

[54] **DEVICE FOR OPENING CONTAINERS IN A STERILE ENVIRONMENT**

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[58] Field of Search 83/411 R, 411 A, 83/167, 567, 914, 165, 733, 859, 925 R; 21/61, 80; 53/381 A, 381 R

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[57] **ABSTRACT**

Device for opening sealingly closed and internally sterile containers, by cutting a portion of the material of said containers, comprising an enclosure isolated from the ambient atmosphere, means for driving the said containers continuously within the said enclosure, a stationary cutting member placed in the path of said containers, so that the portion thus cut meets the said cutting member, means for discharging the portion thus cut from the said enclosure, and sealing means associated with the said driving means and discharge means, to preclude any communication between the enclosure and the exterior.

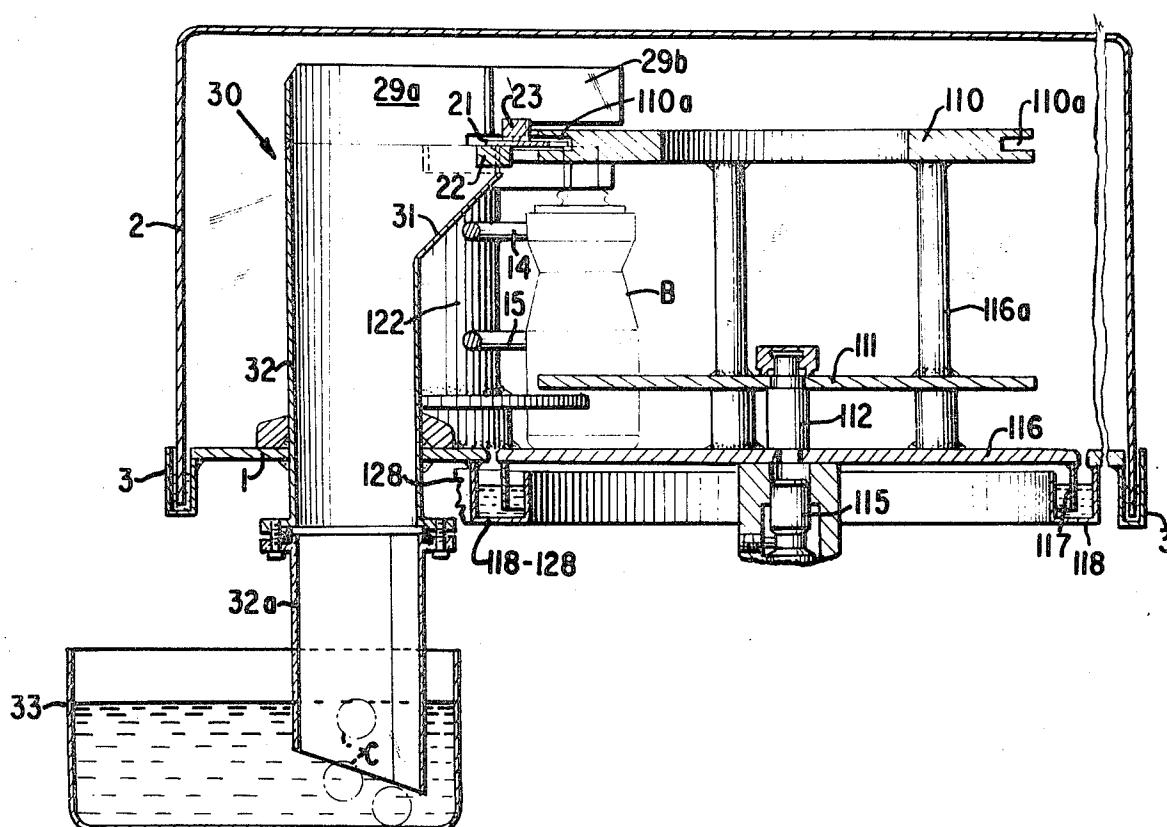
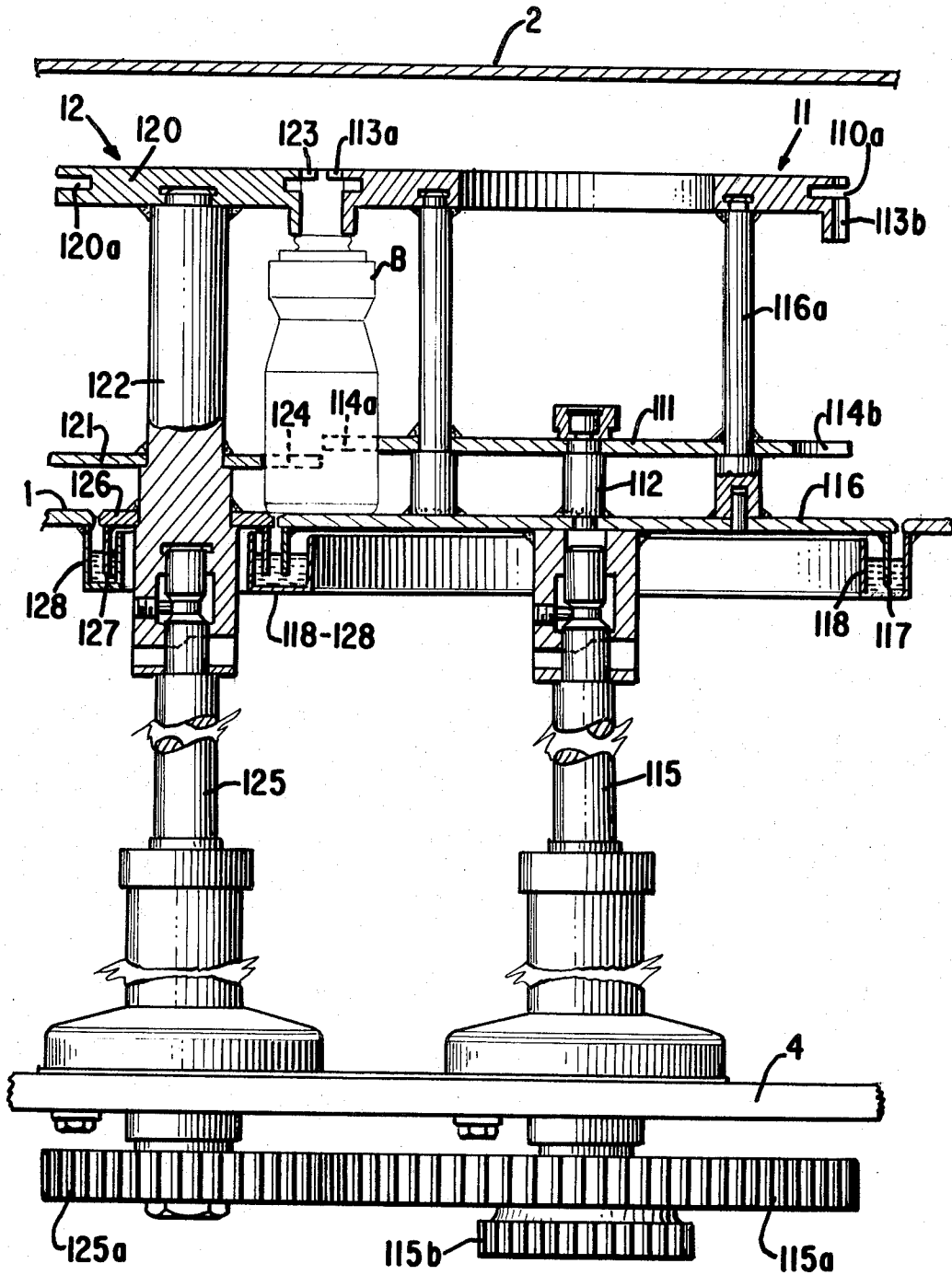
9 Claims, 5 Drawing Figures

