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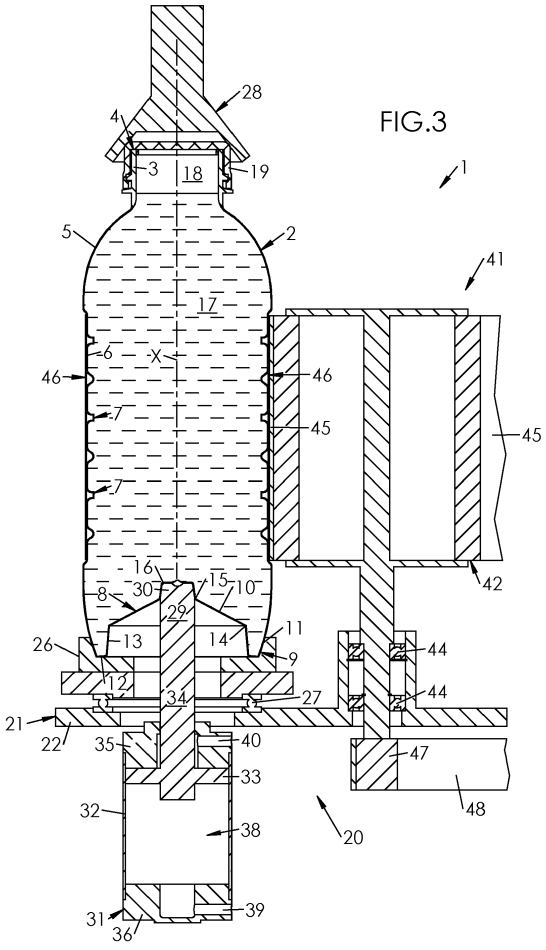
(54) **PACKAGING METHOD INCLUDING INVERSION AND LABELING STEPS ON A CONTAINER**

(57) Packaging method including the following steps:
- a step of providing an empty container (2) comprising a sidewall (6), an open neck (3) and a base (8) including a standing ring (9) and a central invertible diaphragm (10) articulated with respect to the standing ring (9), said diaphragm (10) being in an outwardly-inclined position;
- a filling step of pouring a product (17) within the container (2) through the neck (3);
- a capping step of sealingly closing the filled container (2) by means of a cap (19) mounted onto the neck (3);
- an inversion step of displacing the diaphragm (10) from to an inwardly-inclined position;
- a labeling step of attaching a label (46) onto the container sidewall (6), initiated no later than 10 seconds after completion of the inversion step.

FIG.3



EP 3 088 351 A1

Description

FIELD OF THE INVENTION

[0001] The invention generally relates to the packaging of containers, wherein containers are filled, capped and labeled. More specifically, the invention relates to the packaging of containers including a base provided with a standing ring and a central invertible diaphragm articulated with respect to the standing ring between an outwardly-inclined position and an inwardly-inclined position.

[0002] Such containers are suitable for the packaging of hot pourable products (typically a liquid), the term "hot" meaning that the temperature of the product is higher than the glass transition temperature of the material, in which the container is made. Typically, hot filling of PET containers (the glass transition temperature of which is of about 80°C) is conducted with products at a temperature comprised between about 85°C and about 100°C, typically at 88°C.

BACKGROUND OF THE INVENTION

[0003] U.S. Patent No. 8,671,653 (assigned to Graham Packaging Company) discloses a system for processing a container to be filled with a hot product, wherein the container has a vacuum panel at a bottom end-wall of the container. The vacuum panel is movable between a downwardly inclined position to an upwardly inclined position. The container is positioned in a base cup structure and hot filled with the vacuum panel in the downwardly inclined position. After the container and the product it contains have been cooled, the vacuum panel is moved to its upwardly inclined position, and the container is then sent to a conveying line to be fed to a labeling operation.

[0004] This process has several drawbacks.

[0005] Firstly, it requires one stand-alone machine for each step.

[0006] Secondly, the final packaging has defects.

[0007] More precisely, by the time the container reaches the labeling operation, it has lost some of its rigidity, due to a partial sinking of the vacuum panel under the hydrostatic pressure of the content.

[0008] As a result, the label is affixed to a flexible surface, which later becomes even more flexible as the vacuum panel further sinks. The label therefore creases and becomes loose around the container, which is harmful to the container aesthetics and increases the risk of the client (or even the retailer) tearing apart the label during handling of the container. Reducing the thickness of the label amplifies this phenomenon.

