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(54) CAP APPLICATION DEVICE FOR A CAPPING APPARATUS, CAPPING APPARATUS FOR A PACKAGING MACHINE AND PACKAGING MACHINE HAVING A CAPPING APPARATUS

(57) There is described a cap application device (16) for a capping apparatus (15) for applying caps (7) onto respective collars (6) of packages (2) advancing along an advancement path (P). The cap application device (16) comprises a cap delivery unit (17) configured to deliver the caps (7) to a transfer station (18) at which the caps (7) are applied onto respective collars (6) and an alignment unit (19) configured to align the collars (6) of the packages (2) with respect to the caps (7) at the transfer station (18). The alignment unit (19) comprises a first guide (20) and a second guide (21) spaced apart from one another, configured to engage the collars (6) from opposite sides thereof and to align the collars (6) with respect to the caps (7) and at least one deformation correction surface (22) configured to interact with the collars (6) and to correct deformations of the collars (6).

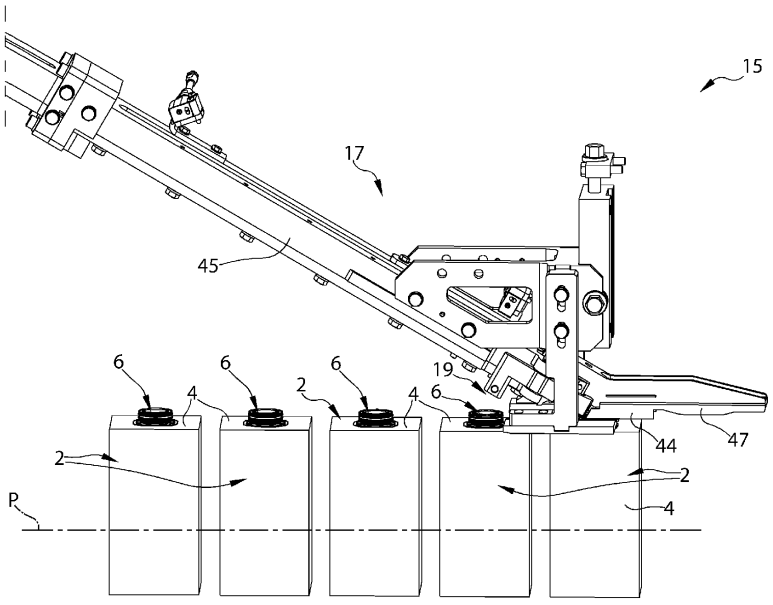

FIG.2

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Description

TECHNICAL FIELD

[0001] The present invention relates to a cap application device for a capping apparatus, the cap application device being configured to apply caps onto collars of packages filled with a pourable product and preferentially being formed from a multilayer packaging material.

[0002] Advantageously, the present invention also relates to a capping apparatus for applying caps onto packages filled with a pourable product, preferentially packages formed from a multilayer packaging material.

[0003] Advantageously, the present invention also relates to a packaging machine for the packaging of pourable products, preferentially pourable food products, into packages, preferentially packages formed from a multilayer packaging material, and having at least one capping apparatus.

BACKGROUND ART

[0004] As is known, many liquid or pourable food products, such as fruit juice, UHT (ultra-high-temperature treated) milk, wine, tomato sauce, etc., are sold in packages, in particular sealed packages, made of sterilized packaging material.

[0005] A typical example is the parallelepiped-shaped package for pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by sealing and folding a laminated strip packaging material. The packaging material has a multilayer structure comprising a carton and/or paper base layer, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene. In the case of aseptic packages for long-storage products, the packaging material also comprises a layer of oxygen-barrier material, e.g. an aluminum foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package eventually contacting the food product.

[0006] Packages of this sort are normally produced on fully automatic packaging machines, which form and fill the packages starting from a multilayer packaging material.

[0007] Some packaging machines are configured to produce packages comprising a main body formed from the multilayer packaging material and an opening device arranged about a pour opening of the main body. The opening device is configured to allow for selectively opening and closing the pouring outlet.

[0008] A typical opening device comprises a collar arranged about the pouring outlet and a cap secured to the collar and being controllable between a closing position and an opening position.

[0009] A typical packaging machine for producing packages having a respective opening device comprises a package forming apparatus configured to form and fill at least the respective main bodies from the multilayer packaging material and a capping apparatus configured to apply at least the cap to the respective package.

[0010] According to one possible embodiment, the package forming apparatus may be configured to produce packages having both the respective main body formed form the multilayer packaging material and a collar arranged about the respective pouring outlet. The capping apparatus is configured to apply and secure the cap onto the collar.

[0011] A typical capping apparatus comprises a conveyor device configured to advance a succession of packages as originating from the package forming apparatus along an advancement path, a cap application device configured to apply the caps onto the collars and a cap securing device arranged downstream from the cap application device and configured to secure the caps onto the collars. According to some possible solutions, the capping apparatus may also comprise a sealing device arranged downstream from the cap securing device and being configured to seal a coupling portion connected to the main body to the cap. An example of a capping apparatus is disclosed in patent document EP3153414A1.

[0012] Also, a capping apparatus may comprise a distribution unit for feeding the caps to the collars of the containers. An example of such a distribution unit is disclosed in patent document EP3205589A1.

[0013] Even though the known cap application devices and/or capping apparatuses and/or packaging machines operate satisfyingly well, a desire is felt in the sector to further improve the known packaging machines.

DISCLOSURE OF INVENTION

[0014] It is therefore an object of the present invention to provide an improved cap application device.

[0015] It is therefore another object of the present invention to provide an improved capping apparatus.

[0016] It is a further object of the present invention to provide an improved packaging machine.

[0017] According to the present invention, there is provided a capping application device according to the independent claim 1.

[0018] Preferred embodiments of the cap application device are claimed in the claims being directly or indirectly dependent on claim 1.

[0019] According to the present inventions, there is also provided a capping apparatus according to claim 14.

[0020] According to the present invention, there is also provided a packaging machine according to claim 15.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a packaging machine having at least one capping apparatus, with parts removed for clarity;

Figure 2 is a perspective view of a cap application device of the capping apparatus of Figure 1, with parts removed for clarity;

Figure 3 is a perspective view of a detail of the cap application device of Figure 2 from a first perspective, with parts removed for clarity;

Figure 4 is a perspective view of a detail of the cap application device of Figure 2 from a second perspective, with parts removed for clarity;

Figure 5a is a section view of the detail of Figures 3 and 4, with parts removed for clarity;

Figure 5b is a top view of package having a collar, with parts removed for clarity;

Figure 6 is a perspective view of a further detail of the cap application device of Figures 3 and 4, with parts removed for clarity; and

Figure 7, is a perspective view of a portion of the further detail of Figure 6, with parts removed for clarity.

BEST MODES FOR CARRYING OUT THE INVENTION

[0022] Number 1 indicates as a whole a packaging machine for producing packages 2 filled with a pourable product, in particular a pourable food product, such as (pasteurized) milk, fruit juice, wine, tomato sauce, salt, sugar, emulsions, yoghurt, milk drinks etc.

[0023] Packaging machine 1 may be configured to produce packages 2 filled with the pourable product.

[0024] In more detail, packaging machine 1 may be configured to produce packages 2 from a packaging material having a multilayer configuration.

[0025] In further detail, the packaging material may comprise at least one layer of fibrous material, such as e.g. a paper or cardboard, and at least two layers of heat-seal plastic material, e.g. polyethylene, interposing the layer of fibrous material in between one another. One of these two layers of heat-seal plastic material may define the inner face of package 2 contacting the pourable product.

