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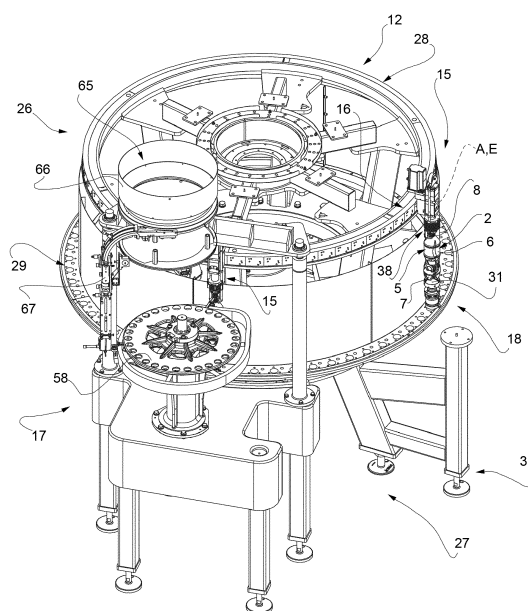
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(54) METHOD AND MACHINE FOR FILLING AND CAPPING RECEPTACLES

(57) There is described a method for at least filling a receptacle (2) with a pourable product and for at least applying a closure (3) onto the receptacle (2) within a packaging machine (1) having at least one filling-and-capping head (15). The receptacle (2) is filled with the pourable product by the filling-and-capping head (15) during a filling phase, followed by the application of the closure (3) by the filling-and-capping head (15) during a capping phase. During the capping phase the closure (3) is fed to a centering device (47) of the filling-and-capping head (15), the closure (3) is inserted into and retained by the centering device (47), the closure (3) and the receptacle (2) are brought into contact with one another and then a relative movement is induced between the receptacle (2) and the closure (3) for fastening the closure (3) on the receptacle (2).

FIG. 2



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Description

TECHNICAL FIELD

[0001] The present invention relates to a filling-and-capping head for filling receptacles with a pourable product and for applying respective closures onto the receptacles after their filling.

[0002] The present invention also relates to a method for filling receptacles with a pourable product and capping the receptacles with respective closures with filling-and-capping heads.

[0003] The present invention also relates to a packaging machine comprising a plurality of filling-and-capping heads.

BACKGROUND ART

[0004] It is known to package pourable products, in particular pourable food products such as carbonated liquids, non-carbonated liquids, emulsions, beverages containing pulp etc., into receptacles such as containers, bottles, and the like.

[0005] This is typically done using packaging machines adapted to perform a variety of treatment steps on the receptacles, such as filling the pourable product into the receptacles, applying and fastening closures onto the receptacles (capping of the receptacles) after their filling and applying label sheets onto the receptacle prior, during or after their filling and/or capping.

[0006] One kind of packaging machine comprises a filling apparatus for filling the receptacles, a labeling apparatus for applying the labels on the receptacles and a capping apparatus for applying the closures onto the receptacles. Typically, the filling apparatus, the labeling apparatus and the capping apparatus are of the carousel type meaning that during respectively the filling, the labeling and the capping the receptacles are advanced along respectively a filling advancement path, a labeling advancement path and a capping advancement path by means of conveying carousels. Furthermore, the filling apparatus, the labeling apparatus and the capping apparatus are arranged in succession and are typically connected to one another by interposed conveyor devices, such as star wheels.

[0007] The filling apparatus comprises a plurality of filling heads arranged on the respective conveyor device, each adapted to fill one respective receptacle during its advancement along the filling advancement path.

[0008] The labeling apparatus comprises a plurality of treatment devices arranged on the respective conveying carousel and each one adapted to rotate one respective receptacle around its longitudinal axis during advancement of the respective receptacle along the labeling path. The labeling apparatus also comprises a label sheet feed device for advancing single label sheets to the rotating receptacles for applying the label sheets on the receptacles.

[0009] The capping apparatus comprises a cap feeding device arranged adjacent to the respective conveying carousel for delivering the closures to the receptacles and a plurality of capping heads arranged on the respective conveying carousel for interacting with the closures positioned on the receptacles, in particular for fastening the closures in the receptacles.

[0010] A drawback of such kind of packaging machines is that they require a significant amount of space within a production plant.

[0011] This is why in the past years more compact packaging machines have been developed aimed on reducing the space the packaging machines occupy within a production plant.

[0012] One kind of these more compact packaging machines comprises a combined labeling and filling apparatus and a capping apparatus arranged in succession of the labeling and filling apparatus.

[0013] The labeling and filling apparatus comprises a respective conveying carousel for advancing the receptacles along an arc-shape receptacle advancement path and carrying a plurality of filling heads, each for filling one respective receptacle during advancement of the receptacles along at least a portion of the arc-shaped receptacle advancement path and each one being adapted to rotate the respective receptacle around at least a portion of the arc-shaped receptacle advancement path. The labeling and filling apparatus also comprises a label sheet feeding device arranged adjacent to the respective conveying carousel for feeding single label sheets to the receptacles at a label application station arranged along the arc-shaped receptacle advancement path. In particular, during the application of the label sheets onto the receptacles, the filling heads actuate rotation of the receptacles around their longitudinal axis.

[0014] Furthermore, it is known that the labeling and filling apparatuses can be configured to label the receptacles prior, during or after the filling of the receptacles.

[0015] As well, the labeling and filling apparatus is connected to the successively arranged capping apparatus by means of a conveyor device, in particular one or more transfer star wheels.

[0016] The capping apparatus comprises a conveying carousel adapted to advance the filled and labeled receptacles along an arc-shaped capping advancement path and a cap feeding device arranged adjacent to the respective conveying carousel for delivering the closures to the receptacles and a plurality of capping heads arranged on the respective conveying carousel for interacting with the closures positioned on the receptacles, in particular for fastening the closures in the receptacles.

[0017] Even though such type of packaging machines are more compact than the other mentioned type of packaging machine, a drawback is that these packaging machines still occupy significant space.

DISCLOSURE OF INVENTION

[0018] It is therefore an object of the present invention to provide a packaging machine to overcome, in a straightforward and low-cost manner, the aforementioned drawbacks.

[0019] It is therefore a further object of the present invention to provide a method to overcome, in a straightforward and low-cost manner, the aforementioned drawbacks.

[0020] According to the present invention, there is provided a method as claimed in claim 1.

[0021] According to another aspect of the present invention, there is provided a filling-and-capping head as claimed in claim 9.

[0022] According to an even other aspect of the present invention, there is provided a packaging machine as claimed in claim 14.

[0023] Further preferred embodiments are claimed in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Two non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic top view of a packaging machine having filling-and-capping heads according to the present invention, with parts removed for clarity; Figure 2 is a perspective view of the packaging machine of Figure 1, with parts removed for clarity; Figure 3 is an enlarged perspective view of a detail of a filling-and-capping head of the packaging machine of Figures 1 and 2 interacting with a receptacle, with parts removed for clarity; Figure 4 is a partially sectional view of a filling-and-capping head of the packaging machine of Figures 1 and 2 interacting with a receptacle, with parts removed for clarity; Figure 5 is a perspective view of some details of the packaging machine of Figures 1 and 2, with parts removed for clarity; Figure 6 is an enlarged perspective view of some parts of the details of Figure 5, with parts removed for clarity; and Figure 7 is a further schematic top view of the packaging machine, with parts removed for clarity.

BEST MODES FOR CARRYING OUT THE INVENTION

[0025] Number 1 in Figure 1 illustrates as a whole a packaging machine for filling receptacles, such as containers, bottles 2 and the like with a pourable product, in particular a pourable food product, such as carbonated liquids (e.g. sparkling water, soft drinks and beer) or non-carbonated liquids (e.g. still water, juices, teas, sport drinks, liquid cleaners, wine, emulsions, suspensions,

high viscosity liquids and beverages containing pulps) and to apply and fasten a respective closure 3, such as screw caps or sports caps made from polymers or metals or the like, onto the receptacles.

[0026] Preferentially, packaging machine 1 is also adapted to apply label sheets 4 onto the receptacles.

[0027] The following description will refer without any limitative scope to the receptacles being bottles 2 being made from polymer such as polytetrafluoroethylene (PET), glass, aluminum, steel or composites.

[0028] As visible in Figures 2 to 4, each bottle 2 has a longitudinal axis A and comprises a hollow main body 5 bounded by sidewalls 6, in particular substantially parallel to axis A, a bottom wall 7 substantially perpendicular to axis A and by a top neck 8 substantially coaxial with axis A; in particular, neck 8 delimits a pouring/inlet opening of bottle 2 opposite to bottom wall 7 allowing for filling bottle 2 with the pourable product and for pouring out the pourable product from bottle 2.

[0029] The following description will also refer without any limitative scope to closures 3, each having a respective inner threaded portion, in particular having a helical pattern, for interacting with a threaded portion, in particular having a helical pattern, provided on the respective neck 8 of a respective bottle 2.

[0030] Preferentially, each closure 3 comprises an outer lateral surface 4, in particular having a defined texture, even more particular being provided with a plurality of grooves (and consequently a plurality of ridges).

[0031] With particular reference to Figure 1, packaging machine 1 comprises:

- a conveying carousel 12 adapted to rotate around a rotation axis B, in particular having a vertical orientation, for advancing bottles 2 along a receptacle advancement path P from an inlet station 13 to an outlet station 14, in particular path P having an arc-shaped configuration; and
- a plurality of filling-and-capping heads 15 arranged on a peripheral portion 16 of conveying carousel 12, each one adapted to fill one respective bottle 2 with the pourable product during advancement of the respective bottle 2 along a filling portion P1 of path P and to apply one respective closure 3 onto the respective bottle 2 during advancement of a capping portion P2 of path P.

[0032] Preferentially, packaging machine 1 also comprises a closure feeding apparatus 17 adapted to feed closures 3, in particular sterile closures 3, to feeding-and-capping heads 15. In particular, closure feeding apparatus 17 is arranged adjacent to conveying carousel 12.

[0033] Preferentially, packaging machine 1 also comprises a plurality of support units 18 arranged on peripheral portion 16 and being adapted to support bottle 2 during their advancement along path P.