SUMMARY OF THE INVENTION

[0009] It is therefore one object of the invention to alleviate those drawbacks and provide a packaging method through which the label is more firmly affixed to the container.

[0010] It is another object of the invention to provide a packaging method, which authorizes the use of thinner labels.

[0011] The invention provides a packaging method including the following steps:

- a step of providing an empty container comprising a sidewall, an open neck and a base including a standing ring and a central invertible diaphragm articulated with respect to the standing ring, said diaphragm being in an outwardly-inclined position;
- a filling step of pouring a product within the container through the neck;
- a capping step of sealingly closing the filled container by means of a cap mounted onto the neck;
- an inversion step of displacing the diaphragm from its outwardly-inclined position to an inwardly-inclined position;
- a labeling step of attaching a label onto the container sidewall, initiated no later than 10 seconds after completion of the inversion step.

[0012] The labeling step may be initiated before initiation of the inversion step.

[0013] The labeling step may be achieved before completion of the inversion step, and possibly even before initiation of the inversion step.

[0014] The inversion step is conducted by means of a pusher.

[0015] In possible embodiments, the pusher is hydraulically or pneumatically actuated; the pusher may also be electrically actuated.

[0016] The above and other objects and advantages of the invention will become apparent from the detailed description of preferred embodiments, considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG.1 is a perspective view partly showing a container handling and packaging machine.

FIG.2 and **FIG.3** are similar cut views showing successive steps of a packaging method conducted in the machine of **FIG.1.**

FIG.4 is a diagram including, from top to bottom, a curve illustrating an inversion phase of the container base diaphragm, and four different chronograms illustrating five example embodiments of the labeling phase, in time correspondence with the top curve.

DETAILED DESCRIPTION

[0018] Partly shown on **FIG.1** is a container handling and packaging machine **1.**

[0019] Each container **2** is made by blow molding or stretch blow molding from a preform made of plastic such as PET. In a preferred though not exclusive embodiment, the container **2** is a hot-fillable container, i.e. it has undergone, during the blow molding process, a heat setting phase in order to increase the resistance of the container **2** to thermal stresses undergone during a filling step with a hot product, "hot" meaning that the temperature of the product is higher than the glass transition temperature of the material. In the case of PET, which has a glass transition temperature of about 80°C, the hot pourable product has for example a filling temperature in a range of about 85-95°C. Examples of hot pourable liquid products include (but are not limited to) tea, fruit juices, sports drinks.

[0020] The container **2** includes an open cylindrical threaded upper portion or neck **3,** which terminates, at an upper end thereof, by an opening or mouth **4** by which the container **2** is capable of being filled and subsequently emptied. Below the neck **3,** the container **2** includes a shoulder **5** of increasing diameter in a direction opposite to the neck **3.**

[0021] Below the shoulder **5,** the container **2** has a sidewall **6,** which is substantially cylindrical around a container main axis **X.** The sidewall **6** may, as depicted in **FIG. 2,** include annular stiffening ribs **7** capable of resisting thermal and mechanical stresses undergone by the container **2** during filling, capping and subsequent handling.

[0022] At a lower end of the sidewall **6,** the container **2** has a base **8,** which closes the container **2** and allows it to be normally put on a planar surface such as a table when used by a final customer.

[0023] The container base **8** includes a standing ring **9,** which may be a high standing ring as it will be explained later, and a central invertible diaphragm **10,** which has a symmetry around the main axis **X** and is deformable with respect to the sidewall **6** between an outwardly-inclined (or lower) position shown on **FIG.2,** wherein the diaphragm **10** projects outwardly with respect to the container **2,** and an inwardly-inclined (or upper) position, shown on **FIG.3,** wherein the diaphragm **10** projects inwardly with respect to the container **2.**

[0024] The container **2** is blow molded with the diaphragm **10** in its lower position. As will be explained in further details below, the diaphragm **10** is capable of being mechanically forced upwards (i.e. inwards with respect to the container **2)** after the container **2** has been filled with a pourable product, capped and cooled down, in order to compensate for the vacuum generated by the cooling of the product and to increase the overall rigidity of the filled container **2,** for the benefits of container handling and customer quality perception.

