

[54] **METHOD AND APPARATUS FOR REMOVING SCREW CAPS FROM CONTAINERS**

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[58] Field of Search. **29/200 D, 426, 427; 53/381 A, 381; 225/96, 96.5**

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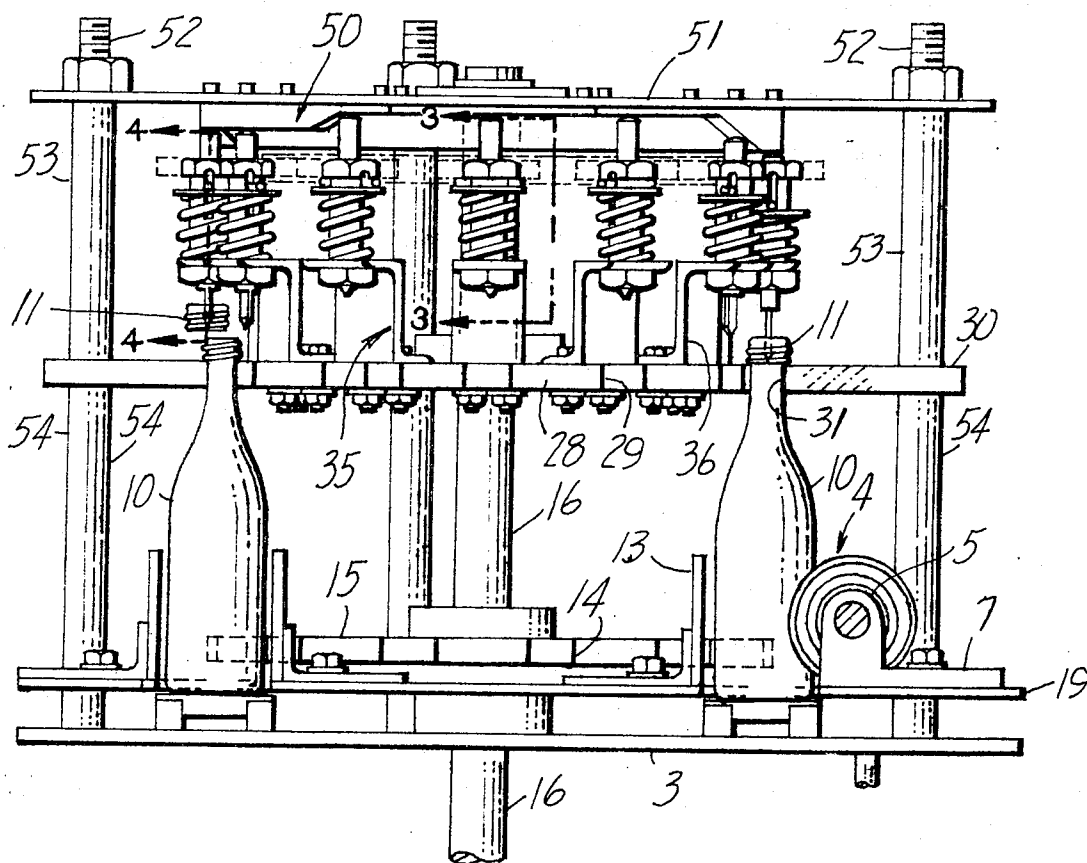
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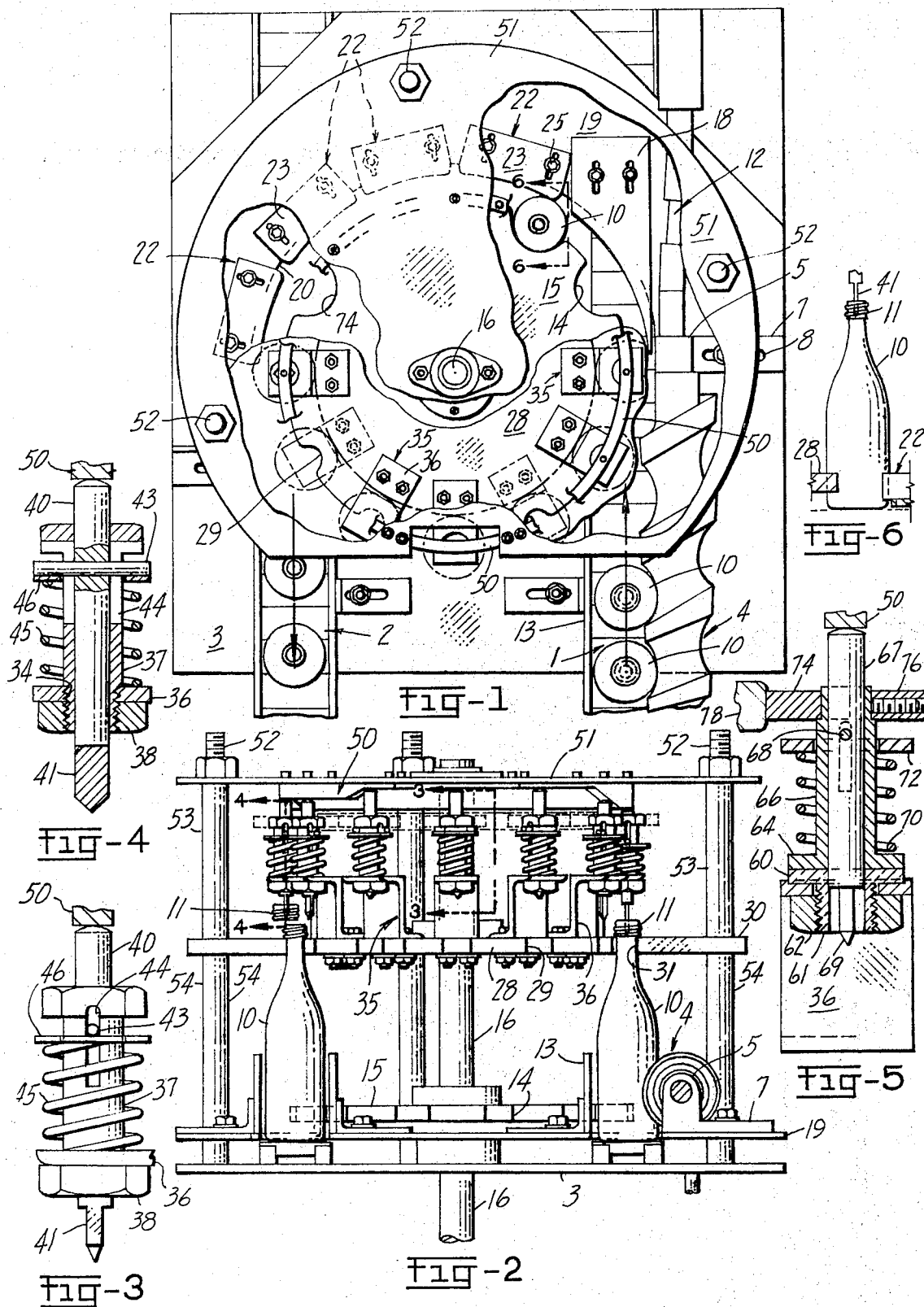
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[57] **ABSTRACT**

