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van Zijp

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[54] GRIPPING DEVICE FOR BOTTLES

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[52] **U.S. Cl.** **198/210,** 198/25

[51] **Int. Cl.** **B65g 29/00**

[58] **Field of Search** ..... 198/25, 22 B, 210

[56] **References Cited**

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[57] **ABSTRACT**

A device for gripping bottles in recesses defined by the circumference of a bottle dial plate of a bottle closing or opening machine comprising a plurality of arcuated gripping means with each of the arcuated gripping means being mounted near a recess in such a way that the gripping means extends around the recess from a place at some distance beyond the circumference of the recess at the inner edge of the dial plate to a place beyond the dial plate. The inner end of each gripping means is mounted in a manner preventing rotation but is releasably mounted to a vertical shaft rotatably supported in the dial plate. The lower end of the shaft is provided with a swing lever mounted thereto in a manner preventing rotation and the lever extends towards the inner side of the dial plate. A vertical shaft is secured to the end of the lever extending to the inner side of the dial plate and a cam roller is rotatably mounted to the vertical shaft. The cam roller follows a fixed cam disc mounted coaxially to a central shaft so that the arcuated gripping means are guided in such a manner that an arriving bottle may pass freely into the recess with the arcuate gripping means being swung into the position by means of the action of the cam and cam follower so that the bottle in the recess is gripped by the free end of the gripping means.