FIG. 2



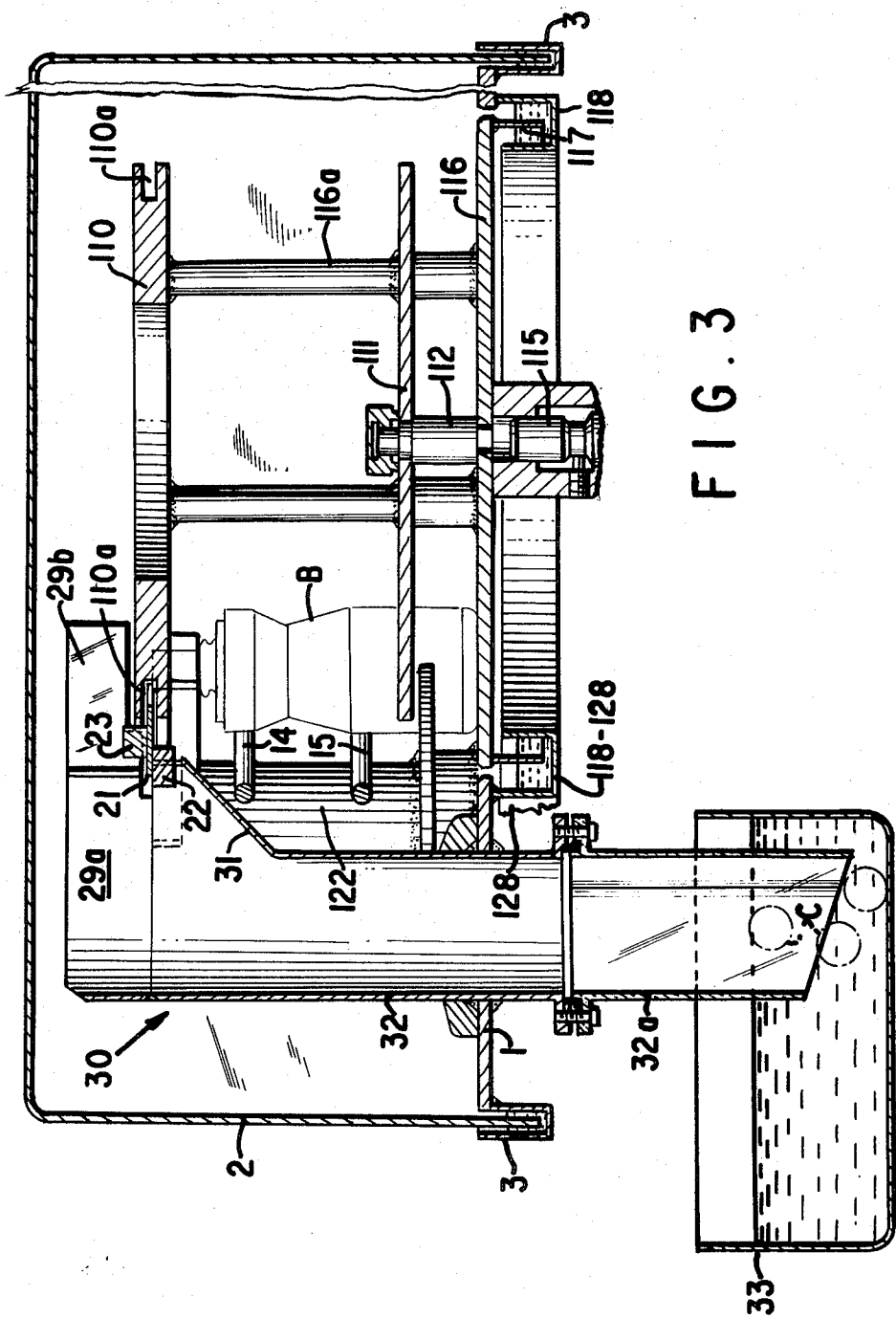


FIG. 3

DEVICE FOR OPENING CONTAINERS IN A STERILE ENVIRONMENT

The presently known devices for opening closed containers by cutting the material of the latter, for instance for removing the top collar of plastics bottles, are devices which are associated with either blow-extrusion machines serving to manufacture the containers, or apparatus separate from the said machines and operating in free atmosphere. Such devices are by no means designed to maintain sterility of the interior of the containers, since the latter enter into contact with the ambient air the moment they leave the blow-extrusion machine or the moment they are opened.

The applicant has disclosed in U.S. Pat. application Ser. No. 165,266 filed on July 22, 1971 and entitled "Method of aseptic packing or conditioning of any product, in particular a food product," a method according to which the closed and internally sterile containers are introduced into a conditioning enclosure which is itself maintained internally sterile, and are opened, filled with the product to be conditioned and, lastly, closed within the said enclosure.

The purpose of the present invention is to enable the said method to be put into practice as far as the opening operation is concerned, and therefore has for its object a device for opening sealingly closed and internally sterile containers by cutting a portion of the said containers, for instance in order to remove the top collars of plastics bottles, the said device comprising an enclosure isolated from the ambient atmosphere, maintained internally sterile and intended to receive the said containers.

The device according to the invention is characterized in that it comprises means for driving the said containers in a continuous manner within the said enclosure, a stationary cutting member placed on the path of the said containers, so that the portion to be cut-off, for instance the top collar of bottle necks, meets the said cutting member, means for discharging the portion thus cut-off, for instance the said top collar, from the said enclosure, and sealing means associated with the said driving means and the said discharge means to preclude any communication between the enclosure and the ambient atmosphere.

