

[54] APPARATUS FOR DECAPPING BOTTLES

[75] Inventor: Carl P. Cato, Lynchburg, Va.

[73] Assignee: Dacam Corporation, Madison Heights, Va.

[22] Filed: Apr. 26, 1973

[21] Appl. No.: 354,486

[52] U.S. Cl. 53/381 A, 53/331.5

[51] Int. Cl. B65d 43/40

[58] Field of Search 53/381 A, 317, 318, 331.5;
29/426; 81/3.2

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Primary Examiner—Travis S. McGehee

[57] ABSTRACT

Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, as well as cap loosening means and cap re-

moval means which are located one after another in the direction of the conveyance of the bottles and positioned to engage the caps on the bottles situated on the conveyor. The cap loosening means comprises a plurality of aligned rotatable discs and a movable belt spaced apart therefrom which is moved at a speed greater than the speed of the conveyor. Each of the discs has a series of recesses along the periphery thereof. Each of the recesses is formed of resilient material to securely engage a cap between the disc upon which it is located and the movable belt. Each disc is rotated by the movement of a bottle whose cap is engaged in a recess thereon to rotate the engaged cap to loosen same. Means are also provided along the belt for intermittently exerting a lateral force on the cap so as to jar the cap and therefore loosen it as it travels through the cap loosening means. The cap removal means comprises a stationary belt and spaced therefrom a belt movable at a speed greater than the speed of the conveyor. Each cap is securely engaged between the belts to further rotate the cap with respect to the bottle until the cap is no longer secured to the bottle.

26 Claims, 8 Drawing Figures

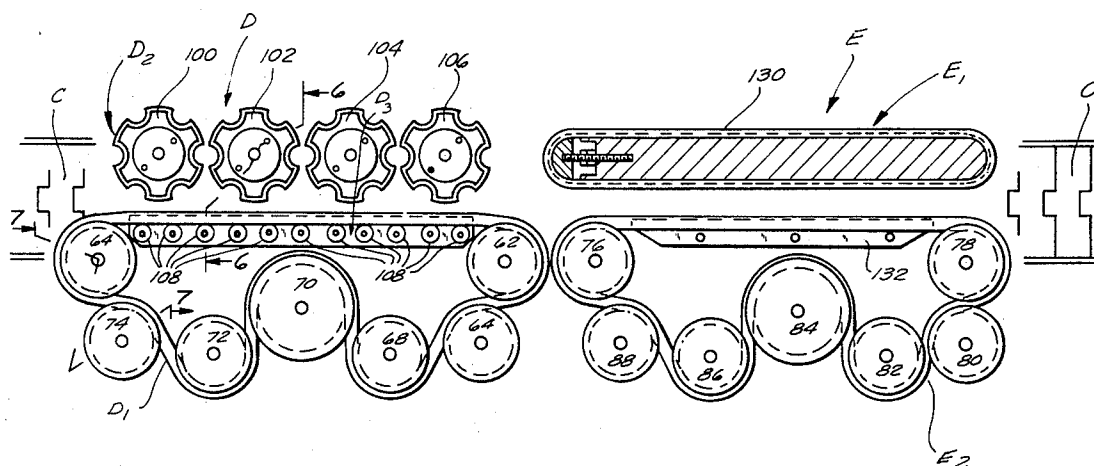
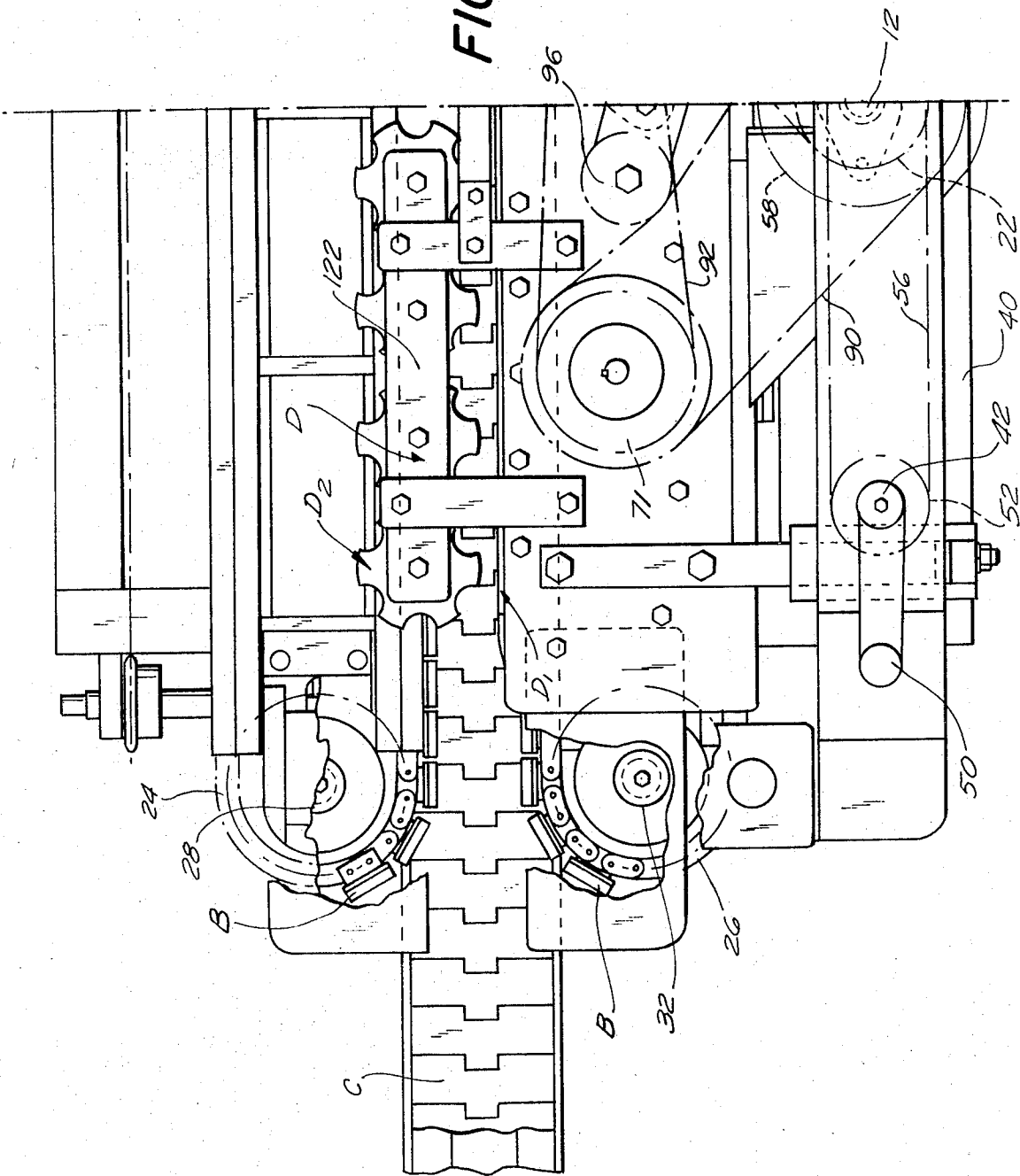