[0026] Moreover, the packaging material may also comprise a layer of gas- and light-barrier material, e.g. aluminum foil or ethylene vinyl alcohol (EVOH) film, in particular being arranged between one of the layers of the heat-seal plastic material and the layer of fibrous material. Preferentially, the packaging material may also comprise a further layer of heat-seal plastic material being interposed between the layer of gas- and light-barrier material and the layer of fibrous material.

[0027] In further detail, the packaging material may be provided in the form of a web 3.

[0028] With particular reference to Figures 1, 5a and 5b, each package 2 may comprise a respective main body 4 formed from the multilayer packaging material and an opening device 5 arranged about a pour opening of the respective main body 4.

[0029] According to some possible embodiments, each pour opening may be covered by a separation membrane, the separation membrane being preferentially formed from portions of the multilayer packaging material.

[0030] Each opening device 5 may comprise a collar 6 protruding from the respective main body 4 and being arranged about the respective pouring opening. Preferentially, each collar 6 may comprise a respective outlet opening configured to allow for the outpouring of the pourable product.

[0031] Each opening device 5 may also comprise a cap 7 secured onto collar 6, and preferentially being configured to selectively open and close the respective pour opening. Preferentially, each collar 6 may include an outer projection and each cap 7 may comprise an inner projection, configured to engage with the outer projection of the respective collar 6.

[0032] In particular, each cap 7 may be controllable between a respective closing position at which cap 7 closes the outlet opening (for impeding the outflow of the pourable product) and an opening position at which cap 7 frees the outlet opening (for allowing the outflow of the pourable product). Preferentially, each cap 7 is secured to the respective package 2 and is in the closing position when being delivered to an end user.

[0033] Preferentially, each cap 7 may be (repeatably) moveable between the respective closing position and the respective opening position.

[0034] Moreover, each cap 7 may comprise a lateral wall, preferentially having an annular shape, and a lid, preferentially, hinged to the respective lateral wall. Preferentially, the lid may be moveable so as to control the respective cap 7 between the respective closing position and the respective opening position.

[0035] Preferentially, each lateral wall surrounds a portion of collar 6 after cap 7 has been secured onto the respective collar 6.

[0036] According to some possible embodiments, each opening device 5 may also comprise a respective coupling element connected to and protruding from the respective separation membrane. Preferentially, each coupling element may be also connected to, preferentially sealed to, the respective cap 7. In particular, during a first-time control of the respective cap 7 into the respective opening position, the coupling element follows movement of the respective cap 7 leading to a detachment of the respective separation membrane from the respective main body 4.

[0037] Preferentially, each coupling element may be surrounded by the respective collar 6. More preferentially, each coupling element may comprise a portion protruding out of collar 6.

[0038] According to some preferred non-limiting embodiments, each opening device 5 may also comprise a base frame 8 carrying the respective collar 6 and being

connected to, preferentially molded to, the respective main body 4.

[0039] Preferentially, each collar 6 may be integral to the respective base frame 8 and/or may extend from the respective base frame 8.

[0040] In further detail, each collar 6 may extend along a respective central axis A.

[0041] Moreover, each collar 6 may have an annular shape. Preferentially, each collar 6 may have a circular shape.

[0042] More specifically, each collar 6 may comprise a first end being in contact with, preferentially being integral to, base frame 8 and a second end delimiting the respective outlet opening.

[0043] Preferentially, collar 6, more preferentially the respective first end, comprises an indent 9 at the interface between collar 6, preferentially the respective first end, and the respective base frame 8.

[0044] According to some preferred non-limiting embodiments, each collar 6 may be molded to the respective main body 4. Preferentially, each collar 6 may be molded to web of packaging material 3 prior to forming and filling packages 2.

[0045] More specifically, each collar 6 may be molded to the respective main body 4 together with the respective base frame 8. Preferentially, each collar 6 may be molded to web of packaging material 3 together with the respective base frame 8 prior to forming and filling packages 2.

[0046] Additionally, also each coupling element may be molded to the respective main body 4, preferentially to web of packaging material prior of forming and filling packages 2.

[0047] With particular reference to Figure 1, packaging machine 1 may comprise:

- a package filling apparatus 14 configured to form and fill packages 2, in particular configured to form packages 2 from the multilayer packaging material and to fill packages 2 with the pourable product; and
- at least one capping apparatus 15 configured to at least secure one respective cap 7 to each collar 6.

[0048] Preferentially, capping apparatus 15 may be arranged downstream from package filling apparatus 14 and may be configured to receive packages 2 from package filling apparatus 14.

[0049] Please note that for reasons of simplicity, in the present description, when discussing operation of capping apparatus 15, one does not use different terms to indicate packages 2 which still need to receive the respective caps 7 and which have the respective caps 7.

[0050] With particular reference to Figure 2, capping apparatus 15 comprises:

- a conveying device configured to advance packages 2 along and advancement path P, preferentially advancement path P having a linear shape;
- a cap application device 16 configured to apply one respective cap 7 onto each collar 6.

[0051] As will be explained further below, cap application device 16 is configured to apply caps 7 onto the respective collars 6, but after application these are not yet fully secured onto the respective collars 6.

[0052] In more detail, in use, after operation of cap application device 16 collar 6, preferentially the respective lateral wall, may be only partially coupled to collar 6; i.e. the respective lateral wall surrounds already some portions of collar 6, but not yet all the portions, which the respective lateral wall should surround.

[0053] Therefore, preferentially, capping apparatus 15 may also comprise one or more cap securing devices configured to secure caps 7 onto the respective collars 6. E.g. each cap securing device may be configured to screw and/or push caps 7 onto the respective collars 6.

[0054] More preferentially, each cap securing device ensures, in use, that each cap 7, preferentially the respective lateral wall, may be fully coupled to the respective collar 6. E.g. the respective lateral wall may surround all the portions which the respective lateral wall should surround after having been secured to collar 6.

[0055] Preferentially, the cap securing devices may be arranged downstream from cap application device 16 along advancement path P.

[0056] According to some possible embodiments, capping apparatus 15 may comprise only one cap securing device. Preferentially, capping apparatus 15 may comprise more than one cap securing device configured to simultaneously secure respective caps 7 onto the respective collars 6.

[0057] According to some possible non-limiting embodiments, capping apparatus 15 may also comprise one or more cap sealing devices configured to seal the respective coupling elements to the respective caps 7.

[0058] Preferentially, the cap sealing devices may be arranged downstream from the cap securing devices along advancement path P.

[0059] According to some possible embodiments, capping apparatus 15 may comprise only one cap sealing device. Preferentially, capping apparatus 15 may comprise more than one cap sealing device configured to simultaneously seal the respective coupling elements to the respective caps 7.

[0060] With particular reference to Figure 2 to 5a, 6 and 7, cap application device 16 comprises:

- a cap delivery unit 17 configured to deliver caps 7 (in sequence) to a transfer station 18 at which caps 7 are applied onto the respective collars 6; and
- an alignment unit 19 configured to receive collars 6 and align collars 6 with respect to caps 7 at transfer station 18.

[0061] In particular, packages 2 when advancing along advancement path P pass (in sequence) through transfer station 18.

[0062] In particular, the scope of alignment unit 19 is such that during the transfer of caps 7 onto collars 6, collars 6 are correctly aligned with respect to the respective caps 7 and such that the respective caps 7 are correctly applied onto the respective collars 6.

[0063] In more detail, alignment of collars 6 with respect to caps 7 means that the respective central axes A of the respective collars 6 are aligned with respect to central axes B of the respective caps 7. Preferentially, a correct alignment may consist in the respective central axes A being coaxial with respect to the respective caps 7 during transfer of the respective caps 7 onto the respective collars 6.