8 Claims, 4 Drawing Figures

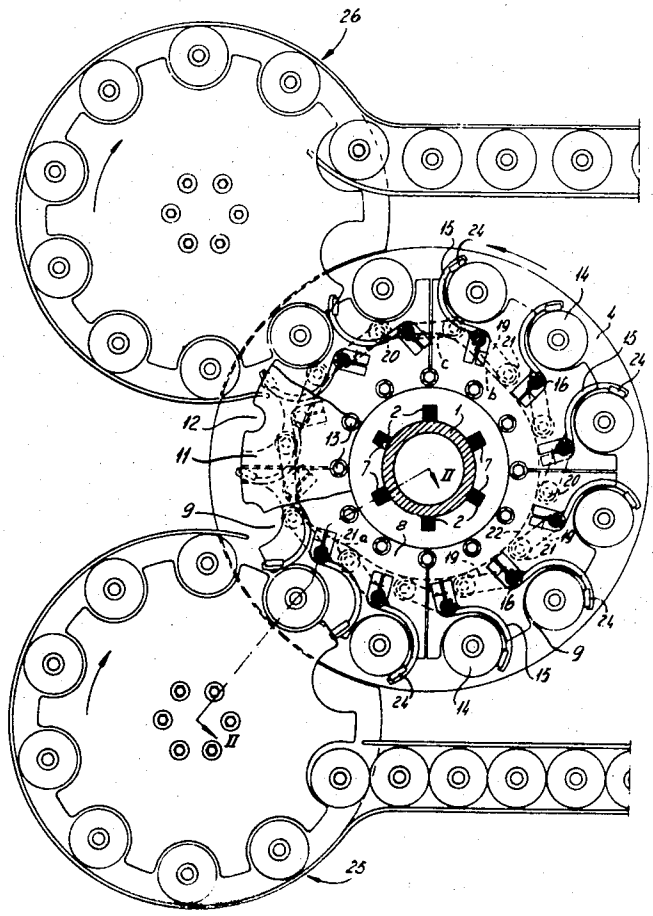

FIG. 1

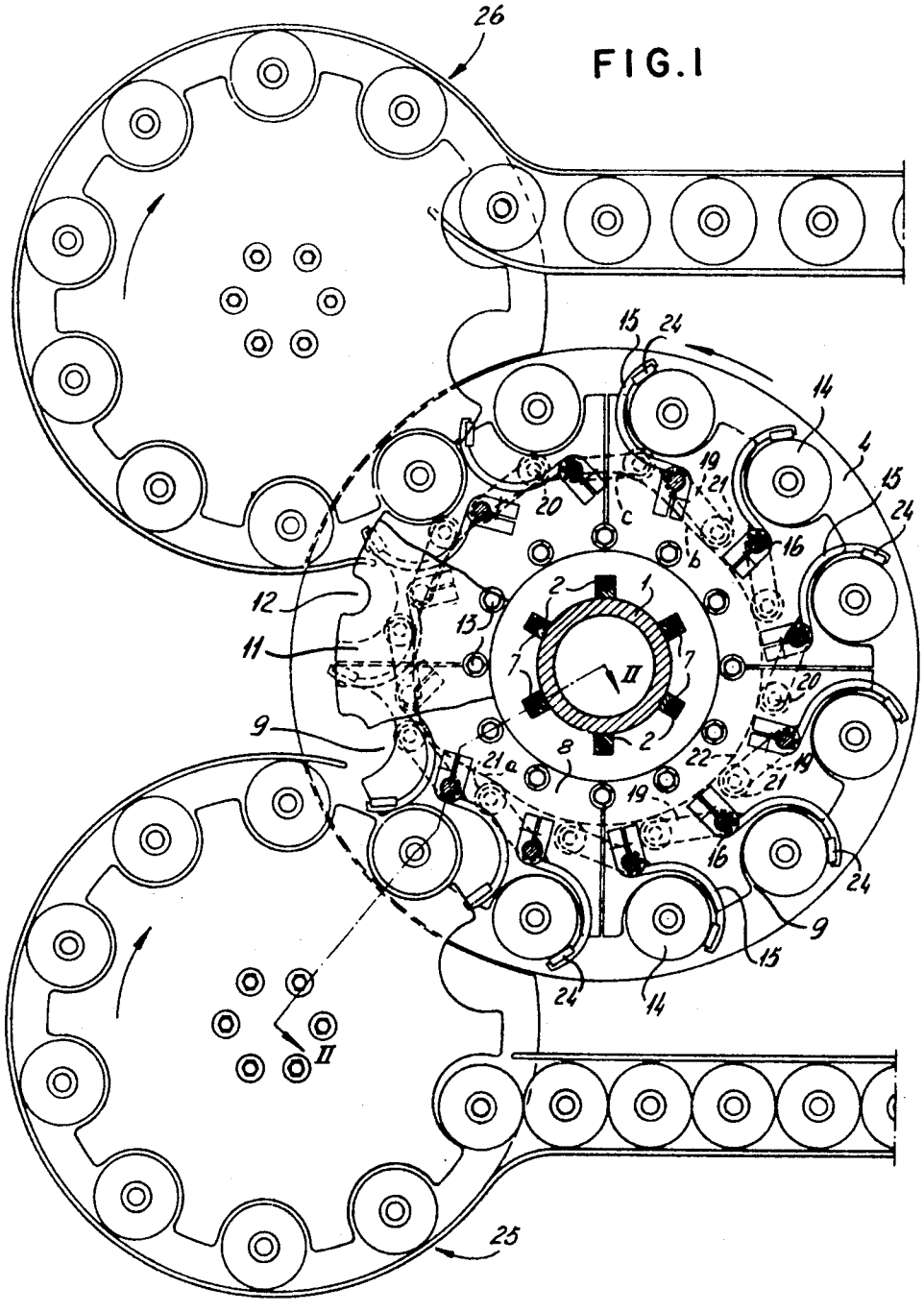

FIG. 2

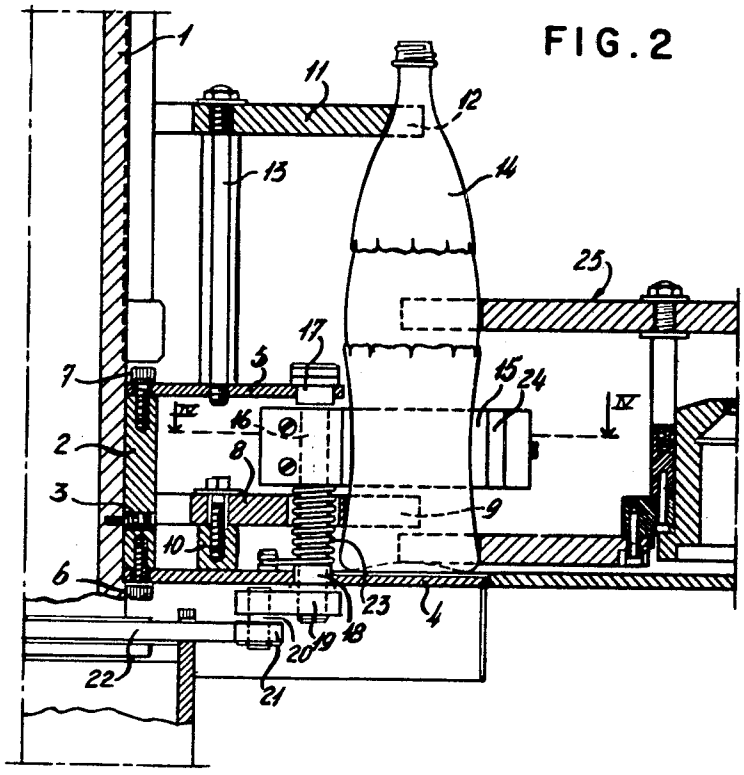