[0034] Preferentially, packaging machine 1 also comprises a label application device 19, in particular arranged

peripherally adjacent to conveying carousel 12, and being adapted to apply respective label sheets 4 onto bottles 2 at a label application station 20.

[0035] In more detail, label application station 20 is adapted to apply one respective label sheet onto each bottle 2 during their advancement along path P.

[0036] In the example shown and as will be explained in further detail, label application device 19 is adapted to apply at least one label sheet onto each bottle 2 during advancement along portion P1 (i.e. during the filling of bottle 2 with the pourable product).

[0037] In an alternative embodiment not shown, label application device 19 is adapted to apply at least one label sheet onto each bottle 2 during advancement of bottle 2 along portion P2 (i.e., during the application of the respective closure 3).

[0038] Preferentially, machine 1 also comprises an inlet conveyor, in particular an inlet star wheel 21 for feeding empty bottles 2 to inlet station 13 and an outlet conveyor, in particular an outlet star wheel 22, for receiving the filled and capped bottles 2, in particular the filled, capped and labelled bottles 2, at outlet station 14.

[0039] In more detail, inlet star wheel 21 and outlet star wheel 22, each are adapted to rotate around a respective rotation axis C. Inlet star wheel 21 is arranged peripherally adjacent, in particular tangential, to conveying carousel 12 at inlet station 13 and outlet star wheel 22 is arranged peripherally adjacent, in particular tangential, to conveying carousel 12 at outlet station 14.

[0040] With particular reference to Figure 2, conveying carousel 12 comprises a rotary body 26 adapted to rotate around axis B and carrying peripheral portion 16 and a fixed base support 27 rotatably carrying rotary body 26.

[0041] In more detail, rotary body 26 comprises an upper support structure 28 carrying filling-and-capping heads 15 and a lower support structure 28 carrying support units 18 and, in particular being arranged below upper support structure 28.

[0042] In particular, upper support structure 28 and lower support structure 28 define respective zones of peripheral portion 16.

[0043] In the specific example shown, upper support structure 28 comprises an annular support ring and lower support structure 29 comprises an annular support disc.

[0044] Preferentially, fixed base support 27 is configured to be placed on a floor or another horizontal support platform within a product plant and comprises means 30 for controlling the orientation and/or elevation of rotary body 26.

[0045] With particular reference to Figures 1 and 2, support units 18 are equally spaced angularly around axis B.

[0046] Preferentially, each support unit 18 is configured to advance along a respective pedestal advancement path Q, in particular having a circular shape, by rotation of conveying carousel 12, in particular rotary body 26, around axis B. In particular, path Q is parallel to path P between inlet station 13 and outlet station 14.

[0047] Each support unit 18 faces one respective filling-and-capping head 15 and is, in particular arranged below the respective filling-and-capping head 15.

[0048] Each support unit 18 comprises a pedestal 31 for supporting and centering one respective bottle 2 during advancement of the respective bottle 2 along path P.

[0049] Preferentially, each pedestal 31 is adapted to rotate around a respective rotation axis, in particular being parallel to axis B. In use, the respective rotation axis of the respective pedestal 31 is coaxial to axis A of the respective bottle 2.

[0050] In particular, each pedestal 31 is configured to interact at least with the respective bottom wall 7, preferentially also with the respective side walls 6 of the respective bottle 2.

[0051] Preferentially, each support unit 18 comprises means (not shown and known as such) for controlling the elevation of the respective pedestal 31 in dependence of the angular position of the respective pedestal 31. E.g. such means can be configured to interact with a cam mechanism of machine 1 or they can be electronically controlled.

[0052] Preferentially, machine 1 also comprises means for controlling a base position of each pedestal 31, in particular in dependence of the height of the specific bottle type of bottles 2, in particular with reference to the respective filling-and-capping heads 15. Such means for controlling the base position can be adapted to control e.g. the respective distance between upper support structure 28 and lower support structure 29 or these means can be adapted to control the relative distance between each one of pedestals 31 and the respective filling-and-capping head 15.

[0053] With particular reference to Figures 1 to 5, filling-and-capping heads 15 are equally spaced angularly around axis B.

[0054] Preferentially, each filling-and-capping head 15 is configured to advance along a respective head advancement path R, in particular having a circular shape, by rotation of conveying carousel 12, in particular rotary body 26, around axis B. In particular, path R is parallel to path P between inlet station 13 and outlet station 14, even more particular path R is also parallel to path Q.

[0055] Preferentially each head 15 comprises:

- a main body 32 extending along a respective central longitudinal axis E, in particular being parallel to axis B, and having an inner flow channel 33 for the pourable product extending parallel to axis E;
- an outlet mouth 34 arranged at one end of flow channel 33, through which the pourable product flows, in use, to fill the respective bottle 2 and being coaxial to axis E;
- a shutter 35 arranged within flow channel 33 and being adapted to control the flow of the pourable product through outlet mouth 34; and
- a centering device coaxially arranged with respect to outlet mouth 34 and being adapted to receive and

to retain the respective closure 3 within filling-and-capping head 15; the centering device being arranged downstream of the respective outlet mouth 34 with respect to the flow direction D1 of the pourable product within the respective channel 33 and out of the respective outlet mouth 34.

[0056] Preferentially, each head 15 also comprises an inlet opening (known as such and not shown) allowing to feed the pourable product into the respective flow channel.

[0057] Preferably, each head 15 also comprises an actuator (known as such and not shown) adapted to control the respective shutter 35, in particular at least between an open position at which the respective shutter 35 allows the pourable product, in use, to flow from the respective outlet mouth 34 into the respective bottle 2 and a closed position at which the respective shutter 35 prevents the pourable product to flow through the respective outlet mouth 34 into the respective bottle 2.

[0058] Preferentially, each head 15 also comprises a pressurizing channel 15 adapted to be in fluid connection with the inner space of the respective bottle 2.

[0059] In particular, each pressurizing channel 15 is adapted to at least feed a pressurizing fluid, in particular carbon dioxide, into the respective bottle 2 for pressurizing the respective bottle 2, in particular prior to the filling of the respective bottle 2 with the pourable product and, preferably, for receiving fluids, in particular the pressurizing fluid, present in the respective bottle 2 during the filling of the respective bottle 2 with the pourable product.

[0060] Even more particular, the pressurizing channel 15 is fluidically connected to a pressurizing fluid source, even more particular the pressurizing channel is adapted to establish, in use, a fluid connection between the pressurizing fluid source and the respective bottle 2.

[0061] Preferentially, each head 15 also comprises a first control valve member interacting with a first valve seat provided within the respective pressurizing channel 15 for controlling, in use, the flow of the pressurizing fluid from the pressurizing fluid source through the respective pressurizing channel 15 into the respective bottle 2. In particular, each first control valve member is configured to at least open or close the fluid connection between the pressurizing fluid source and the respective bottle 2.

[0062] Preferentially, each head 15 also comprises a decompression channel (not shown and known as such) adapted to establish a fluid connection with the inner space of the respective bottle 2. In particular, each decompression channel is adapted to receive, in use, a residual fluid, in particular a residual gas, remaining within the respective bottle 2 after the filling of the respective bottle 2 with the pourable product and to direct the fluid away from the respective bottle 2.

[0063] Even more preferentially, each head 15 also comprises a second control valve member interacting with a second valve seat provided within the respective decompression channel for controlling, in particular for

opening and closing, in use, the fluid connection of the respective decompression channel with the inner space of the respective bottle 2.

[0064] Preferentially, each head 15 also comprises a gripping device, in particular a clamp 37, for retaining the respective bottle 2, in particular, in use, during advancement of the respective bottle 2 along path P. In particular, each gripping device, in particular each clamp 37, is moveable into a direction D2 parallel to axis E for, in use, approaching or withdrawing the respective bottle 2 to or from the respective outlet mouth 34. Preferably, each gripping device, in particular each clamp 37, is adapted to rotate around axis E.

[0065] Preferentially, each head 15 also comprises an actuation group 38 (only partially shown to the extent necessary for the comprehension of the present invention) for at least actuating rotation of the respective bottle 2 around its longitudinal axis A into a first direction of rotation and into a second direction of rotation.

[0066] In particular, the first direction of rotation is anti-clockwise and the second direction of rotation is clockwise.

[0067] In more detail, each main body 32 comprises:

- an inner end portion 41 carrying the respective outlet mouth 34 and the respective centering device and being rotatable around a respective first rotation axis being parallel, preferentially coaxial, to axis E;
- an outer portion 42 coaxial to the inner end portion 41 and at least partially surrounding the inner end portion 41, being rotatable around a respective second rotation axis being parallel, preferentially coaxial, to axes E and the first rotation axis, and being connected to the respective gripping device, in particular the respective clamp 37;
- a first rotation coupling element, in particular a first bearing 43, coupling inner end portion 41 to the respective actuation group 38 and being adapted to constrain rotation only to the first direction of rotation; and
- a second rotation coupling element, in particular a second bearing 44 coupling outer portion 42 to the respective actuation group 38 and being adapted to transmit rotation into the first direction of rotation and into the second direction of rotation.

[0068] In other words, each first rotation coupling element, in particular each bearing 43, is adapted to permit rotation of the respective inner end portion 41 around the first rotation axis into the first direction of rotation and is adapted to prevent rotation of the respective inner end portion 41 around the first rotation axis into the second direction of rotation; and each second rotation coupling element, in particular each bearing 43, is adapted to permit rotation of the respective outer portion 42 around the respective second rotation axis into both the first direction of rotation and the second direction of rotation.

[0069] According to this configuration, each inner end

portion 41 is adapted to rotate around the respective first rotation axis into the first direction of rotation only and each outer portion 42 is adapted to rotate around the respective second rotation axis into the first direction of rotation and into the second direction of rotation.

[0070] In other words, each gripping device, in particular the respective clamp 37, is adapted to rotate around axis E into the first direction of rotation and into the second direction of rotation due to its connection to the respective outer portion 42; and each outlet mouth 34 and the respective centering device are adapted to rotate around the respective first rotation axis only into the first direction of rotation.