During the displacement, of the continuously driven containers the latter come into contact with the cutting member which is stationary, so that the opening operation takes place continuously.

According to another feature of the invention, the said driving means are constituted by a first rotary star member intended to receive the containers and drive them in rotation and a second rotary star member arranged in tangential relationship to the first star member, the star members being driven in synchronism in mutually opposite directions of rotation and being provided with complementary slots or recesses adapted to receive the containers and to tightly grip the latter when the said slots are in mutually confronting relationship, in proximity to the tangential point, the said cutting member being arranged in immediate proximity to the tangential point of the said star members.

Such a star system forms a very simple driving means occupying little space and imparting to the said bottles or the like a motion along a circular path which is compatible with hydraulic joints of simple structure ensuring the fluid-tightness of the enclosure, and requiring minimum space, thus offering considerable advantage

for sealingly closed enclosure whose dimensions are necessarily limited.

According to another feature of the invention, each star member is provided with at least two superposed plates, generally circular in shape secured to a common shaft, the two upper plates, located substantially in one and the same horizontal plane, being provided with slots whose shape and dimensions correspond to the shape and dimensions of the upper portions of the containers, for instance, of the bottle necks, the two lower plates being provided with slots whose shape and dimensions correspond to the shape and dimensions of the lower portions of the containers, for instance the bottle bodies.

The bottles are therefore retained through the medium of both their body and neck, and can thus be driven without incurring any risk of falling or accident, the driving of the bottles being therefore compatible with the maintenance of a sterile enclosure, since any opening of the latter in order to have access to the driving device destroys the sterilization.

According to another feature of the invention, both upper plates are provided at their peripheral edge with a groove, both grooves being arranged in confronting relationship so as to allow the said cutting member between the said plates.

Therefore, the cutting member to engage removes the top collar of the bottle the moment its neck is gripped in the slots of the upper plates.

Again according to the invention, each star member is provided at its lower portion with a circular base-plate secured to the aforesaid shaft and forming a portion of the bottom wall of the fluid-tight enclosure, the said base-plate being provided at its lower portion with a peripheral side-wall or skirt engaged in a stationary annular channel arranged under the bottom wall and filled with a liquid in which the said side wall is immersed.

A hydraulic joint is thus obtained which, while permitting the rotation of the star members, precludes any communication between the internal space of the enclosure and the ambient atmosphere.

Other features and advantages of the invention will appear as the following description proceeds.

In the appended drawings given solely by way of example :

FIG. 1 is a top view of a device for removing the top collar of plastics bottles, according to the invention ;

FIG. 2 is a sectional view upon the line II—II of FIG. 1 ;

FIG. 3 is a sectional view upon the line III—III of FIG. 1 ;

FIG. 4 is a sectional view of the cutting member upon the line IV—IV of FIG. 1 ;

FIG. 5 is a sectional view upon the line V—V of FIG. 4.

There is shown in the drawings a device according to the invention for removing the top collars of plastics bottles sealingly closed and internally sterile plastic bottles supplied by a blow-extrusion machine. This device comprises essentially means indicated generally at 10 and adapted to continuously drive the bottles B, a cutting member 20 serving to remove the top collars of the said bottles, i.e., to cut the collars at the upper portion of their necks, and means 30 for discharging the said collars. The device is located within an enclosure

isolated from the ambient atmosphere and maintained internally sterile, the said enclosure, which is shown only partially in the drawings, being constituted essentially by a bottom wall and an upper casing 2 made preferably from a transparent material and removably supported on the said wall through the medium of a hydraulic joint 3 (in FIG. 1 the said upper casing is assumed to be removed).

The bottle driving means 10 comprise a first rotary star member 11, generally circular in shape and adapted to receive the bottles and drive them in rotation, and a second rotary star member 12 which is also circular in shape and is arranged tangentially to the star member 11.

Each of the two star members 11 and 12 comprises two superposed plates: namely and respectively an upper plate 110, 120 and a lower plate 111, 121. Both plates of one and the same star member are substantially equal in diameter.

The upper plates 110 and 120 are adapted to grip the bottle necks and are provided to this end with slots 113a, 113b and 123 whose dimensions correspond to those of the said necks. Likewise, the lower plates 111 and 121 are adapted to grip the bottle bodies and are provided to this end with slots 114a, 114b and 124 whose dimensions correspond to those of the said bodies.