[0064] In particular, alignment unit 19 may be configured to guarantee a desired relative position of each collar 6 at transfer station 18.

[0065] Preferentially, alignment unit 19 may be configured to center collars 6; i.e. alignment unit 19 may be configured such that respective center points of collars 6 take a predefined position, which is substantially the same for all collars 6.

[0066] Moreover, alignment unit 19 may be configured to compensate for production tolerances inherently related to the connection of collars 6 to main bodies 2.

[0067] Alignment unit 19 comprises a first guide 20 and a second guide 21 spaced apart from one another, configured to engage the collars from opposite sides thereof and to align collars 6, in particular with respect to caps 7.

[0068] More specifically, first guide 20 and second guide 21 are configured to engage with collar 6 such that interaction of first guide 20 and second guide 21 with collar 6 determines the relative position of collar 6 with respect to the respective caps 7.

[0069] In particular, the positions of first guide 20 and second guides 21 with regard to transfer station 18 are fixed and accordingly, even if the relative positions of collars 6 on main bodies 2 may vary, first guide 20 and second guide 21 provide for the correct relative positioning of collars 6 so that collars 6 are correctly arranged at transfer station 18.

[0070] When reverting to Figure 5b one sees an example of a collar 6 being molded onto the respective main body 2. One notes that collar 6 is slightly deformed (the right portion deviates from the shape of a half-circle). In the specific example one notes that one portion of collar 6 follows the shape of a half-circle, while the other not. However, such deformations may be critical with regard to the correct application of the respective cap 7. In particular, if the extent of the deformation is considerable, the cap 7 is not correctly applied and package 2 needs to be discarded. A high rate of discarding is undesirable.

[0071] Therefore, alignment unit 19 also comprises at least one deformation correction surface 22 configured to interact with collars 6 and to correct any deformations of collars 6. Preferentially, deformation correction surface 22 may be configured to engage one portion of collars 6 and/or to exert a force on collars 6 towards a center of the respective collars 6.

[0072] More preferentially, deformation correction surface 22 may be configured to correct deformations so that each collar 6 substantially describes a circular shape.

[0073] According to the preferred embodiment, alignment unit 19 may comprise exactly one deformation correction surface 22. The Applicant has observed that deformations typically occur only on one side of collars 6.

[0074] According to some preferred non-limiting embodiments, deformation correction surface 22, first guide 20 and second guide 21 may be arranged such that deformation correction surface 22 engages, in use, with collar 6 after first guide 20 and second guide 21 have engaged with collars 6; i.e. deformation correction surface 22 starts to correct any deformations only after first guide 20 and second guides 21 have started to align, preferentially to center, collars 6 and/or before first guide 20 and second guide 21 have ended to engage with collar 6.

[0075] With particular reference to Figures 2 to 5a and 6, first guide 20 and second guide 21 may be elongated along advancement path P.

[0076] According to some possible embodiment, first guide 20 and second guide 21 may define an advancement space 23 within which collars 6 advance, in use, when interacting with first guide 20 and second guide 21.

[0077] More specifically, first guide 20 and second guide 21 may define an inlet opening 27 and an outlet opening 28 arranged downstream from inlet opening 27 with regard to advancement path P.

[0078] Preferentially, advancement space 23 extends from inlet opening 27 to outlet opening 28.

[0079] In use, collars 6 advance within advancement space 23 from inlet opening 27 to outlet opening 28.

[0080] According to some preferred non-limiting embodiments, first guide 20 and second guide 21 may define a center axis C, preferentially being parallel to advancement path P.

[0081] In more detail, each one of first guide 20 and second guide 21 may extend from a first terminal portion 29 to a second terminal portion 30.

[0082] Preferentially, first terminal portions 29 may define together inlet opening 27 and second terminal portions 30 may define outlet opening 28.

[0083] Preferentially, a first size of inlet opening 27 may be larger than a second size of outlet opening 28. In particular, the first size and the second size may be defined as a distance D1 and a distance D2 between, respectively, first terminal portions 29 and second terminal portions 30 along a direction perpendicular to advancement path P.

[0084] In further detail, each one of first guide 20 and second guide 21 may comprise an auxiliary portion 31 and a main portion 32 downstream (with respect to advancement path P) from the respective auxiliary portion 31.

[0085] Moreover, each auxiliary portion 31 may be inclined with respect to the respective main portion 32.

[0086] Preferentially, each auxiliary portion 31 may

carry the respective first terminal portion 29 and each main portion 32 may carry the respective second terminal portion 30.

[0087] In further detail, each auxiliary portion 31 may comprise a free end and a connection end opposite to the free end and being connected to the respective main portion 32. Preferentially, each first terminal portion 29 may comprise the respective free end.

[0088] Advantageously, the free ends may delimit inlet opening 27.

[0089] Preferentially, a distance (equaling distance D1) (with regard to a direction perpendicular to advancement path P) between the free ends may be larger than a distance (with regard to a direction perpendicular to advancement path P) between the connection ends.

[0090] In other words, inlet opening 27 may be larger than other parts of advancement space 23 which allows to receive collars 6 independently of their precise position and to correctly position them with regard to caps 7.

[0091] In further detail, main surface portions 32 may be parallel to one another, and preferentially also to advancement path P and/or center axis C. Preferentially, transfer station 18 may be arranged along main portions 32. So, collar 6 and/or package 2 is in contact with main portions 32, while cap delivery unit 17 delivers cap 7 onto collar 6.

[0092] Additionally, auxiliary portions 31 may define a portion of advancement space 23 tapering towards connection ends.

[0093] With particular reference to Figures 5a and 7, each one of first guide 20 and second guide 21 may comprise a lateral surface 33 facing, in use, collars 7.

[0094] Preferentially, each lateral surface 33 may be designed so as to be complementary (i.e. have a complementary shape) to a respective portion of collars 7, preferentially of the respective indent 9. In this way, one guarantees that first guide 20 and second guide 21 interact with a defined and locally restricted portion of collar 6. In particular, one guarantees that first guide 20 and second guide 21 can reach into the respective indent 9.

[0095] Additionally or alternatively, first guide 20 and second guide 21 may have a thickness being equal to or smaller than 1.2 mm, preferentially equal or smaller than 1.0 mm. This contributes to first guide 20 and second guide 21 to interact with a locally restricted portion of collar 6 and not to eventually exert forces onto collar 6 which may lead to deformation of collar 6.

[0096] In further detail, each one of first guide 20 and second guide 21 may comprise a first face configured to face and/or facing in use main bodies 4 and/or base frames 8 and a second face 34 opposite to the respective first face. Preferentially, each first face may cover a larger area than the respective second face 34.

[0097] Preferentially, each lateral surface 33 may extend between the respective first face and the respective second face 34.

[0098] Preferentially, each lateral surface 33 may comprise a section being inclined with respect to the respective first face and the respective second face 34. Preferentially, each section may extend from the respective second face 34 towards center axis C.

[0099] With particular reference to Figures 2 to 5a, 6 and 7, deformation correction surface 22 may comprise a transition surface portion 40 and a main surface portion 41 connected to transition surface portion 40. In particular, transition surface portion 40 may be inclined with respect to main surface portion 41.

[0100] In particular, main surface portion 41 may be configured to contact collar 6 for the correction of any deformations of collars 6, while transition surface portion 40 may be configured to guarantee for a smooth force profile acting on collars 6 and to avoid any sudden interactions between deformation correction surface 22 and collars 6.