FIG. 1A



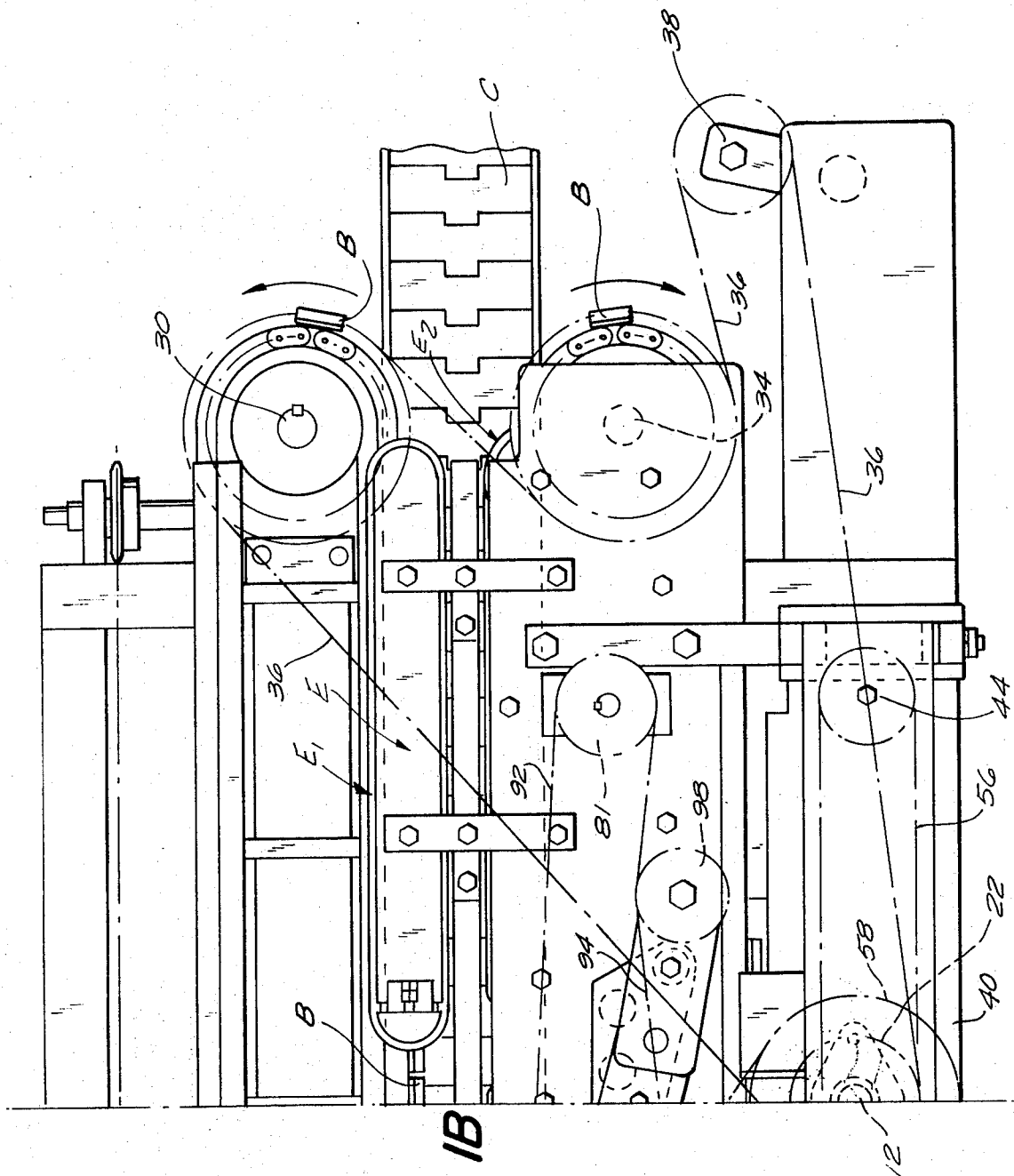
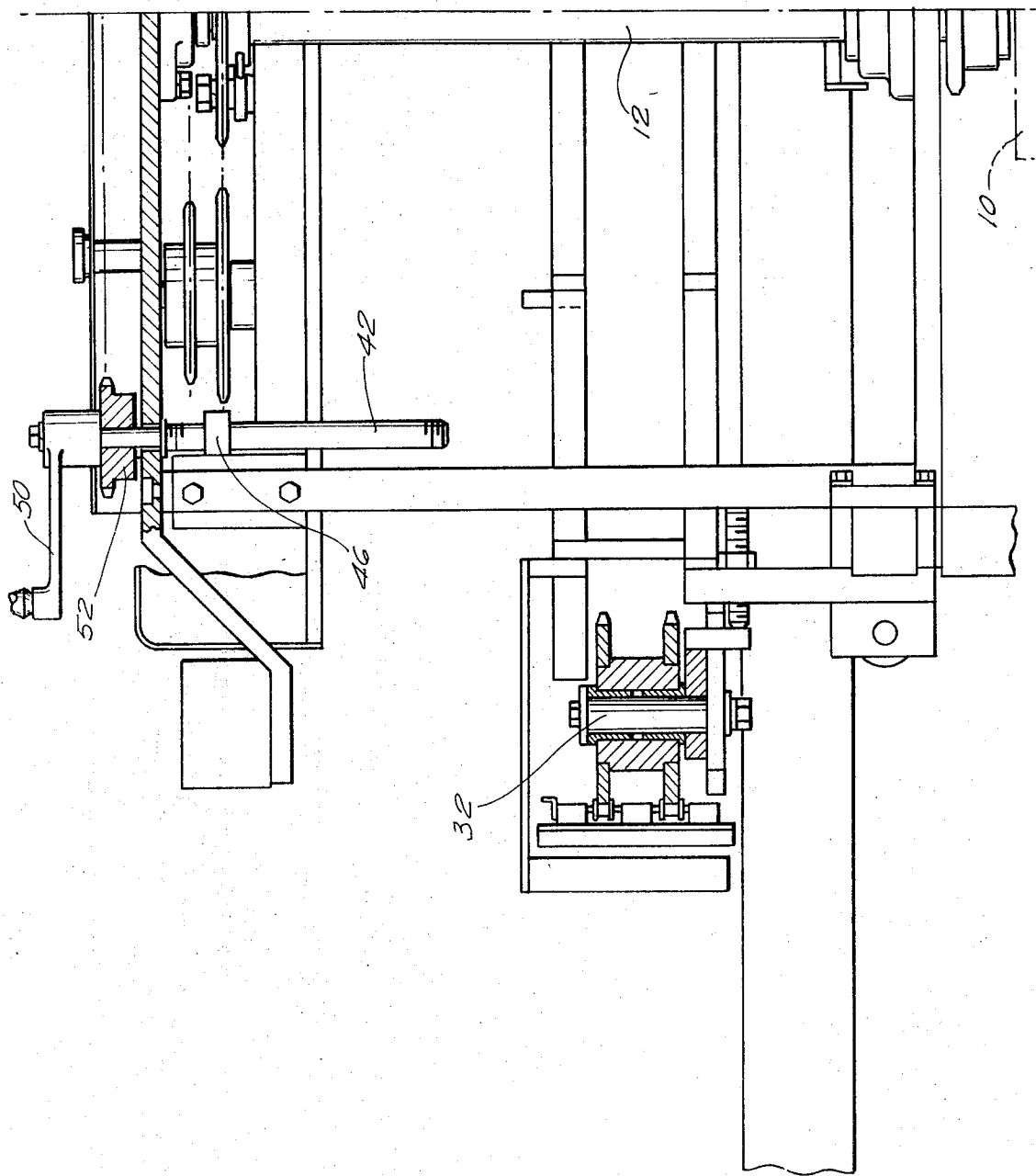