A method and apparatus for removing the screw cap from returnable bottles and like containers prior to refilling the bottles. The twist-off cap on the bottle is impaled by a blade and the blade and bottle are then relatively rotated to remove the cap. In the preferred form of the invention the bottles are moved around an arcuate path of travel and the large diameter body portion of the bottles are pressed against a frictional material to rotate the bottle while the impaling blade is held stationary relative to the bottle. Ejector means is provided for removing the caps from the blades. In another form of the invention, particularly adaptable for use with noncircular bottles, the impaling blades are rotated relative to the bottles.

7 Claims, 6 Drawing Figures





METHOD AND APPARATUS FOR REMOVING SCREW CAPS FROM CONTAINERS

This invention relates to a method and apparatus for removing screw caps from containers such as returnable bottles.

Bottlers employing returnable bottles receive a large percentage of the returned bottles with the screw caps thereon. In other words, when the user has emptied the contents of the bottle, he quite often replaces the cap on the bottle rather than throwing the cap away. In such instances, it is necessary for the bottler to remove the screw cap before the bottles are put through the washing and filling steps. The problem of removing such screw caps is made more difficult by the fact that in many cases the bottles contain liquids having sugar dissolved therein and such solutions cause the cap to become firmly adhered to the bottle neck so that a relatively strong torque is required to unscrew the cap.

One approach to the problem would be to frictionally engage the exterior of the cap and relatively rotate the cap and bottle. However, the take-off torque required in many instances is much greater than one would suppose and frictional engagement of the cap is insufficient to develop the torque required for removal.

The main object of the present invention is to provide an effective decapping method and apparatus for removing screw caps from containers such as bottles.

Another object of the invention is the provision of a decapper which is simple in operation, inexpensive to make, and which is adapted to exert the relatively high torque required in many instances to remove the screw-off caps from returnable bottles.

Yet another object of the invention is the provision of a method and apparatus for removing caps from bottles regardless of the shape of the bottle and whether the bottles are circular or not circular in cross section.