Each star member 11 and 12 comprises a base-plate 116 and 126 respectively, secured to shafts 112 and 122, the said base-plates being located substantially at the level of the bottom wall 1 of the enclosure. The diameter of the base-plates 116 supporting the plates 110, 111 by means of rods 116a is considerably greater than that of plates 110 and 111, in order that the base-plate 116 may engage the bottom of the bottles and drive the latter in rotation.

The guiding of the bottles being conveyed towards the star members 11 and 12 and driven by the star member 11 is ensured by stationary guiding means 14 and 15 comprising successively a rectilinear portion 14a, 15a and a circular portion 14b, 15b, concentric with the star member 11.

The star members 11 and 12 are supported by driving shafts 115 and 125 respectively, located below the base-plates 116 and 126 coaxially with their shafts 112 and 122, and with respect to which they can be keyed angularly and adjustably. The shafts 115 and 125 are provided at their lower ends, i.e., outside the enclosure, with pinions 115a and 125a meshing with one another; in addition the shaft 115 is provided, with a pinion 115b connected to a drive motor (not shown). The two star members are therefore driven in rotation in mutually opposite directions and in synchronism, their respective plates being to be positioned angularly that, during the rotation, the slots 123 and 124 will coincide successively with the slots 113a and 113b and with the slots 114a and 114b respectively.

The base-plates 116 and 126 are provided on their lower faces with circular walls or skirts 117 and 127 engaged in U-section channels 118 and 128 secured, for instance welded, to the bottom wall 1. The channels, which comprise a common portion 118-128, in the region where they are at a tangent to one another, are filled with any suitable liquid, for instance water, so as to form a hydraulic joint precluding any communication between the internal space of the enclosure and the ambient atmosphere.

The upper plates 110 and 120 are provided with grooves 110a and 120a made in their peripheral edges and serve to allow the blade of the cutting member to penetrate into the said grooves, as will be explained in the following.

The cutting member 20 comprises essentially a blade 21, made preferably of steel and mounted on a fastening system constituted by two clamping plates 22 and 23 between which the said blade is inserted and with respect to which it can be adjusted in position. A tightening screw 25 enables the blade to be secured in a selected position with respect to the clamping plates. The lower clamping plate 22 comprises, at one end, a sleeve 24 mounted on a stationary vertical rod 27 and provided with a tightening screw 26 so as to allow for angular adjustment and vertical positioning of the blade.

The blade 21 is provided, at its front portion, with a substantially V-shaped cutting edge, and is arranged so that its tip be located in proximity to the tangential point of the upper plates 110 and 120 of the star members 11 and 12, slightly upstream or downstream of the said tangential point with respect to the direction of movement of the bottles, shown by the arrow F.

Guides 29a and 29b are provided above the cutting member so as to guide the bottle top collars towards the discharge device.

The top-collar discharge device 30 comprises essentially a funnel-shaped member 31 arranged below the cutting member and connected with a vertical discharge conduit 32 passing through the bottom wall 1 of the enclosure and the lower portion 32a of which is constituted by a pipe made from a transparent material, for instance glass. The lower end of the pipe 32a is connected with a vat 33 filled with a liquid, for instance water, and in which its lower end is immersed. The vat thus forms together with the conduit 32 a hydraulic joint preventing any communication between the internal space of the enclosure and the ambient atmosphere.

The device according to the invention operates as follows: the sealingly closed and internally sterile bottles B are supplied through the medium of conveying means of any known type (not shown), which displace the bottle according to F, between the star members 11 and 12 driven in rotation as indicated by the arrows F₁ and F₂ respectively (see FIG. 1). Each bottle first moves onto the base-plate 116 and is then seized by the slots, its neck engaging into the slots of the upper plates and its body into the slots of the lower plates. The bottle is then driven by the star member 11 along a circular path and, while it is thus driven and firmly retained in the slots, the upper portion of its neck meets the edge of the blade 21 which first perforates it with its tip and then cuts it progressively with both its cutting edges 21a, 21b. The bottle is then freed from the slots of the star member 12, but is guided by the circular portions 14b and 15b of the stationary guiding means 14 and 15, so that they remain in the slots of the star member 11 until they are taken by another driving device (not shown) which directs it, for instance, towards a filling station.

The top collars C separated by the blade 21 are conveyed along the guides 29a and 29b to the funnel-shaped member 31 from which they fall by gravity into the vat 33 through the conduit 32 - 32a. Owing to the fact that the density of the plastics used (polyethylene) is close to that of water, the collars first remain at the lower end of the pipe 32a; after they have accumulated

in sufficient quantity, they pass under the pipe 32a floating at the surface of the liquid in the vat, from which they can be discharged periodically.