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FIG. 3

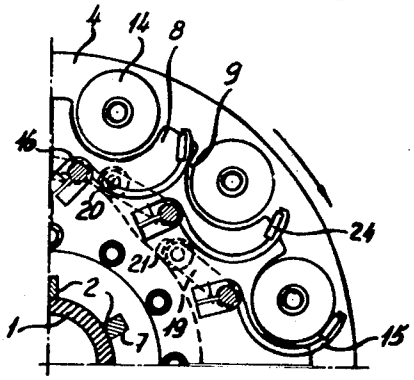
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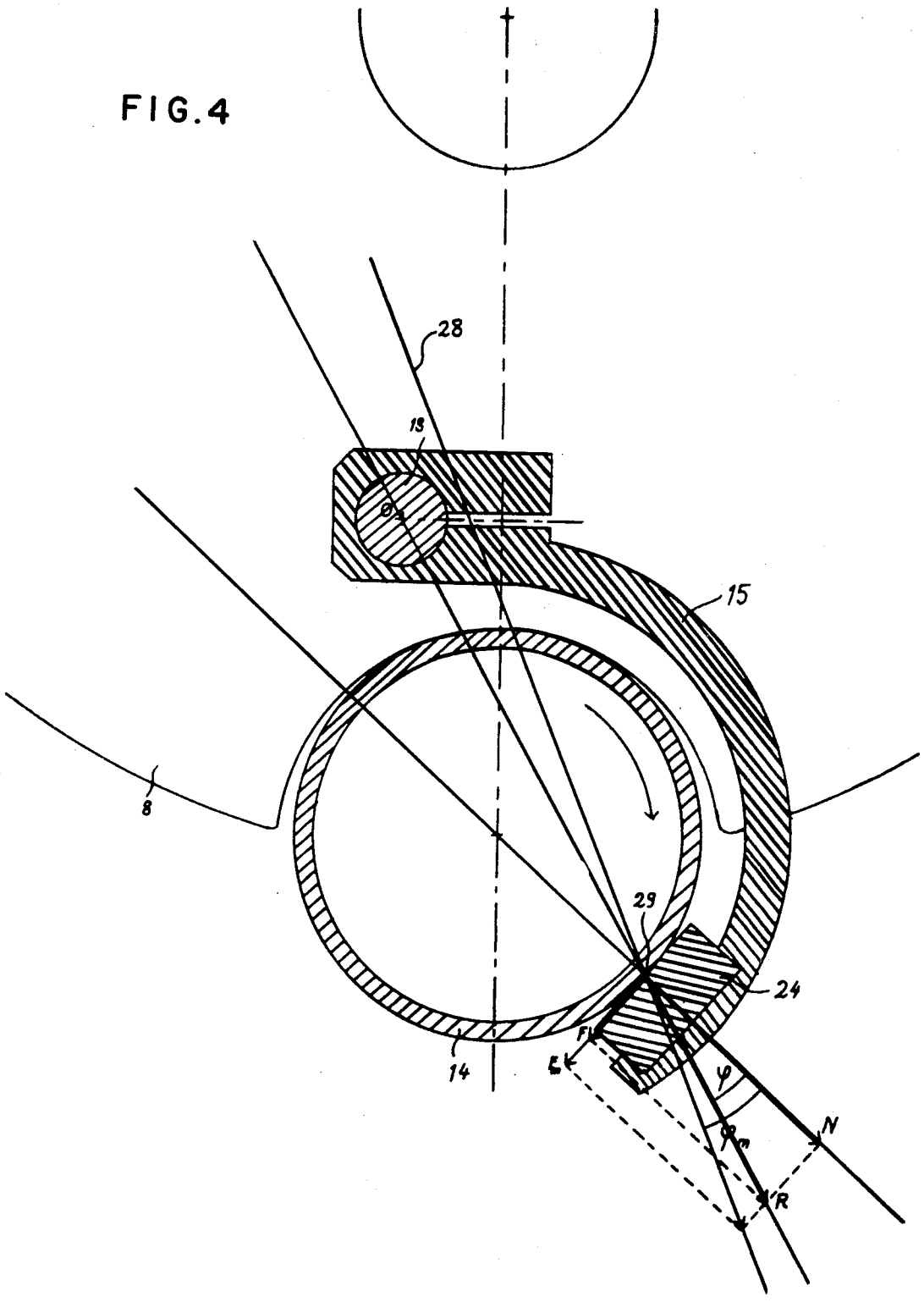
FIG. 4