[0025] The standing ring **9** connects to the sidewall **6** of the container at a lower end portion **11** thereof. The standing ring **9** has a support flange **12** adjacent and substantially perpendicular to the lower end portion **11** of the sidewall **6,** and a cylindrical or frustoconical inner portion **13,** which connects the support flange **12** to the diaphragm **10.** The support flange **12** is also substantially perpendicular to the container main axis **X.**

[0026] In a preferred embodiment, the lower end portion **11** of the sidewall **6** has, when viewed in transversal section as shown on **FIG.3,** the shape of an arch with a concavity turned inward with respect to the container **2,** whereby the outer diameter of the support flange **12** is smaller than the overall diameter of the sidewall **6.**

[0027] As depicted, the inner portion **13** preferably has the shape of a frustum of a cone and, when viewed in transversal section as shown on **FIG.2,** inclines inwardly with respect to the container base **8,** with a draft angle.

[0028] The cone shape of the inner portion **13** provides a vault stiffening and locking function to the diaphragm **10** in its inverted position (shown in **FIG.3),** whereby the restriction of diameter of the inner portion **13** at its junction with the diaphragm **10** prevents the latter to articulate back from its inverted position with respect to the inner portion **13.** As a result, re-inversion of the diaphragm **10** back to its initial outwardly-inclined position under the mere hydrostatic pressure of the poured product is prevented.

[0029] The inner portion **13** has an axial extension, which is important with respect to the outer diameter of the support flange **12,** hence the expression "high standing ring" to name the standing ring **9.** More specifically, the axial extension (or height) of the inner portion **13** is greater than 1/10 of the outer diameter of the support flange **12,** and preferably comprised between 1/10 and 1/5 of the outer diameter of the support flange **12.**

[0030] In the blown (and filled) configuration of the container **2** depicted on **FIG.2,** the invertible diaphragm **10** extends outwards in a frusto-conical shape from an outer edge **14** where the diaphragm **10** connects to an upper end of the inner portion **13,** to an inner edge **15** where the diaphragm **10** connects to a central upwardly protruding recess **16.**

[0031] Also in the blown configuration of the container **2,** the axial extension, or height, of the diaphragm **10,** is such that the inner edge **15** of the diaphragm **10** extends slightly above support plane defined at the junction between the support flange **12** and the lower end portion **11** of the sidewall **6.** In other words, the height of the diaphragm **10** is slightly lower than the height of the standing ring **9.**

[0032] After the container **2** has been blow molded, it undergoes, within a filling unit, a filling step of pouring a product **17** (such as a liquid, e.g. a beverage) through its neck **3** (and more precisely through its mouth **4).** The container **2** is normally not fully filled, so that an empty volume (also called headspace) **18,** remains above the product **17** within the neck **3.** Depending upon the reliability of the filling machine, the volume of poured product **17** may vary from one container **2** to another. As a consequence, the headspace **18** may also vary from one container **2** to another, although the headspace **18** should always be substantially equal in volume to a reference headspace corresponding to the correct volume

of dispensed product.

[0033] The filled container **2** then undergoes a capping step of sealingly closing the mouth **4** (and hence the container **2)** by means of a cap **19** mounted onto the neck **3.** In a preferred embodiment, neck **3** and cap **19** are both correspondingly threaded and the cap **19** is screwed onto the neck **3** to provide sealing closure of the container **2.**

[0034] After having been filled and capped, the container **2** may, in case the product **17** is poured hot, undergo a cooling step during which the container **2** and its content (product **17)** are placed in a cooling tunnel, wherein they are artificially cooled down in a range from about 20°C to 35°C.

[0035] After having been capped, and, in the event the container **2** is cooled, after it has been cooled, the container **2** undergoes an inversion phase and a labeling phase.

[0036] Although the inversion phase and the labeling phase may be conducted at two different locations by means, respectively, of separate inversion and labeling units, both phases may, as illustrated, be conducted within a same unit.

[0037] In the example depicted on **FIG.1,** the container handling machine **1** includes a plurality of processing units **20** each capable of conducting the labeling of the container **2** and the inversion of its diaphragm **10** to the inwardly-inclined position. Processing units **20** may, as depicted, be mounted onto a carrousel **21** including a frame **22** rotatably mounted around an axis **23** so as to be displaced around a circular path.