[0101] Preferentially, main surface portion 41 may be positioned downstream from transition surface portion 40 with regard to advancement path P.

[0102] Preferentially, transition surface portion 40 may comprise and may extend from a connection section connected to main surface portion 41 and an initial section opposite to the connection section. More preferentially, the connection section and/or main surface portion 41 may be closed to center axis C than the initial section.

[0103] Preferentially, main surface portion 41 may be parallel to advancement path P and/or center axis A.

[0104] Preferentially, main surface portion 41 may be parallel to the respective main portion 32 of second guide 21 and/or transition surface portion 40 may be parallel to the respective auxiliary portion 31 of second guide 21.

[0105] Additionally or alternatively, main surface portion 41 may lie within a plane.

[0106] According to some preferred non-limiting embodiments, deformation correction surface 22 may extend at least until transfer station 18 and/or to outlet opening 28 and/or may be configured to interact with collars 6 being located at transfer station 18. Hence, the deformation correction surface 22 contacts the collar 6 such to correct any deformation, while the cap 7 is applied onto the collar 6 at the transfer station 18.

[0107] In this way, one guarantees that during the application of caps 7 onto collars 6 any deformations are corrected and it is possible to correctly apply caps 7. After application of caps 7 onto collars 6 it is the cap 7, which guarantees that collars 6 do not return elastically to their initial deformed shape but retain the desired shape, preferentially the desired circular shape.

[0108] Additionally, alignment unit 19 may also comprise an auxiliary surface portion 42 connected to deformation correction surface 22, preferentially transition surface portion 40. In particular, transition surface portion 40 may be interposed between auxiliary surface portion 42 and main surface portion 41. In particular, auxiliary surface portion 42 may be arranged such so as to guarantee that auxiliary surface portion 42 does not engage to collars 6.

[0109] In more detail, auxiliary surface portion 42 may be arranged upstream from deformation correction surface 22 along advancement path P.

[0110] Preferentially, main surface portion 41 may be closer to center axis C than auxiliary surface portion 42.

[0111] Auxiliary surface portion 42 may be parallel to main surface portion 41.

[0112] According to some preferred non-limiting embodiments, deformation correction surface 22 may be associated to second guide 21 and/or carried by second guide 21. Preferentially, deformation correction surface 22 may extend from second guide 21, preferentially second face 34.

[0113] Possibly, deformation correction surface 22 may be perpendicular to second guide 21, preferentially second face 34.

[0114] According to some preferred non-limiting embodiments, second guide 21 and deformation correction surface 22 may be integral to one another.

[0115] Preferentially, second guide 21 may be closer to center axis C than deformation correction surface 22.

[0116] With particular reference to Figures 2 to 5a and 6, cap application device 16 may further comprise a support surface 43 associated to, preferentially extending from, first guide 20, preferentially the respective second face 34.

[0117] Preferentially, a first extension E1 of first guide 20 with respect to and/or from support surface 43 towards center axis C is larger than a second extension E2 of second guide 21 with respect to and/or from deformation correction surface 22, preferentially main surface portion 41, towards center axis C. In particular, support surface 43 may be arranged such to avoid any interaction and/or contact with collars 6; in other words, support surface 43 remains detached from collars 7 while advancing within advancement space 23, differently from deformation correction surface 22 which may engage with collar 6.

[0118] In particular, first extension E1 and second extension E2 may be determined along a direction perpendicular to center axis C.

[0119] Typically, there is no need to lay out support surface 43 as a deformation correction surface as typically deformations only occur on one side of collars 7.

[0120] With particular reference to Figures 2, 4 and 5a, cap delivery unit 17 may comprise a pair of delimiting walls 44 configured to laterally engage caps 7 from opposite sides thereof at transfer station 18 and during transfer (application) of caps 7 onto the respective collars 6. In particular, delimiting walls 44 allow to stabilize caps 7 during transfer onto collars 6.

[0121] In particular, delimiting walls 44 may be arranged above alignment unit 19.

[0122] Preferentially, delimiting walls 44 may be parallel to advancement path P and/or center axis C. Preferentially, delimiting walls 44 may be positioned on opposite sides of center axis C such to retain caps 7 therebetween during transfer onto collars 6.

[0123] Preferentially, delimiting walls 44 may be arranged at transfer station 18.

[0124] According to some preferred non-limiting embodiments, cap delivery unit 17 may also comprise a delivery channel 45 configured to contain a plurality of caps 7 and to direct cap 7 to transfer station 18. Preferentially, delimiting walls 44 may delimit delivery channel 45 and/or extend from delivery channel 45 downwards, at least at transfer station 18.

[0125] It is noted that delimiting walls 44 of delivery unit 17 may be provided irrespective of the provision of deformation correction surface 22. In other words, it is possible to provide an alignment unit 19 having the first guide 20 and the second guide 21, but not necessarily having the deformation correction surface 22, in combination with the delimiting walls 44 of delivery unit 17.

[0126] Additionally, cap delivery unit 17 may also comprise a retaining mechanism 46 controllable between an active configuration at which retaining mechanism 46 is configured to retain one cap 7 at a time at transfer station 18 and a release configuration at which retaining mechanism 46 is configured to release caps 7 onto one respective collar 6 at transfer station 18.

[0127] According to some possible embodiments, cap delivery unit 17 may be configured such that while retaining mechanism 46 retains caps 7 at transfer station 18, caps 7 are inclined with respect to the respective receiving collars 6; i.e. the respective central axes B are inclined with respect to the respective central axes A. Moreover, only during release, caps 7 change their orientation such that during application of caps 7 onto collars 6, the respective central axes B and the respective central axes C may be parallel, preferentially coaxial, to one another.

[0128] According to some preferred non-limiting embodiments, cap delivery unit 17 may also comprise a pressuring mechanism 47, e.g. a pressuring cam, arranged downstream from transfer station 18 with respect to advancement path P and configured to exert a force onto caps 7 and towards main body 2 so as to further press caps 7 onto collars 6.

[0129] With particular reference to Figure 1, package filling apparatus 14 may be configured to produce packages 2 and to fill packages 2 with the pourable product.

[0130] In more detail, package filling apparatus 14 may be configured to produce packages 2 by forming a tube 50 from web 3, longitudinally sealing tube 50, filling tube 50 with the pourable product and to transversally seal and cut tube 50.

[0131] In use, packaging machine 1 produces packages 2 filled with the pourable product.

[0132] Operation of packaging machine 1 comprises at least the steps of:

- forming and filling packages 2 with the pourable product, in particular executed by of package filling apparatus 14; and
- securing caps 7 on collars 6, in particular executed by capping apparatus 15.

[0133] Even more particular, during the step of forming and filling, tube 50 is formed from advancing web 3, is longitudinally sealed, filled with the pourable product and transversally sealed and cut.

[0134] According to some preferred embodiments, operation of packaging machine 1 may also comprise a step of feeding, during which packages 2 are fed, in particular from package filling apparatus 7, to capping apparatus 15.

[0135] In more detail, during the step of securing, the following sub-steps are executed:

- applying caps 7 onto collars 6 by means of cap application device 16;
- preferentially, securing caps 7 on collars 6 by means of one cap securing device; and
- preferentially, sealing the connection elements to caps 7.

[0136] During the sub-step of applying, alignment unit 19 aligns collars 6 with respect to the respective caps 7. Additionally, alignment unit 19, preferentially deformation correction surface 22 may correct any deformations of collars 6.

[0137] During the sub-step of applying, delimiting walls 44 delimit movement of caps 7 so as to ensure a correct application of caps 7 onto collars 6.