The device according to the invention offers a certain number of advantages resulting from its structure. The cutting of the material by means of a blade offers the advantage of not causing the formation of dust as is the case with cutting apparatus operating by way of shearing by means of a rotary cutting-wheel. The various members of the collar removing device, which are located within the enclosure, do not comprise any friction member requiring lubrication, so that all the said members can be sterilized thermally without difficulty. Therefore, the invention uses exclusively such technical means as are compatible with the requirements of thermal sterilization, which unquestionably constitutes the most efficient and reliable sterilizing method. Lastly, the operation of the device, more particularly the discharge of the collars cut off, can be supervised visually.

Of course, the invention is by no means limited to the forms of embodiment described and illustrated, which have been given by way of example only. In particular, it comprises all the means constituting technical equivalents to the means described as well as their combinations, should the latter be carried out according to the spirit of the invention.

What is claimed is :

1. A device for opening sealingly closed and internally sterile containers, such as plastic bottles or the like, having a lower portion and an upper neck portion having a top collar portion, by severing the said collar portion, comprising an enclosure having a bottom wall, said enclosure being isolated from the ambient atmosphere and being adapted to receive said container, means located within said enclosure for driving said containers continuously along a predetermined path, said means comprising a first rotary substantially circular star member adapted to receive said containers and move them in a rotary path and a second rotary, substantially circular star member arranged in tangential relationship to said first star member, means for continuously driving said star members in synchronism in mutually opposite directions of rotation, said star members being provided with complementary slots adapted to receive said containers and grip them closely when said slots are in confronting relationship with one another, a stationary cutting member located within said enclosure and arranged in immediate proximity to tangential position of the said star members, so that said portion to be severed meets said cutting member and is cut off thereby, means for discharging the portion thus cut off from the said enclosure, and sealing means associated with said driving means and said discharge means, to preclude any communication between said enclosure and said ambient atmosphere.

2. Device according to claim 1, wherein said means for discharging said cut-off portions comprise a funnel-shaped member arranged below said cutting member, a discharge conduit connected with said member and made at least partially of a transparent material and passing through said bottom wall, said conduit having a lower end, and a vat, filled with a liquid in which said

lower end is immersed.

3. Device according to claim, 1 wherein each one of said star members comprises at least two upper and lower plates each having peripheral edges which are generally circular in shape, a common shaft on which said upper and lower plates are secured, the two upper plates of said star members being located substantially in the same horizontal plane and arranged in tangential relationship to one another, both upper plates being provided with slots, the shape and dimensions of which correspond to the shape and dimensions of said upper portions of said containers, and the two lower plates of said star members, being provided with slots the shape and dimensions of which correspond to the shape and dimensions of said lower portions of said containers.

4. Device according to claim 3, wherein each of the said upper plates is provided with a groove on its said peripheral edge, the said grooves being arranged in confronting relationship so as to permit the engagement of the said cutting member between the said plates.

5. Device according to claim 3, including a circular base-plate having a lower portion for each star member, each said base plate being secured to a said common shaft and forming a portion of a bottom wall for said device, said base plate comprising at said lower portion a peripheral side wall and a stationary annular channel arranged under said bottom wall in which said side wall is engaged along the junction between said channel and said base plate, said channel being filled with a liquid in which said side wall is immersed.

6. Device according to claim 5 wherein the diameter of the circular base plate of a first of said star members is substantially greater than that of its superposed plates, so as to engage lower portions of containers and drive the latter along a rotary path of motion and stationary guiding means of generally circular shape and concentric with said last-named star member to guide said containers during their said motion.

7. Device according to claim 3, including base plates for each said star member, and driving shafts extending in prolongation of respective of said common shafts to support said star members, said driving shafts being arranged below respective of said base plates and having pinions meshing with one another.

8. Device according to claim 4, wherein said cutting member comprises an adjustable blade having a front portion and arranged substantially horizontally, at the level of said grooves in said upper plates, said blade being provided, at said front portion, with a substantially V-shaped cutting edge whose tip is located in proximity to the tangential position of said upper plates, so that each container meets said cutting edge, which perforates it with said tip and then cuts it as the motion of said container proceeds.

9. Device according to claim 8 including a stationary support on which said blade is mounted, and adjusting means serving for varying the angular positioning and vertical positioning of said blade with respect to said support and the positioning of said blade with respect to the tangential position of said upper plates.

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