United States Patent [19]

Risener

[11] **3,852,867**

[45] **Dec. 10, 1974**

[54] **BOTTLE DECAPPING SYSTEM**

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[22] Filed: **July 9, 1973**

[21] Appl. No.: **377,287**

[52] **U.S. Cl.** ..... **29/208 B,** 29/240

[51] **Int. Cl.** **B23p 19/04**

[58] **Field of Search**.. 29/208 B, 240, 200 D, 203 V, 29/200 A

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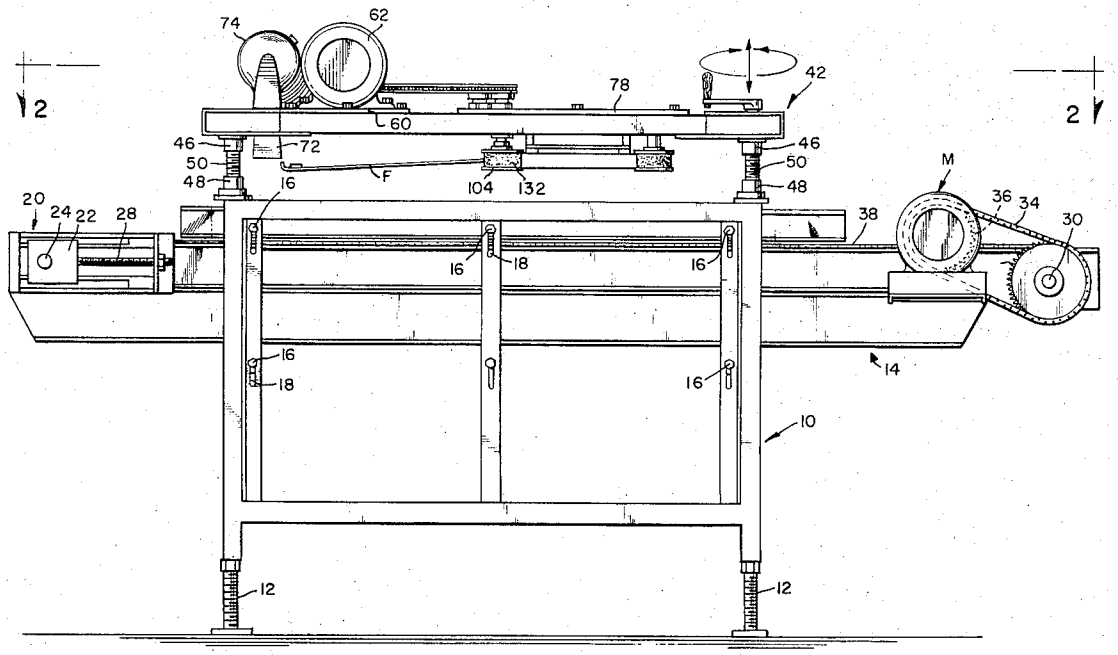
Primary Examiner—Thomas H. Eager

Attorney, Agent, or Firm—Newton, Hopkins & Ormsby

[57] **ABSTRACT**

Bottle caps are removed from recycled bottles either while the bottles are in half cases or are in case formation by an endless belt system which engages only the bottle caps and requiring no positive control or constraint of the bottles. Incidental to the decapping action the endless belt system causes the bottles to press downwardly to react against the bottle conveyor system, thereby to stabilize the bottles during the decapping action. The caps remain seated upon but unscrewed from the bottles until removed.