[0138] The advantages of cap application device 16 and/or capping apparatus 15 and/or of packaging machine 1 according to the present invention will be clear from the foregoing description.

[0139] In particular, cap application device 16 ensures that collars 6 are correctly aligned and/or have the desired shape during application of caps 7 onto collars 6.

[0140] Additionally, cap application device 16 also ensures that caps 7 correctly move onto collars 6 due to the presence of delimiting walls 44.

[0141] Clearly, changes may be made to cap application device 16 and/or capping apparatus 15 and/or packaging machine 1 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. Cap application device (16) for a capping apparatus (15) for applying caps (7) onto respective collars (6) of packages (2) advancing along an advancement path (P), the cap application device (16) comprises:

- a cap delivery unit (17) configured to deliver the caps (7) to a transfer station (18) at which the caps (7) are applied onto respective collars (6);
- an alignment unit (19) configured to align the collars (6) of the packages (2) with respect to the caps (7) at the transfer station (18);

wherein the alignment unit (19) comprises:

- a first guide (20) and a second guide (21) being spaced apart from one another, being elongated along the advancement path (P), and being configured to engage the collars (6) from opposite sides thereof and to align the collars (6) with respect to the caps (7); wherein the first guide (20) and the second guide (21) define an advancement space (23) within which the collars (6) advance, in use, while interacting with the first guide (20) and the second guide (21); and
- at least one deformation correction surface (22) configured to interact with the collars (6) and to correct deformations of the collars (6).

2. Cap application device (16) according to claim 1, wherein the deformation correction surface (22), the first guide (20) and the second guide (21) are arranged such that the deformation correction surface (22) engages, in use, with the collar (6) after the first guide (20) and the second guide (21) have started to engage with the collar (6) and/or before the first guide (20) and the second guide (21) have ended to engage with the collar (6).

3. Cap application device (16) according to claim 1 or 2, wherein the deformation correction surface (22) comprises a transition surface portion (40) and a main surface portion (41) connected to the transition surface portion (40);
wherein the transition surface portion (40) is inclined with respect to the main surface portion (41).

4. Cap application device (16) according to claim 3, wherein the main surface portion (41) is parallel to the advancement path (P) and/or to a center axis (C) defined between the first guide (20) and the second guide (21); and/or
wherein the main surface portion (41) lies within a plane.

5. Cap application device (16) according to any one of the preceding claims, wherein the deformation correction surface (22) extends at least to the transfer station (18) and/or is configured to interact with the collar (6) being located at the transfer station (18).

6. Cap application device (16) according to any one of the preceding claims, wherein the deformation correction surface (22) is associated to and/or is carried by and/or extends from the second guide (21).

7. Cap application device (16) according to any one of the preceding claims, wherein the second guide (21) is closer to a center axis (C) defined between the first guide (20) and the second guide (21), than the deformation correction surface (22).

8. Cap application device (16) according to any one of the preceding claims, wherein the cap application device (16) further comprises a support surface (43) extending from and/or being associated to and/or being carried by the first guide (20) and the deformation correction surface (22) being associated to and/or extending from the second guide (21);

wherein the first guide (20) and the second guide (21) define a center axis (C);
wherein a first extension (E1) of the first guide (20) with respect to the support surface (43) towards the center axis (C) is larger than a second extension (E2) of the second guide (21) with respect to the deformation correction surface (22) towards the center axis (C).

9. Cap application device (16) according to claim 7 or 8, wherein each one of the first guide (20) and the second guide (21) comprises a lateral surface (33) facing, in use, the collars (6);
wherein each lateral surface (33) is complementary to a respective portion of the collar (6).

10. Cap application device (16) according to any one of claims 7 to 9, wherein the first guide (20) and the second guide (21) have a thickness being equal to or smaller than 1.2 mm.

11. Cap application device (16) according to any one of claims 7 to 10, wherein each one of the first guide (20) and the second guide (21) extends from a respective first terminal portion (29) to a respective second terminal portion (30); wherein the first terminal portions (29) define an inlet opening (27) and the second terminal portions (30) define an outlet opening (28); wherein a size (D1) of the inlet opening (27) is larger than a size (D2) of the outlet opening (28); and/or
wherein each one of the first guide (20) and the second guide (21) comprises an auxiliary portion (31) and a main portion (32) being downstream from the respective auxiliary portion (31); wherein each auxiliary portion (31) is inclined with respect to the respective main portion (32); wherein each auxiliary portion (31) comprises a free end and a connection end opposite to the free end and being connected to the respective main portion (32); wherein a distance (D1) between the free ends is larger than a distance between the connection ends.

12. Cap application device (16) according to any one of the preceding claims, wherein the cap delivery unit (17) comprises a pair of delimiting walls (44) configured to laterally engage the caps (7) from opposite sides thereof at the transfer station (18) and during transfer of the caps (7) onto the collar (6).

13. Cap application device (16) according to claim 12, wherein the delimiting walls (44) are parallel to the advancement path (P) and/or to a central axis (C) defined between the first guide (20) and the second guide (21).

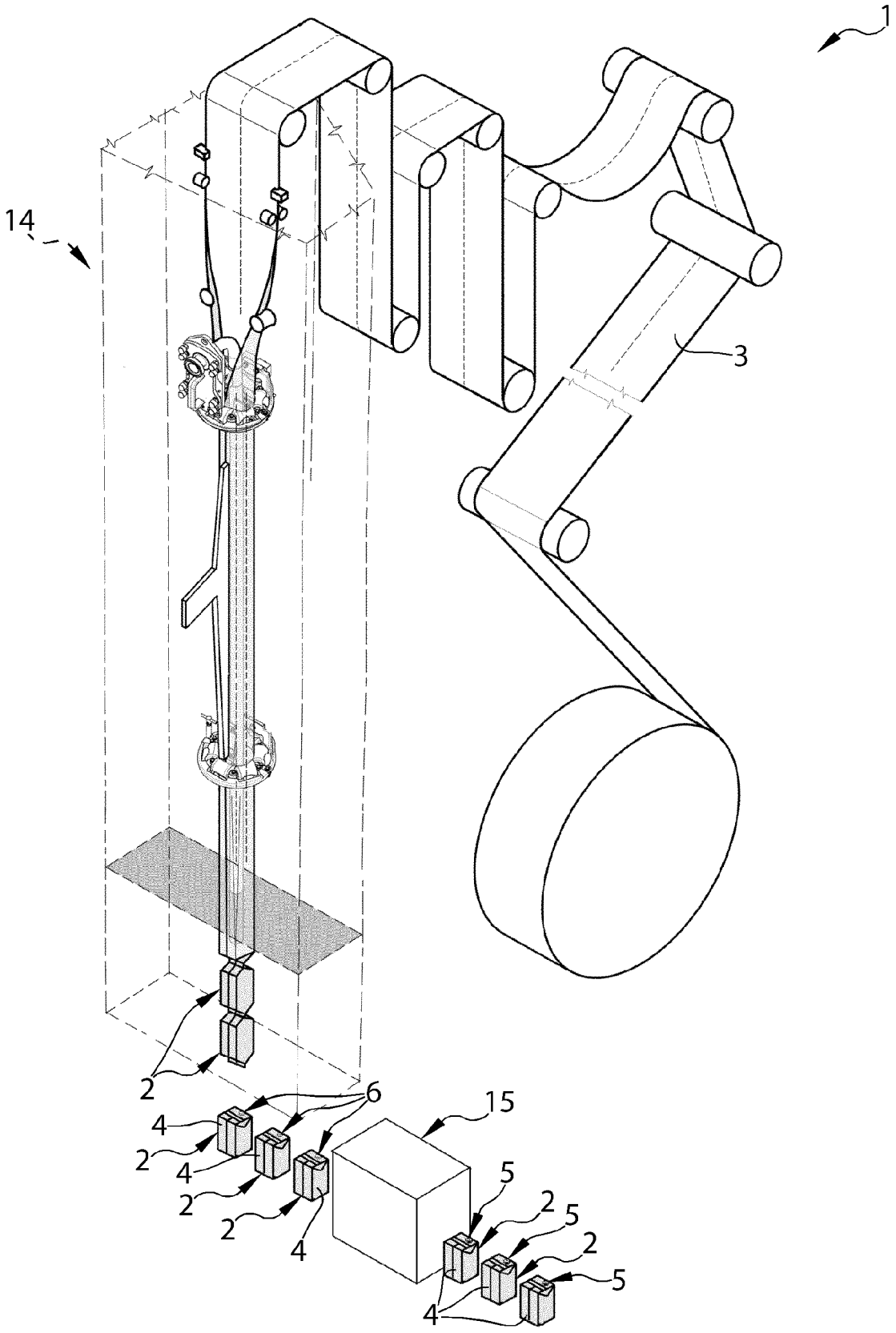
14. Capping apparatus (15) for securing caps (7) onto collars (6) of packages (2) produced in a packaging machine (1) comprising:

- a conveying device configured to advance the respective packages (2) along an advancement path (P);
- a cap application device (16) according to any one of the preceding claims configured to apply caps (7) onto the collars (6) of the packages (2); and
- at least one securing device arranged downstream from the cap application device (16) along the advancement path (P) and configured to secure the caps (7) on the collars (6) .

15. Packaging machine (1) for producing packages (2) having collars (6) and being filled with a pourable product comprising:

- a package filling apparatus (14) for forming and filling the packages (2) with the pourable product; and
- at least one capping apparatus (15) according to claim 14.

FIG.1



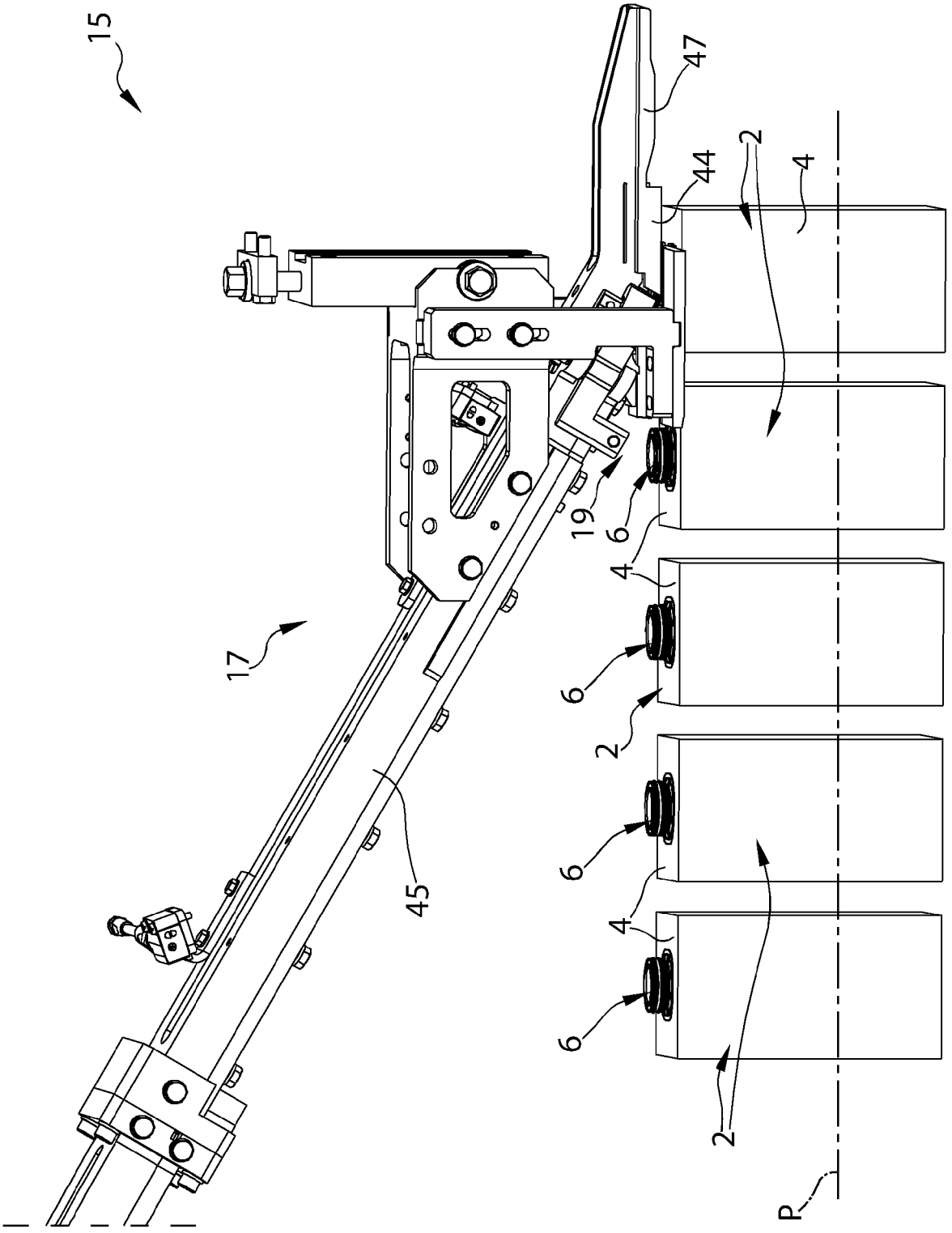


FIG.2

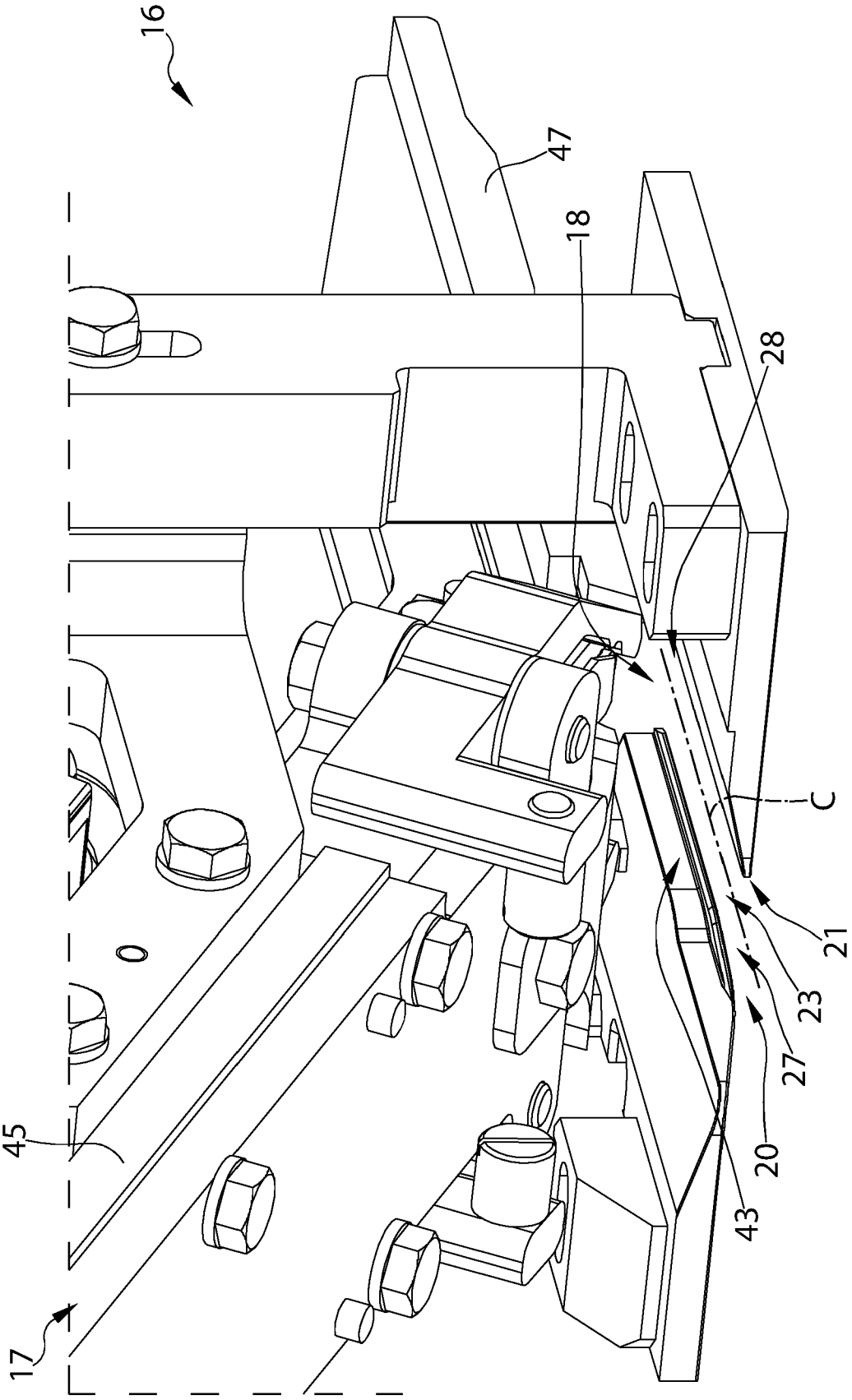


FIG.3

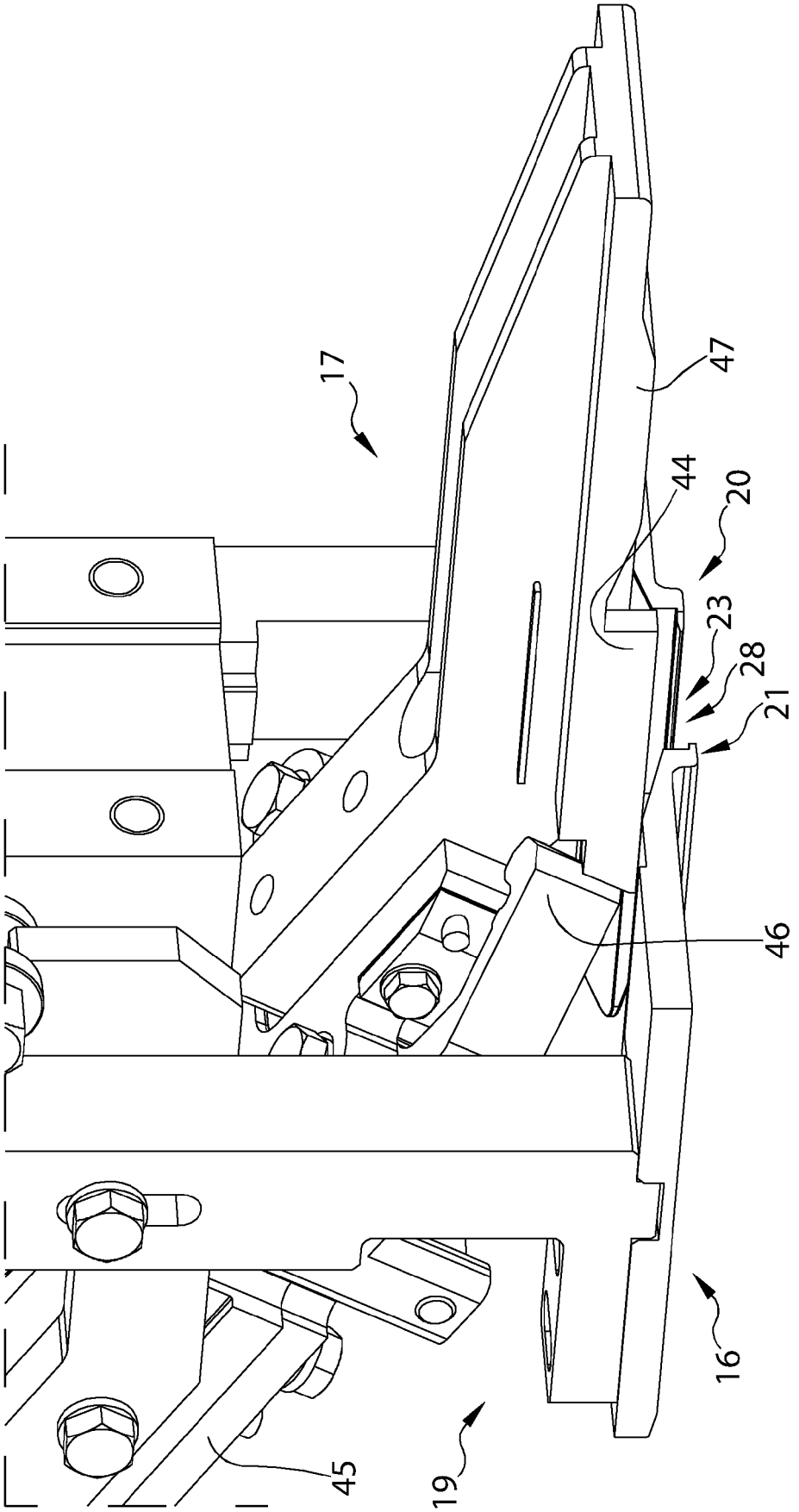


FIG.4

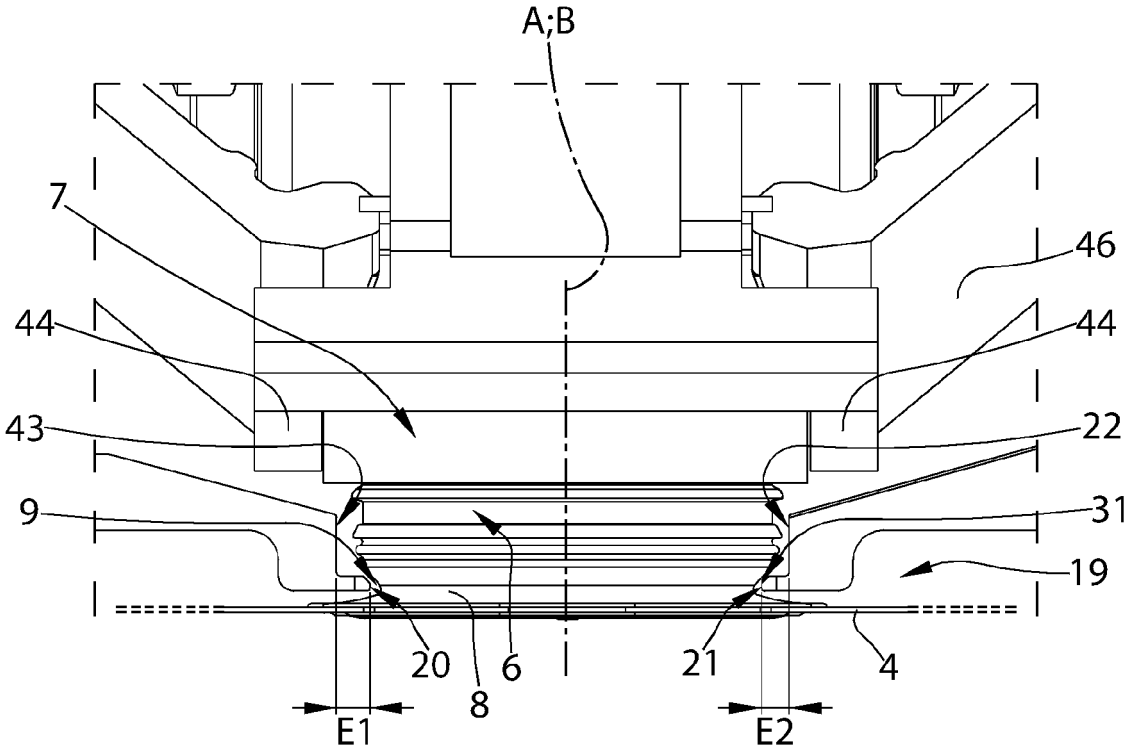