[0038] In the example of **FIG.1,** the container handling machine **1** also comprises a rotary transfer unit **24,** e.g. under the form of a star wheel provided with a plurality of peripheral gripping devices **25,** which grab the filled and cap containers **2** from the capping unit and release each of them at a processing unit **20.**

[0039] Since processing units **20** are identical, only one will be disclosed in detail hereinafter for the sake of clarity and simplicity.

[0040] Each processing unit **20** comprises a hollow container support ring **26** suitable for engaging a container base **8.** More precisely, the support ring **26** forms a counter print of at least the support flange **12** and the lower end portion **11** of the container sidewall **6.**

[0041] The container support ring **26** is rotatably mounted onto the frame **22,** e.g. by means of a bearing **27.**

[0042] The processing unit **20** further includes a container retaining member **28** (only few of which are depicted on **FIG.1)** for rigidly retaining the container **2** in vertical position with its base located within the support ring **26** while the container **2** is being labeled and while the diaphragm **10** is being inverted.

[0043] In the depicted example, the retaining member **28** is provided with a conical head suitable for vertically coming into abutment with the cap **19** along the container axis **X.**

[0044] The processing unit **20** further includes a pusher **29** movable with respect to the frame **22** (and hence to the support ring **26)** and capable of coming into abutment with the container base **8** through both the frame **22** and support ring **26** for inverting the diaphragm **10** from its outwardly-inclined position to its inwardly-inclined position.

[0045] More precisely, the pusher **29** is slidingly displaceable along axis **X** for coming into abutment within the central recess **16,** as shown on **FIG.3.** In the depicted example, the pusher **29** has a tip **30,** which is complementary in shape to the central recess **16,** but the tip **30** may be of a simpler shape, such as a cylinder.

[0046] The processing unit **20** further includes an actuator **31** for slidingly moving the pusher **29** frontwards (i.e. upwards) towards the container base **8** through the frame **22** in order to achieve inversion of the diaphragm **10,** and backwards (i.e. downwards) thereafter, to be ready for another inversion cycle.

[0047] More precisely, in the depicted example, it can be seen that the actuator **31** is a hydraulic or pneumatic cylinder, preferably of the two-way type.

[0048] The actuator **31** has a cylinder housing **32,** a piston **33** and a rod **34** fixed to the piston **33,** with the pusher **29** mounted onto the rod **34** or integral therewith.

[0049] In a known manner, the actuator **31** has a closure head **35** and a closure bottom **36** connected through the housing **32.** The piston **33** defines within the housing **32** a front chamber **37** around the rod **34** and a back chamber **38** opposite to the rod **34,** whereby the front chamber **37** is mainly defined between the piston **33** and the closure head **35** whereas the back chamber **38** is mainly defined between the piston **33** and the closure bottom **36.**

[0050] The back chamber **38** is in fluidic connection, through a bottom fluid port **39** formed in the closure bottom **36,** with a control valve linked to a source of fluid (such as air or oil) under pressure and to a vent. Likewise, the front chamber **37** is also in fluidic connection, through an upper fluid port **40** formed in the closure head **35,** with a control valve linked to a source of fluid under pressure and to a vent. The back chamber **38** and front chamber **37** are alternately fluidly connected to the source of fluid and to the vent, so as to move the pusher **29** forth (or up) and back (or down) between a lower position in which the piston **33** is in the vicinity of the closure bottom **36 (FIG.2),** and an upper position in which the piston **33** is in the vicinity of the closure head **35 (FIG.3).**

[0051] Position (or height, denoted H) of the pusher **29** vs. time, within a container packaging cycle, is plotted on the uppermost curve of **FIG.4.** The pusher **29** is initially in its lower position.

[0052] Inversion of the diaphragm **10** is conducted as described hereinafter.

[0053] At instant t_0, the back chamber **38** is connected to the source of fluid and the front chamber **37** to the vent, so that the piston **33,** together with the whole pusher **29,** begins to move forward (or up), away from its lower

position. The pusher **29** moves forward in a linear manner with respect to time as long as it encounters no resistance.