20 Claims, 9 Drawing Figures



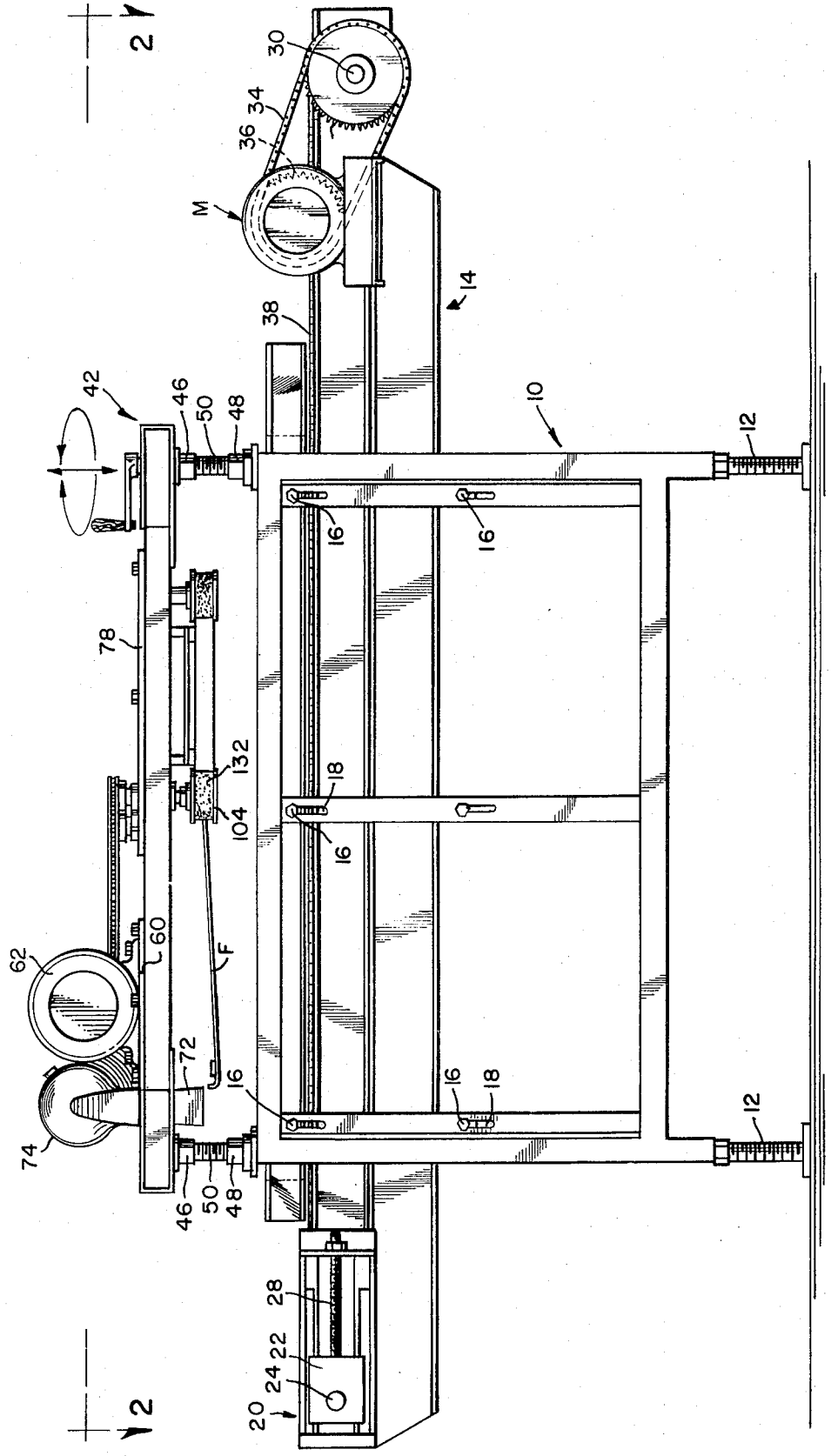

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FIG. 1

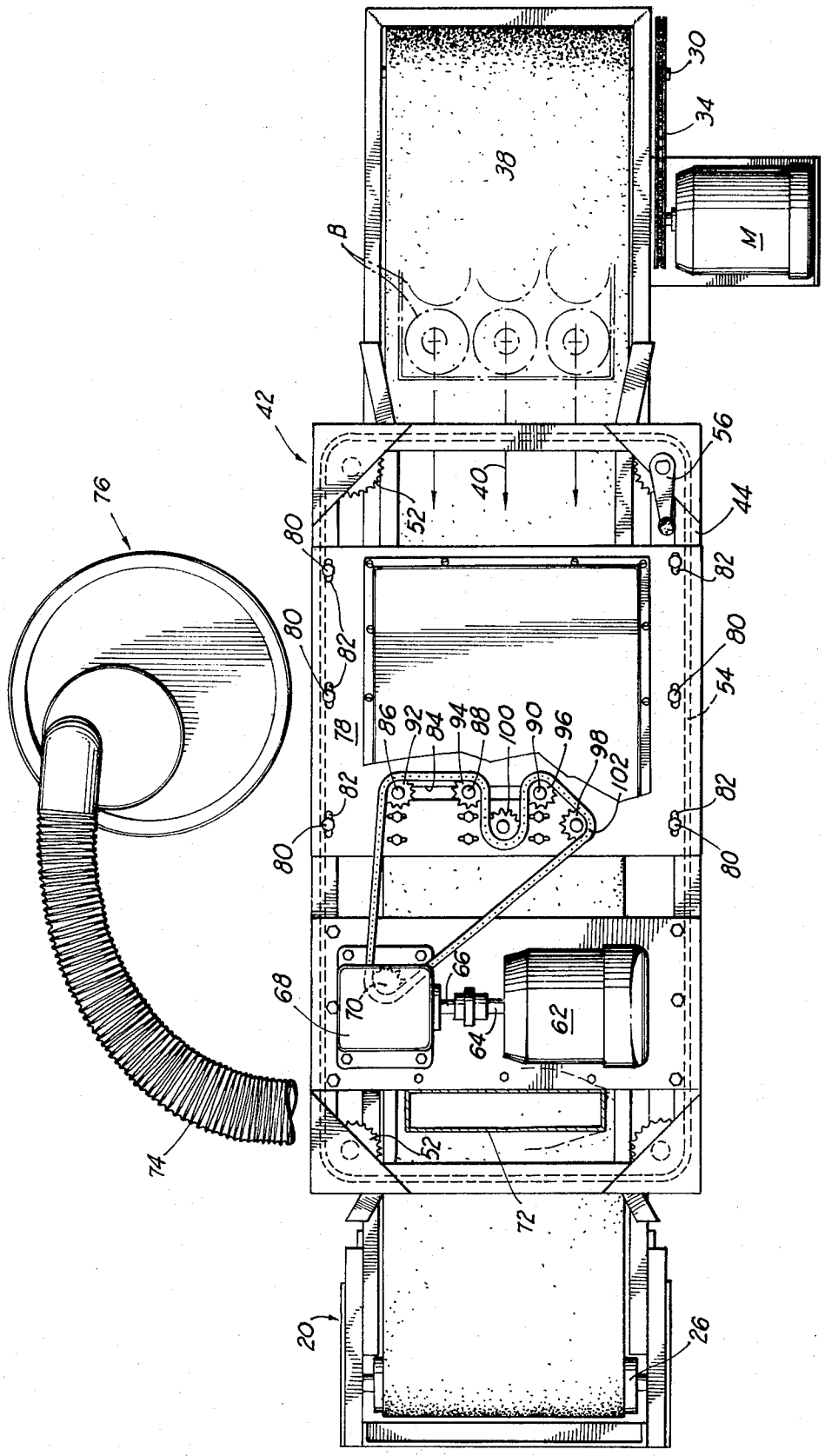
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FIG 2

