successive stations where, as previously described, the closure is screwed thereon until the jaws with the container arrive at the fourth station of the machine. Provision is made for opening the jaws at this station and after the jaws have been opened, the stationary jaw 16 during the next step in the rotation of the machine pushes the container in between the guide members 415 into a position where it rests upon a rotary conveying disc 418. The disc is arranged to be driven at accelerated speed compared with the rotations of both the jaws and toothed wheel and assists in rapidly conveying the containers onto the discharge conveyor 420. The latter may comprise a belt or any other usual or preferred form of conveyor for continuously removing the completed containers from the machine.

Provision is made for driving both the rotary discs 410, 418, the toothed member 412, and the cam shaft 417 from the gear 424 cut upon the drum 40 and, as shown in Fig. 3, the gear 424 is arranged to mesh with a similar gear 425 upon a vertical shaft 426 upon which the toothed member 412 is mounted. The gear 425 is arranged to mesh with gears 427, 429 upon the vertical shafts 428, 430 upon which the rotating discs 410, 418 are mounted. The cam shaft is driven through a gear 435 mounted upon the vertical shaft 426 and a smaller gear 436 mounted upon the cam shaft 417, as shown.

Provision is made, as has been described, for permitting the vertical adjustment of the closure applying devices and their supporting shaft 50, and as illustrated in Fig. 1, provision is also made for effecting vertical adjustment of the entire cap feeding mechanism. As herein shown, the lower end of the shaft 50 is threaded and screws through a threaded hole in a sprocket 500 adapted to be turned by the revolution of the handle 504 through connections including the worm 506, worm wheel 508, sprocket 510 and chain 512 running around both the sprockets 510 and the sprockets 500. A suitable friction bearing 502 is provided between the sprocket and its supporting bracket 503 in order to frictionally retain the shaft 50 and closure applying devices supported thereon in all of its adjusted positions. In order to effect the simultaneous adjustment of the entire cap feeding mechanism with the vertical adjustment of the closure applying devices, the entire cap feeding mechanism is mounted upon a bracket 514 arranged to slide in suitable guides in an upstanding bracket 516 forming a part of the machine frame. The vertical screw shaft 518 on which both the worm wheel 508 and sprocket 510 are mounted is arranged to screw through a threaded hole in a portion of the bracket 514, as clearly shown in Fig. 1.

Referring now to Fig. 17, the essentials of the electrical connections for controlling the operation of the machine are diagrammatically illustrated in the wiring diagram therein shown. The electrical power is derived from the supply line 600 being controlled by the main switch 602. The driving motor 400 is directly connected so that when the switch 602 is thrown into circuit closing position, the driving motor is started and operates through the connections described to continuously operate the incoming conveyor.

Provision is made for controlling the operation of the machine in response to the development and abnormal condition of either or both of the supply of closures to the machine, and the supply of containers to the closure applying mechanism of the machine, and as herein shown two switch members 604, 606 are arranged to be actuated to open the circuit, as will be described,

and controlling the operation of the main driving motor 24 to stop the machine in the event of the development of an abnormal condition in either the supply of closures or the supply of containers to the closure applying mechanism, as will be described. As herein shown, the two switch members 604, 606 are connected in series with the armature 610 of a magnetic switch of any usual or preferred construction designed so that when both switch members 604, 606 are closed, the armature 610 will effect movement of the switch member 612 into contact with the contact points of a second switch member 614 to thereby close the main circuit leading from the supply line 600 to the motor 24.

Provision is preferably made, however, for opening or closing the circuit from the switch members 612, 614 to the motor 24 at an intermediate point in accordance with the presence or absence of a supply of containers upon the incoming conveyor, and for this purpose an additional switch member 616 is arranged to be operated in response to the presence or absence of such containers upon the incoming conveyor by mechanism to be described to open and close the circuit to the motor 24 by a magnetic relay switch indicated generally at 618 of any usual or preferred construction, the armature 620 of which is connected in series with the switch 616. It will therefore be apparent that when the switch members 612, 614 are closed to the motor 24, the motor 24 will start only when the supply of containers is present on the incoming conveyor and when the switch 616 has been closed by the control switch 616.