[0071] In even other words, in use, with the respective bottle 2 being retained by the respective gripping device, in particular the respective clamp 37, actuation of rotation of bottle 2 around axis A and of the respective outer portion 42 around the respective second rotation axis by the respective actuation group 38 into the first direction of rotation leads also to a concurrent rotation of the respective inner end portion 41 and the respective outlet mouth 34 and the respective centering device around the respective first rotation axis into the first direction of rotation. However, during actuation of rotation of bottle 2 around axis A and of the respective outer portion 42 around the respective second rotation axis by the respective actuation group 38 into the second direction of rotation, the respective inner end portion 41 and the respective outlet mouth 34 and the respective centering device are nonrotating around the respective first rotation axis (there is a rotation around axis A, however, for advancing the respective bottle 2 and simultaneously the respective head 15).

[0072] Preferentially, each head 15 is configured such that, in use, during a filling of the respective bottle 2 with the pourable product, the respective actuation group 38 is configured to actuate rotation of the respective bottle 2 into the first direction of rotation and during the application, in particular the fastening of the respective closure 3 on the respective bottle 2, the actuation group 38 is configured to actuate rotation of the respective bottle 2 into the second direction of rotation.

[0073] This means that each head 15 is configured such that in use, during the filling of the respective bottle 2, the respective bottle 2 and the respective outlet mouth 34 (and the respective centering device) rotate around respectively axis A and the respective first rotation axis and during the application, in particular the fastening, of the respective closure 3 onto the respective bottle 2, bottle 2 rotates around axis A, while the respective centering device (and the respective outlet mouth 34) are nonrotating around the respective first rotation axis.

[0074] In more detail, each bearing 43 comprises an outer annular ring coupled to the respective actuation group 38 and an inner annular ring coupled to the respective inner end portion 41, and, in particular thereby to outlet mouth 34 and the respective centering device.

[0075] Each bearing 43 also comprises a plurality of

rolling elements interposed between and coupling the respective inner annular ring and the respective inner annular ring.

[0076] The respective inner annular ring is adapted to rotate around the respective first rotation axis into the first direction of rotation and is adapted to prevent rotation around the respective first rotation axis into the second direction of rotation, in particular as a consequence of the interaction between the respective outer annular ring, the respective rolling elements and the respective inner annular ring.

[0077] Preferentially, each bearing 43 is of the free-wheel type.

[0078] Each bearing 44 comprises an outer annular ring coupled to the respective actuation group 38 and an inner annular ring coupled to the respective outer portion 42. The inner annular ring is adapted to rotate around the respective second rotation axis into both the first direction of rotation and the second direction of rotation.

[0079] Each bearing 44 also comprises a plurality of rolling elements interposed between and coupling the respective outer annular ring and the respective inner annular ring with each other.

[0080] With particular reference to Figures 3 and 4, each outlet mouth 34 comprises an outlet opening 45 through which, in use, the pourable product flows out of head 15 into the respective bottle 2, having a substantially circular cross-section, the cross-section having a first inner diameter. In particular, the first inner diameter is selected according to the size of the inlet/outlet opening of the kind of bottles, which are treated by machine 1.

[0081] Preferentially, each outlet mouth 34 comprises an engagement element, in particular a seal element 46, at least partially surrounding the respective outlet opening 45 and adapted to engage, in use, with the respective bottle 2, in particular the respective neck 8, in particular for sealing the inner space of the respective bottle 2 from an outer environment.

[0082] With particular reference to Figures 3 and 4, each centering device comprises, in particular is, a centering ring 47 being adapted to receive and to retain one respective closure 3.

[0083] Preferentially, each centering ring 47 is coaxially arranged with respect to the respective outlet mouth 34 (and the respective outlet opening 45).

[0084] Preferably, each centering ring 47 has a second inner diameter being larger than the second inner diameter, in particular each centering ring 47 having a circular cross-section.

[0085] In particular, the second inner diameter being determined by an outer diameter of the respective closure 3.

[0086] Preferentially, each centering ring 47 is removably mounted, in particular to the respective inner end portion 41, so as to exchange a first kind of centering ring 47 having a given second inner diameter with a second kind of centering ring 47 having a second inner diameter distinct from the second inner diameter of the first kind

of centering ring 47. This is of advantage during a format change, so as to adopt head 15, in particular the centering device, to interact with a different kind of closure 3 having a different outer diameter.

[0087] Preferably, each centering ring 47 is arranged downstream, in particular directly downstream from the respective outlet mouth 34 (and the respective outlet opening 45) with respect to the flow direction of the pourable product.

[0088] In more detail, each centering ring 47 comprises an inner lateral interaction surface 48 adapted to interact with the respective outer lateral surface 4 of the respective closure 3.

[0089] In even more detail, each inner lateral interaction surface 48 comprises a plurality of ridges (and grooves as a consequence) adapted to engage with the respective grooves of the respective outer lateral surface 4 so as to increase, in use, the friction between inner lateral interaction surface 48 and closure 3. This is advantageous, so as to ensure that, in use, during the application, in particular the fastening) of the respective closure 3 onto the respective bottle 2, the respective closure 3 is securely retained by the respective centering ring 47.

[0090] Preferentially, each centering ring 47 also comprises a plurality of further interaction elements (not shown), in particular interaction spheres, at least partially protruding away from the respective inner lateral interaction surface 48 and being adapted to apply, in use, a radial force onto the respective closure 3 for further securing the clamping of the respective closure 3 within the respective centering ring 47.

[0091] With particular reference to Figures 3 and 4, each clamp 37 comprises a first clamp finger 49 and a second clamp finger 50 adapted to grip in cooperation the respective bottle 2. In particular, the respective clamp finger 49 and the respective clamp finger 50 are adapted to engage the respective bottle 2 from opposites thereof.

[0092] Preferentially, each clamp 37, in particular the respective clamp finger 49 and the respective clamp finger 50, comprise a plurality of interaction members (not shown) protruding towards the respective outlet mouth 34 and being adapted to interact with an annular protrusion 51 of the respective neck 8 so as to increase the clamping force acting on the respective bottle 2.

[0093] With particular reference to Figure 3 and 4, each actuation group 38 comprises:

- a circular transmission element 52 being coaxial to the respective axis E and being connected to at least the respective outer portion 42; and
- a motor assembly (not shown) adapted to actuate rotation of transmission element 52 around the respective axis E into the first direction of rotation or the second direction of rotation.

[0094] In particular, each transmission element 52 is coupled to the respective inner end portion 41 through the respective bearing 43; and to the respective outer

portion 42 through the respective bearing 44.

[0095] Thus, in use, rotation of the respective transmission element 52 around the respective axis E into the first direction of rotation leads to rotation of the respective inner end portion 41 and the respective outer end portion 42 around the respective axis E into the first direction of rotation and rotation of the respective transmission element 52 around the respective axis E into the second direction of rotation leads to rotation of the respective the respective outer end portion 42 around the respective axis E into the second direction of rotation while the respective inner end portion 41 is nonrotating with respect to (around) the respective axis E.

[0096] With particular reference to Figures 2 and 5, each head 15 also comprises a displacement group 56 adapted to move the respective gripping device, in particular the respective clamp 37, into the respective direction D2.

[0097] In particular, each displacement group 56 is connected to the respective outer portion 42 so as to move the respective gripping device, in particular the respective clamp 37, together with the respective outer portion 42 into the respective direction D2.

[0098] Preferably, each displacement group 56 is adapted to control the respective gripping device, in particular the respective clamp 37, into:

- a proximal position at which the respective gripping device, in particular the respective clamp 37, is arranged in the proximity of the respective outlet mouth 34, in particular, at which, the respective bottle 2 engages with the respective outlet mouth 34, in particular the respective sealing element 46; and
- a distal position at which the respective gripping device, in particular the respective clamp 37, is arranged at a certain distance from the respective outlet mouth 34, in particular, at which, the respective bottle 2 is disengaged from the respective outlet mouth 34, in particular the respective sealing element 46.

[0099] Preferentially, each displacement group 56 is configured to bias the respective displacement device, in particular the respective clamp 37, into the proximal position. In other words, displacement group 56 is configured to exert a biasing force such to bias the respective gripping device, in particular the respective clamp 37 in the proximal position.

[0100] Even more preferentially, each displacement group 56 also comprises an interaction assembly adapted to interact with a cam mechanism (not shown) of machine 1 so as to move the respective clamp 37 into the distal position, in particular through interaction with the cam mechanism.

[0101] With particular reference to Figures 1, 2 and 5 to 7, closure feeding apparatus 17 is adapted to feed closures 3 to heads 15 at a cap delivery station 57 and to insert closures 3 into the respective centering devices,

in particular into the respective centering ring 47.

[0102] In more detail, closure feeding apparatus 17 is adapted to advance closures 3 along a closure feeding path S comprising at least an initial portion S1 having a circular shape (i.e. when superimposing the shape of S1 onto a circle having a defined radius, S1 covers the respective section of the respective circle), at least an intermediate portion S2 having a non-circular shape (i.e. when superimposing the shape of S2 onto a respective circle having a defined radius, S2 does not cover the respective section of the respective circle) downstream of portion S1 along path S, and at least a final portion S3 having a circular shape (i.e. when superimposing the shape of S3 onto a respective circle having a defined radius, S3 covers the respective section of the respective circle) and being parallel to a section of path P and being downstream of portion S2 along path S (see in particular Figure 7).

[0103] Preferentially, closure feeding apparatus 17 is also adapted to advance closures 3 into a first advancement direction and into a second advancement direction, being transversal, in particular perpendicular, to the first advancement direction, when, in use, closures 3 are placed in the proximity of the respective head 15, in particular of the respective centering device.

[0104] Preferentially, apparatus 17 comprises:

- a conveying carousel 58 being arranged adjacent to conveying carousel 12 and being adapted to rotate around a respective rotation axis F and to advance closures 3 along path S, in particular from a pick-up station 59 to station 57; and
- a plurality of support arms 60 arranged on conveying carousel 58, in particular equally spaced angularly around axis F, and, each one being adapted to support one respective closure 3 during advancement along path S.

[0105] Preferentially, support arms 60 are equally spaced angularly around axis F.