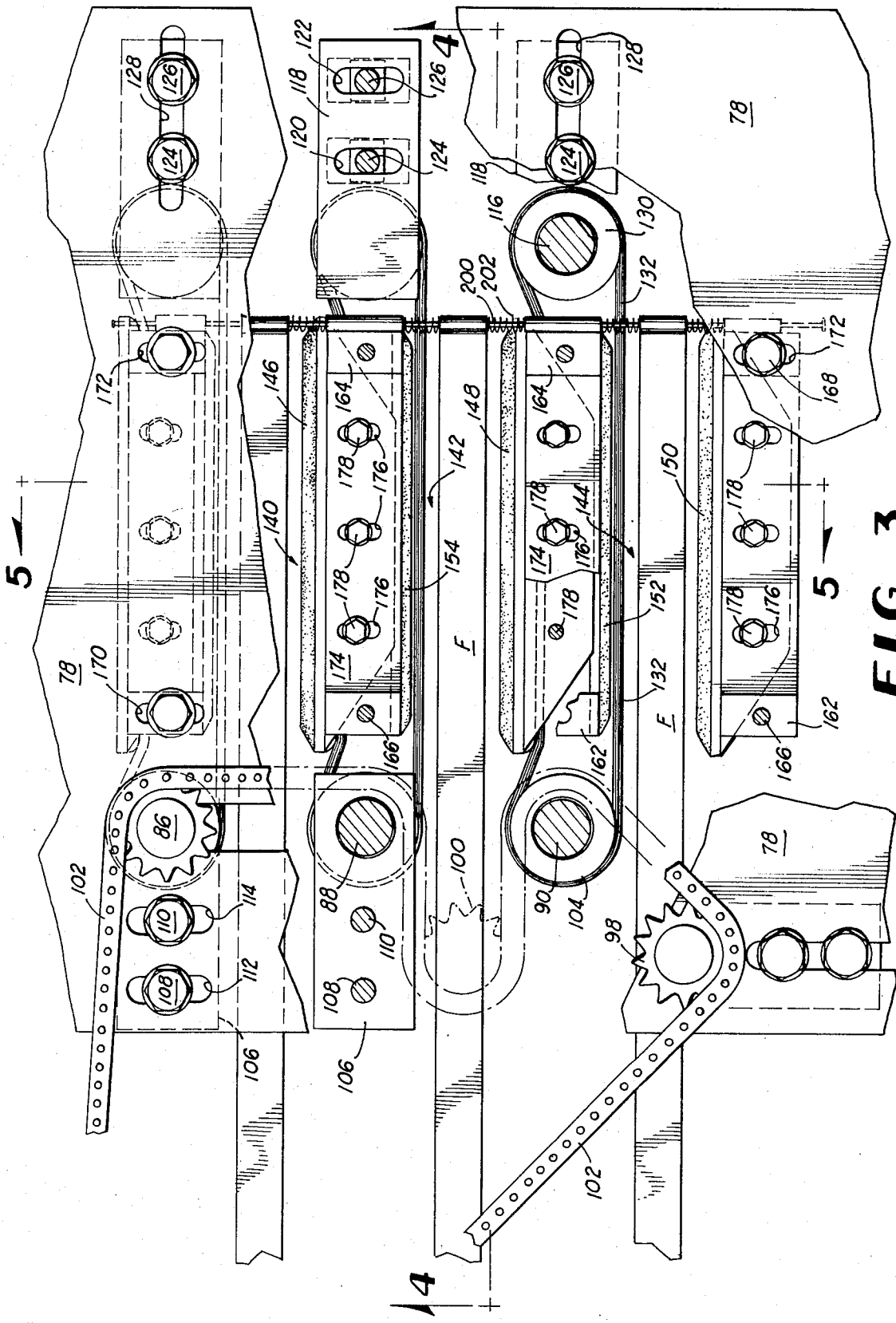
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FIG 3

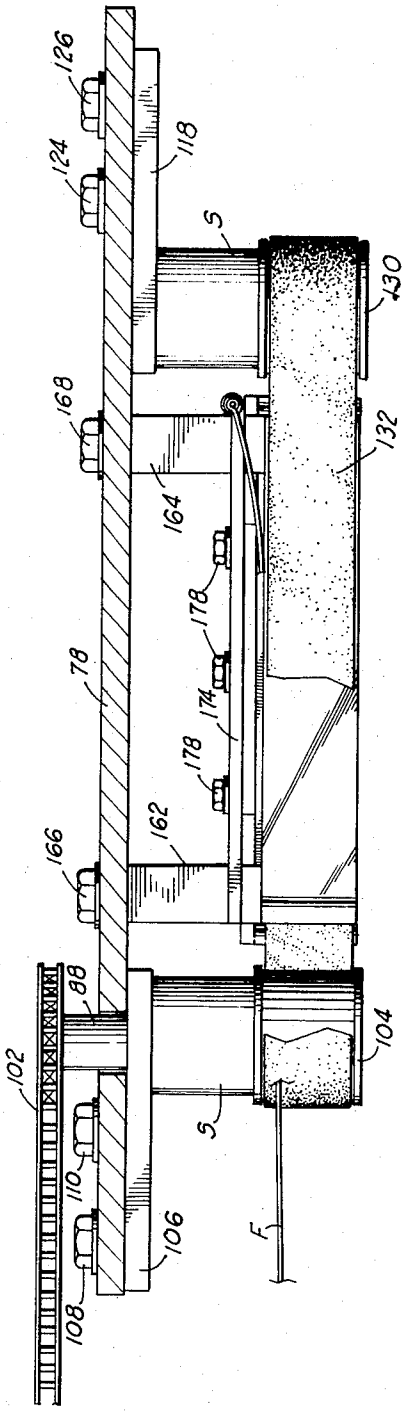
126
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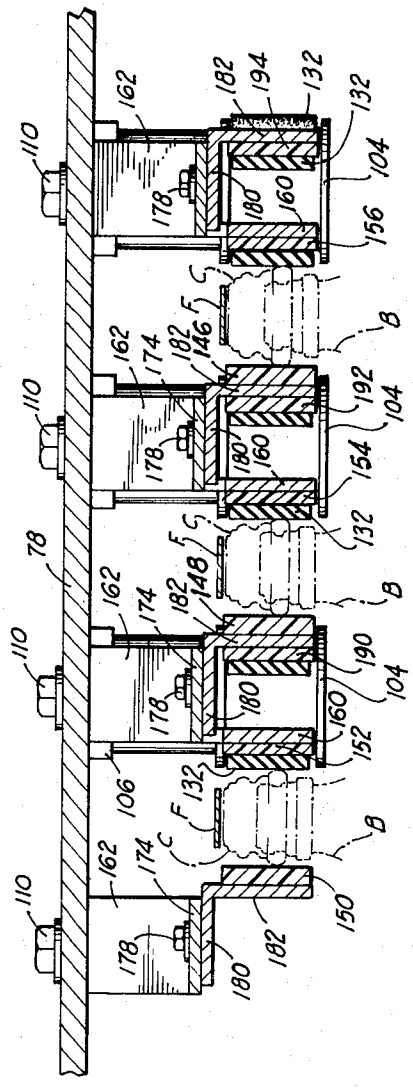
FIG 4


