

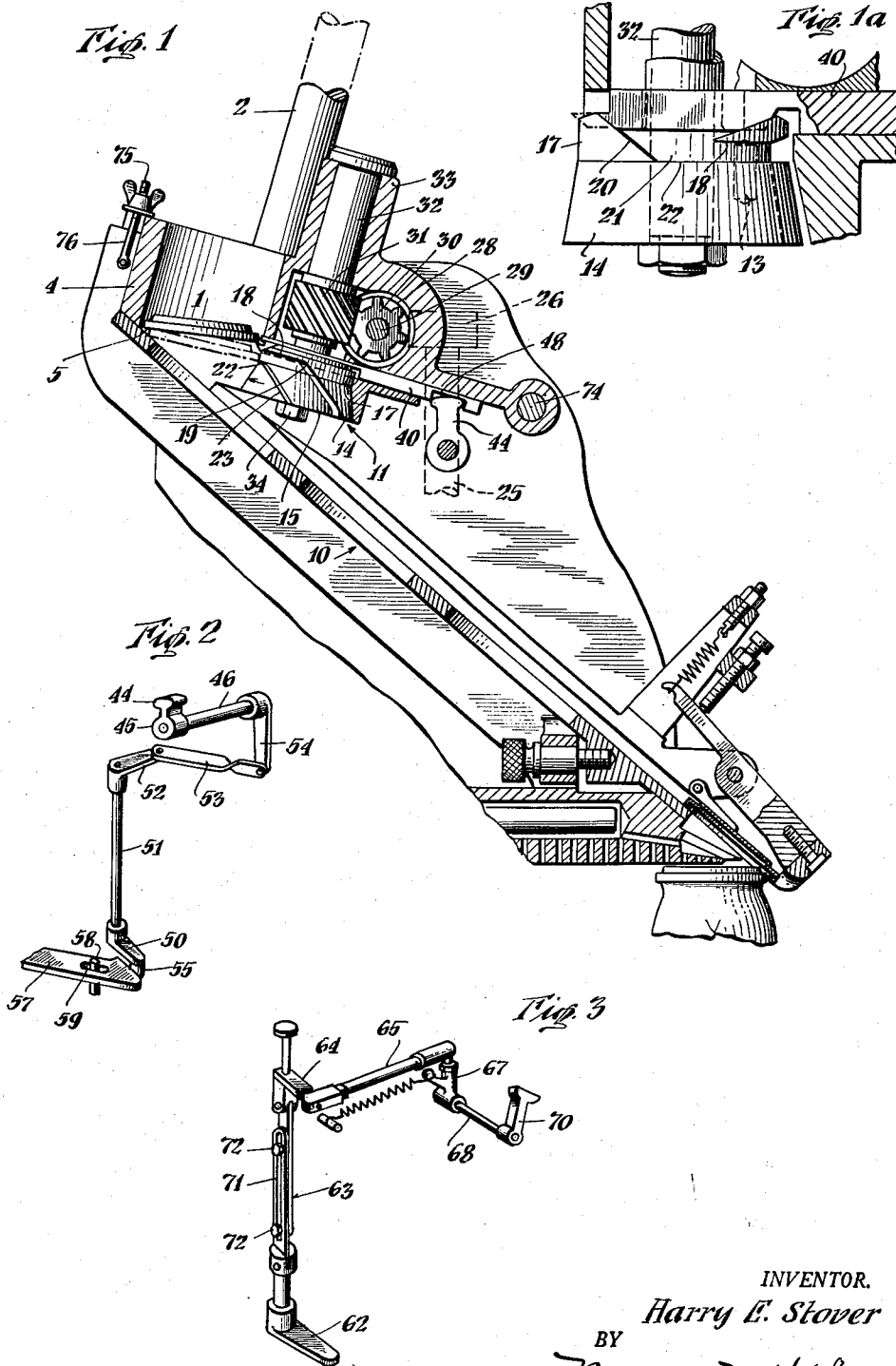
Jan. 19, 1954

H. E. STOVER
CLOSURE CAP FEEDING DEVICE

2,666,563

Filed Sept. 30, 1949

2 Sheets-Sheet 1



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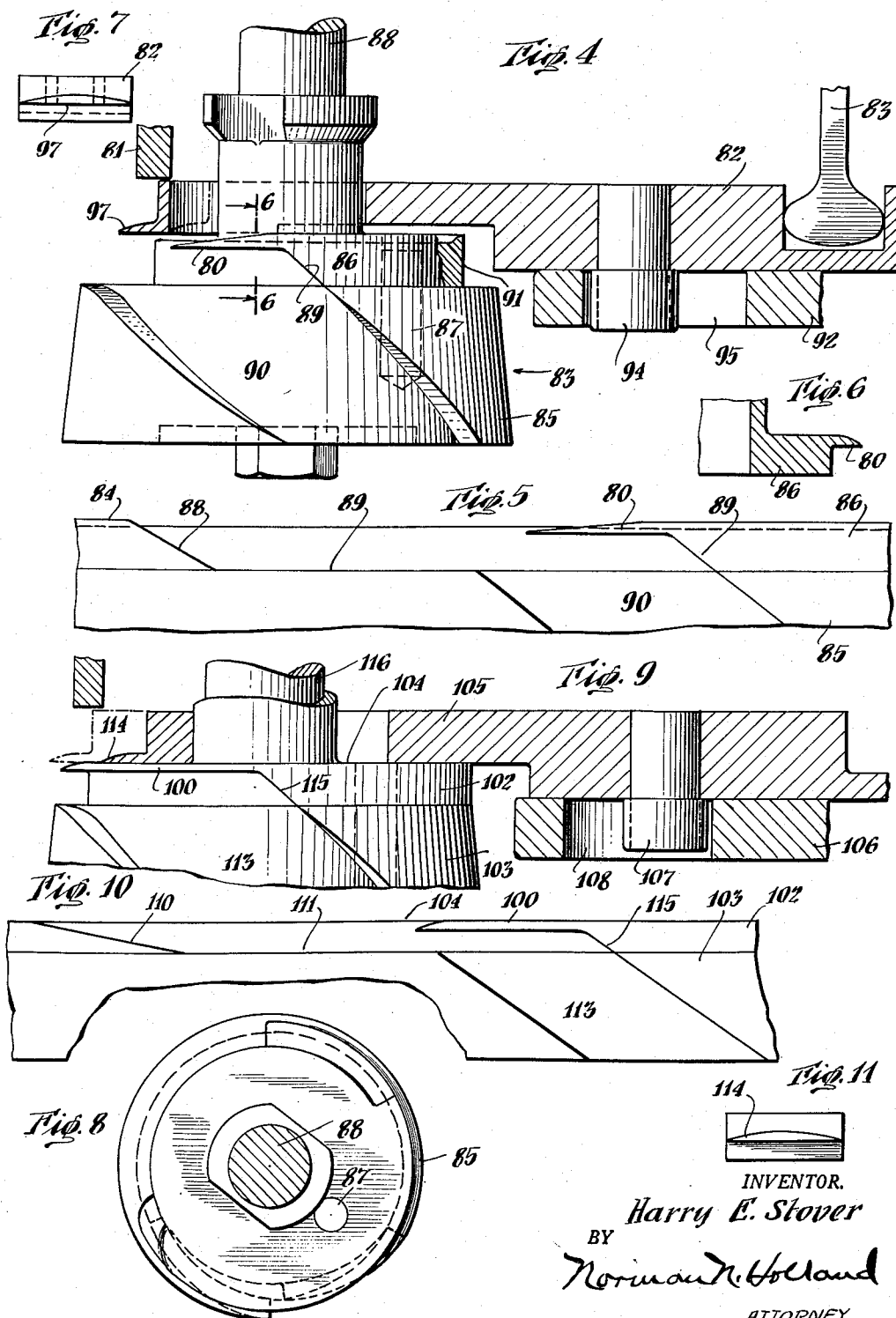
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CLOSURE CAP FEEDING DEVICE

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Application September 30, 1949, Serial No. 118,802

6 Claims. (Cl. 226—88.1)

1

The present invention relates to the feeding of closure caps, and more particularly to such a device, which may be utilized with sealing machines, for removing closure caps from a stack of caps and discharging them one at a time.

This application is in part a continuation of applications Serial Nos. 579,671 and 698,124 filed in the United States Patent Office on February 24, 1945 and September 20, 1946, now Patents Nos. 2,529,199 and 2,618,425, respectively.