[0106] Preferably, each support arm 60 is substantially transversal to axis F and is arranged on conveying carousel 58 in such a manner to be adapted to move into a radial direction RD for being moved between an extracted configuration at which the respective support arm 60 is extracted and a retracted configuration at which the respective support arm 60 is retracted.

[0107] In particular, each support arm 60 is configured to be in its respective retracted configuration at pick-up station 59 and to be in its respective extracted configuration at station 57.

[0108] Preferentially, each support arm 60 is also arranged on conveying carousel 58 in such a manner that at least an end portion 61 of support arm 60 is adapted to be moved into a direction parallel to axis F, in particular parallel to axis B and axis E, in particular in the area of station 57.

[0109] More specifically, each end portion 61 is adapted

to be moved between a base position and an elevated position for delivering the respective closure 3 into the respective centering device.

[0110] Preferentially, each support arm 60 also comprises a first control group 62 adapted to control the respective support arm 60 itself between the respective retracted configuration and extracted configuration. In particular, the respective control group 62 is adapted to interact with a cam 63 of apparatus 17 for moving the respective support arm 60 between the retracted configuration and the extracted configuration.

[0111] More specifically, each control group 62 comprises at least a cam follower 64 adapted to interact with cam 63 for moving the respective support arm 60 between the retracted configuration and the extracted configuration.

[0112] Even more specifically, each support arm 60 comprises biasing means (not shown) for biasing the respective support arm 60 into the retracted configuration and the control group 62 is adapted to move, in particular through interaction of the respective cam follower 64 with cam 63, the respective support arm 60 into its extracted configuration.

[0113] Preferentially, each support arm 60 also comprises a second control group (not shown) adapted to control the respective end portion 61 between the respective base position and the elevated position.

[0114] In particular, each second control group comprises at least a support bar (not shown) carrying the respective end portion 61 and being moveable into a direction parallel to axis F.

[0115] Even more particular, each second control group also comprises a respective cam follower (not shown) adapted to interact with a further cam (not shown) of apparatus 17 so as to move the respective support bar, in particular up and down.

[0116] Preferentially, each apparatus 17 also comprises a closure feeder 65 adapted to feed closures 3, in particular sterile closures 3, to pick-up station 59.

[0117] In more detail, closure feeder 65 comprises a closure storage 66 for providing for closures 3 and a feeding channel 67 adapted to guide closures 3 from closure storage 65 to pick-up station 59.

[0118] In use, machine 1 fills bottles 2 with the pourable product and applies (and fastens) one respective closure 3 onto bottles 2 after their filling with the pourable product. Preferentially, machine 1 also applies at least one respective label sheets 2 onto bottles 2, in particular during the filling of the bottles 2.

[0119] In particular, machine 1 is adapted to treat a succession of bottles 2. In the following, the method will be explained in detail on the example of one bottle 2. The treatment of the other bottles 2 of the succession of bottles 2 is accordingly.

[0120] In more detail, the method of operation of machine 1 comprises at least:

- an advancement phase during which bottle 2 ad-

vances along path P;

- a filling phase during which bottle 2 is filled with the pourable product by the respective filling-and-capping head 15 during advancement of bottle 2 along portion P1; and
- a capping phase during which one respective closure 3 is applied onto bottle 2 by the respective filling-and-capping head 15 while bottle 2 advances along portion P2.

[0121] Preferentially, the method also comprises a labeling phase during which at least one respective label sheet is applied on bottle 2, in particular at labeling application station 20. In particular, the labeling phase is executed during execution of the filling phase or execution of the capping phase.

[0122] Preferably, the method also comprises a feeding phase during which bottle 2, in particular empty bottle 2, is fed at inlet station 13 to the respective head 15. In particular, during the feeding phase bottle 2 is advanced by inlet star wheel 21 to inlet station 13.

[0123] Even more preferably, the method also comprises an outlet phase during which bottle 2, in particular filled and capped bottle 2, even more particular filled, capped and labeled bottle 2, is delivered from the respective head 15 to delivery station 14. In particular, during the outlet phase bottle 2 is delivered from the respective head 15 to outlet star wheel 22.

[0124] In more detail, during the advancement phase bottle 2 is received by the respective filling-and-capping head 15 at inlet station 13 and advances along path P to outlet station 14 through rotation of conveying carousel 12 around axis B while being retained by the respective gripping device, in particular the respective clamp 37.

[0125] In even more detail, during the advancement phase the respective head 15 advances along path R through rotation of conveying carousel 12 around axis B through inlet station 13 and outlet station 14.

[0126] More specifically, the respective gripping device, in particular the respective clamp 37, being in the distal position at inlet station 13 and at outlet station 14. Even more specifically, the respective gripping device is controlled by the respective displacement group 56 into the proximal position, in particular through interaction with the cam mechanism, at inlet station 13 and outlet station 14.

[0127] Preferably, the respective pedestal 31 of the respective support unit 18 is in its base position at inlet station 13 and outlet station 14 so that bottle 2 is detached from the respective bottle 2 at inlet station 13 and outlet station 14 (i.e. there is no contact between the respective pedestal 31 and bottle 2).

[0128] Preferably, during the advancement phase the respective support unit 18, in particular pedestal 31, is positioned to support and center bottle 2. This also means that the respective support unit 18 follows the displacements bottle 2 is subjected to during advancement of bottle 2 along path P.

[0129] In more detail, during the filling phase the following sub-phases are executed:

- a preparation sub-phase during which bottle 2 is moved to engage with the respective engagement element, in particular the respective seal element 46;
- a pouring sub-phase during which the pourable product is filled into bottle 2 and being executed after the preparation sub-phase; and
- a final sub-phase during which bottle 2 is withdrawn from the engagement element, in particular the respective sealing element 46 and the centering device, in particular the centering ring 47, leaving at least a space between bottle 2 and the centering device, in particular centering ring 47, allowing for interposing one respective closure 3 between bottle 2, in particular the respective neck 8, and the centering device, in particular the respective centering ring 47.

[0130] In even further detail, during the preparation sub-phase the respective gripping device, in particular the respective clamp 37, is moved into its proximal position, in particular by actuation of the respective displacement group 56.

[0131] More specifically, the cam mechanism is such that the interaction with the respective displacement group 56 is such that there is no force exerted counteracting the biasing force.

[0132] In even further detail, during the pouring sub-phase the respective shutter 35 is controlled into its respective open position so that the pourable product flows from the respective flow channel 33 through the respective outlet mouth 34, in particular the respective outlet opening 45, into bottle 2.

[0133] Furthermore, after the termination of the filling the respective shutter 35 is controlled into its respective closed position so as to interrupt the flow of the pourable product into bottle 2.

[0134] In even further detail, during the final sub-phase the respective gripping device, in particular clamp 37, is detached from the respective outlet mouth 34, in particular the respective engagement element and the respective centering device, in particular the respective centering ring 47, by actuation of the respective displacement group 56.

[0135] More specifically, the respective displacement group 56 interacts with the cam mechanism (for counteracting the biasing force) so that the respective gripping device, in particular the respective clamp 37, is moved from the proximal position towards the distal position.

[0136] In particular, the final sub-phase is executed such that the space between bottle 2 and the centering device, in particular centering ring 47 allows insertion of the respective closure 3 into the space at cap delivery station 57.

[0137] Preferentially, during the filling phase also a pressurizing sub-phase during which a pressurizing fluid

is directed into bottle 2 and a decompression sub-phase is executed.

[0138] In more detail, the pressurizing sub-phase is executed before the pouring sub-phase and the decompression sub-phase is executed after the pouring sub-phase.

[0139] In further detail, during the pressurizing sub-phase the pressurizing fluid flows through the respective pressuring channel 36 into bottle 2.

[0140] Furthermore, during the pouring sub-phase the pressurizing fluid is re-directed out of bottle 2 back into pressuring channel 36.

[0141] During the decompression sub-phase the residual fluid remaining in bottle 2 after its filling, is evacuated from bottle 2. In particular, the residual fluid is directed away from bottle 2 through the respective decompression channel.

[0142] Preferentially, during the filling phase a first rotation sub-phase is executed during which bottle 2 is rotated around axis A into the first direction at least during a section of portion P1.

[0143] More specifically, during the first rotation sub-phase the respective gripping device, in particular the respective clamp 37, retaining bottle 2 rotates around the respective axis E, thereby actuating rotation of bottle 2 around axis A.

[0144] Even more specifically, during the first rotation sub-phase the respective actuation group 38 actuates rotation of the respective outer portion 42, which carries the respective gripping device, in particular the respective clamp 37, around the respective second rotation axis into the first direction of rotation.

[0145] Furthermore, during the first rotation sub-phase also the respective outlet mouth 34 (together with the respective outlet opening 45 and the respective engagement element, in particular the respective seal element 46) rotates around the respective first rotation axis into the first direction of rotation as bearing 43 allows for rotation in the first direction of rotation. Furthermore, during the first rotation sub-phase also the respective centering device, in particular the respective centering ring 47, rotates around the respective first rotation axis.

[0146] Preferentially, the labeling phase is executed at the same time as the first rotation sub-phase.

[0147] Advantageously, capping phase comprises at least the following sub-phases:

- a feeding sub-phase during which the respective closure 3 is fed to the respective centering device, in particular the respective centering ring 47;
- an insertion sub-phase during which the respective closure 3 is inserted into and retained by the respective centering device, in particular the respective centering ring 47;
- an approaching sub-phase during which the respective closure 3 and bottle 2 are brought into contact with one another; and
- a fastening sub-phase during which a relative move-

ment is induced between bottle 2 and the respective closure 3 around respectively the respective axis A and a central axis of the respective closure 3 for fastening the respective closure 3 on bottle 2.

[0148] In more detail, during the feeding sub-phase the respective closure 3 is interposed between bottle 2, in particular the respective neck 8, and the respective centering device, in particular the respective centering ring 47. In particular, the respective closure 3 is positioned within the space between bottle 2 and the respective centering device, in particular generated during the final sub-phase.