110
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182
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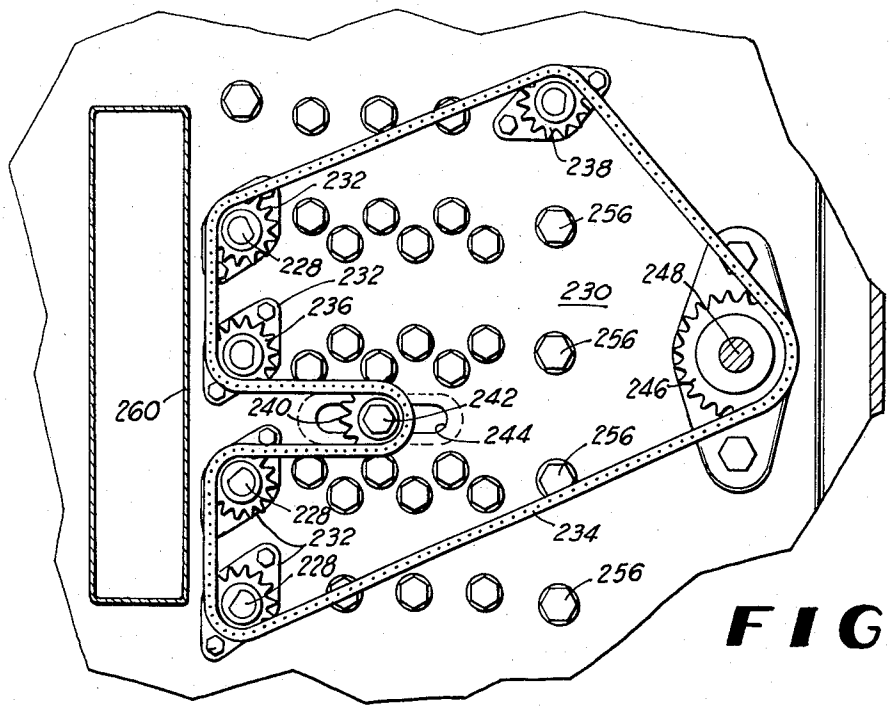
C
150

FIG 5


238
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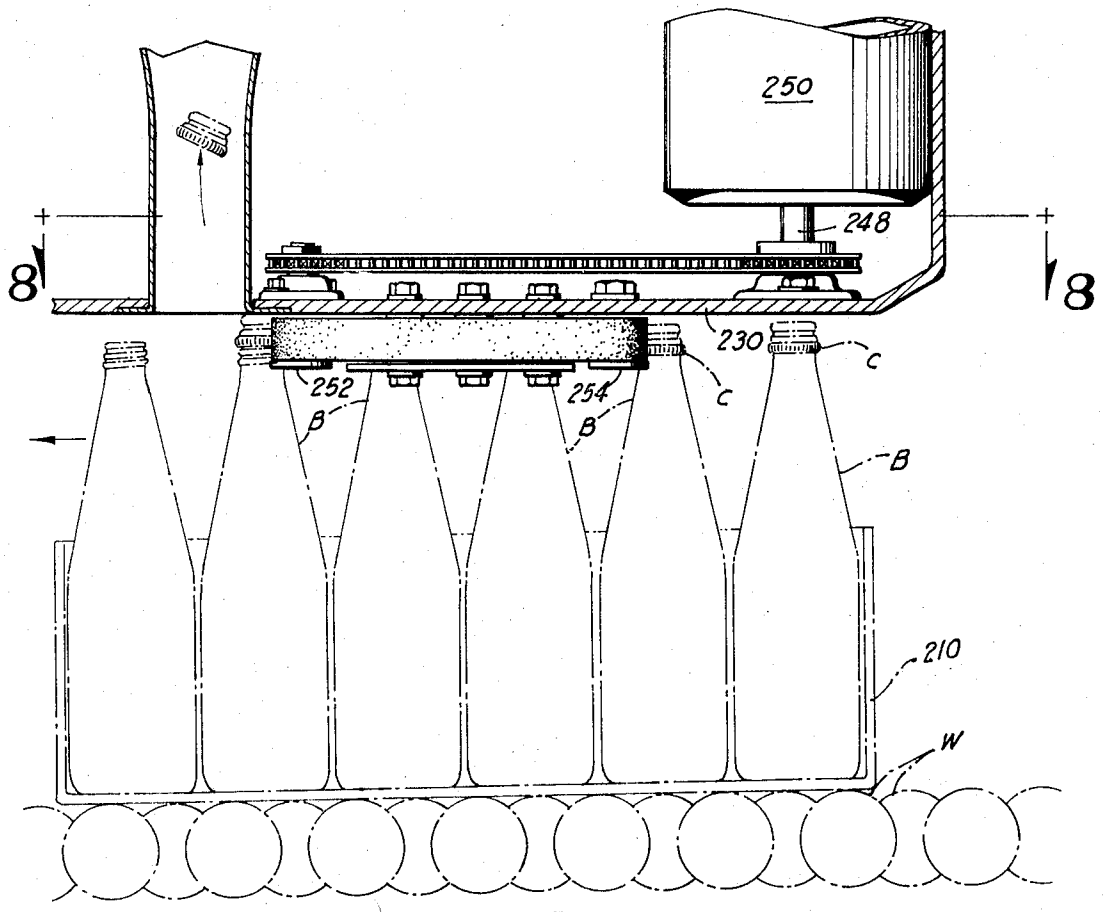
228
256

FIG 6


250
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C
252
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C
B
B
B
210
W