FIG. 2A



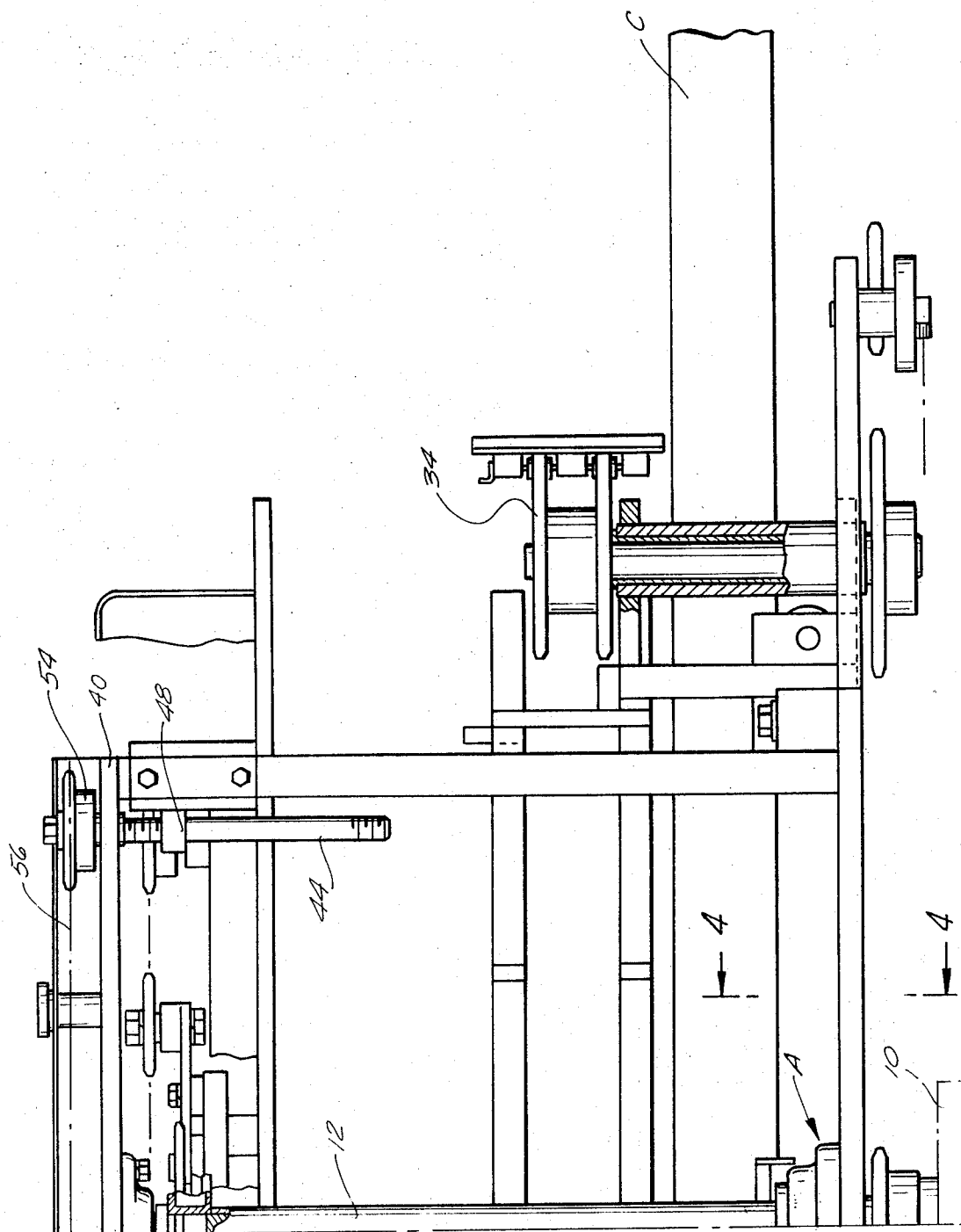
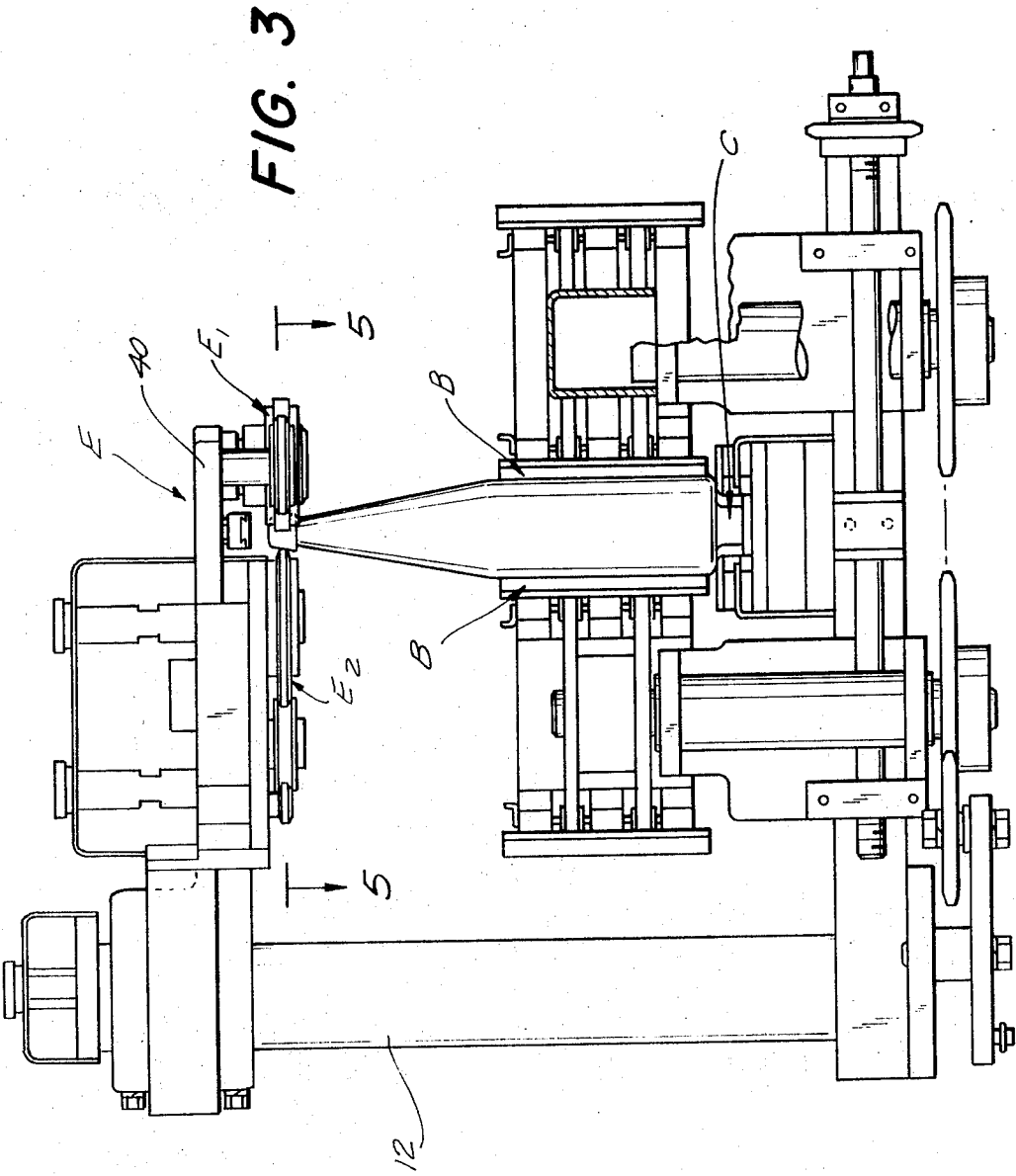