Other objects and advantages of the invention will be apparent from the following specification, and from the drawings.

FIG. 1 is a top plan view of the apparatus of the present invention with portions of the same broken away to show additional structure.

FIG. 2 is a side elevation of the apparatus of FIG. 1.

FIG. 3 is an enlarged side elevation of the spring urged impaling blade and its mount.

FIG. 4 is a view similar to FIG. 3 but taken at right angles thereto.

FIG. 5 is a view similar to FIG. 3 showing a modified form of the invention.

FIG. 6 is a sectional view taken in a plane indicated by line 6-6 in FIG. 1.

In detail, and first with reference to FIG. 1, the preferred form of the invention includes a pair of parallel conveyors generally designated 1, 2 respectively. Conveyor 1 is employed to feed the bottles 10 to the decapper and conveyor 2 is employed to take away the bottles after the caps 11 have been removed. The conveyors 1, 2 may be supported on a base plate 3 which is in turn spaced upwardly from the floor by any convenient means (not shown). Alongside intake conveyor 1 is a conventional feed screw generally designated 4 which is supported at its opposite ends in bearings 5. These bearings are preferably mounted on mounts 7 which are provided with elongated slots 8 (FIG. 1) to permit the feed screw 4 to be moved toward and away from conveyor 1 to suit the size of the bottles being run and to permit replacement of feed screws of different size

and pitch, as required. The inner end of the screw 4 is driven from a universal joint generally designated 12 and connected to a suitable source of power (not shown).

On the side of conveyor 1 opposite feed screw 4 is provided a guide rail 13 for restraining the bottles laterally so that the same register with a plurality of outwardly opening recesses 14 in a lower star wheel 15. The star wheel 15 is fixedly secured to a vertically extending shaft 16 which is rotated by a power means (not shown), and which is synchronized with the drive of feed screw 4 so that successive bottles on conveyor 1 are received in the pockets formed by recesses 14.

The bottles 10 are removed from intake conveyor 1 by a guide plate 18 which in turn is adjustably secured to a support plate 19 spaced upwardly from base plate 3. This support plate 19 is formed with a generally semicircular inner edge 20 and a plurality of pressure blocks 22 are adjustably secured to plate 19. These pressure blocks are provided with a layer 23 of leather-like material having high friction characteristics and are further provided with a plurality of elongated slots for receiving securing bolts 25 therethrough so that the frictional resistance on the bottles 10 may be adjusted as desired.

Spaced upwardly from the star wheel 15 and also mounted on vertically extending shaft 16 is a second star wheel 28 which is formed around its periphery with relatively small recesses 29 for receiving the necks of the bottles at a point just below the cap. As the bottles are moved about their arcuate path of travel by star wheel 15, the necks of the bottles are retained in recesses 29 by means of a guide plate 30 which is formed with a generally semicircular inner edge 31 for slidably engaging the necks of the bottles. By the above described structure, it will be apparent that each bottle is maintained in an exact position relative to the axis of shaft 16.

Mounted on upper star wheel 28 are a plurality of mounts generally designated 35, each of which is in registration with the recesses 29 into which the bottle necks are received. Each of said mounts 35 comprises a Z-bar 36, the bottom flange of which is secured to upper star wheel 28 and the upper flange of which is provided with an aperture 34 for receiving therethrough the lower externally threaded end of a tubular spring retainer 37. The retainer 37 is reduced in diameter at its lower end to pass through the aperture 34 in the bar 36 and a nut 38 is threadably secured to said lower end for securing the mount in place.

Slidably received within retainer 37 is an elongated cylindrical shaft 40 which is formed at its lower end to provide a sharpened blade 41. Fixedly secured to shaft 40 and extending diametrically thereof is a short pin 43 that is slidably received in longitudinally extending slots 44 formed in retainer 37. The upper end of retainer 37 is formed to a hexagonal or other non-circular shape adapted to receive a wrench to permit securement of nut 38. By this structure it will be apparent that the shaft 40 is held against rotation by pin 43 in slots 44 and at the same time vertical longitudinal movement of the shaft 40 is permitted. Surrounding retainer 37 is a compression spring 45 which abuts at its lower end, the upper side of Z bar 36 and at its upper end with a washer 46 against pin 43. By this structure it will be apparent that the impaling blade 41 is urged at all times upwardly away from the bottle cap.