FIG 7

FIG 8

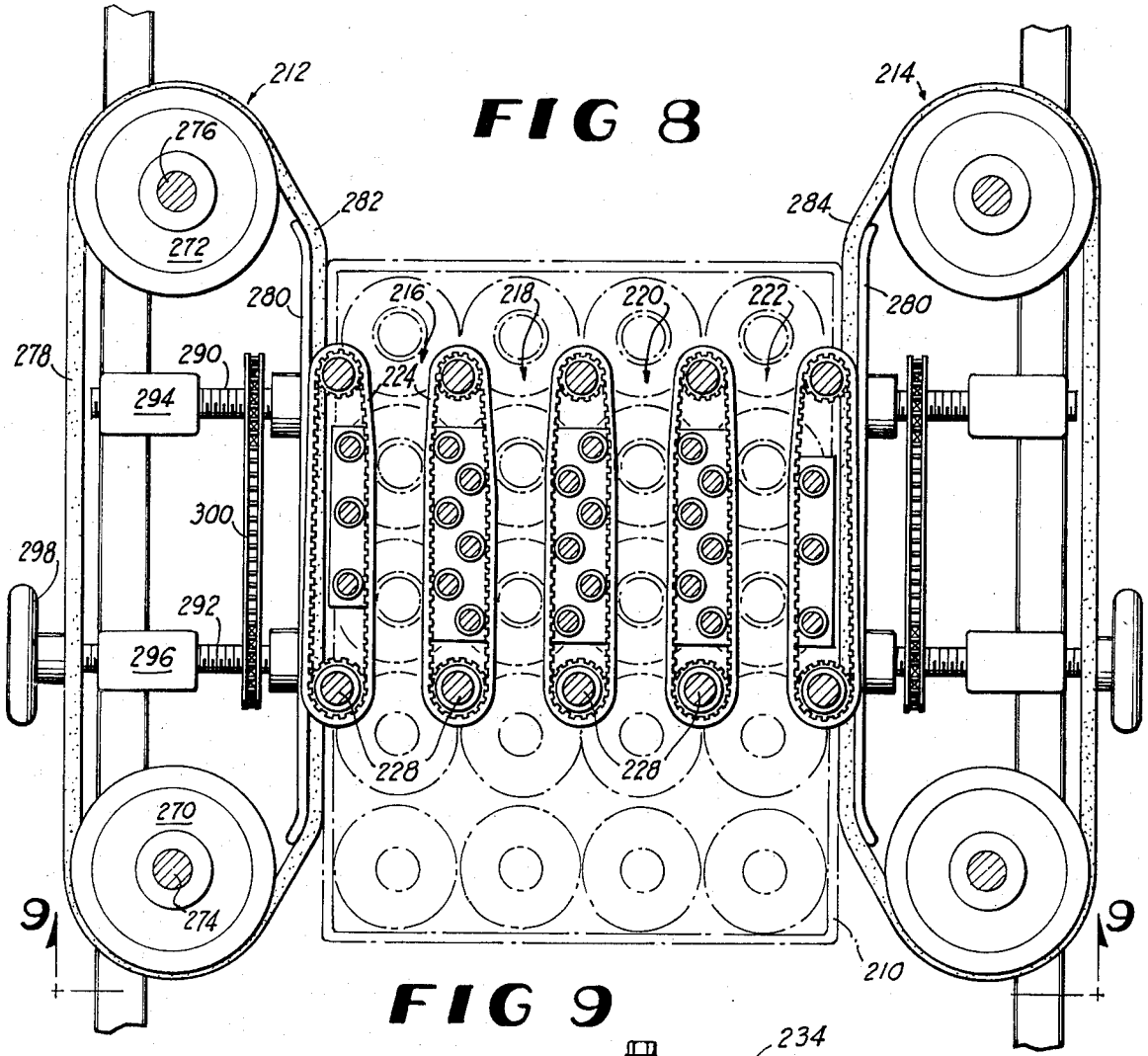
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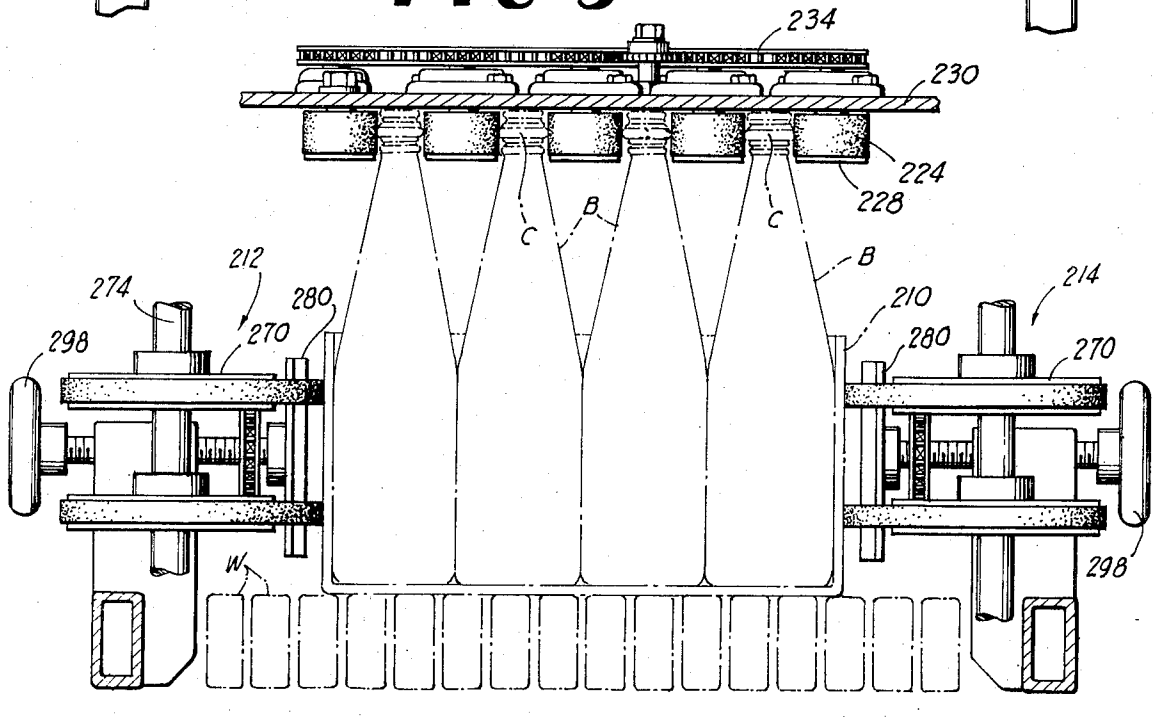
FIG 9


234
230
224
228
C
B
C
B
212
274
280
210
214
298
270
280
270
298
W

BOTTLE DECAPPING SYSTEM

BACKGROUND OF THE INVENTION

In the bottling industry the use of automatic devices for applying screw caps has long been known. Because of the fact that a line of filled bottles is formed in the normal course of procedure, it is a simple matter to grip or stabilize the bottles successively in the line and accurately to control their movement therealong during the capping operation whereby to optimize this stage of the system. In general, this same type of constraint or control of the bottles has been used to effect decapping of successive bottles in a line thereof.

However, in a system where empty bottles are returned in cases, the empties will be grouped initially so as to be abreast as they move down the line, either while still in the cases of after having been decased, and it would be advantageous to decap them at this time. However, the fact that the bottles are either in their cases or are loose but abreast precludes the usual stabilizing or control engagement therewith.