FIG.5a

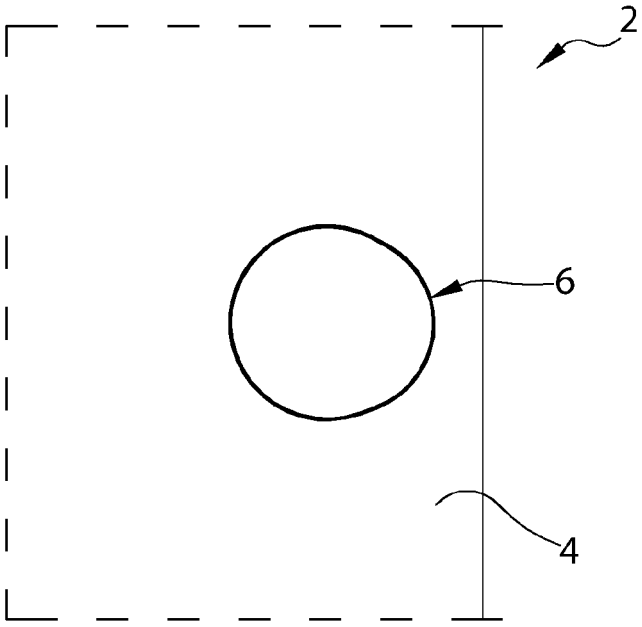


FIG.5b

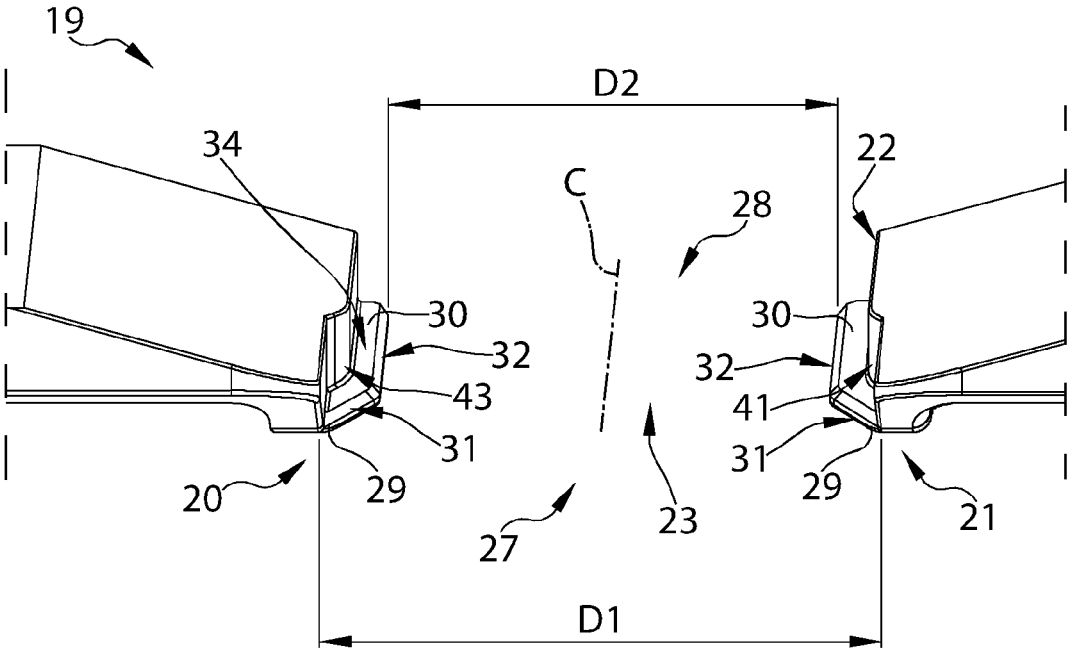

19
D2
34
22
C
28
30
32
43
31
20
29
27
23
30
32
41
31
29
21
D1

FIG.6

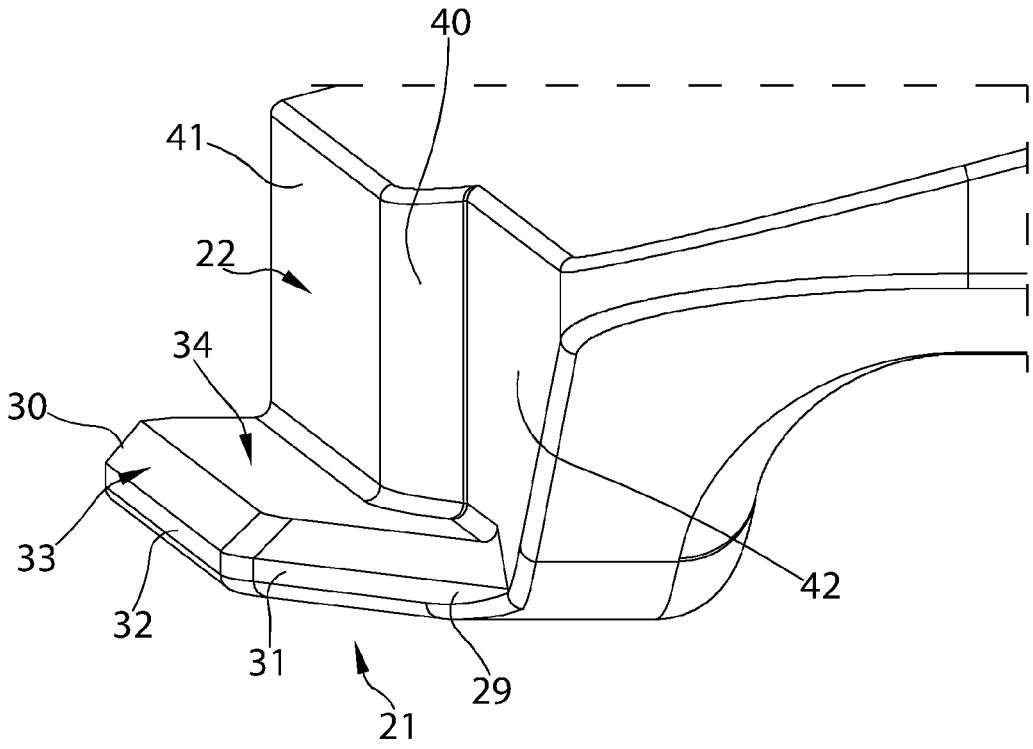

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FIG.7

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 5088

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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