[0149] Preferentially, during a final step of the feeding sub-phase and during at least an initial step of the insertion sub-phase the respective closure 3 advances below and parallel to the respective head 15, in particular the respective centering device.

[0150] In even further detail, during the feeding sub-phase the respective closure 3 advances along path S, in particular at first along portion S1, then along portion S2 and finally along portion S3.

[0151] Preferentially, during the feeding sub-phase the respective closure 3 is retained by the respective support arm 60, in particular the respective end portion 61.

[0152] More specifically, the respective closure 3 is fed to pick-up station 59 to the respective support arm 60, in particular being in the retracted configuration. Then, the respective closure 3 advances along portion S1, in particular as a consequence of rotation of conveying carousel 58 around axis F while the respective support arm 60 remains in its retracted configuration.

[0153] Then, the closure 3 advances along portion S2, in particular as a consequence of the rotation of conveying carousel 58 around axis F and the movement of the respective support arm 60 from the respective retracted configuration to the respective extracted configuration. In particular, while the respective closure 3 advances along portion S2, the respective support arm 60 moves to its extracted configuration as a consequence of actuation of the respective control group 62, even more particular as a consequence of the interaction with cam 63.

[0154] Once the respective support arm 60 is in its extracted configuration, closure 3 continues to advance along portion S3.

[0155] In more detail, during the insertion sub-phase the respective closure 3 advances the respective closure 3 advances into a first advancement direction and into a second advancement direction, wherein the first advancement direction and the second advancement direction are transversal to one another.

[0156] In even more detail, during the insertion sub-phase the closure 3 respective advancement path of closure 3 comprises a linear component, in particular due to a relative movement along the first advancement direction towards and into the respective centering device, and a circular component, in particular parallel to a section of portion P2 (in other words, the respective closure

3 advances such to be coaxial to the respective centering device, in particular the respective centering ring 47.

[0157] In other words, during the insertion sub-phase the respective closure 3 is linearly moved relative to the respective centering device. In particular, is respective closure 3 is moved upwards towards and into the respective centering device, in particular the respective centering ring 47, until being retained by the respective centering device.

[0158] More specifically, during the insertion sub-phase the respective closure 3 is supported by the respective support arm 60, in particular the respective end portion 61. As conveying carousel 58 rotates around axis F and the movement of the respective support bar, in particular as a consequence of the respective cam follower and the further cam, parallel to axis F leads to movement of the respective end portion 61 and the respective closure 3 into the same direction parallel to axis F.

[0159] The circular component of the respective advancement path during the insertion sub-phase is a consequence of the rotation of conveying carousel 58 and the linear component results from the movement of the respective support bar.

[0160] At a final step of the insertion sub-phase after insertion of the respective closure 3 into the respective centering device, the respective support arm 60 is distanced from the respective closure 3 and the respective head 15. In particular, the respective end portion 61 is detached from the respective closure 3 and the respective support arm 60 is controlled into its retracted configuration.

[0161] In more detail, the approaching sub-phase is executed after the insertion of the respective closure 3 into the respective centering device.

[0162] In particular, the respective gripping device, in particular the respective clamp 37 is moved into its proximal position so as to establish contact between bottle 2 and the respective closure 3.

[0163] Even more particular, the respective displacement group 56 biases the respective gripping device into its proximal position so that bottle 2, in particular neck 8 contact one another.

[0164] Preferentially, during the fastening sub-phase bottle 2 is rotated around its axis A, in particular into the second direction of rotation, and, even more preferentially, the respective centering device, in particular the respective centering ring 47, is nonrotating around its central axis as is, as a consequence, the respective closure 3.

[0165] More specifically, during the fastening sub-phase the respective actuation group 38 actuates rotation of the respective outer portion 42 around the respective second rotation axis into the second direction of rotation resulting into rotation of the respective gripping device, in particular the respective clamp 37 around axis E. As rotation is into the second direction of rotation, the respective first rotation coupling element, in particular

the respective bearing 43, locks the rotation of the respective inner end portion 41, i.e. the respective inner end portion 41 is impeded from rotating (is nonrotating) around the respective first rotation axis.

5 [0166] Preferentially, at the end of the fastening sub-phase, the respective bottle 2 together with the respective fastened closure 3 are distanced from the respective head 15, in particular by controlling the respective gripping device into the respective distal position.

10 [0167] Preferentially, the method also comprises a closure expelling phase, in particular to be executed after the capping phase, during which the closure is expelled, in particular by a pressurized fluid, from the respective centering device, in the case that during the capping phase the respective closure 3 is not correctly applied on bottle 2 (and the respective closure 3 remains within the respective centering device). In particular, during the closure expelling phase the pressurized fluid is provided by the respective pressuring channel 36.

15 [0168] Even more preferentially, the method also comprises an analysis phase during which the presence or non-presence of the respective closure 3 on bottle 2 is detected and/or determined and the closure expelling phase is executed if the non-presence is detected and/or determined during the analysis phase.

20 [0169] The advantages of machine 1, in particular head 15 according to the present invention will be clear from the foregoing description.

25 [0170] In particular, machine 1 allows to obtain a more compact packaging machine by combining at least the filling and capping within one single packaging machine. An even compacted packaging machine is obtained by combining filling, labeling and capping.

30 [0171] A further advantage resides in that the filling-and-capping heads 15 are simple in structure as the centering device for retaining the respective closure 3 can be easily mounted.

35 [0172] An additional advantage is that the centering device can be easily removed from the respective head 15 and can be exchanged by a new respective centering device, e.g. needed due to a format change.

40 [0173] A further advantage is that the heads 15 allow to rotate bottles 2 around the respective axes A and to simultaneously rotate the respective outlet mouths 24 so as to avoid any relative motion of the bottles 2 with respect to the respective outlet mouths 24. This allows to accelerate the filling of bottles 2 and to avoid any wear of the respective outlet mouths 24 due to a relative motion between bottles 2 and the respective outlet mouths 24. As well, rotation of bottles 2 around the respective axes A is possible during the capping while not rotating the respective closures 3.

45 [0174] Clearly, changes may be made to machine 1, in particular head 15 and/or the method as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. A method of treating at least one receptacle (2) on a packaging machine (1) having at least one filling-and-capping head (15) for at least filling the receptacle (2) with a pourable product and for at least applying a closure (3) onto the receptacle (2); the method comprising the following phases:

- an advancement phase during which the receptacle (2) advances along a receptacle advancement path (P);
- a filling phase during which the receptacle (2) is filled with the pourable product by the filling-and-capping head (15) while the receptacle (2) advances along a filling portion (P1) of the receptacle advancement path (P) and while the pourable product flows from an outlet mouth (24) of the filling-and-capping head (15) into the receptacle (2);
- a capping phase during which the closure (3) is applied onto the receptacle (3) by the filling-and-capping head (15) while the receptacle (2) advances along a capping portion (P2) of the receptacle advancement path (P) being downstream of the filling portion (P1) along the receptacle advancement path (P);

characterized in that the capping phase comprises the following sub-phases:

- a feeding sub-phase during which the closure (3) is fed to a centering device (47) of the filling-and-capping head (15), in particular the centering device (47) being coaxial to the outlet mouth (24) and being arranged downstream from the outlet mouth (24) along a flow direction (D1) of the pourable product;
- an insertion sub-phase during which the closure (3) is inserted into and retained by the centering device (47) ;
- an approaching sub-phase during which the closure (3) and the receptacle (2) are brought into contact with one another; and
- a fastening sub-phase during which relative movement is induced between the receptacle (2) and the closure (3) around respectively a longitudinal axis (A) of the receptacle and a central axis of the closure (3) for fastening the closure (3) on the receptacle (2).

2. The method according to claim 1, wherein during the filling phase the receptacle (2) is rotated around its longitudinal axis (A) in a first direction of rotation; and wherein during the fastening sub-phase the receptacle (2) is rotated around its longitudinal axis (A) in a second direction of rotation opposed to the first direction of rotation.

3. The method according to claim 1 or 2, wherein the centering device comprises a centering ring (47) for receiving and retaining the closure (3); wherein during the fastening sub-phase the centering ring (47) is nonrotating around its central axis as is the closure (3).

4. The method according to any one of the preceding claims, wherein the filling phase comprises

- a preparation sub-phase during which the receptacle (2) is moved to engage with an engagement element (46) of the outlet mouth (24) so as to seal the receptacle (2) from an outer environment;
- a pouring sub-phase during which the pourable product is filled into the receptacle (2) and being executed after the preparation sub-phase; and
- a final sub-phase during which the receptacle is withdrawn from the engagement element (46), the outlet mouth (24) and the centering device (47) leaving at least a space between the receptacle (2) and the centering device (47) allowing for interposing the closure (3) between the receptacle (2) and the centering device (47);

wherein during the feeding sub-phase the closure (3) is interposed between the receptacle (2) and the centering device (47); and

wherein during the insertion sub-phase the closure (3) is moved into the centering device (47).

5. The method according to any one of the preceding claims, wherein during the feeding sub-phase and the insertion sub-phase the closure is retained on a support arm (60); wherein after the insertion sub-phase the support arm (60) is distanced from the closure (3) and the filling-and-capping head (15).

6. The method according to any one of the preceding claims, wherein during a final step of the feeding sub-phase and prior to the insertion sub-phase the closure (3) advances below and parallel to the filling-and-capping head (15).

7. The method according to any one of the preceding claims wherein the closure (3) advances along a closure feeding path (S) comprising at least a first portion (S1) having a circular shape and at least a second portion having a non-circular shape downstream of the first portion (S2) along the closure feeding path (S).

8. The method according to any one of the previous claims, wherein during the insertion sub-phase the closure (3) advances into a first advancement direction and into a second advancement direction,

wherein the first advancement direction and the second advancement direction are transversal to one another.