BRIEF SUMMARY OF THE INVENTION

It is therefore of principal concern in connection with this invention to provide a bottle decapping device which does not require the bottles to be held captive and closely controlled in their movements as the decapping action takes place. In short, the decapping operation may take place while the bottles are disposed in a case which exposes the upper regions of the bottles, or if the incoming bottles are in full depth cases, decapping can be effected subsequent to decasing and while the bottles are still in the case formation.

Essentially, a decapping device according to this invention incorporates means which sandwiches the caps of the empty bottles and imparts an untwisting of unscrewing action upon them as the bottles are moving along the conveyor path. The bottles themselves are not held, gripped, stabilized or otherwise controlled during the decapping operation. Instead, a slight downward thrust is imparted to the bottles incident to the decapping action and which is sufficient itself to impart a stabilizing action on the bottles. Thus, any tendency for the bottles simply to spin with their caps and which would therefore defeat the purpose of the machine is greatly reduced. This self-stabilizing action also allows a number of bottles to be decapped while they are abreast and therefore eliminates any need for them first to be unscrambled and placed in a single line.

Moreover, the decapping action according to this invention does not require precise timing and adjustment either among the components of the decapper or between the decapper mechanism and the conveyor mechanism which is transporting the bottles. That is, the decapping means somewhere along its extent will achieve full disengagement between the threads of the cap and the threads of the bottle, at which time the cap simply "sits" at this height on the bottle top (although it also will spin harmlessly so long as engaged by the unscrewing means) and continues to move along with the bottle. After passing from the unscrewing means, the cap simply rests lightly on the top of the bottle where it is easily removed as by a suction hood.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is side elevational view of an illustrative embodiment of the invention;

FIG. 2 is a plan view taken generally along the plane of section line 2—2 in FIG. 1 and showing the bottle decapping system with portions thereof broken away for clarity;

FIG. 3 is an enlarged horizontal section showing a portion of the assembly as illustrated in FIG. 2 with further portions being broken away for the sake of clarity;

FIG. 4 is a vertical section taken substantially along the plane of section line 4—4 in FIG. 4;

FIG. 5 is a transverse section taken substantially along the plane of section line 5—5 in FIG. 3;

FIG. 6 is a view similar to FIG. 3 but illustrating another embodiment of the invention;

FIG. 7 is a longitudinal section taken through the assembly of FIG. 6;

FIG. 8 is a horizontal section taken substantially along the plane of section line 8—8 in FIG. 7; and

FIG. 9 is a transverse section taken substantially along the plane of Section line 9—9 in FIG. 8.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. 1, a bottle decapping system is shown therein which forms part of the bottle line in a bottling system. The decapper assembly includes a frame indicated generally by the reference character 10 having adjustable feet or legs 12 and which mounts a conveyor frame indicated generally by the reference character 14 through suitable bolt 16 and slot 18 arrangements whereby the height of the conveyor frame 14 may be adjusted, in conjunction with suitable adjustment of the legs 12 so as to position the conveyor mechanism carried by the frame 14 at the requisite height to integrate with the conveying system of the bottling plant.

A generally U-shaped frame 20 as is shown in FIG. 2, is mounted at one end of the frame 14 and it acts as a guide for the bearing box 22 which carry the shaft 24 of the roller or drum 26 so as to adjust this roller or cylinder 26 longitudinally of the frame through the medium of suitable adjusting members 28 as shown in FIG. 1. One end of an endless conveyor belt is trained over the cylinder 26 and the opposite end is trained about a similar drive roller mounted on the shaft 30 at the opposite end of the frame and this shaft, provided with the sprocket 32, is driven through the medium of the chain 34 from the sprocket 36 secured to the output shaft of a suitable motor M. The motion of the upper flight 38 of the conveyor belt is in the direction of the arrows 40 as illustrated in FIG. 2.

The decapping frame 42 is mounted atop the base frame 10 and in the embodiment shown incorporates an open-rectangular frame section 44 as may be seen in FIG. 2 and at the corners of which there are located the internally screw threaded members 46 as will be apparent from FIG. 1. Bearing members 48 are secured to the frame section 10 and journal threaded members 50 therein which respectively are engaged in the internally screw threaded members 46 secured to the undersides of the corners of the frame 42 and the upper end of these members 50 are, in each case, provided with a sprocket 52 as will be evident from FIG. 2. A chain

54 is trained about all of these sprockets 52 as may be seen in FIG. 2 and one of the screw threaded shafts 50 is provided with a crank or handle 56 by means of which all of the members 50 may simultaneously be rotated in the same direction either to raise or to lower the frame 42 with respect to the frame 10 and particularly with respect to the upper flight 38 of the conveyor mechanism. The reason for vertically adjusting the frame section 42 is properly to position the cap engaging means 58 hereinafer more particularly described.

The frame section 42 mounts a support plate 60 upon which a drive motor 62 is mounted and which has it output shaft 64 coupled to the input shaft 66 of a speed reduction unit 68, also mounted on the plate 60 as is shown in FIG. 2 and the unit 68 is provided with an output shaft having a sprocket 70 thereon. The plate 60 also mounts the intake hood 72 of a vacuum means which is connected, through the flexible conduit 74, to a suitable source of vacuum indicated generally by the reference character 76.

The frame section 42 also mounts a frame plate 78 which is adapted to be longitudinally adjustable with respect to the frame section 42 through the medium of the mounting bolts 80 and cooperating elongate slots 82 as is shown in FIG. 2, the purpose of which will be presently apparent. The plate 78 is provided with a transversely elongate slot 84 through which a plurality of endless belt drive shafts 86, 88 and 90 project and these shafts respectively carry the sprockets 92, 94 and 96. The frame plate mounts a pair of idler sprockets 98 and 100 on suitable shafts therefor and in fixed relation to the plate 78 and an endless chain 102 is trained as is illustrated in FIG. 2 about all of these sprockets and additionally about the drive outputs sprockets 70 of the reduction gear device 68 so that all of the shafts 86, 88 and 90 rotate in unison in the same direction.

As can be seen from FIG. 3, each of the shafts 86, 88 and 90 projects below the frame plates 78 and is provided thereat with a drive pulley 104 in the fashion indicated for the shaft 90 in FIG. 3. Each shaft 86, 88 and 90 is journalled in a hournal plate such as the plate 106 as shown associated with the shaft 88 and which is rigidly affixed to the frame plate 78 against the undersurface thereof through the medium of a pair of mounting bolts 108 and 110. These mounting bolts project through transversely elongated slots 112 and 114 in the frame plate 78, as is shown in FIG. 3 for the bearing plate 106 associated with the shaft 86 so that each shaft may be laterally positioned in the frame as is necessary and desired, the purpose of which will be presently apparent.