FIG. 2B



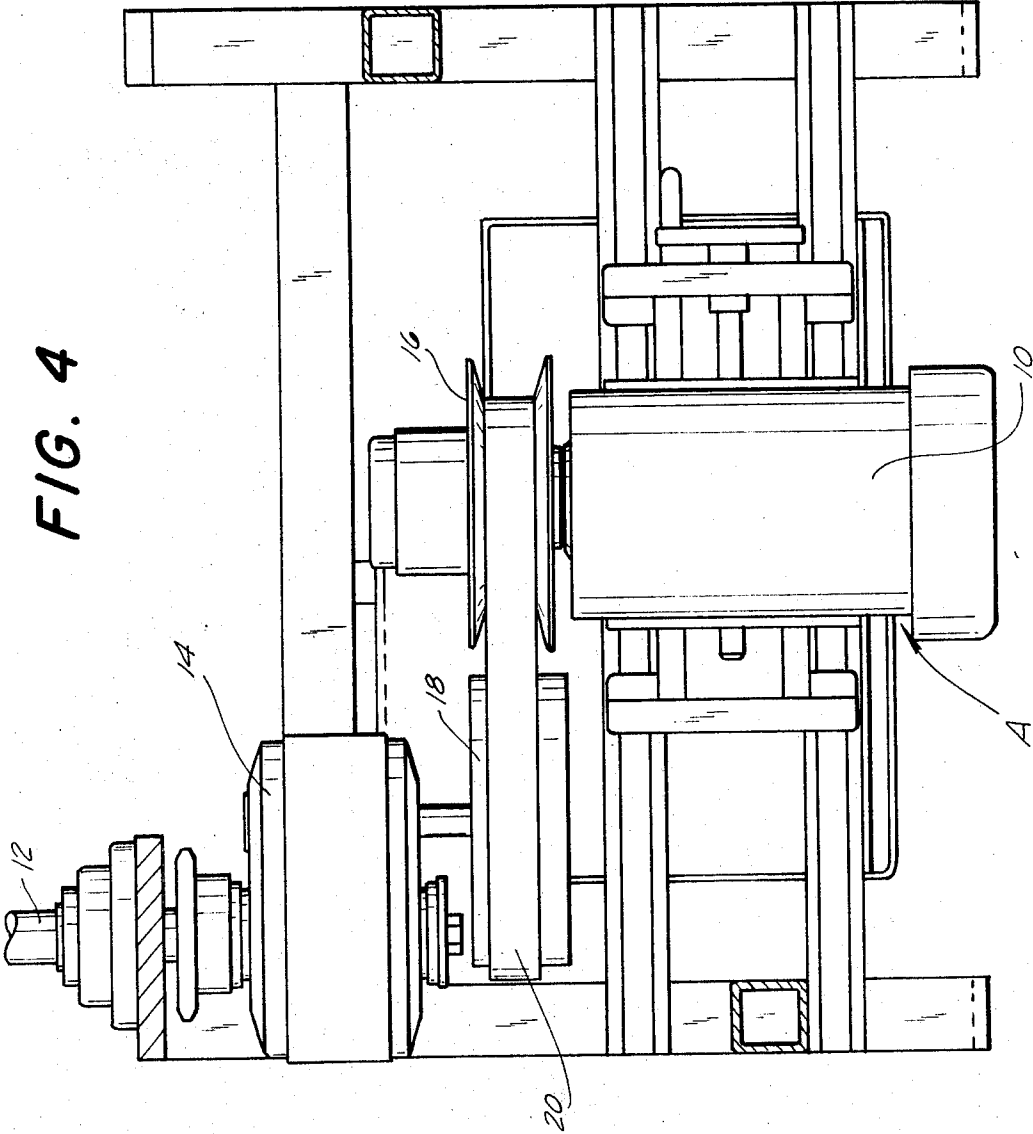


FIG. 5

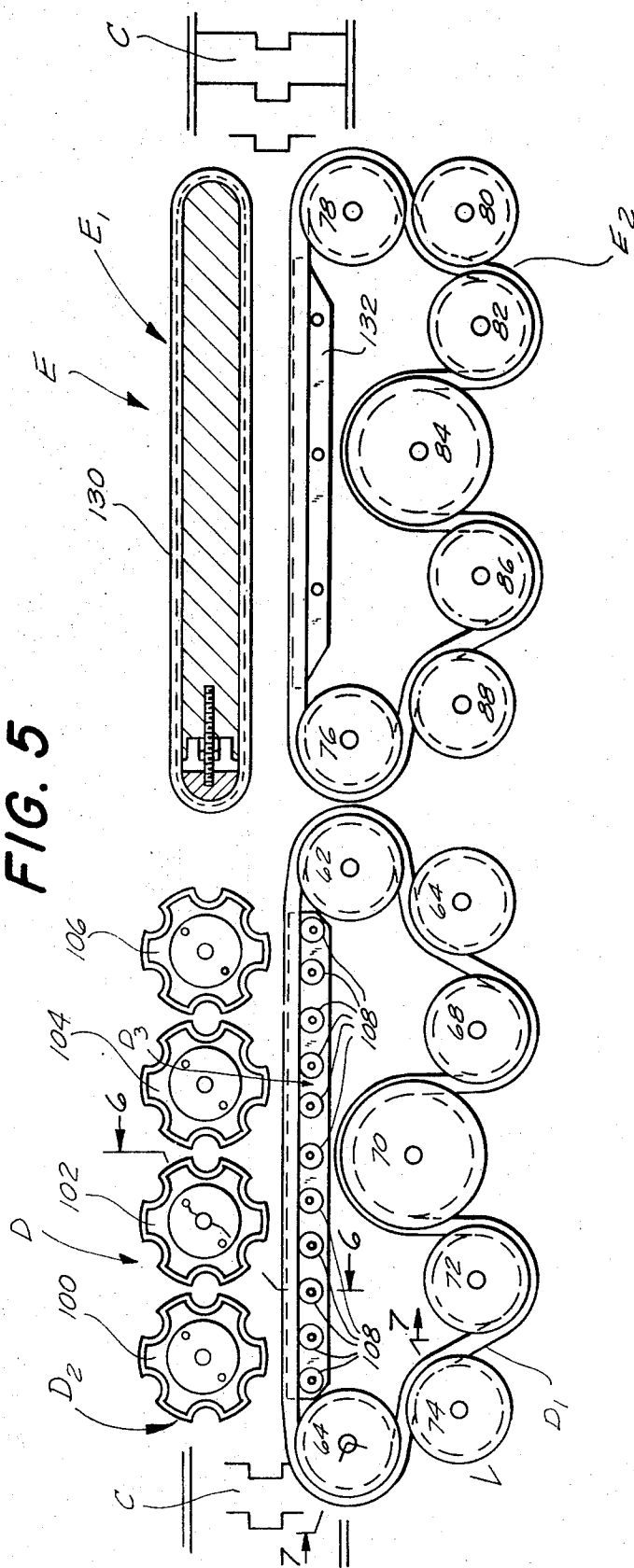


FIG. 6

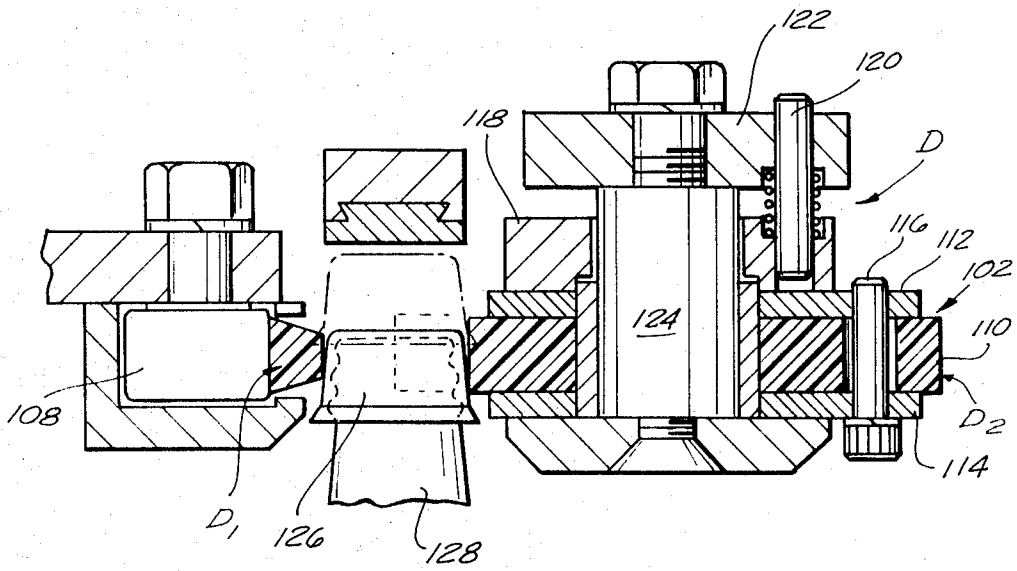
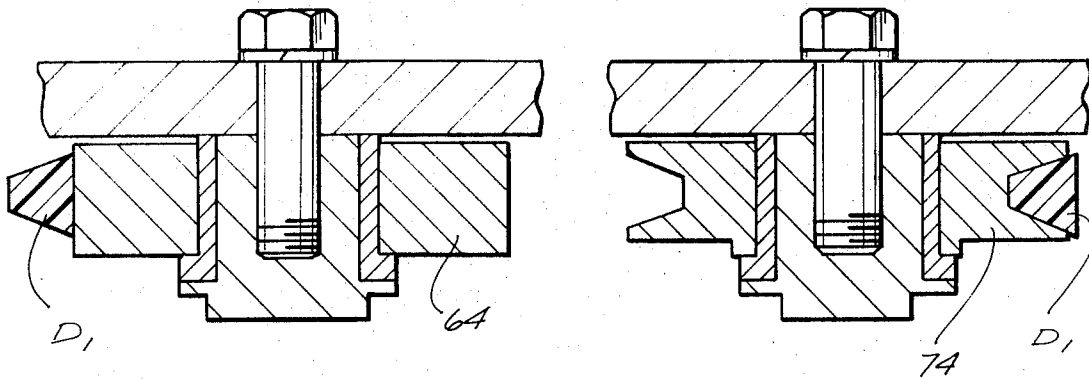


FIG. 7



APPARATUS FOR DECAPPING BOTTLES

The present invention relates to bottle decapping machines and more particularly to apparatus for removing twist-type caps from bottles.

Manufacturers of glass containers manufacture bottles for use by product manufacturers to package products of various types. These bottles are relatively expensive to produce and therefore constitute a substantial percentage of the cost of the product to the ultimate consumer. In order to minimize this cost and ecological reasons, many product manufacturers make it economically beneficial for the consumer to return the bottles to the product manufacturer so that they can be reused.

Twist or screw-type caps have recently become popular for use on bottles because of the modest cost of these caps. Further, these types of caps have a definite utilitarian advantage over caps which must be defomed during the bottle opening process, such as those which are removed by a bottle opener, because the consumer can reuse these caps to reseal the bottle if the contents have not been entirely consumed.

Reusable bottles with twist-type caps, therefore, are commonly in use. However, it has been found that often the bottles are returned with the cap in place thereon. These caps, of course, must be removed by the product manufacturer prior to refilling the bottles. The cap removal procedure presents certain difficulties because not all of the bottles are returned with the caps and those that are so tightly sealed that conventional decapping procedures have proven ineffective. Since it is time consuming and costly to separate the capped returned bottles from the non-capped return bottles it is necessary to have apparatus which will remove the caps from capped bottles but will pass the non-capped bottles without acting upon them.

One system which has been utilized in order to decap returned bottles with twist-type caps is a stationary belt spaced from a moving belt. The bottles are conveyed in line by a conveyor belt such that the caps, if present, are engaged between the belts. The movable belt is driven faster than the movement of the bottles and the caps are therefore rotated and removed. This system is advantageous because no separation is necessary as non-capped bottles pass through unaffected.

However, the above described system is extremely disadvantageous because caps which are tightly sealed on the bottles may pass through the device still secured to the bottle. This means that the entire operation must be stopped in order to remove the capped bottle. This system works well for caps that are relatively loosely screwed on the bottles, but for the occasional cap which is tightly sealed, the friction between the cap and the bottle may be greater than the friction between the cap and the belts. The cap is therefore not rotated and remains sealed to the bottle.

It is, therefore, the prime object of the present invention to provide apparatus for removing twist-type caps from bottles wherein the caps are loosened prior to removal such that substantially all of the caps are removed.

A second object of the present invention is to provide apparatus for removing twist-type caps from bottles which can be installed as a unit in a pre-existing bottle conveyor system.

A third object of the present invention is to provide apparatus for removing twist-type caps from bottles as they are continuously moved through the apparatus by means of a conveyor.

5 A further object of the present invention is to provide apparatus for removing twist-type caps from bottles which can be easily adjusted to accommodate bottles of various sizes.

10 It is another object of the present invention to provide apparatus for removing twist-type caps from bottles which can be utilized to remove caps of different sizes with only minor modification and which will not effect bottles without caps as they pass through the apparatus.