GRIPPING DEVICE FOR BOTTLES

The invention relates to a gripping device for bottles, and more specifically to a device for gripping bottles in recesses provided in the circumference of a bottle dial plate of a bottle closing or opening machine.

Automatic bottle closing or opening machines comprise a rotating bottle table guiding bottles in a continuous circular motion under screw clamps for turning screw caps to the filled bottles or from empty bottles. During the turning motion, rotation of the bottles should be prevented. Several gripping devices have been provided to prevent such rotation. The gripping means in those devices are generally closed around the bottles by the pressure of a spring so that a sufficient grip is obtained to prevent rotation of the bottles during turning the cap to or from the bottles.

Generally, the structure of the gripping devices previously used is rather complicated, besides the fact that gripping devices in bottle closing machines are different from the gripping devices in bottle opening machines. In addition, the gripping means used are usually only suitable for bottles of one and the same profile, and those gripping means should be replaced by other adapted gripping means when bottles of a different profile are used.

The present invention provides a gripping device which may be applied to bottle closing machines or bottle opening machines, and is suitable for gripping bottles of different diameters and shape.

The device comprises a plurality of arcuated gripping means, each of them being mounted near a recess or between a set of related recesses above each other in such a way that the gripping means extends around the said recess or recesses from a place at some distance beyond the circumference of the recess or recesses at the inner edge of the said dial plate to a place beyond the dial plate. The inner end of each gripping means is mounted in a manner preventing rotation, but is mounted releasably to a vertical shaft rotatably supported in the said dial plate. The lower side of the shaft is provided with a swing lever mounted thereto in a manner preventing rotation with the lever extending to the inner side of the dial plate. A vertical shaft is secured to the end of the lever and a cam roller is rotatably mounted to the vertical shaft. The cam roller follows a fixed cam disc mounted coaxially with the central shaft of the dial plate, so that the arcuated gripping means are mounted and guided in such a way that an arriving bottle may pass freely into a recess or a set of related recesses above each other in the said dial plate, and thereafter, the arcuated gripping means may be swung into the position in which the bottle in the recess is gripped by the free end of the said gripping means.

In the invention, the arcuated gripping means are positively guided by a fixed cam disc mounted coaxially with the central shaft of the dial plate, through a swing lever and the shaft connected therewith, to which the gripping means is mounted, so that the lever always moves in the same manner and pressure is not influenced by the differences in sizes of the bottles. Thus, the system may be used for substantially all bottle profiles. By their arcuated shape, the gripping means can be mounted so that they extend around the bottle from the end mounted to the rotating shaft to the end beyond the dial plate in a direction corresponding to that of the torsion moment exerted on the bottle during the running motion of the cap to or from the bottle. The arcuated gripping means may be reversed so that they may be applied in bottle closing machines, in which the torsion moment exerted to the bottle is in a clockwise direction. In bottle opening machines the torsion moment is in a counter-clockwise direction. Therefore, in a preferred embodiment of the invention, a device is provided, in which the arcuated gripping means are mountable in a 180° reversed position so that the device is usable in bottle closing machines as well as in bottle opening machines.