An idler shaft 116 is associated with each of the drive shafts 86, 88 and 90 and each such drive shaft is journalled in a bearing plate 118 having transversely elongated slots 120 and 122 therein and through which mounting bolts 124 and 126 project. These mounting bolts, in turn, project through the longitudinally elongated slots 128 in the frame plate 76 so as to permit longitudinal adjustment of the shafts 116 with respect to their corresponding shafts 86, 88 and 90, as will be evident and also to permit, as is the case for the drive shafts 86, 88 and 90, transverse adjustment thereof with respect to the frame plate 78.

Each idler shaft 116 mounts a pulley or spool 130 which cooperates with the spool or pulley 104 on its corresponding shaft 86, 88 or 90 to receive the endless belt 132 associated with each pair of shafts such as the pair 90, 116 shown in FIG. 3.

The system as shown in FIG. 3 is adapted to accommodate three bottles abreast to engage and unscrew caps on the necks thereof as these caps progress through the respective channels 140, 142 and 144, (see also FIG. 5). Each such channel is formed between one flight of a belt 132 and an opposed gripper block 146, 148 or 150 and each such flight portion is backed up by a rubbing block 152, 154 or 156 as is shown most clearly in FIG. 5. Each of the blocks 152, 154 and 156 preferably is formed of teflon or similar material having a low coefficient of friction and each is bonded or otherwise secured to a web plate 160 provided at its opposite ends with a pair of upstanding pedestals 162 and 164. The pedestals receive mounting bolts 166 and 168 which project through transversely elongate slots 170 and 172 in the frame plate 78 and each pair of pedestals 162, 164 is joined by a bridging plate 174 likewise provided with transversely elongated slots 176 receiving the mounting bolts 178. The bolts 178 secure the horizontal legs 180 of inverted, L-shaped members adjustably thereto, the depending vertical legs 182 of which mount the cap engaging blocks 146, 148 and 150 all of which are formed of rubber to provide a reasonably high coefficient of friction. Certain of these legs 182 also mount, on their opposite sides, the take-up rubbing blocks 190, 192 and 194 which preferably are constructed of teflon or low coefficient of friction material and which engage against those flight portions of the endless belt 132 opposite to those portions thereof which engage the bottle caps in the several channels 140, 142, and 144. Spacers S are provided properly to locate the pulleys 104 and 130.

The widths of the channels 140 and 142 and 144 are properly adjusted so as to pinch and engage at diametrically opposed points of the bottle caps C as same progress through the passages due to the movements of the bottles B therethrough.

As will be evident from FIGS. 3 and 5, the flights of the belts 132 which engage the bottle caps C move in the same direction as do the bottles but at a faster rate of linear speed tending to rotate the caps in the direction to unscrew them from the threads of the bottle neck on which the caps are engaged. The bottles may be introduced onto the conveyor flight 38 in half cases which leaves their upper extremities exposed and the bottles are abreat as is illustrated in FIG. 2 and also in FIG. 5, the case, or the bottles in case formation, being carried along by the conveyor belt 38 so that their necks pass through the channels 140, 142 and 144, respectively during which time the decapping action takes place. The conveyor flight 38, as is conventional, will be supported by suitable rollers or a rubbing plate beneath it to prevent sagging of the conveyor belt between the drive and idler cylinders therefor and, incidental to the unscrewing action of the caps as effected by the endless belts 132, the caps will tend to rotate relative to the bottles and, in so doing, to move vertically with respect thereto. The endless belts, however, move in planes parallel or essentially parallel to the direction of movement of the bottles and thus impart no lifting action on the caps a they are unscrewed and, in fact, midly resist such lifting action which is incidental to the unscrewing operation so as, correspondingly, lightly to press the bottles downwardly during the unscrewing action to react against the conveyor means 38. This ac-

tion imparts a stabilizing action to the bottles and tends to reduce any tendency thereof to rotate with the caps. With regard to this it will be appreciated that the bottles have substantial inertia so as to resist rotation as the belts **132** intially contact the caps C so that the screw cap connections are easily "broken" before the bottles have had an opportunity to rotate with the caps and, thereafter, the mild downward pressing of the bottles is effected until the caps are completely unscrewed from the bottles, at which time the caps will simply spin harmlessly while still nested over the tops of the bottle necks until the caps pass from the channels **140, 142** and **144** whereafter the caps merely "sit" lightly on the bottle necks but are no longer screw-threadedly engaged therewith. In order to assure positively that the caps cannot accidentally be disengaged completely from the bottles until the bottles and caps reach the region of the vacuum hood **72,** the restraining fingers F are provided in overlying relationship to each of the channels **140, 142** and **144** and extend therebeyond to terminate just upstream from the hood **72.** These restraining fingers may be mounted on a cross shaft **200** as is shown in FIG. **3** and are normally loaded by the springs **202** to remain in essentially horizontal positions. It will be appreciated that the system as described above requires no precise timing or control as between either the positions of the bottles as they move along the conveyor path or as between the travel of the bottles and the exact time at which the unscrewing action is completed. That is to say, the bottle cap can be unscrewed completely at any point within any of the channels **140, 142** and **144** and in fact the point at which the unscrewing is effected or completed will occur at random points along the channels particularly in view of the fact that the "empties" normally will not have their caps all screwed back on to the same extent.