[0054] At instant t_1 (which, in practice, is of about one tenth of a second to few tenths of a second after t_0), the pusher **29** comes in contact with the container base, and more precisely with the central recess **16.** Under the pressure inside the container **2,** the container base **8** resists to the upward movement of the piston **33,** which is no longer linear in time but asymptotic as the pusher **29** reaches its upper position at instant t_2 (which, in practice, is of few tenths of a second after t_1) whereas the diaphragm **10** is inverted to its inwardly-inclined position **(FIG.3).**

[0055] During inversion of the diaphragm **10,** the product **17,** which is virtually incompressible, is displaced upwardly, whereby the gas (generally air) enclosed in the headspace **18** is compressed by a volume substantially equal to the volume (so-called extraction volume) swept by the diaphragm **10** during its inversion, between its outwardly-inclined and outwardly-inclined positions.

[0056] At instant t_2, inversion of the diaphragm **10** is achieved. From instant t_2 and until instant t_3 (which is from few seconds to several tens of seconds), the pusher **29** is held in its upper position to ensure stabilization (and dampen vibrations) of the diaphragm **10** in its inwardly-inclined position and prevent its re-inversion back to its outwardly-inclined position.

[0057] From instant t_3 and until instant t_4 (which is of few tenths of a second after t_3), the pusher **29** is moved back to its lower position, which it holds until the next cycle is initiated with another container **2.**

[0058] Instead of being hydraulically or pneumatically actuated, the pusher may be electrically actuated by means of an electric motor, such as a linear motor.

[0059] In order to conduct the labeling of the container **2,** each processing unit **20** comprises a labeling device **41,** which, in the depicted example, includes a driving pulley **42** and a driven pulley **43** both rotatably mounted onto the frame **22** (e.g. by means of bearings **44)** and connected to each other through an endless labeling belt **45** carrying a label **46** to be affixed onto the container sidewall **6.**

[0060] The driving pulley **42** may be coupled, through a pinion **47** fixed to the pulley **42** and a driving belt **48,** to a motor, which controls rotation and stopping of the driving pulley **42.**

[0061] One of the pulleys **42, 43** (the driving pulley **42** in the example depicted on **FIG.2** and **FIG.3)** is located in the vicinity of the support ring **26,** at a distance such that, when a container **2** is mounted on the support ring **26,** the labeling belt **45** is in contact with the container sidewall **6** so as to be capable of wrapping a label **46** therearound as the container **2** is driven in rotation around its axis **X** by the retaining member **28** and/or by the support ring **26.**

[0062] The processing unit **20** also includes a glue applicator (not depicted) capable of applying a strip of glue either on an edge of the label **46** or directly on the container sidewall **6** to make the label **46** stick thereto.

[0063] Initiation of the labeling phase of the container **2** is based on the timeline of the inversion step (or phase). More specifically, the labeling phase is initiated not later than 10 seconds after completion of the inversion step, i.e. not later than 10 seconds after t_2.

[0064] In a first example (Ex.1 on **FIG.4),** the labeling phase is initiated after completion of the inversion step, i.e. after instant t_2. The advantage of such embodiment is that the container **2** is rigid, due to inversion of the diaphragm **10,** which increases pressure inside the container **2.**

[0065] In a second example (Ex. 2 on **FIG.4),** the labeling phase is initiated during inversion of the diaphragm **10,** i.e. between instants t_1 and t_2, and ends after completion of the inversion step, i.e. after t_2.

[0066] In a third example (Ex. 3 on **FIG.4),** the labeling phase is initiated before initiation of the inversion step, i. e. before t_1, and achieves after completion of the inversion step, i.e. after t_2.

[0067] In a fourth example (Ex. 4 on **FIG.4),** the labeling phase is initiated before initiation of the inversion step, i. e. before t1, and achieves before completion the inversion phase, i.e. between t_1 and t_2.

[0068] In a fifth example (Ex. 5 on **FIG.4),** the labeling phase is both initiated and completed before initiation of the inversion step, i.e. before t_1.

[0069] In any case, the label is firmly affixed to the container, and the use of thinner labels is possible.

Claims

1. Packaging method including the following steps:

- a step of providing an empty container **(2)** comprising a sidewall **(6),** an open neck **(3)** and a base **(8)** including a standing ring **(9)** and a central invertible diaphragm **(10)** articulated with respect to the standing ring **(9),** said diaphragm **(10)** being in an outwardly-inclined position;
- a filling step of pouring a product **(17)** within the container **(2)** through the neck **(3);**
- a capping step of sealingly closing the filled container **(2)** by means of a cap **(19)** mounted onto the neck **(3);**
- an inversion step of displacing the diaphragm **(10)** from its outwardly-inclined position to an inwardly-inclined position;
- a labeling step of attaching a label **(46)** onto the container sidewall **(6);**

characterized in that the labeling step is initiated no later than 10 seconds after completion of the inversion step.