9. The method according to any one of the preceding claims further comprising a closure expelling phase during which the closure (3) is expelled, in particular by a pressurized fluid, from the centering device (47) in the case that during the capping phase the closure (3) is not correctly applied on the receptacle (2). 5 10
10. The method according to claim 9 further comprising an analysis phase during which the presence or non-presence of the closure (3) on the receptacle is detected and/or determined and the closure expelling phase is executed if the non-presence is detected and/or determined. 15
11. The method according to any one of the preceding claims further comprising a labeling phase during which at least one label sheet is applied on the receptacle; wherein the labeling phase is executed while the filling phase or the capping phase is executed. 20 25
12. Filling-and-capping head (15) for a packaging machine (1) for filling a receptacle (2) with a pourable product and for applying a closure (3) onto the receptacle (2); the filling-and-capping head (15) comprises: 30
 - a main body (32) having an inner flow channel (33) for the pourable product;
 - an outlet mouth (34) arranged at one end of the flow channel and through which the pourable product flows, in use, to fill the respective receptacle (2); 35
 - a shutter (35) arranged within the inner flow channel (33) and being adapted to control the flow of the pourable product through the outlet mouth (34); 40

characterized in further comprising a centering device (47) adapted to receive and to retain the closure (3) within the filling-and-capping head (15); wherein the centering device (47) is coaxial to the outlet mouth (24). 45

- 13. The filling-and-capping head according to claim 12, wherein the outlet mouth (24) has an outlet opening (25) having a first inner diameter; and wherein the centering device comprises a centering ring (47) being arranged downstream of the outlet mouth (24) with respect to a pourable product flow direction (D1) and having a second inner diameter being larger than the first inner diameter. 50 55
- 14. The Filling-and-capping head according to claim 12

or 13, further comprising:

- an actuation group (38) for at least actuating rotation of the receptacle (2) around its longitudinal axis (A) into a first direction of rotation and into a second direction of rotation; and
- a gripping device (37) for retaining the receptacle (2) and being moveable into a direction parallel to a longitudinal axis (E) of the filling-and-capping head (15) for, in use, approaching or withdrawing the receptacle to or from the outlet mouth (24);

wherein the main body (32) comprises:

- an inner end portion (41) carrying the outlet mouth (24) and the centering device (47) and being rotatable around a respective first rotation axis;
- an outer portion (42) coaxial to the inner end portion (41) and at least partially surrounding the inner end portion (41), being rotatable around a respective second rotation axis and being connected to the gripping device (37);
- a first rotation coupling element, in particular a first bearing (43), coupling the inner end portion (41) to the actuation group (38) and being adapted to constrain rotation of the inner end portion (41) around the first rotation axis only into the first direction of rotation; and
- a second rotation coupling element, in particular a second bearing (44), coupling the outer portion (42) to the actuation group (38) and being adapted to allow for rotation of the outer portion (42) around the second rotation axis into the first direction of rotation and into the second direction of rotation.

15. The filling-and-capping head according to claim 14, wherein the filling-and-capping head (15) is configured such that, in use, during a filling of the receptacle (2) with the pourable product the actuation group (38) is configured to actuate rotation into the first direction of rotation and during the application of the closure (3) on the receptacle (2) the actuation group (38) is configured to actuate rotation into the second direction of rotation.
16. A packaging machine (1) for at least filling receptacles (2) with a pourable product and for at least applying one respective closure (3) onto the receptacles (2); the packaging machine (1) comprises:
 - a conveying carousel (12) adapted to rotate around a rotation axis (B) for advancing the receptacles (2) along a receptacle advancement path (P); and

- a plurality of filling-and-capping heads (15) according to any one of claims 11 to 14 and being arranged on a peripheral portion (16) of the conveying carousel (12), each one adapted to fill one respective receptacle (2) with the pourable product during advancement of the respective receptacle (2) along a filling portion (P1) of the receptacle advancement path (P) and to apply one respective closure (3) onto the respective receptacle (2) during advancement along a capping portion (P2) of the receptacle advancement path (P).

17. The packaging machine according to claim 16 further comprising a label application device (19) adapted to apply at least one respective label onto the receptacles (2) during advancement of the receptacles (2) along the receptacle advancement path (P).

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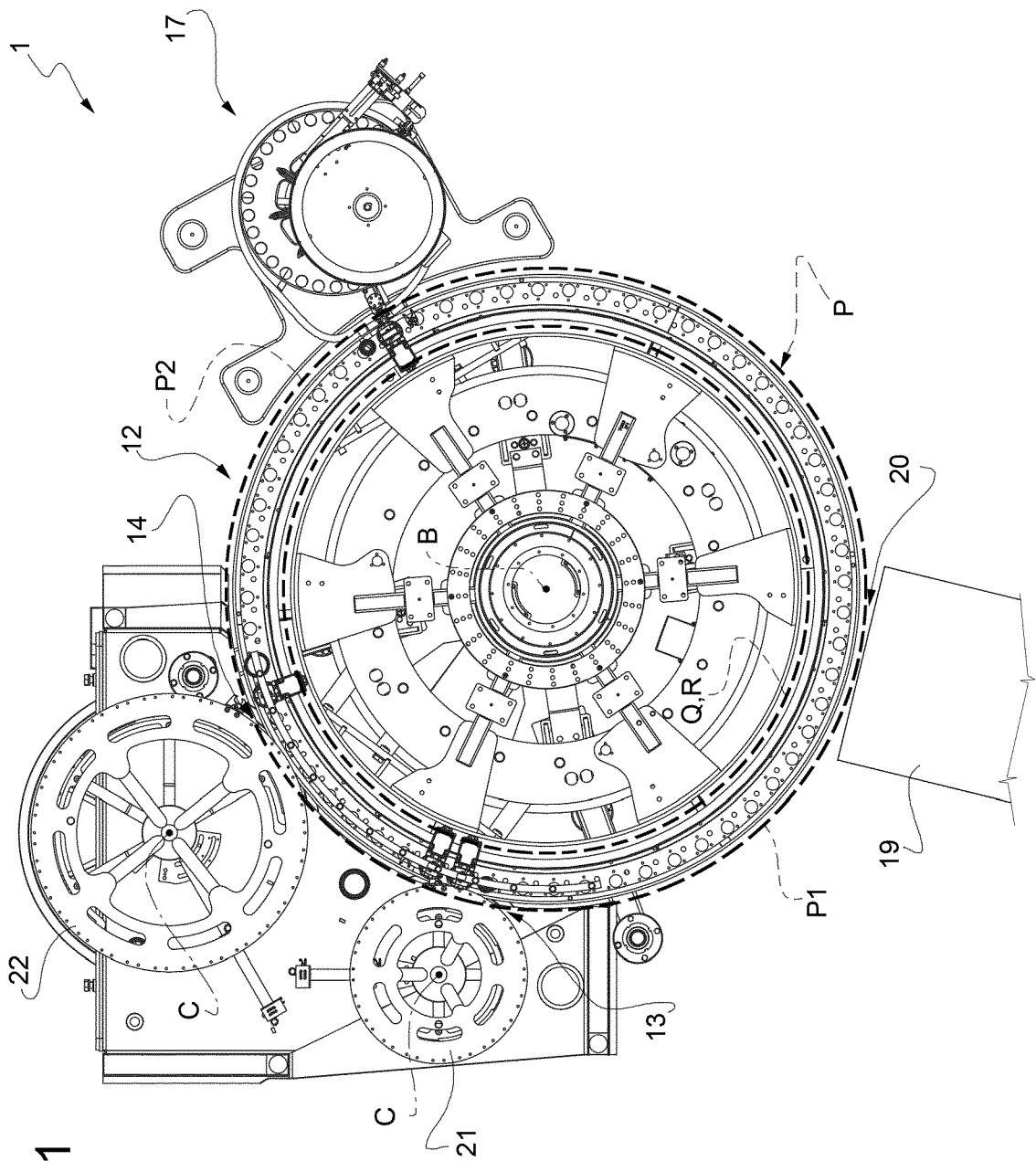