In order to effect the desired vertical movement of the impaling blade 41 a cam generally designated 50 is provided above the upper ends of shafts 40 of the blade assembly. This cam 50 is secured to the under side of an upper plate 51 which in turn is supported at preferably three points around its periphery by bolts 52. Interposed between upper plate 51 and guide plate 30 are a plurality of spacing sleeves 53 through which the bolts 52 pass. Similarly spacing sleeves 54 are interposed between the under sides of the guide plate 30 and the upper side of the support plate 19 to which the pressure blocks 22 are secured. This structure permits the spacing between the cam 50 and the guide 30 to be adjusted by replacement of sleeves 53 with similar sleeves of different length. In addition, the spacing between the support plate 19 and the guide plate 30 may also be changed to suit the height of the bottles being run.

The cam 50 is formed so as to slidably engage the upper end of each shaft 40 so that when the bottles are being received from intake conveyor 1 into registration with the recesses 14 formed on the star wheels 15, 28, the blades 41 are retracted upwardly so as to be clear of the bottle caps. However, once the bottles are positioned by star wheels 15, 28, the cam 50 causes the shaft 40 to be moved downwardly against the urgency of springs 45 so that the blades 41 impale the cap on the bottle which it is in registration with. The cam 50 is further formed so as to hold the blade downwardly as the bottles engage pressure blocks 22, thereby rotating the bottles relative to the impaling blades 21. This, of course, results in the cap on each blade being removed from its associated bottle.

As the bottles approach the take-away conveyor 2, the cam 50 is formed so as to permit the blades 41 to move upwardly with the caps frictionally secured thereto. After the bottles are on conveyor 2 the cam 50 is formed so as to permit the impaling blades 41 to move further upwardly so that the caps thereon engage the lower sides of nuts 38 thereby ejecting the caps from the blades. The ejected caps may then fall by gravity into a suitable chute (not shown).

In the event the bottles are noncircular in cross section, or if, for some other reason, it is desired to rotate the impaling blades relative to the bottles, the modified form of the invention shown in FIG. 5 may be employed.

In this case each Z bar 36 is provided on its upper flange with a bearing washer 60 which has an integral downwardly extending central boss 61 externally threaded to receive thereon a nut 62. Slidably supported on bearing washer 60 is an annular flange 64 provided with an upwardly extending tubular sleeve 66 in which is slidably received a shaft 67 formed at its lower end with a blade 69 similar to shaft 40 and provided with diametrically extending pin 68. A helical compression spring 70 urges a washer 72 upwardly against pin 68 so that shaft 67, as in the previously described embodiment, is urged upwardly at all times against cam 50.

At the upper end of sleeve 66 the same is provided with a disk 74 fixedly secured to said sleeve 66 by set

screw 76. Disk 74 is adapted to engage, at its periphery, friction pressure blocks such as that indicated at 78 and similar to friction pressure blocks 22 heretofore described. It will be apparent that pressure blocks 78 may be supported on an elevated support plate (not shown) similar to support plate 19 hereinbefore described.

By the above described structure it will be apparent that the cam 50 will, as in the previously described embodiment, urge the shaft 67 downwardly after the adjacent bottle has been received in the pocket corresponding to the pockets formed by the recesses 14 above described. After the cap of each bottle is impaled by the blade 69, the disk 74 engages the pressure blocks 78 causing the sleeve 66 and blade 69 to be rotated to remove the cap.

I claim:

1. In the method of removing a screw cap from a cylindrical container, the steps of:

moving the container along a path of travel,

impaling the cap during said movement by an impaler having a noncircular cross section and simultaneously holding said impaler against rotation relative to the axis of rotation of said cap,

establishing an abutment having a frictional surface alongside said path,

urging said bottle laterally against said abutment surface during said movement whereby said container rotates about its longitudinal axis relative to said cap during said movement.

2. The method of claim 1 wherein said surface is cylindrical and said path of travel is circular.

3. Apparatus for removing a screw cap from a cylindrical container comprising:

means for moving said container along a path of travel,

an impaler supported for movement with said container,

means for impaling said cap by said impaler during said movement,

an abutment having a friction surface alongside said path,

means for urging said container laterally against said abutment surface during said movement whereby said container rotates about its longitudinal axis relative to said impaler.

4. Apparatus according to claim 3 wherein said impaler is spring urged away from said cap at all times and cam means is provided for urging said impaler through said cap.

5. Apparatus according to claim 4 wherein stop means is provided for engaging said cap when said cap has been removed and said spring means moves said impaler away from said cap for ejecting said cap.

6. Apparatus according to claim 3 wherein said path is arcuate and said friction means is radially outward of said container.

7. Apparatus according to claim 6 wherein a wheel radially inwardly of said path urges said container radially outwardly against said friction means during said movement.

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