15 It is another object of the present invention to provide apparatus for removing twist-type caps which functions automatically and at high speeds in order to substantially facilitate the bottle removal process.

20 It is still another object of the present invention to provide apparatus for removing twist-type caps from bottles which comprises inexpensive, sturdy and reliable mounted parts for ease of repair and long machine life.

25 In accordance with the present invention apparatus for removing twist-type caps from bottles is provided having means for conveying the bottles at a given speed. Cap loosening means and cap removal means are located one after the other in the direction of the conveyance of the bottles. The cap loosening means and cap removal means each operably engage each cap as the bottles are conveyed by the conveyor means such that the caps are acted upon to loosen same by the cap loosening means and further acted upon to remove same by the cap removal means.

30 The cap loosening means is necessary to insure that each cap which enters the cap removal means is loosened to the point where the cap removal means can act upon the cap to remove it. In this way, substantially all of the caps will be removed. The cap loosening means comprises a plurality of rotatable discs each of which has a series of recesses along the periphery thereof. Spaced from the discs is a movable belt operably connected to a means for moving the belt at a speed greater than the speed of the conveyor means. A plurality of recesses are situated along the periphery of each disc. The recesses are formed to securely engage each cap in turn as it is moved between the discs and the movable belt. The movement of the bottle along the conveyor rotates the disc containing the recess in which the cap on the bottle is engaged from a position wherein one of the recesses thereon accepts a cap to a position wherein the cap is released by the recess. The recesses are spaced along the periphery of each disc such that when a cap is released by one recess another recess on that disc is positioned to accept the cap on the next successive bottle on the conveyor. The rotation of the disc tends to rotate the cap to loosen it. The discs are aligned such that when a cap is released by the recess of one disc a recess on the next succeeding disc is in position to accept the cap. The cap is therefore rotated a given amount by each of the discs in succession. Several discs are utilized in tandem in case a cap is so tightly secured to a bottle that it is not rotated by the action of the primary discs. Thus several similar but separate operations are performed to insure that at least one will provide an initial rotation of the cap. In

order to facilitate the initial rotation, the cap is jarred as it moves along the discs.

Means for intermittently exerting a lateral force on the cap as it moves between the discs and the movable belt is provided so that the caps are jarred to further insure loosening of the caps from the bottles. This means comprises a plurality of rollers preferably mounted on the side of the belt other than the side which engages the caps such that the force is exerted through the belt. The jarring action of the intermittent force exerting means works in conjunction with the discs to insure that each and every cap will be rotated by at least one disc and therefore loosened before entrance into the cap removal means.

The cap removal means comprises a stationary belt and a movable belt spaced therefrom. The movable belt is operably connected to means for moving the belt at a speed greater than the speed of the conveying means. The caps, as they move from the cap loosening means, are securely engaged between the stationary and movable belts which comprise the cap removal means. The cap removal means acts to further rotate the cap with respect to the bottle until it is no longer secured to the bottle. At this point compressed air may be pumped underneath the cap to lift it from the bottle and suction means used to convey the lifted cap and dispose of same.