In the food packaging industry closure caps are applied to containers at relatively high rates of speed, usually several hundred per minute. In order to achieve such high rates of application the closure caps must be delivered accurately and rapidly. A cap feeding device must remove closure caps at high speed from a group and deliver them, one at a time, without marring protective lacquer coatings of the caps and without "skipping" or omitting to deliver the caps at proper intervals. In addition, the cap feeding device should deliver a cap only when there is a container in position to receive the cap. A still further requirement of the cap feeding device is that it be simple in construction and operable over relatively long periods of time without requiring excessive maintenance.

The provision of a cap feeding means or device including a combination of all the above and various other desirable qualities has proven difficult. Various constructions have been devised but they have presented one or more difficulties. For example, some of them have been too complicated or too expensive, others have not provided accurate separation of closure caps from stacks one at a time over relatively long periods of operation. Still other constructions have looked well on a drawing board where precise dimensions and cap sizes could be depicted, but have not proven satisfactory in actual usage due, for example, to the fact that closure caps of a given size are not precisely identical with each other but must vary slightly in tolerances. Still other constructions which have been attempted have not performed satisfactorily at high speeds in the neighborhood of 300, 400 or 500 caps delivered per minute.

The present invention aims to overcome the above or other difficulties or disadvantages by providing a new and improved cap feeding device of relatively simple construction which is adapted to accurately separate closure caps one at a time from a stack of caps and to discharge them into suitable cap moving or cap receiving

2

means. The invention further contemplates the provision of such a cap feeding device which may be operated at high speeds without objectionably "bouncing" a stack of caps or setting up objectionable conditions of resonance or harmonic vibration in a stack of caps.

An object of the present invention is to provide a new and improved cap feeding device.

Another object of the invention is to provide a new and improved cap feeding device which operates effectively at relatively high speeds.

Another object of the invention is to provide a new and improved cap feeding device which may be operated at relatively high speeds without objectionably bouncing a stack of caps or setting up resonant conditions in a stack of caps.

Still another object of the invention is to provide a new and improved cap feeding means which accurately separates a lowermost cap of a stack from a next upper cap of the stack.

A further object of the invention is to provide an improved cap feeding device which provides for improved entry of a closure cap edge into a feeding or lowering recess of the device.

A still further object of the invention is to provide a cap feeding device embodying new and improved means for intermittently interrupting the separation of caps from a stack.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

Fig. 1 is a sectional view illustrating one form of the present invention, together with a cap delivering means;

Fig. 1a is an enlarged fragmentary view, partly in section, showing some of the parts of Fig. 1;

Fig. 2 is a diagrammatic perspective view of a mechanism for operating the closure cap feed in response to movement of containers;

Fig. 3 is a diagrammatic perspective view of another form of container-actuated means for feeding closure caps;

Fig. 4 is an enlarged fragmentary view, partly in section, of an improved form of cap feeding means generally similar to that of Figs. 1 and 1a;

Fig. 5 is a surface development of the cap separating and feeding parts shown in Fig. 4;

Fig. 6 is a sectional view taken along the line 6—6 of Fig. 4;

Fig. 7 is a front end view of the reciprocable latch or interrupting member shown in Fig. 4;

Fig. 8 is a top plan view of the rotatable separator and feeder part shown in Fig. 4;

Fig. 9 is an enlarged fragmentary view, partly in section, of an improved form of cap feeding means generally similar to that of Fig. 4;

Fig. 10 is a surface development of the cap separating and feeding parts shown in Fig. 9; and

Fig. 11 is a front end view of the reciprocable latch or interrupting member shown in Fig. 9.

While the present invention may be used with various types and sizes of closure caps it will, for purposes of convenience in illustration and description, be described chiefly with reference to a closure cap of the type illustrated in Norman N. Holland Patent No. 1,909,406.

The cap feeding device is illustrated in Fig. 1 utilized to feed closures from a stack to an inclined guideway or chute 10. The closure feeding device and inclined guideway of this figure are particularly useful in feeding the closure caps to straight-in-line type sealing machines, but the closure feeder may be used with various other sealing machines, for example, those of the rotary type.

A stack of closure caps may be placed in the inclined cylindrical chamber 1 so as to rest against inclined spaced rods 2 carried by a base portion 4. If desired the chamber and the stack of closure caps may be vertical. The lowermost cap of a stack is shown resting at an edge or side 5 thereof against a base portion 7 of the inclined slide 10 and at an opposite edge against the mechanism for separating the caps one by one.