Provision is also preferably made for preventing the initiation of the machine following the discontinuance in the operation thereof as a result of opening of either of the switches 604, 606, or in other words, when an abnormal condition has developed in either the supply of closures to the machine or the supply of containers to the closure applying mechanism, and as herein shown two push-button switches 622, 624 of any usual or preferred construction and involving spring-actuated pivoted switch members 623, 625 are arranged to close the circuit at the contacts 627, 629 leading from the control switches 604, 606 through the armature 610 to the terminal 630, so that whenever the switch members 612, 614 are not in contact the armature 610 will not be energized upon the closing of the control switches 604, 606. When the switch members 625, 627 are manually operated to close the circuits at the contacts 631, 633, the armature 610 is energized directly from the lines around the switch members 612, 614, as shown, thus causing the switch members 612, 614 to be closed and enabling the motor 24 to be operated provided the switch member 616 has been moved in circuit closing position in response to the supply of containers upon the incoming conveyor.

Referring now to Fig. 20, the control switch 604 may and preferably will comprise a standard construction of mercury switch adapted to be operated to open and close the circuit when tilted into different positions, and as therein illustrated the switch 604 is mounted fast upon an arm 636.

Referring now to Figs. 18 through 23 as previously described, during the operation of the closure feeding mechanism the bell crank 220 is oscillated, and as illustrated in Figs. 18, 19 and 22, the bell crank is fast upon the end of a shaft 638 on the second end of which an upright arm 640 is secured. The arm 640 has fastened to it a connecting rod 642 arranged to slide in suitable bearings so that during the operation of the mechanism the rod 642 is reciprocated back and forth. The movements of the reciprocatory rod 642 are utilized to effect the movement of the feeler member 644 into engagement with the caps being fed through the chute 104, and during normal operation the feeler member 644 is restrained from movement by engagement with the top of the caps. The feeler 644 is secured to the shaft 638 and a cam member 646 is also secured to the shaft and arranged to cooperate with a dog 647 on the arm 636 to hold the arm in circuit closing position, such as is illustrated in Fig. 18, during the oscillation of the cam 646 and the feeler 644 until such time as either the failure occurs in the supply of caps being fed beneath the feeler or a cap is presented in an inverted position, in either of which events the feeler 644 will be rocked into the position shown in Fig. 20 and permit the dog to fall into a recess in the cam 646, thus rocking the arm 636 to cause the switch 604 to be moved into open circuit position. The parts remain in their locked positions with the dog 647 in the recess in the cam 646 until the parts are restored by an operator. The connections between the rod 642 and the shaft 638 include two collars 650, 651 secured to the rod and a spring 653 interposed between one of the collars 651 and a swivel block 655 carried by an arm 656 free on the shaft 638. The movement of the rod 642 in one direction causes the collar 650 to engage and move the block 655 on the arm 656 while the movement of the rod 652 in the reverse direction effects movement of the arm to the block 651 and the yieldable spring 653. The arm 656 is yieldably connected by a second spring 657 to a second arm 658 clamped on the end of the shaft 638, and through the connections described the reciprocations of the rod 642 are transmitted to the shaft 638 and operate to rock the feeler 644 and the cam 646 back and forth, the spring 657 yielding whenever the feeler engages the top of the cap. From the description thus far it will be observed that the control switch 604 is opened whenever an abnormal condition occurs in the supply of closures to the machine.

Referring now to Fig. 11, provision is made for disconnecting the toothed member 412 from its driving shaft 426 in the event that the rotation of the toothed member 412 is abnormally resistant. Such a condition obtains when a container becomes jammed between the toothed member and its guide rail 413, and as illustrated in Figs. 11, 12 and 13, this result is secured by a clutch including a disc 660 keyed to the shaft 426 and provided with a recess 662 into which a detent 664 fits, being yieldingly held in such position by a spring 666. The detent is formed upon one of two arms 668, 670, said arms being connected together by the spring 666 and each arm being secured by screws 672 to the face of the toothed member 412. When the rotations of the toothed member 412 are abnormally resistant, then the walls of the recess 662 operate to cam out the arms 668 and 670 from the position illustrated in Fig. 12 to that illustrated in Fig. 13, and in such position the end of the arm 670 falls into a notch in the end of the arm 668, thus locking the parts in their disengaged position and holding the detent 664 out of the recess 662, so that until such time as an operator restores the

parts to the position shown in Fig. 12, further rotation of the toothed member 412 will be prevented. This insures that the operator will cure the abnormal condition in the delivery of the containers by the toothed member and prevents the toothed member breaking the containers and distributing the glass if they be bottles throughout the machine. In addition, it insures against breaking other parts of the machine by undue strains.