The torsion moments exerted to the bottles by turning the caps to or from the bottles, exert a further force to the gripping means in such a way that the grip on the bottles is increased. This effect may be increased by providing the inner wall at the free end of the gripping means with a block of an elastic material having a relatively high friction coefficient. The contact place of the block and the bottle may be selected with respect to the shaft of the gripping arm so that the friction force of the block, which is preferably constructed of rubber, on the bottle increases the grip by the turning motion of the screw clamp for closing or opening the bottle.

The device according to the invention provides a relatively simple structure for a bottle grip mechanism which may be applied in bottle closing machines as well as in bottle opening machines for gripping bottles of different sizes and/or different profiles.

An additional embodiment of the invention is provided by a device, in which the gripping means is provided between two dial plates, the higher dial plate being provided with recesses corresponding to those of the lower dial plate, but having smaller sizes for centering the bottles to be capsulated, while each gripping means extends beyond the dial plates in such a way that each bottle may be held between the free end of the said gripping means and the inner edges of the corresponding dial plates.

In this embodiment, an advantage is attained in that centering of the bottles almost always occurs at the neck of the bottles even though the diameters of the bottles, in fact, may differ to a relatively large extent. Since the gripping means is placed between the dial plates, it can act on the broader part of the bottles, so that a relatively small force is necessary to exert a sufficient moment to avoid rotation of the bottles during the closing or opening motion with respect to the force necessary when the gripping means would act on the neck of the bottle. When the bottles are wet, which occurs frequently in practice, the action of the gripping means on the broader part of the bottles has advantages over the action on the necks of the bottles in that slip is more easily avoided before the necessary moment of the screw cap clamp is exerted on the bottle.

The invention is discussed in further detail by the aid of the attached drawings in which, as illustration only, an embodiment of a bottle grip mechanism according to the invention is shown.

IN THE DRAWINGS

FIG. 1 is a plan view of a rotating bottle table for a bottle closing machine, in which the mechanism according to the invention is applied, the table being partially shown in section.

FIG. 2 is a section through the device of FIG. 1 along the line II — II.

FIG. 3 is a plan view of a partial section through a rotating bottle table used in a bottle opening machine.

FIG. 4 is a section through a part of the gripping means and a bottle held thereby, along the line IV — IV in FIG. 2.

The rotating bottle table shown in the drawings comprises a central rotating shaft 1, having mounting means 2 fixed to the lower end at regular distances along its circumference by means of lock screws 3. The mounting means 2 serves for the securing of a rotating disc 4 and a disc 5. The rotating disc 4 is secured to the lower end of the mounting means 2 by means of bolts 6. The disc 5 is secured to the upper edge of the mounting means 2 by means of a bolt 7. Thus rotating disc 4 and the disc 5 are mounted to the central shaft 1 in a manner that rotation of the discs with respect to the shaft is avoided. The rotating bottle table further comprises a lower bottle dial plate 8, the circumference of which is provided with moonlike recesses 9 at regular distances. The dial plate 8 is mounted at some distance above the rotating disc 4 and is fixed near its inner circumference to mounting means 10, which is in turn mounted to the rotating disc 4. A second dial plate 11 is mounted relatively high above the disc 5. This dial plate 11 is provided with the same number of moonlike recesses 12 as the recesses 9 of dial plate 8 at regular distances, with the recesses 12 being of smaller diameter than the recesses 9 of the dial plate 8. The dial plate 11 is secured to the disc 5 by a long bolt 13, and between the lower side of the dial plate 11 and the upper side of the disc 5, a distance tube is provided in order to keep the dial plate 11 at a spaced distance from the disc 5.