The mechanism for separating the lowermost cap from the stack and delivering it comprises a rotor or rotary means 11 preferably made in two parts and dowelled together by a pin 13 (Fig. 1a) to serve as a single rotatable element. The lower member or bottom part 14 has an inclined or spiralled groove or recess 12 for feeding or forcing the side portion of the bottom cap downwardly. The upper part 17 has an elongated tongue 18 for entering between two bottom caps and separating the bottommost cap from the stack. A cam surface 19 below the tongue 18 leads to the upper part of the feeding groove 15 to direct or force the bottommost or separated cap into the groove. A cam surface 20 (Fig. 1a) spaced circumferentially from the tongue 18 permits the stack of caps to ride down, upon clockwise rotation of the rotor, so that the bottommost cap is in the receiving recess 21 and below the tongue 18. In this position the bottom cap rests upon the ledge or shoulder 22 which is intermediate and joins the inclined surface 20 with the inclined leading edge 23 of the narrower recess 15. As the rotor 11 continues to turn, the cap thence moves into the circumferential recess intermediate the ledge and the underside of the tongue; this latter recess or channel below the tongue leads to the spiral recess or channel 15 in the outer surface of the rotor.

Preferably the bottom part 14 is conical in shape so that the closure, as it drops about its upper or outer end, is continuously engaged by portions forming the groove to force it downwardly.

Thus the closure separated is guided downwardly until it drops into the guideway 10 and slides by gravity to the end thereof. Each time

that the rotor is turned one revolution a closure is delivered.

The cap receiving recess 21 and inclined cap feeding recess 15, together with the connecting ledge 22, may be of any suitable width or length, depending upon the sizes and shapes of the particular closure caps to be fed. Likewise, the length and width of the tongue portion 18 spaced above the ledge 22 may be varied in accordance with the closure caps to be fed.

It has been found that this relatively simple feed operated by the continuous rotation of the rotor 11 will feed closures at a rate of several hundred or more a minute. A rapid feed of this type is particularly desirable where the sealing machine is operated with a dual action sealing head for sealing small sizes of containers.

The rotor 11 may be driven from a shaft 25 through bevel gear 26, meshing bevel gear 28, shaft 29, gear 30 mounted on shaft 29, and meshing 45° spiral gear 31 carried by shaft 32, shown mounted in a suitable bushing 33. The rotor 11 is secured to the lower portion of the shaft 32 by a nut 34. The drive shaft 25 may be operatively connected to a driving connection or additional shaft in any suitable manner.

If containers move into the sealing machine in consecutive order the cap feed can be timed to feed a closure for each container. In practice, however, a filling machine may be stopped for some reason or a container may be removed before it reaches the sealing machine. For this reason it is desirable to have a closure cap fed as each container approaches a steam injector shown adjacent the lower portion of the inclined guideway 10. To accomplish this the latch or slide member 40 is provided with an end portion 41 at its end adapted to be inserted under the edge of the stack of closures to prevent the closure from being fed by the tongue 18 and the co-operating recess or channel. This latch member 40 has a recess fitting about the shaft 32 and has an upper surface at its outer pointed end 41 substantially at the height of the upper disc-like member 17. When the latch member 40 is forced to the left closures cannot be fed. When the latch member is moved to the right the rotor 11 and the tongue 18 feed a closure once during each revolution of the shaft 32. The rotation of the shaft 32 is timed to rotate once whenever a container passes the injector.

The latch member 40 may be controlled in any suitable manner; as illustrated in Figs. 1 and 2, an arm 44 integral with the sleeve 45 on the shaft 46 engages in a slot 48 in the slidable latch member 40 to control the movement of it. The sleeve 45 is operatively connected with an arm 50 through vertical shaft 51, arm 52 thereon, link 53 and arm 54 on shaft 46. The cam roller 55 on arm 50 engages a cam surface 56 on a pivoted feeler or arm 57. Movement of the feeler about its pivot may be limited by means of a pin 58 extending through a slot 59 in the feeler. The feeler is normally in the path of the containers moved along by any suitable conveyor. Whenever a container passes, the arm 57 is forced outwardly by the container, which causes the cam surface to move the arm 59 and rock the vertical shaft 51 which in turn rocks the sleeve 45 on shaft 46 and retracts the latch member 40, thus permitting a closure to be fed.