A further embodiment of the invention is illustrated in FIGS. **6–9.** As can be seen in FIGS. **7** and **9,** a half case or carton **210** containing the bottles B with their caps C and with the bottles four abreast is travelled along a conveyor system consisting of a plurality of freely rotatable wheels or rollers W and positive conveying means **212, 214** are provided to pass the bottles and their caps along the conveyor path so that the caps run through the several channels **216, 218, 220** and **222** as shown in FIG. **8.** In this case, each channel is defined between opposed flights **224** and **226** of a pair of the five endless belt arrangements illustrated. The drive shafts **228** of these endless belt devices are all driven in the same direction of rotation so that the opposed flights **224** and **226** are moving in a relatively opposite direction and at sufficient speed with respect to the travel of the bottles as effected by the conveying means **212, 214** as to unscrew the bottle caps essentially in the fashion as described hereinbefore with respect to the embodiment illustrated in FIGS. **1–5.**

The frame plate **230** of the decapping assembly mounts the drive shafts **228** through suitable fixed puller blocks **232** as illustrated in FIG. **6** and a common chain **234** is engaged over all of the sprockets **236** fixed to the drive shafts **228.** Two idler sprockets **238** and **240** are provided, the latter of which is carried by a shaft mounted in a suitable puller block or bearing plate and having associated with it a mounting bolt **242** cooperative with an elongate slot **244** in the frame plate **230** so as to allow take-up of the drive chain **234.** The drive chain **234** is trained about the drive sprocket **246** on the output shaft **248** of the motor **250** as is shown in FIGS. **6** and **7.** In the embodiment of FIGS. **6–9,** the drive pulleys **250** which are connected to the drive shafts **228** below the plate **230** and the idler pulleys **254** are mounted directly below the underside of the frame plate **230,** the idler pulley being mounted through the medium of the bolts **256.** With this arrangement, the underside of the frame plate **230** in those regions about the channels **216, 218, 220** and **220** serve as the restraining means to prevent complete disengagement of the caps from the bottles after they have been unscrewed, as will be evident from FIG. **7** and this restraining action is effected until the bottles and caps reach the position of the vacuum hood **260** as is illustrated in FIG. **7.** The action otherwise is the same as has been described in conjunction with FIGS. **1–5.**

The conveying means **212, 214** comprises in each case a pair of pulleys **170** and **272,** one of which is driven and each associated with its respective shaft **274** or **276,** as illustrated. An endless belt **278** is trained about each pulley pair and rubbing plates **280** are provided to cause the inner flights **282** and **284** of the belts positively to engage the opposite sides of the case **210,** as will be obvious from FIGS. **8** and **9.** Adjustment of the plates **280** is effected through the medium of a pair of screw shafts **290** and **292** each engaged in a nut member **294** or **296** and with the shaft **292** having a hand wheel **298** for rotating in either direction. The two shafts **290** and **292** are tied together by means of sprockets and an intervening chain **300** to cause the shafts **290** and **292** to retract or withdraw the corresponding bearing blocks or plate **280,** as will be obvious.

What is claimed is:

1. In a bottle handling system including conveyor means for travelling empty bottles along a predetermined path, which bottles may have screw caps engaged thereon, and decapping means for removing the screw caps from the bottles as they travel along said path, said decapping means comprising:

cap engaging means disposed above said conveyor means for engaging opposite sides of screw caps on the bottles during a selected length of travel of said bottles along said path, said cap engaging means including an endless belt essentially parallel to said path and means for driving said belt at a linear speed greater than that of said conveyor means whereby to unscrew the caps and cause the bottles to be pressed downwardly against said conveying means as a result of such unscrewing action.

2. In a bottling system as defined in claim **1** wherein said decapping means comprises a plurality of said cap engaging means disposed in side-by-side relation to accommodate a plurality of bottles moving abreast along said path.

3. In a bottling system as defined in claim **2** including vacuum means located downstream from said cap engaging means for sucking unscrewed caps off said bottles.

4. In a bottling system as defined in claim **3** including restraining means overlying the bottle caps for preventing disengagement thereof from the bottles until the bottles pass beneath said vacuum means.

5. In a bottling system as defined in claim **4** wherein said decapping means includes a frame plate disposed above said conveyor means and supporting said cap en-

gaging means therebeneath to engage the bottle caps.

6. In a bottling system as defined in claim 5 including a drive shaft for each endless belt, each drive shaft being rotatably mounted on said frame plate and having portions projecting above and below said frame plate, and said means for driving said endless belts drivingly engaging that portion of each drive shaft which projects above said frame plate.

7. In a bottling system as defined in claim 6 wherein said restraining means is constituted by the underside of said frame plate.

8. In a bottling system as defined in claim 6 wherein said restraining means comprises a finger.

9. In a bottling system as defined in claim 1 including vacuum means located downstream from said cap engaging means for sucking unscrewed caps off said bottles.

10. In a bottling system as defined in claim 9 including restraining means overlying the bottle caps for preventing disengagement thereof from the bottles until the bottles pass beneath said vacuum means.

11. In a bottling system as defined in claim 10 wherein said decapping means includes a frame plate disposed above said conveyor means and supporting said cap engaging means therebeneath to engage the bottle caps.

12. In a bottling system as defined in claim 11 including a drive shaft for said endless belt, said drive shaft being rotatably mounted in said frame plate and having portions projecting above and below it, and said means for driving the endless belt drivingly engaging that portion of the drive shaft which projects above said frame plate.

13. In a bottling system as defined in claim 12 wherein said restraining means is constituted by the underside of said frame plate.

14. In a bottling system as defined in claim 12 wherein said restraining means comprises a finger.

15. In a bottling system as defined in claim 1 wherein said decapping means includes a frame plate disposed above said conveyor means and supporting said cap engaging means therebeneath to engage the bottle caps.

16. In a bottling system as defined in claim 15 including a drive shaft for said endless belt, said drive shaft being rotatably mounted in said frame plate and having portions projecting above and below it, and said means for driving the endless belt drivingly engaging that portion of the drive shaft which projects above said frame plate.

17. A bottle decapping assembly for use in combination with conveyor means for travelling a plurality of bottles abreast along a predetermined horizontal path, said decapping assembly comprising, in combination:

a plurality of cap engaging means disposed above said conveyor means for intercepting and engaging diametrically opposed portions of bottle caps on the bottles as the bottles are travelled along said path, each cap engaging means including an endless belt travelling in a plane parallel to said path; and

means for driving all of said endless belts at a linear speed greater than the speed of movement of said bottles.

18. A bottle decapping assembly as defined in claim 17 including vacuum means located downstream from said cap engaging means for sucking the caps from said bottles.

19. A bottle decapping assembly as defined in claim 18 including restraining means for preventing complete removal of said caps from the bottles until they reach the region of said vacuum means.

20. A bottle decapping system comprising, in combination:

conveyor means for travelling pluralities of bottles abreast along a predetermined path; and

cap engaging means disposed above said conveyor means and along said path for unscrewing bottle caps from said bottles while pressing the bottles downwardly against the conveyor means incidental to such unscrewing.

* * * * *