To the accomplishment of the above, and to such other objects as they may hereinafter appear, the present invention relates to apparatus for removing twist-type caps from bottles as defined in the appended claims and as described in this specification, taken together with the accompanying drawings in which like numerals refer to like parts and wherein:

FIGS. 1A and 1B combine to form a top elevational view of a preferred embodiment of the present invention;

FIGS. 2A and 2B combine to form a side elevational view of a preferred embodiment of the present invention;

FIG. 3 is an end elevational view of a preferred embodiment of the apparatus showing a bottle being decapped therein;

FIG. 4 is an end elevational view of the drive means of the present apparatus taken along lines 4—4 of FIG. 2B;

FIG. 5 is a top elevational view of the cap loosening means and cap means of the present invention taken along lines 5—5 of FIG. 3;

FIG. 6 is a side cross-sectional view of the cap loosening means of the present invention taken along lines 6—6 of FIG. 5; and

FIG. 7 is a side cross-sectional view of the movable belt means of the present invention taken along lines 7—7 of FIG. 5.

The present invention comprises a drive means, generally designated A, which is operably connected to drive a pair of upstanding conveyor belts, generally designated B. The upstanding conveyor belts B are situated to securely engage a bottle positioned on a conventional bottle conveyor, generally designated as C. All three conveyor belts are moved at a single given speed to move a stream of bottles through the apparatus. The upstanding conveyor belts B are utilized to prevent the rotation of the bottles with respect to conveyor belt C as the bottle passes through the decapping apparatus.

Cap loosening means D comprises, in addition to a movable belt means, generally designated D₁, a series of aligned rotatable discs driven by drive means A and generally designated D₂, each of which has a plurality of recesses along the periphery thereof. In the preferred embodiment, four rotatable discs are shown each of which has six recesses along the periphery thereof. The recesses are situated such that each cap in turn may be securely engaged therein between each disc and the portion of the movable belt D₁ situated across therefrom. Each of the discs is rotatable from a position wherein one of the recesses thereon accepts a cap to a position wherein the recess releases the cap. The recesses are spaced along each disc such that when the cap is released by one recess a succeeding recess is in position to accept the cap on the next successive bottle on conveyor means C. Further, the discs are aligned such that when a cap is released from the recess of one disc a recess on the next successive disc is in position to accept that cap. The rotation of each of the discs rotates the cap thereby loosening it.

However, certain caps may be tightly secured to the bottle. Too tightly, in fact, for the first disc to rotate it. In order to overcome this problem several discs are located in tandem such that if the cap is not rotated by the primary disc it will be rotated by one of the subsequent discs. In this way cap loosening is insured. Preferably, the recesses are formed of resilient material such that a retentive engagement of the cap is facilitated between the disc and the movable belt. The recesses are formed such that a non-capped bottle will pass through cap loosening means D without being affected thereby.

Cap loosening means D further comprises a means generally designated D₃ for intermittently exerting a lateral force on each cap as each cap in turn moves through the cap loosening means D. Intermittent force exerting means D₃ comprises a plurality of rotatable rollers fixedly mounted to the frame of the apparatus immediately behind the portion of the belt means which is opposite the discs. As each cap moves through cap loosening means D each of the rollers will jar the cap so as to further loosen it from the bottle. Means D₃ further insures that the cap will be rotated by at least one disc to loosen it by working in conjunction with the discs to jar the cap sufficiently to permit rotation of the cap by the discs.

Since the movement of the movable belt means D₁ is at a speed which is greater than the movement of the bottles on the conveyor means C, the action of the movable belt D₁ along with the rotatable discs D₂ and the intermittent force exerting means D₃ insures that the caps will be loosened and rotated with respect to the bottles. Thus, each cap will be loosened to the point where it can be removed by cap removal means E.

After each bottle in turn emerges from cap loosening means D it passes into cap removal means E which comprises a stationary belt generally designated E₁ which is spaced from a second movable belt generally designated E₂, the latter also being movable at a speed greater than the speed of the bottles on the conveyor C. The caps are firmly engaged between the stationary belt E₁ and the movable belt E₂ to rotate the caps with respect to the bottles until they are no longer secured to the bottle neck. At this point the cap may be lifted or sucked from the bottle by conventional means such

as a compressed air source or suction means and thereby disposed of.

More specifically, as seen in FIGS. 2A, 2B and 4, the apparatus of the present invention comprises a drive means A which has a motor 10 which is operably connected to a main drive shaft 12. Because motor 10 will operate at a speed which is too fast to drive the apparatus, a speed reducer 14 is interposed between motor 10 and main drive shaft 12. A pulley 16 operably connected to motor 10 and a pulley 18 operably connected to reducer 14 are connected by a flexible belt 20 to provide the connection between motor 10 and reducer 14.

As best seen in FIGS. 1A and 1B, main drive shaft 12 has a roller chain sprocket 22 connected thereon. Each of the upstanding conveyors 24, 26 is situated around a pair of spaced spindles 28, 30, and 32, 34 respectively. A chain 36 is threaded around sprocket 22, spindle 30, spindle 34 and a spring loaded sprocket idler 38. In this way, spindle 30 is rotated in a counterclockwise direction (as viewed in FIGS. 1A and 1B) and spindle 34 is rotated in a clockwise direction (as viewed in these figures). The motion of spindles 30 and 34 will cause upstanding conveyor belts 24 and 26 to engage the sides of the bottles between them and convey the bottles in turn along the length of the machine. Conveyor belt C supports the bottles from beneath. Upstanding conveyors 24 and 26 are moved at the same speed as conveyor C and serve to eliminate any rotational movement of the bottle with respect to conveyor belt C. Conveyor belt C is normally driven by a drive means external to the apparatus of the present invention and which is therefore not illustrated in the drawings.

Although chain 36 is not shown in FIGS. 2A and 2B, it can be appreciated from the position of spindles 32 and 34 that chain 36 lies in a plane beneath the portion of the apparatus upon which cap loosening means D and cap removal means E is situated. Such a configuration is desirable in order to prevent the interference of chain 36 with the remainder of the bottle decapping apparatus.

Cap loosening means D and cap removal means E are both situated on a vertically movable frame 40. Frame 40 is adjustable with respect to the plane of conveyor belt C so that bottles of various heights may be decapped by the apparatus of the present invention. This height adjustment is accomplished by means of a pair of externally threaded shafts 42 and 44 each of which supports frame 40. Shaft 42 is inserted into bracket member 46 which is fixedly mounted to the frame of the apparatus. Likewise, shaft 44 is situated within mounted member 48 which is also fixedly mounted to the frame of the apparatus. Mounting members 46 and 48 are internally threaded to interlock with the external threads on shafts 42 and 44 respectively. The height of frame 40 is adjusted by turning a rotatable handle 50 which is operably connected to shaft 42. The rotation of handle 50 serves to rotate shaft 42 thus axially moving the shaft with respect to mounted means 46. A roller chain sprocket 52 is mounted on shaft 42 which is operably connected to a roller chain sprocket 54 mounted to shaft 44 by means of a chain 56. In this way, the rotation of handle 50 not only serves to rotate shaft 42 but also simultaneously to rotate shaft 44 such that the platform 40 is moved up or down with respect to conveyor belt C. Of course, this height adjustment

need be performed only once for each type of bottle which is being decapped. When the height of a series of bottles being fed into the machine changes, the position of frame 40 is adjusted such that the cap loosening means D and cap removal means E are in the appropriate position to engage the caps on the bottles (see FIG. 3).