Provision is also made for operating the control switch 606, see Fig. 17, when the rotation of the toothed member 412 is interposed in the manner just described, and for this purpose the control switch 606 may comprise the standard mercury tube switch mounted upon an arm 676 pivoted at 678 and normally urged to oscillate in a clockwise direction by a coiled spring 680, one end of which is secured to an arm 682, as shown in Fig. 11. The arm 676 is provided with a projecting portion 684 adapted to engage the end of a pin 686 forming a part of a hub 688 depending from a circular plate 690. The plate 690 is mounted to be capable of vertical movement and is arranged to support a pin 692 floatingly received within the vertical hole in the hub of the toothed member 412 to be capable of movement vertically upwardly through the hole when permitted to so move by the position of the arm 668. By reference to Figs. 11, 12 and 13, it will be apparent that when the clutch is disengaged in the manner above described and the arms 668, 670 are moved into the position shown in Fig. 13, opportunity is afforded for the pin to be projected upwardly by the tension in the spring 680, thereby permitting the mercury switch 606 to be rocked to break the circuit shown in Fig. 17, and to operate in a manner similar to the mercury switch 604. During the normal operation of the machine, the pin 692 is held down against the tension in the spring 680 by the arm 668, the parts being in the position shown in Fig. 12. An operating handle 694 is provided in order to enable an operator to restore the various parts to the position shown in Fig. 11 against the tension in the spring 680 following interruption in the rotation of the toothed member 412.

Referring again to Fig. 17, the control switch 616 above referred to may and preferably will comprise the standard mercury tube switch, and, as illustrated in Figs. 4 and 24, the mercury tube switch 616 is mounted upon a bracket 800 clamped to a shaft 802 having a suitable bearing in the bracket 803 and having upon its end a bevel gear 804 which meshes with a corresponding bevel gear 806 on the lower end of a vertical shaft 808 to which a feeler 810 is directly clamped to oscillate as the shaft is oscillated. The shaft 802 is provided with a counter weight 812 arranged as illustrated in Fig. 4, tending through the connections described to rock the shaft 808 so as to hold the feeler 810 against the line of incoming containers, and when failure occurs in the supply of containers to effect inward movement of the feeler across the incoming conveyor. When the failure of the containers occurs, the movement of the shaft 802 under the influence of the counterweight 812 operates to oscillate the switch 616 to open the circuit previously referred to so as to interrupt the circuit to the driving motor 24, as above described.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:—

1. In a closure applying machine, in combination, a revoluble closure applying device including a rotatable chuck for engaging and holding a screw closure to effect the application thereof to a container upon rotation of the chuck, closure feeding means and with relation to which said closure applying device is arranged to revolve, and revoluble means for transferring a closure from the closure feeding means to the closure applying device, said revoluble transferring means having provision whereby the closure being transferred is revolved with the closure applying device during the period when the closure is being engaged by the closure applying device.

2. In a closure applying machine, in combination, a revoluble closure applying device including a rotatable chuck for engaging and holding a screw closure to effect the application thereof to a container upon rotation of the chuck, closure feeding means and with relation to which said closure applying device is arranged to revolve, and closure transferring means arranged to revolve with the closure applying device and capable of general radial movement with relation thereto whereby substantially all relative movement between the closure applying device and closure transferring means is eliminated while the closure is being engaged by the chuck.

3. In a closure applying machine, in combination, a plurality of revoluble closure applying devices including rotatable chucks, closure feeding means and with relation to which said closure applying device is arranged to revolve, and a plurality of closure transferring means, one for each closure applying device, said closure transferring devices being arranged to revolve with the closure applying devices and capable of movement toward and from the closure applying devices to effect the transfer of closures thereto in such manner as to eliminate substantially all relative movement between the closures and chucks while the chuck is engaging the closure.

4. The combination in a closure applying machine, with closure applying mechanism capable of applying a screw closure to a container, of closure feeding mechanism, container feeding mechanism, and control mechanism including detecting means cooperating with the two last mentioned means for stopping the machine in the event of failure in the supply of either a closure or a container.