The timing of the operations is preferably such that a closure is fed to the bottom of the guideway 10 at or prior to the time that a container reaches the lower end of the guideway. Thus

5

a closure is fed for each container approaching the injector mechanism. When a container fails to pass the arm 57 the latch member 40 is not retracted and hence prevents the feed of a closure. In this way the guideway is free of closures except when a container approaches the injector mechanism.

In Fig. 3 there is shown a latch controlling mechanism generally similar to that in Fig. 2 but which may be preferred in certain instances. Containers moving along a conveyor belt (not shown) may operate a suitable cap trip which in turn oscillates the arm, shaft 63, and upper arm 64 thereon connected to the link 65. The link 65 is connected to the arm 67 on shaft 69 having the arm 70 thereon which engages with the latch member 40 and moves it toward the right to release a closure from the bottom of the stack. The released closure is fed downwardly by the rotating cutter or rotor 11, the edge of the cap following the helical or inclined channel therein. The shaft 63 comprises a pair of flat members slotted longitudinally as shown at 71 and bolted together at 72; this construction facilitates varying the length of the shaft 63 in accordance with the height of the superstructure or cap feed device, in order to accommodate different sizes of containers.

Feeding closures singly as needed is particularly desirable with steam injection machines for if the guideway 10 is kept filled with closures the heat of the steam injector over a period of time may damage the rubber forming the gasket in the closure and prevent proper sealing.

Preferably the casing or housing 4 is mounted on a stud 74 extending through a bearing in a boss at one end thereof. The other end is held in position by a wing nut 75 on bolt 76. By loosening the wing nut to release that end, the member 4 may be swung about the shaft 74 to afford access to the guideway 10 and to the interior of the cap feed. This mounting also permits ready removal of the cap feed block by pulling it off the stud 74 after the wing nut 75 is loosened.

While the cap feeding devices hereinabove described have proven very satisfactory in feeding closure caps from a stack one by one at relatively high rates of speeds it has been found that in some instances a stack of caps seems to be set "bouncing" or into harmonic motion or vibration when the cap feeding device is operated at various high speeds. This tends to interfere with or prevent optimum delivery of closure caps. For this reason the cap feeding means illustrated in Figs. 4 through 11 are preferred since it has been found to minimize setting a stack of caps into a resonant or vibrating condition. These cap feeds are generally similar to that of Figs. 1 and 1a; that of Figs. 4 to 8 is particularly useful for feeding caps of about 58 mm. size and that of Figs. 9 to 11 for feeding caps of about 48 mm. size.

As shown in Figs. 4 through 11, the upper portion of the rotor is provided with a relatively narrow elongated tongue (80 in Figs. 4 to 8, and 100 in Figs. 9 to 11), shown extending generally parallel to the direction in which the rotary part turns, having an entering or leading edge of slight inclination. This narrow elongated tongue with gently sloping leading edge is adapted to fit more readily between a lowermost cap of a stack and the next higher cap in "cutting out" the caps one by one. The front or leading edge of the feed-interrupting latch lies close to the path or plane through which the tongue rotates and is

6

such as to reduce stack movement to a minimum, as will be further described.

The preferred cap feeds of Figs. 4 through 11 are shown horizontally disposed for convenience of illustration but it is to be understood that they may be positioned at any suitable inclination, for example, as illustrated in Fig. 1.

As with the previously described cap feeds of Figs. 1 to 3, closure caps are held in a stack in a chamber (not shown) and bottommost closure caps are removed one by one from the stack. In Fig. 4 closures thus move downwardly past a portion 81 of the stacking chamber toward the slide or latch 82 and the rotor 83. When the latch 82 is positioned at the right, in the position shown by the dot-dash lines of Fig. 4, closure caps may move downwardly onto the upper surface 84 of the separator or upper member 86, which is dowelled together with the lower or "feeder" member 85 by a pin 87. The upper and lower members of the rotor 83 thus rotate together as a unit.

As the rotor turns beneath the lowermost cap of a stack, the bottom cap slides down along the inclined leading edge 83 of the separator 86 to the shelf-like portion 89. In this relationship the stack of caps is in position for the leading edge of the narrow tongue 80 to enter between the bottom cap and the next higher cap. As the tongue passes between these two lower caps, the bottom one is separated from the others and thence passes down through the inclined recess or groove 90 at the periphery of the lower member 85. The smaller diameter of the upper or separator member 86 serves to accommodate relatively large diameter closure caps and facilitates their movement downwardly toward a chute or other cap-receiving or applying device. The narrow elongated tongue 80 with its upper surface of slight inclination fits readily between two caps of a stack and reduces to a minimum any bouncing or up and down movement of the stack during the separation of caps therefrom.