FIG. 1

FIG. 2

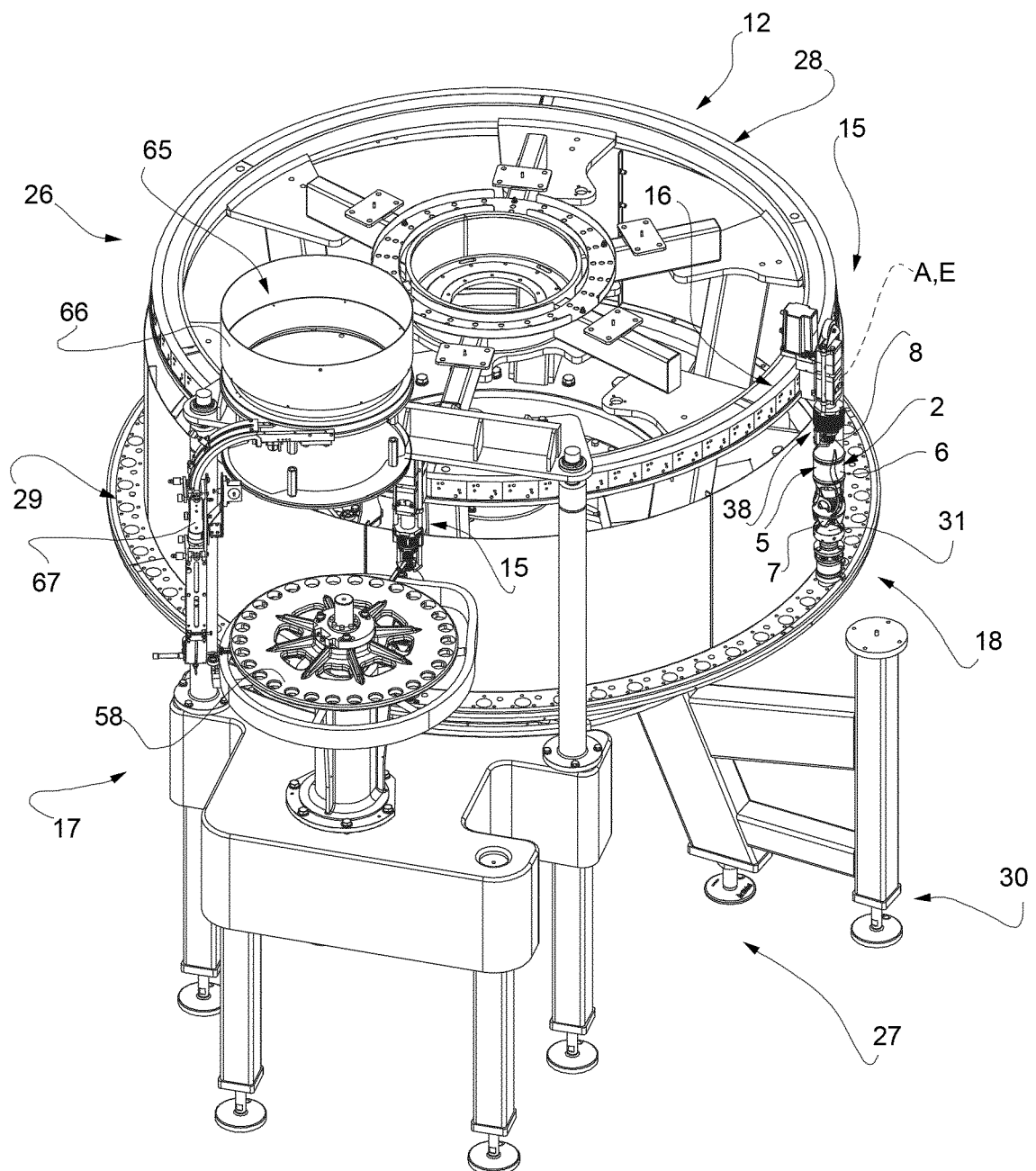


FIG. 3

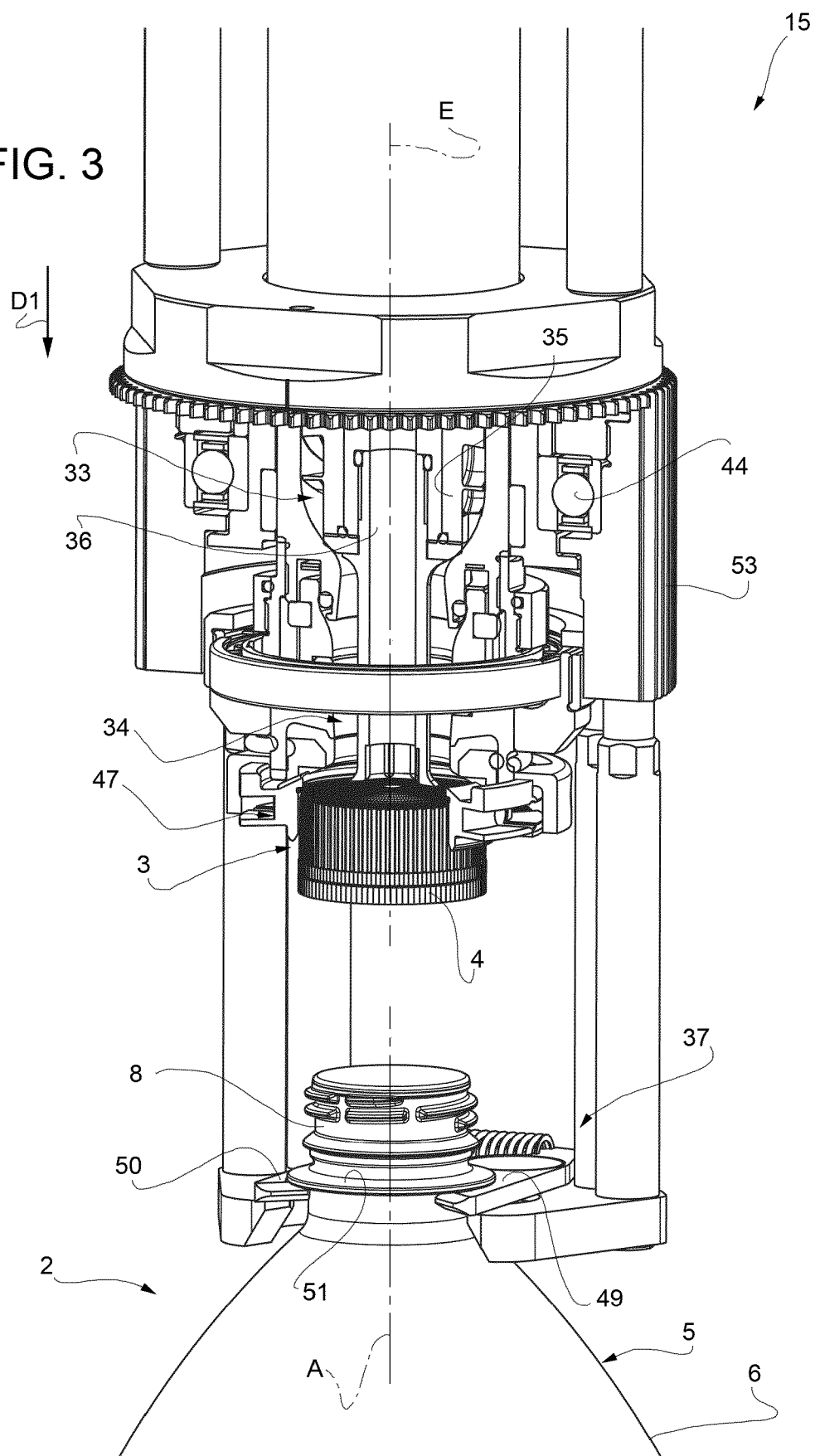


FIG. 4

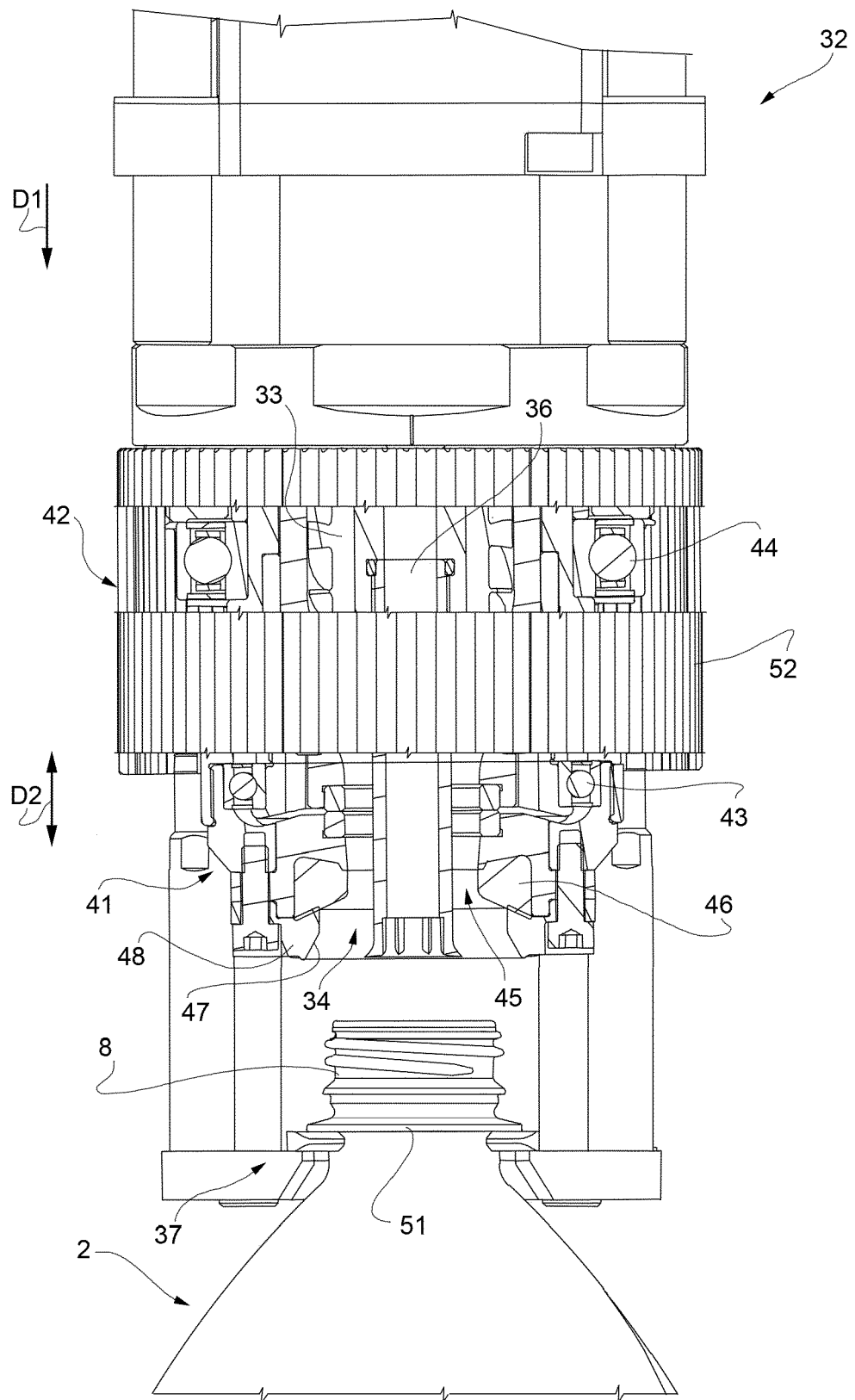


FIG. 5

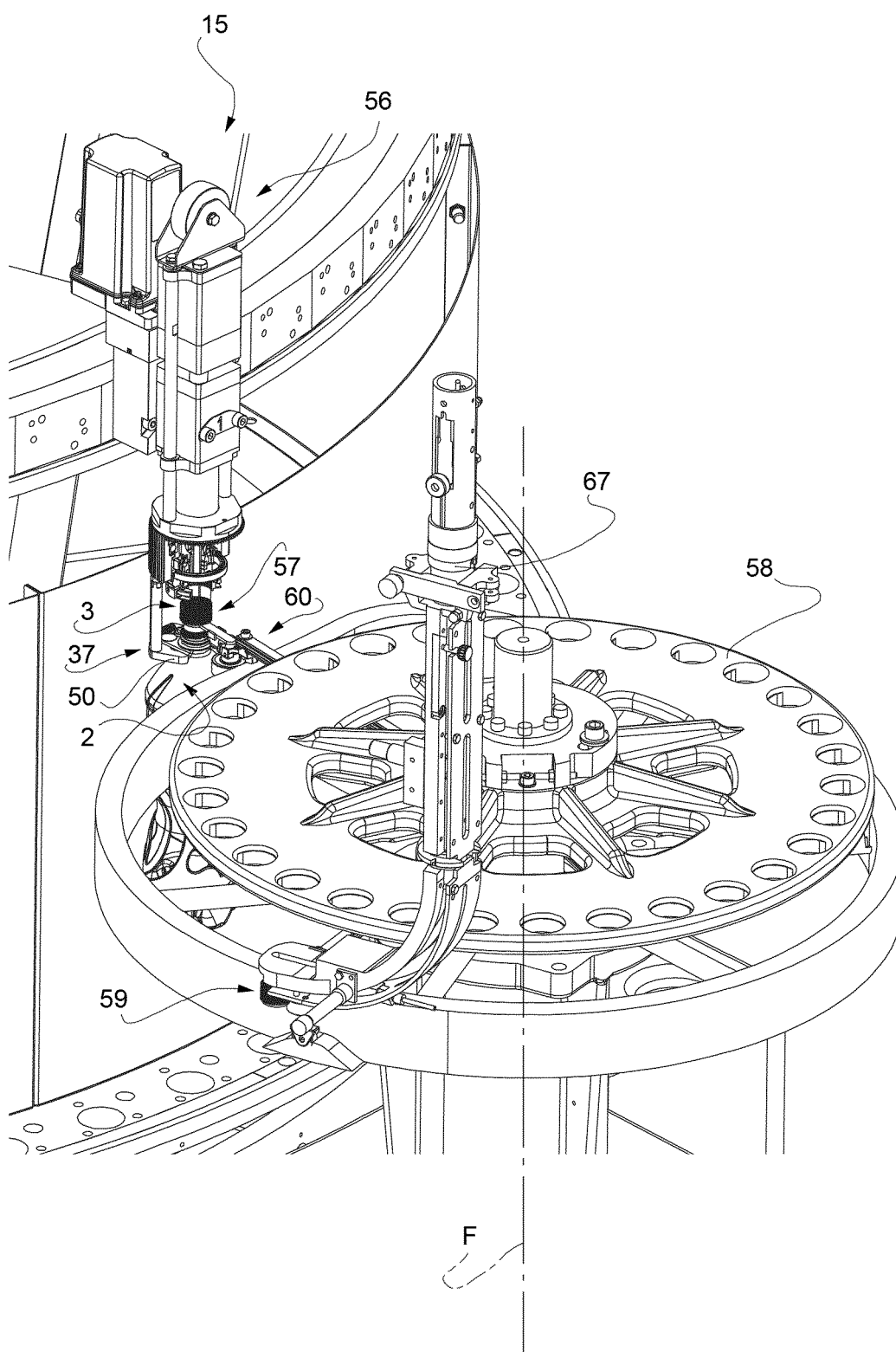
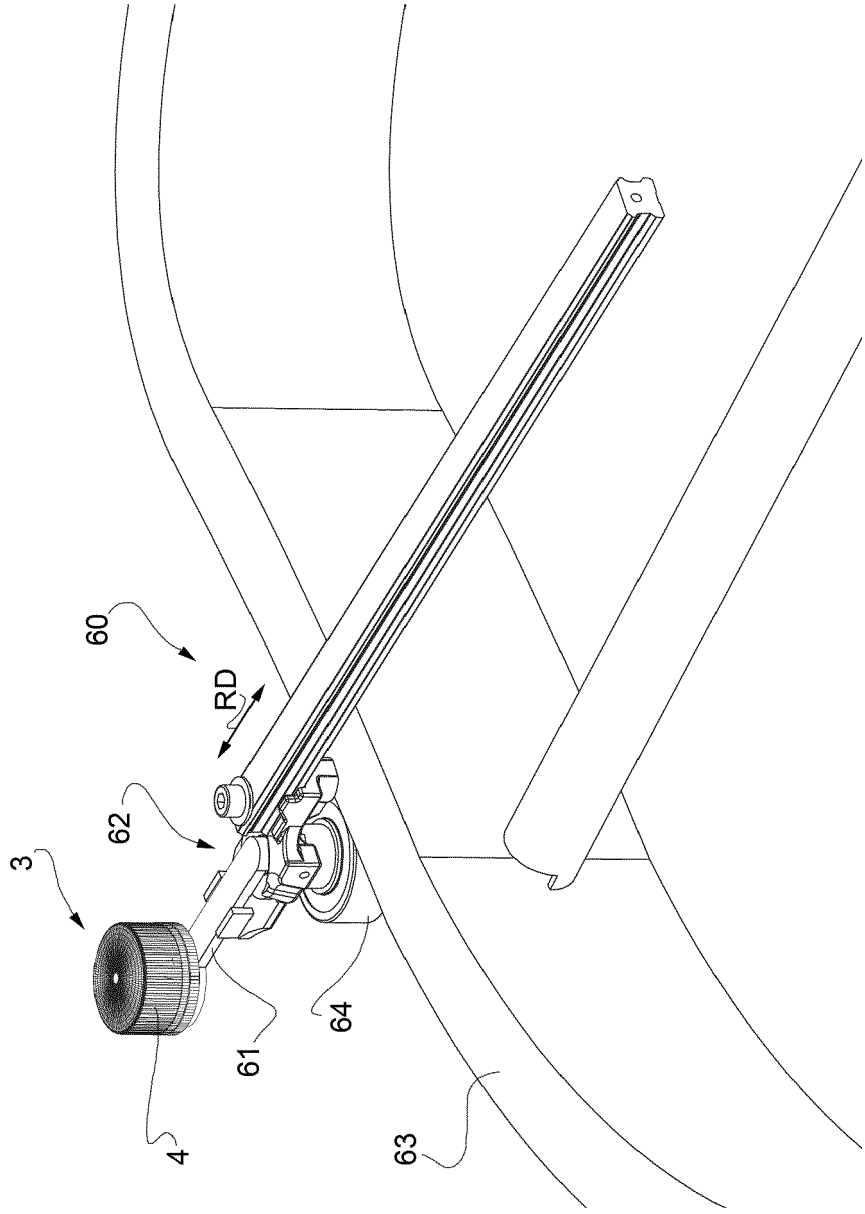
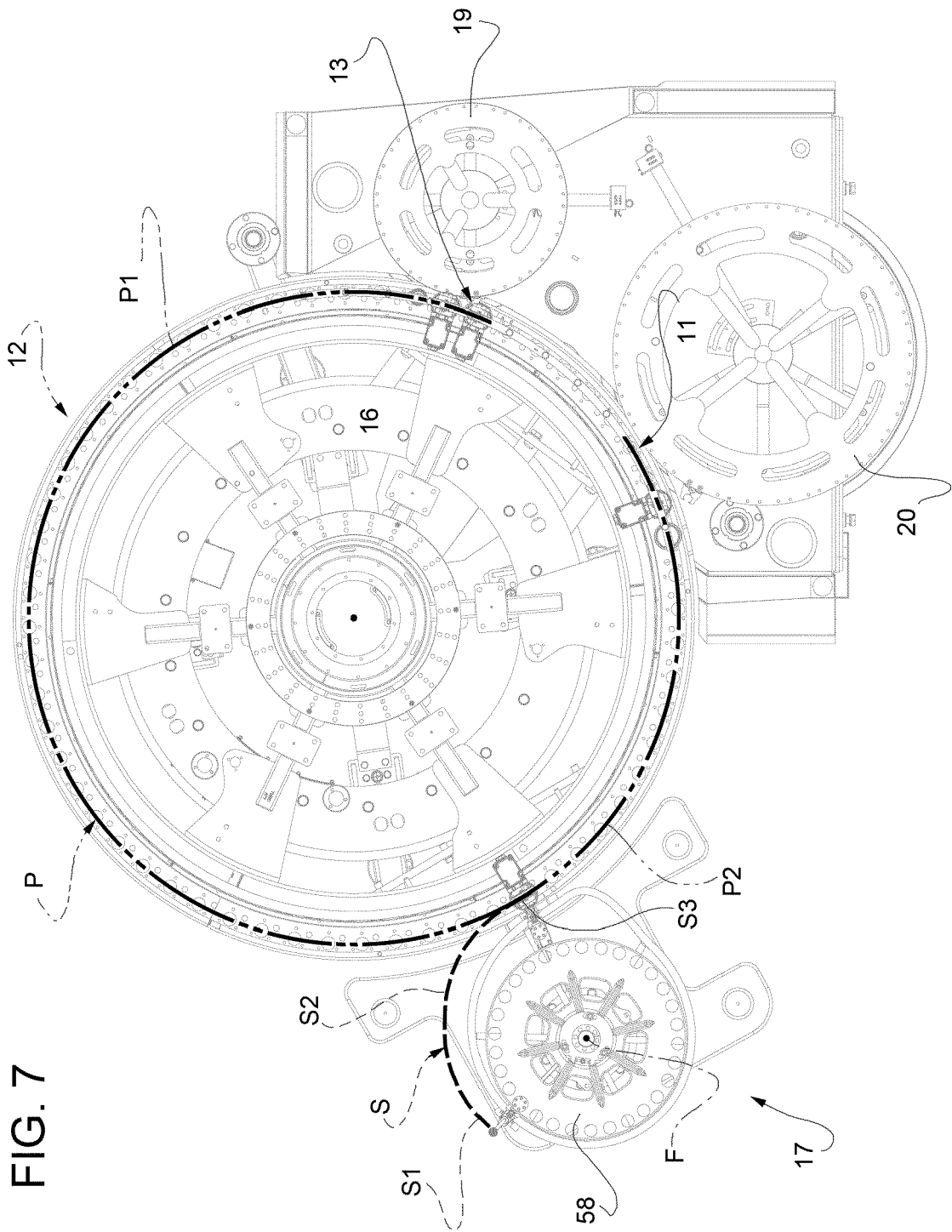


FIG. 6







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Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 March 2018	Examiner Wartenhorst, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ON EUROPEAN PATENT APPLICATION NO.**

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The members are as contained in the European Patent Office EDP file on
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