Mounted on main drive shaft 12 is a roller chain sprocket 58 which is used to transfer the rotation of main drive shaft 12 to each of the movable belts D₁ and E₂ which form a part of cap loosening means D and cap removal means E, respectively. As can best be seen by FIG. 5, belt D₁ passes along intermittent force exerting means D₃ between pulleys 62 and 64 as well as in a zigzag configuration between pulleys 66, 68, 70, 72 and 74 thereby forming a loop. As seen in FIGS. 1A and 1B, sprocket 58 on drive shaft 12 is operably connected to rotate a sprocket 71 by means of a chain 90. Sprocket 71 is situated on the same shaft as pulley 70 such that the rotation of sprocket 71 rotates pulley 70.

In a similar manner belt E₂ is situated in a straight path between pulleys 76 and 78 and a zigzag path between pulleys 80, 82, 84, 86 and 88. A roller chain sprocket 81, which is on the same shaft as pulley 84, is operably connected to sprocket 71 by means of a chain 92. In order to maintain the proper tension on chains 90 and 92, a spring-loaded rotatable bracket 94 is mounted on frame 40. Bracket 94 has a pair of rotatable sprockets 96 and 98 each of which is situated on a different end of bracket 94. Rotatable sprockets 96 and 98 are in communication with chains 90 and 92, respectively. Rotatable bracket 94 is urged to rotate in a counterclockwise manner as seen in FIGS. 1A and 1B. The spring bias on bracket 94 is adjusted to maintain the tension chains 90 and 92 at a level to prevent slippage between these chains and the sprockets to which they connected. Sprockets 71 and 81 are connected to sprocket 58 on main drive shaft 12 such that movable belt D₁ and movable belt E₂ each travel at a speed which is greater than the speed of upstanding conveyors 24 and 26 and bottle conveyor C. This may be accomplished by a suitable sizing of the respective sprockets, a gear box (not shown) or in any other conventional manner.

As seen in FIG. 5, cap loosening means D comprises four rotatable discs D₂ designated separately as 100, 102, 104 and 106 aligned opposite the straight portion of the path of belt D₁. Although four discs are shown in the preferred embodiment of the present invention, it is obvious that any number of discs which are desired can be utilized herein. Each of the discs 100 through 106 has six recesses along the periphery thereof. The number and size of the recesses on each of the discs will depend upon the diameter of the caps which the recesses will engage. Each recess must be small enough to engage the caps securely but large enough to permit the neck of an uncapped bottle to pass through it without engaging it. If different size caps are to be removed, each of the discs 100 to 106 can be replaced by discs having recesses of different size which are more suitable to engage the cap which is being removed. In this way, the machine of the present invention can be easily modified to accommodate bottles having different size caps.

Each of the discs 100 through 106 is rotatable from a position wherein one of the recesses is situated to accept a cap as the bottle containing the cap travels along

conveyor belt C (from left to right as seen in FIG. 5) to a position wherein the cap is released from the recess. The recesses are spaced along the periphery of each disc such that when the disc is rotated to release the cap from one recess another recess is situated to accept the cap on the next successive bottle on bottle conveyor means C. The discs 100 through 106 are aligned such that when one disc is rotated in order that the recess thereon releases a cap, the next disc is in an angular position to have one of its recesses situated to accept the cap as the bottle moves along conveyor C.

Each of the recesses on disc 100 through 106 are formed to securely engage a cap between the disc upon which the recess is situated and flexible belt D₁. The rotation of the disc is caused by the movement of the bottle whose cap is engaged within a recess thereon as the bottle is moved along conveyor belt C. The recesses on each of the discs 100 to 106 are preferably formed of a resilient material to facilitate firm frictional engagement of the cap. Such frictional engagement is necessary so that the rotation of the disc will also rotate the cap to loosen it. The rotation of each of the discs 100 through 106 will each rotate the cap through an arc of about 30° if the frictional engagement between the disc and cap is greater than between the cap and the bottle. Therefore, if each of the discs 100 to 106 performs its rotational function on the cap, the cap loosening means as a whole will rotate the cap through an arc of approximately 120°. It is possible that a cap will be so tightly secured to the bottle that the first disc will be unable to rotate it. For this reason a number of discs in tandem is provided. Experience has shown that such a setup substantially reduces the chances of an unloosened cap entering the removal means E. It is necessary that only loosened caps enter cap removal means E because an unloosened cap may pass through removal means E and not be removed therein.

However, there may be instances when the cap is screwed so tightly on the bottle that the friction created by the resilient recess which engages the cap between the disc and movable belt D₁ is not sufficient to rotate the cap with respect to the bottle. If an individual were unscrewing the cap manually but could not exert sufficient frictional force on the cap to overcome the frictional forces between the cap and the bottle, he might tap the cap on the edge of a rigid surface to loosen it. Intermittent force exerting means D₃ performs this tapping function automatically.

Intermittent force exerting means D₃ comprises a series of rollers 108 rotatably mounted along the straight part of the path of belt D₁ on the side of belt D₁ which does not contact the caps. As the cap moves between discs 100 to 106 and belt D₁ each of the rollers 108 exerts a lateral force on the cap through belt D₁ which acts in a manner similar to tapping the bottle cap on a rigid surface in order to jar the cap. In aggregate, the rollers 108 serve to intermittently exert lateral forces on the cap as the cap moves through the cap loosening means. Intermittent force exerting means D₃ tends to loosen the cap. Means D₃ works in conjunction with discs 100 through 106 and movable belt D₁ (which is moving faster than the bottle on conveyor belt C) to insure that at least one of the discs will be able to rotate each of the caps.

Referring now to FIG. 6, it can be seen that rotatable disc 102 is made up of a resilient body section 110

which is sandwiched between an upper rigid plate 112 and a lower rigid plate 114. Plates 112 and 114 secure flexible body portion 110 therebetween by means of a plurality of screw members 116. Mounted on top of upper plate 112 and rotatable therewith is a motion limiting member 118 having a pin 120 in communication therewith. Pin 120 is mounted in bracket 122 into which the shaft 124 of each of the rotatable discs extends. Pin 120 communicates with member 118 in order to create a frictional drag on disc 102 such that the disc is not entirely free to rotate. A certain amount of force must be exerted by a cap 126 thereon in order to rotate the disc. This exertion of force by the cap facilitates the loosening of the cap.

As also can be seen in FIG. 6, flexible belt D₁ as shown has a conventional trapezoidal shaped cross-section. The pulleys which contact the wider surface of belt D₁ have non-recessed peripheries. These are pulleys 64 (see FIG. 7), 72, 68 and 62. On the other hand, those pulleys 74 (see FIG. 7), 70 and 66 which contact the narrower portion of belt D₁ have a circumferential trapezoidal recess along the peripheries thereof to maintain the alignment of belt D₁. Thus the cross-sectional shape of belt D₁ and the peripheries of certain of the pulleys serve to maintain the alignment between belt D₁ and the remainder of the pulleys around which belt D₁ travels.

After being released by the recess on disc 106, the loosened cap travels from cap loosening means D into cap removal means E which is situated immediately behind it in the direction of bottle movement on bottle conveyor means C. Cap removal means E comprises a stationary belt E₁ which is spaced from a movable belt E₂. Movable belt E₂ is driven by means of pulley 84 which is operably connected to sprocket 81 and thus sprocket 71 by means of chain 92 as previously described. Belt E₂ and pulleys 76 through 88 have the same configuration and operate in substantially the same manner as belt D₁ and pulleys 64 through 74, which is described in detail above. The belts E₁ and E₂ are spaced apart sufficiently to permit the neck of a non-capped bottle to pass through cap removal means E unaffected.