The bottles 14 to be guided by the rotating table as shown in FIG. 2 rest with their neck part in the recesses 12 of the upper dial plate 11 and with their lower part in the recesses 9 of the lower dial plate 8, with the bottoms resting on the rotating disc 4. During rotation of the shaft 1, the bottles 14 are taken along with the rotating disc 4 and the dial plates 8 and 11. The bottles thus taken along, are guided under screw clamps for turning caps to or from bottles, and placed above the rotating bottle table. The bottles during the turning motion of the caps should not be allowed to rotate. For this purpose, gripping mechanisms are provided in the rotating table, and a gripping mechanism is added to each set of corresponding recesses 9 and 12. The mechanism comprises an arcuated grip arm 15 extending around the circumference of a bottle 14 by a recess defined therein from a point at some distance beyond the circumference of the recess at the inner side of the dial plate to beyond the dial plate. Each grip arm 15, is mounted to a vertical shaft 16 by the inner ends so that rotation with respect to the shaft is avoided. The upper end of the shaft 16 is supported in a bearing 17 mounted in an opening in the disc 5. The lower end is supported in a bearing 18 in the rotating disc so that the shaft 16 extends below the rotating disc 4. The extending end of the shaft 16 is provided with one end of a swing lever 19 fixed to the shaft 16 so that rotation with respect to the shaft is avoided. The other inwardly extending end is provided with a roller 21 freely rotatable around a vertical shaft 20. The roller 21 rests on the periphery of a cam disc 22 coaxially mounted to the central shaft of the rotating table and is secured under the rotating disc 4. The roller 21 is pressed to the cam disc 22 by a torsion spring 23 placed around the shaft 16. When the shaft 1 is rotated in the direction of the arrow in FIG. 1, the rotating disc 4 and the dial plates 8 and 11 are rotated. Thus, the lever 19 and the roller 21 are turned along, the roller 21 following the periphery of the cam disc 22. In FIG. 1, when the cam roller 21 passes the stretch *a–b* of the cam disc, the position of the swing levers 19 and the grip arms 15 on the shafts 16 is thus that the free ends of the grip arms 15 are resting on the bottles 14. In this position, the bottles are kept secured and cannot rotate when caps are screwed on the bottles. Passing the stretch *b–c* of the cam disc 22, the levers 19 are forced to swing counterclockwise, so that the grip arms 15 also swing counterclockwise, and the ends of the arms become released from the bottles, liberating the bottles. In this position, the bottles may be removed from the bottle table. The rotating bottle table shown in FIG. 1 is suitable for bottle closing machines, in which, during turning of the cap, a torsion moment is exerted to the bottles by the screw clamps in a clockwise direction. Movement of the bottles in that direction is avoided by the grip arms 15 when mounted as shown in FIG. 1.

The free ends of the grip arms 15 are preferably provided with rubber blocks 24 which are mounted in such a position with respect to the shaft 16 that, due to friction of the blocks 24 and the bottles, the grip of the arms 15 is further increased.

The increase of the gripping force may be derived from FIG. 4, which indicates the forces appearing when a bottle 14 is gripped by a gripping means 15 and a moment is exerted on the bottle caused by the capsulation action. That moment causes a force R acting on the bottle, composed of a normal force N and a friction force F. The direction of the force R is through the point O of the shaft 18. When the moment exerted on the bottle increases, the force F increases proportionally, which means that N increases, since the direction of the resultant force R should go through O. In other words, the force exerted by the gripping means 15 on the bottle 14 increases proportionally. This is true as long as the friction angle ϕ is smaller than the maximum friction angle ϕ_m. Thus, the force exerted on the gripping means 15 by the spring 23, may be small, and needs only to be sufficient to bring the gripping means 15 from the open position to the bottle. It is an advantage, therefore, that only very small forces are exerted on the bottle when it is opened or closed, so that bottles, which are very fragile or can collapse very easily, may be capsulated or opened in a proper manner.

The bottles may, in a way known per se, be supplied continuously to the bottle closing machine according to FIG. 1 by means of a rotating bottle table 25, and may be taken away continuously by means of a rotating bottle table 26.