The slide or latch 82 which interrupts the feed of closure caps in response to movement of containers into position to receive them is carried by a frame portion 92 and is moved to and fro, in response to feeding of containers, by an actuating member 83. The actuating member 83a may be operated by shafts, arms and links similar to those shown and described in connection with Figs. 1, 2 and 3. Guiding of the latch during its to and fro movement may be facilitated by a pin having a bearing 94 thereon which moves to and fro in a slot 95 of the stationary part 92.

The leading or front edge 97 of the slide 82 is relatively thin and its underside lies close to the upper edge 84 of a ridge or elevated portion 91 on the upper or separator member 86. The upper surface of this leading edge 97 slopes gently upwardly so that when it is moved forwardly to fit between two caps of a stack it does not violently lift or tilt the entire stack in an upward direction. The importance of this feature is apparent when it is realized that closures are delivered at a rate of several hundred a minute, in response to containers which are also moving to the cap receiving position at a similar high speed. When containers are missing from an advancing row the latch or slide 82 will be moved to and fro very rapidly and for best results it should not "bounce" the stack up and down.

Thus the elongated tongue 80 and the thin leading portion 97 of the latch 82 cooperate so that when the latch moves to the left to sup-

port a stack of caps, the stack is not lifted by any objectionable amount, and so that when the latch is moved toward the right the stack is not dropped any objectionable amount but is gradually lowered and released onto the closely adjacent upper surface of the separator member 86. It is believed that the foregoing is the reason for the greatly improved feeding and smoother movement of the caps from the stack and the elimination or minimization of any tendency to create a resonant condition in a stack of closure caps being fed. At first glance the difficulty might not appear of great importance but when the high rate of feed, in some instances as high as five hundred a minute, is realized, the importance of overcoming the difficulty is readily apparent.

The drive for the rotor 32 may be similar to that described in connection with Fig. 1, the rotor 33 being carried by a rotatable shaft 88.

The construction and operation of the cap feeding device illustrated in Figs. 9, 10 and 11 is along the lines of that of Figs. 4 to 8. The separator or upper member 102 of Figs. 9 and 10 is, however, of a diameter about equal to that of the upper portion of the lower member 103 and has a smooth or planar upper surface 104. The slide or latch member 105 is supported on a stationary portion 106 and may be guided in its to and fro movement by a pin carrying a bushing 107 extending into a recess 108. When the slide 105 is withdrawn to the right (Fig. 9) a bottom closure cap of a stack rests at one edge against the upper portion of the separator member 102, which is dowelled to and rotates with the lower member 103. As the members 102, 103 rotate, the lowermost closure slides along the moving inclined leading edge 110 of the upper separator member and reaches the horizontal portion 111 which lies spaced downwardly with respect to the undersurface of elongated tongue 100. Further rotation of the members moves the leading edge of the elongated tongue 100 between the lowermost cap and the next higher cap and thus separates the bottom cap from two others of the stack. The lowermost closure then moves downwardly into the feeding groove 113, from which it is discharged into any suitable guiding or moving means for delivering it to a container.

The flat upper surface 104 of the rotor shown in Figs. 9 and 10 is preferred to that shown in Figs. 4 and 5 which has a raised rib or edge 91, as the former tends to give lesser movement of a cap stack. However, the form of Figs. 4 and 5 is useful with cap stacks of certain weights and dimensions.

The leading edge 114 of the slide or latch 105 shown in Figs. 9-11 is generally similar to that shown in Figs. 4 and 7 in that it has a gentle slope or sort of blunt knife edge. The construction permits "smooth" and ready entry between closure caps of a stack without setting the entire stack into objectionable bouncing or vibratory movement.

The latch may be operated by mechanism similar to that previously disclosed and the separator 102 and feeder 103 of the rotor may be operated from a shaft 116 in a similar manner.