5. The combination in a closure applying machine, with closure applying mechanism, of closure feeding mechanism, container feeding mechanism, and control mechanism including a circuit and detecting means cooperating with one of the two last mentioned means for stopping the machine in the event of failure in the supply of either a closure or a container, a manual operated circuit closing device, and means for preventing the initiation of the operation of the machine until such defective condition has been cured and until the circuit has been closed by the manual operation of said device.

6. In a machine for applying closures to containers, in combination, conveying means for the containers, closure feeding means, operating means for the machine, a control device for stopping the machine in the event of an ab-

normal condition in the operation of the cap feeding means, a second control device for stopping the machine in the event of an abnormal condition in the conveyance of the containers, and a manual control device for controlling the operation of the machine operatively connected with the foregoing control devices to prevent the machine being restarted until operation of the manual control device following a discontinuance in the operation of the machine by either of the other control devices.

7. In a machine for applying closures to containers, in combination, closure feeding means, container feeding means, means for controlling the operation of the container feeding means upon the development of an abnormal condition therein, means for controlling the operation of the machine in response to the closure feeding means, and a manually operated electrical control device operatively connected with the foregoing means to prevent restarting of the machine after it has been stopped by the operation of either of the aforesaid control devices.

8. In a machine for applying closures to containers, in combination, closure feeding means, means for operating the machine including a motor, a plurality of control devices for interrupting the supply of current to the motor, one control device being rendered operative by abnormal conditions in the closure feeding means, the second control device being rendered operative by an abnormal condition in the feeding of the containers, and a manually operated switch electrically connected to the foregoing control devices to prevent the restarting of the machine after it has been stopped by the operation of either of the foregoing control devices.

9. In a machine for applying closures to containers, in combination, closure feeding means, means for operating the machine including a motor, a plurality of control devices for interrupting the supply of current to the motor, one control device being rendered operative by abnormal conditions in the closure feeding means, the second control device being rendered operative by an abnormal condition in the feeding of the containers, a manually operated switch, and electrical means for preventing restarting of the machine after it has been stopped by the operation of one of the foregoing control devices.

10. In a closure applying machine, in combination, container supporting means, a chuck constructed to be capable of gripping a closure to apply it to a container, means for imparting rotary movement to the chuck about its own axis whereby to effect relative rotary movement between a closure gripped by the chuck and the container, means for revolving the chuck as a unit in a circular path, and means for moving successive closures into alignment with the chuck, said means having provision whereby substantially all relative movement between it and the chuck except that produced by rotation of the chuck about its own axis, is eliminated during a substantial period following the alignment of a closure with the chuck and until the chuck engages the closure.

11. In a closure applying machine, in combination, container supporting means, a chuck constructed to be capable of gripping a closure to apply it to a container, means for imparting rotary movement to the chuck about its own axis whereby to effect relative rotary movement between a closure gripped by the chuck and the container, means for revolving the chuck as a unit in a predetermined circular path, and closure feeding means constructed and arranged to move a closure into alignment with a chuck and for thereafter moving said closure in the aforesaid predetermined path whereby during such movement substantially all relative movement between it and the chuck except that produced by rotation of the chuck about its own axis, is eliminated.

12. In a closure applying machine, in combination, a chuck constructed to be capable of gripping a closure to apply it to a container, means for revolving the chuck as a unit in a circular path, means for revolving the containers in a circular path, means for imparting relative rotary movement between the chuck and a container about the axis of the chuck, and means for moving successive closures into alignment with the chuck, said means having provision whereby substantially all relative movement between it and the chuck except that produced by rotation of the chuck about its own axis, is eliminated during a substantial period following the alignment of a closure with the chuck and until the chuck engages the closure.

13. In a closure applying machine, in combination, movable container supporting means, a chuck constructed to be capable of gripping a closure to apply it to a container, means for imparting rotary movement to the chuck about its own axis whereby to effect relative rotary movement between a closure gripped by the chuck and the container, means for revolving the chuck as a unit in a circular path, and closure feeding mechanism for feeding successive closures into alignment with the chuck and with relation to a portion of which the chuck is arranged to revolve, said mechanism having provision whereby substantially all relative movement between it and the chuck except that produced by rotation of the chuck about its own axis, is eliminated during a substantial period following the alignment of a closure with the chuck and until the chuck engages the closure.

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