In bottle opening machines, in which, during the action of opening clamps, a torsion moment is exerted in a reverse direction with respect to the moment exerted when bottles are closed with caps, the grip arms 15 may be placed in a 180° reversed position on the shafts 16 with respect to the position shown in FIG. 1. Such a use is shown in FIG. 3, in which the rotating bottle plate is rotatable in a counter-clockwise direction as shown in

FIG. 3 by an arrow, and the grip arms 15 are placed in a 180° reversed position on the shafts 16 with respect to the position shown in FIG. 1. Such a use is shown in FIG. 3, in which the rotating bottle plate is rotatable in a counter-clockwise direction as shown in FIG. 3 by an arrow, and the grip arms 15 are placed in a 180° reversed position on the shafts 16, with respect to the position shown in FIG. 1.

Although the invention is illustrated by the embodiment shown in the drawings, it is obvious that the invention is not restricted to the drawings, and that modifications and variations are within the scope of the invention.

What is claimed is:

1. A device for gripping bottles comprising a central shaft, holding means secured to said central shaft, a vertical shaft connected to said holding means and a plurality of bottle dial plates connected to said holding means, said plurality of bottle dial plates having circumferences which define recesses for gripping bottles, a plurality of gripping means connected to said vertical shaft, each of said gripping means being releasably mounted to said vertical shaft and positioned near one of said recesses so that the gripping means extends around said recess from a place at some distance beyond the circumference of the recess at the inner edge of said dial plate to a place beyond the dial plate, and placed in such a way that the point of rotation of said vertical shaft lies within an imaginary conical surface formed by the maximum friction angle at the contact point of the bottle and the free end of said gripping means, the lower end of said vertical shaft is provided with a swing lever mounted thereto in a manner preventing rotation, said swing lever extending towards said central shaft with the end extending towards said central shaft being provided with a rotatable cam roller mounted thereto, said cam roller following a fixed cam disc mounted coaxially with said central shaft so that the gripping means is mounted and guided in such a way that an arriving bottle may pass freely into each recess of said dial plate allowing the gripping means to be swung by action of the cam disc into a position in which the bottle in the recess is gripped by said gripping means.

2. A device according to claim 1, wherein the gripping means has one end releasably mounted to the vertical shaft with the free end being swung by the action of the cam disc into a position in which it grips the bottle in the recess.

3. A device according to claim 1, wherein the arcuated gripping means are mountable in a 180° reversed position so that the device is usable in bottle closing machines and in bottle opening machines.

4. A device according to claim 1, wherein the inner sides of the said arcuated gripping means are provided with a block of a resilient material having a high friction coefficient near the free end.

5. A device for gripping bottles comprising a central shaft, holding means secured to said central shaft, a vertical shaft connected to said holding means and a plurality of bottle dial plates connected to said holding means, said plurality of bottle dial plates having circumferences which define recesses for gripping bottles, a plurality of arcuated gripping means connected to said vertical shaft, each of said arcuated gripping means being releasably mounted to said vertical shaft rotatably and positioned near a set of related recesses positioned above each other in such a way that the gripping means extends around said recesses from a place at some distance beyond the circumference of the recess at the inner edge of one of the dial plates to a place beyond said one dial plate, the lower end of said vertical shaft being provided with a swing lever mounted thereto in a manner preventing rotation, said lever extending toward a central shaft with the end of the lever extending towards the central shaft being provided with a rotatable cam roller mounted thereto, said cam roller following a fixed cam disc mounted coaxially with the central shaft so that the action of the cam and cam follower allow the arcuated gripping means to be mounted and guided in such a way that an arriving bottle may pass freely into a set of related recesses positioned above each other in the respective dial plates so that the arcuate gripping means may be swung into the position in which the bottle in the recesses is gripped by said gripping means

6. A device according to claim 5, wherein the gripping means has one end releasably mounted to the vertical shaft with the free end being swung by the action of the cam disc into a position in which it grips the bottle in the recess.

7. A device as claimed in claim 5, wherein the gripping means is provided between two dial plates, the higher dial plate being provided with recesses corresponding to those of the lower dial plate, but having smaller sizes for centering the bottles to be capsulated, and each gripping means extends beyond the dial plates in such a way that each bottle may be held between the free end of the said gripping means and the inner edges of the two corresponding dial plates.

8. A device for gripping bottles as claimed in claim 5, wherein said holding means comprises a mounting element secured to said central shaft and a plurality of discs secured to said mounting element.

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