As the cap enters cap removal means E it is securely engaged between stationary belt E₁ and movable belt E₂. It must be remembered that movable belt E₂ is moving at a speed which is greater than the linear movement of the cap. The movement of movable belt E₂ with respect to stationary belt E₁ tends to rotate the cap engaged therebetween with respect to the bottle upon which it is secured. As the cap moves along cap removal means E it is continuously rotated until the cap is no longer secured to the bottle. At the end of cap removal means E, a stream of compressed air may be utilized from beneath the cap to lift the cap off the bottle. Likewise or alternatively, a suction means may be used to lift the cap from the bottle and dispose of it. These compressed air means and suction means are not shown in the drawings as they are state-of-the art.

The bottle within the cap removed continues to move along bottle conveyor means C and comes to the end of upstanding conveyors 24 and 26 at which time it is released from engagement between the upstanding conveyors. After release from the upstanding conveyors 24 and 26 the bottle moves along bottle conveyor belt C to the next station, which may be a bottle filling operation.

Because of the nature of the apparatus, it can readily be placed, as a unit, on any conventional conveyor system, such as a bottle conveyor described herein as conveyor C. This means that it can be utilized with any pre-existing system to perform the cap removal process automatically and continuously.

The preferred embodiment of the present invention has been specifically disclosed herein for purposes of illustration. It is apparent that many modifications and variations may be made upon this specific structure disclosed herein. It is intended to cover all of these variations and modifications which fall within the scope of this invention as defined by the appended claims.

I claim:

1. Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, cap loosening means and cap removal means located one after the other in the direction of conveyance of the bottles, said cap loosening means and cap removal means each operably engaging each cap as the bottles are conveyed by said conveyor means such that the caps are acted upon by said cap loosening means to provide an initial rotation of each cap, said initial cap rotation being insufficient to permit removal of the cap from the bottle and further acted upon to remove the cap from the bottle by said cap removal means.

2. Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, cap loosening means and cap removal means located one after the other in the direction of conveyance of the bottles, said cap loosening means comprising a rotatable disc having a recess on the periphery thereof, said recess formed to securely engage a cap as the bottle upon which the cap is situated is conveyed by said conveyor means, said cap loosening means and cap removal means each operably engaging each cap as the bottles are conveyed by said conveyor means such that the caps are acted upon to loosen same by said cap loosening means and further acted upon to remove same by said cap removal means.

3. The apparatus according to claim 2 wherein said recess is formed of resilient material.

4. The apparatus according to claim 2 wherein said disc is rotated from a position wherein said recess accepts the cap to a position wherein said cap is released from said recess such that the rotation of said disc acts on the cap to loosen same.

5. The apparatus according to claim 4 wherein said disc has a plurality of recesses along the periphery thereof, said recesses being spaced such that the rotation of the disc to release a cap from one recess moves another recess into position to accept the cap on the next successive bottle on said conveyor means.

6. The apparatus according to claim 5 wherein said disc is rotated by the movement of the bottle whose cap is engaged in a recess thereon.

7. The apparatus according to claim 2 wherein the rotation of the disc tends to rotate the cap through an arc of about 30°.

8. Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, cap loosening means and cap removal means located one after the other in the direction of conveyance of the bottles, said cap loosening means comprising a plurality of aligned rotatable discs which successively act upon a cap to rotate the cap, said cap

loosening means and cap removal means each operably engaging each cap as the bottles are conveyed by said conveyor means such that the caps are acted upon to loosen same by said cap loosening means and further acted upon to remove same by said cap removal means.

9. The apparatus according to claim 8 wherein each of said discs has a plurality of recesses thereon, each of said recesses being formed to securely engage a cap, each of said discs being rotated by the movement of the bottle whose cap is engaged in a recess thereon from a position wherein one recess accepts the cap to a position wherein the cap is released by said recess such that the rotation of each disc acts on the cap to loosen same, said recesses on each disc being spaced such that the rotation of that disc to release a cap from one recess moves another recess into position to accept the cap on the next successive bottle on said conveyor means.

10. The apparatus according to claim 9 wherein each of the recesses are formed of resilient material.

11. The apparatus according to claim 8 wherein a cap is accepted by a recess on one disc after the cap is released from a recess on the disc immediately preceding said disc.

12. The apparatus according to claim 9 wherein the rotation of each of said discs tends to rotate the cap through an arc of about 30°.

13. Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, cap loosening means and cap removal means located one after the other in the direction of conveyance of the bottles, said cap loosening means comprising means for intermittently exerting a lateral force on a cap as the bottle upon which the cap rests is moved by said bottle conveying means so as to jar the cap to loosen same, said cap loosening means and cap removal means each operably engaging each cap as the bottles are conveyed by said conveyor means such that the caps are acted upon to loosen same by said cap loosening means and further acted upon to remove same by said cap removal means.

14. Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, cap loosening means and cap removal means located one after the other in the direction of conveyance of the bottles, belt means spaced from said cap loosening means such that each cap is securely engaged between said cap loosening means and said belt means as the bottle upon which the cap is situated is conveyed and means for moving said belt at a speed greater than said given speed, said cap loosening means and cap removal means each operably engaging each cap as the bottles are conveyed by said conveyor means such that the caps are acted upon to loosen same by said cap loosening means and further acted upon to remove same by said cap removal means.

15. The apparatus according to claim 14 further comprising means for intermittently exerting a lateral force on the caps as they move between said cap loosening means and said belt means so as to jar the cap to loosen same, said force means acting through at least a portion of said belt means.

16. The apparatus according to claim 14 wherein said force exerting means comprises a plurality of rollers situated along that portion of said belt means which engages said caps, but on the other side of said belt means portion from said caps such that said intermittently ex-

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erted force is exerted on the cap through said belt means.

17. The apparatus of claim 14 wherein said force exerting means is a movable belt.

18. Apparatus for removing twist-type caps from bottles comprising means for conveying the bottles at a given speed, rotatable means having a recess on the periphery thereof, said recess being situated to engage the caps of each of the bottles moved by said conveyor means to rotate the cap to loosen same, and means for exerting a force on said caps in the direction of said recess thereby insuring secure engagement of the caps within said recess.

19. The apparatus according to claim 18 wherein said rotatable means comprises a disc having a plurality of recesses along the periphery thereof, said disc being rotated by the movement of the bottle whose cap is engaged within a recess thereon from a first position wherein one of the recesses accepts a cap to a position wherein said recess releases said cap, said recesses being spaced such that when said cap is released another recess is situated to accept the cap on the next successive bottle on said conveyor means.

20. The apparatus according to claim 18 wherein said recess is formed of resilient material to facilitate the engagement of a cap therein.

21. The apparatus according to claim 19 wherein the rotation of said disc tends to rotate the cap engaged within a recess thereon through an arc of about 30°.

22. The apparatus according to claim 19 wherein said

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rotatable means comprises a plurality of aligned discs situated such that when the recess of one disc releases a cap the cap is accepted by a recess on the next successive disc.

23. The apparatus according to claim 18 wherein said cap loosening means comprises means for intermittently exerting a lateral force on a cap as the bottle upon which the cap rests is moved by said bottle conveying means so as to jar the cap to loosen same.

24. The apparatus according to claim 18 further comprising belt means spaced from said cap loosening means such that each cap is securely engaged between said cap loosening means and said belt means as the bottle upon which the cap is situated is conveyed and means for moving said belt at a speed greater than said given speed.

25. The apparatus according to claim 17 further comprising means for intermittently exerting a lateral force on the caps as they move between said cap loosening means and said belt means so as to jar the cap to loosen same, said force means acting through at least a portion of said belt means.

26. The apparatus according to claim 25 wherein said force exerting means comprises a plurality of rollers situated along that portion of said belt means which engages said caps, but on the other side of said belt means portion from said caps such that said intermittently exerted force is exerted on the cap through said belt means.

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