Various suitable dimensions and widths may be used for the various inclined surfaces and recesses of the rotors of Figs. 4 and 9. In some instances excellent results have been obtained by employing an inclined leading edge (62, Fig. 5 and 110, Fig. 10) which extends about 60° around the rotor circumference, a ledge (89, Fig. 5 and 111,

Fig. 10) which extends about 110° from the lower end of the inclined portions (88, 110) to the tip of the above elongated tongues (80, 100), a tongue that extends around the rotor about 50° to 65°, and a downwardly inclined trailing edge (89, Fig. 5 and 115, Fig. 10) of about 20° circumferential extent. Of course other suitable measurements or dimensions may be used, those given being illustrative.

It will be seen that the present invention provides a new and improved cap feeding device of relatively simple construction and operation which is adapted to operate over long periods of time without requiring an excessive amount of maintenance. Closure caps are supported out of contact with the rotary part of the device during intervals when containers are not moving into cap receiving position. When containers are moving toward cap receiving position the caps move into a cap receiving recess or entrance opening of the device and a lowermost cap is separated from the stack, moves along a supporting ledge beneath the "cutting-out" tongue, and thence moves downwardly through the cap feeding recess of the rotary member. The increased taper toward the bottom of the rotatable member facilitates the feeding of closure caps which may vary from optimum diameter of the closure, closures of smaller diameter due to minimum tolerances being supported by an outwardly sloping portion of the rotary member. Thus closure caps of minimum tolerances are prevented from dropping past the rotary member without coming into contact with the inclined cap feeding recess therein. The improved construction whereby the leading edge of the reciprocable latch member and the elongated tongue of the rotary member are positioned closely adjacent each other minimizes the possibility of a cap stack being set into resonant oscillation or vibration and hence greatly facilitates feeding of closures at all speeds from minimum to maximum.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a closure cap feeding device, the combination of rotatable means for separating successive closure caps from a stack of closure caps, reciprocable means above and adjacent said rotatable means for supporting closure caps out of contact with said rotatable means, a housing carrying said rotatable means and reciprocable means, and a mounting shaft extending through a portion of said housing, said housing being swingable about the axis of said shaft into and out of operating position.

2. In a closure cap feeding device, a rotatable member having adjacent an upper portion thereof of a cap receiving opening and having adjacent a lower portion thereof an inclined cap feeding recess comprising generally parallel front and rear walls joined by a bottom surface, said bottom surface being of increasing diameter from upper to lower portions thereof to thereby provide a bottom surface that slopes outwardly toward the bottom of said lower portion.

3. In a closure cap feeding device, a rotatable member having a circumferentially inclined cap feeding recess with a bottom wall that is circumferentially arcuate and tapers outwardly

longitudinally of the axis of rotation of said member from upper to lower portions thereof.

4. In a closure cap feeding device, the combination of rotatable means for separating successive closure caps from a stack of closure caps, a reciprocable member projecting over and disposed in close proximity to said rotatable means adapted to support said stack and prevent feeding of closure caps to said rotatable means, a stationary guide member supporting and extending along said reciprocable member, one of said members having a guide slot therein extending in the direction of reciprocation of said reciprocable member, and a guide pin secured to the other of said members and projecting into said slot for guiding said reciprocable member during its reciprocation.

5. In a closure cap feeding device, the combination of rotatable means provided with a tongue having a flat rear upper surface portion and a front upper surface portion gently sloping downwardly from the flat rear upper surface portion to a thin front edge for movement between the bottommost closure cap of a stack and the caps thereabove to separate said bottommost cap from the stack, and a reciprocable member above said rotatable means having a knife-like front edge formed by the junction of a downwardly sloping upper surface and a flat lower surface, said flat lower surface being superposed on and engaged with the flat rear upper surface portion of the rotatable means, and said reciprocable member being movable forwardly to position the knife-like edge thereof beneath one side of said stack of closure caps for supporting said stack and preventing feeding of said caps to said rotatable means.

6. In a closure cap feeding device, the combination of rotatable means provided with a tongue having a flat rear upper surface portion and a front upper surface portion gently sloping downwardly from the flat rear upper surface portion to a thin front edge for movement between the bottommost closure cap of a stack and the caps thereabove to separate said bottommost cap from the stack, and a reciprocable member above said rotatable means having a knife-like front edge and thin side edges formed by the junction of a downwardly sloping upper surface and a flat lower surface, said flat lower surface being superposed on and engaged with the flat rear upper surface portion of the rotatable means, and said reciprocable member being movable forwardly to position the knife-like edge thereof beneath one side of said stack of closure caps for supporting said stack and preventing feeding of said caps to said rotatable means.

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