2. Packaging method to claim 1, wherein the labeling

step is initiated before initiation of the inversion step.

3. Packaging method of claim 1 or claim 2, wherein the labeling step is achieved before completion of the inversion step.

4. Packaging method of any of the preceding claims, wherein the labeling step is completed before completion of the inversion step.

5. Packaging method according to any of the preceding claims, wherein the inversion step is conducted by means of a pusher.

6. Packaging method according to claim 5, wherein the pusher is hydraulically or pneumatically actuated.

7. Packaging method according to claim 5, wherein the pusher is electrically actuated.

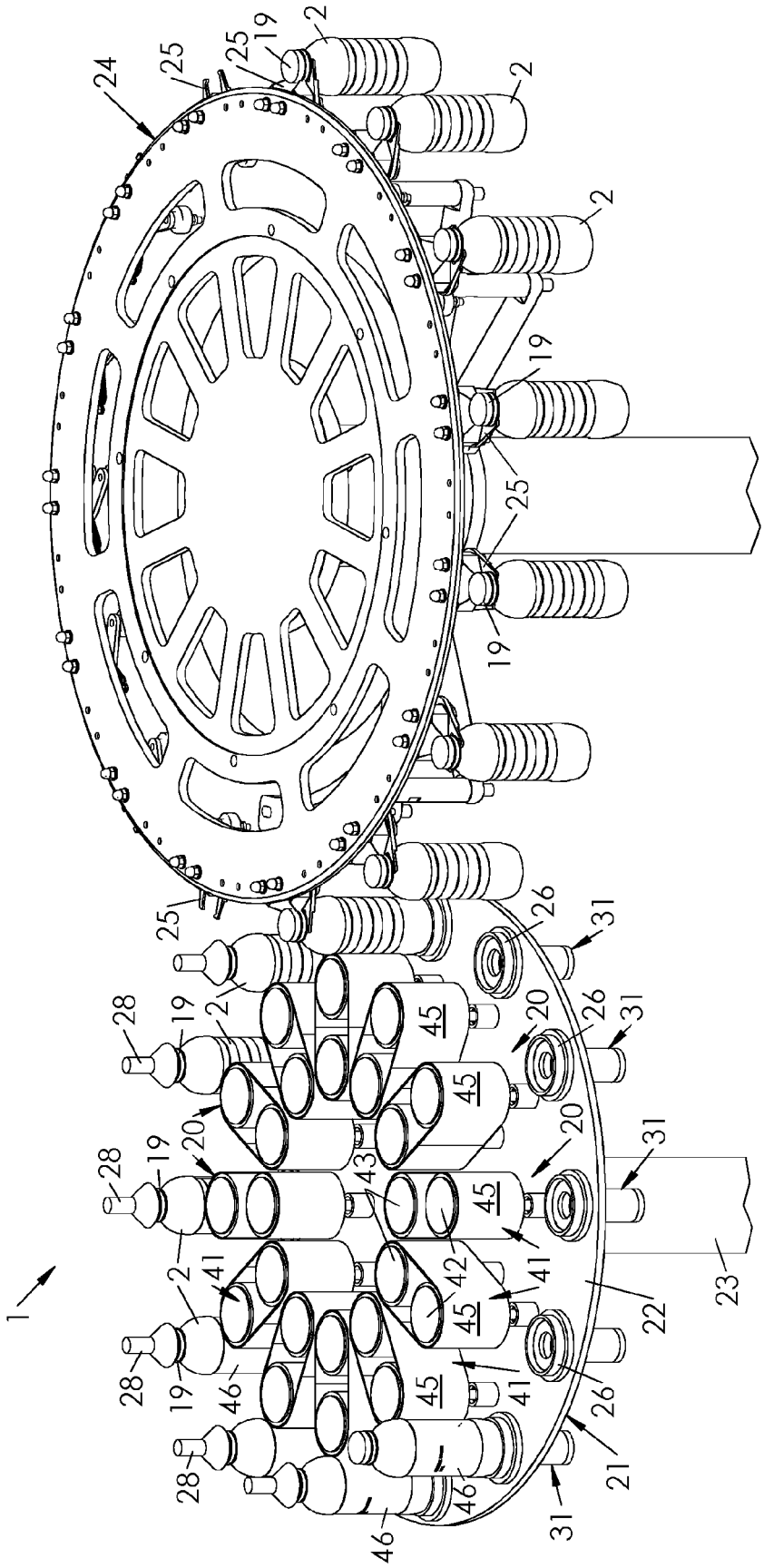


FIG.1

FIG.2

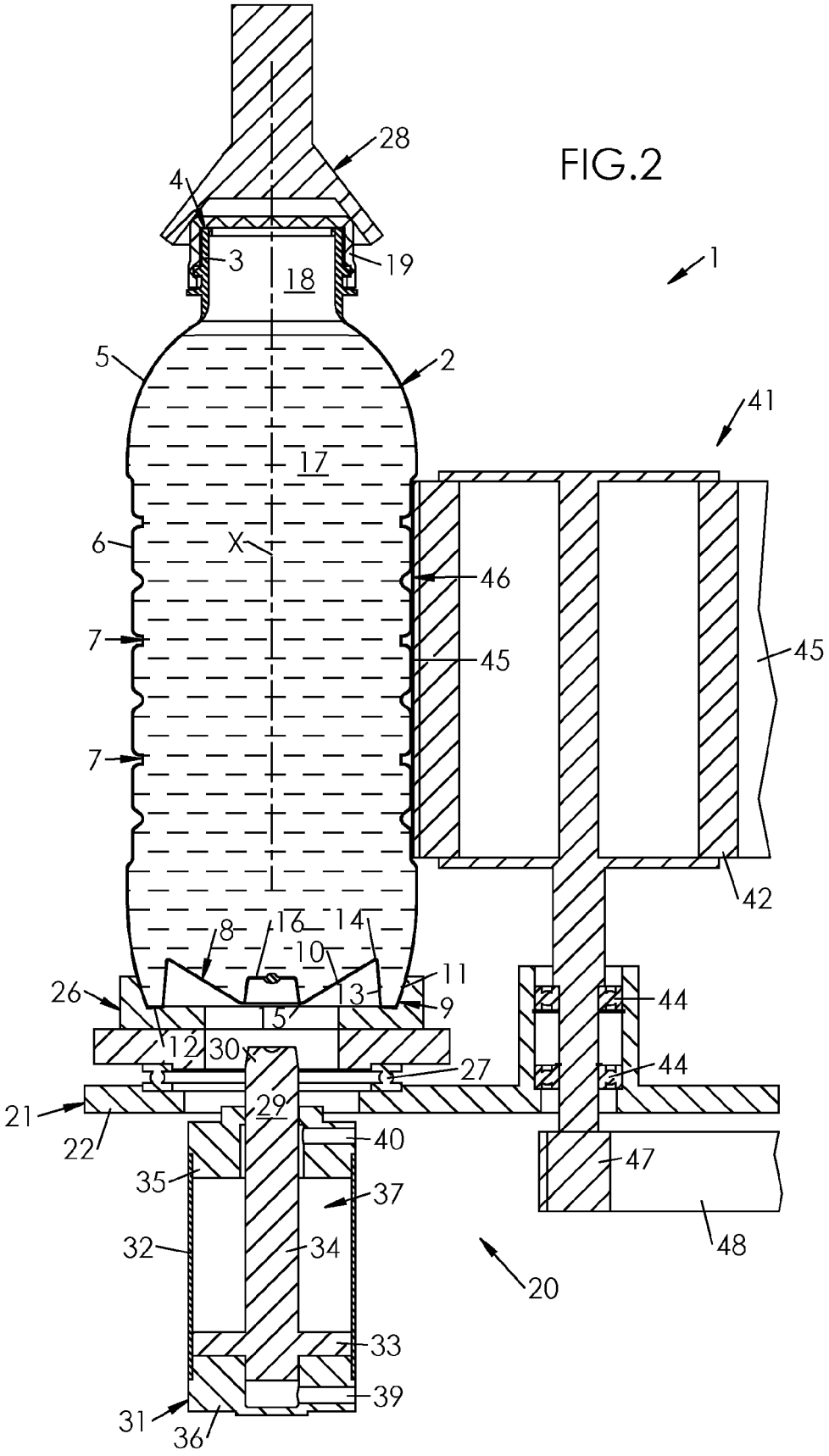

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FIG.3

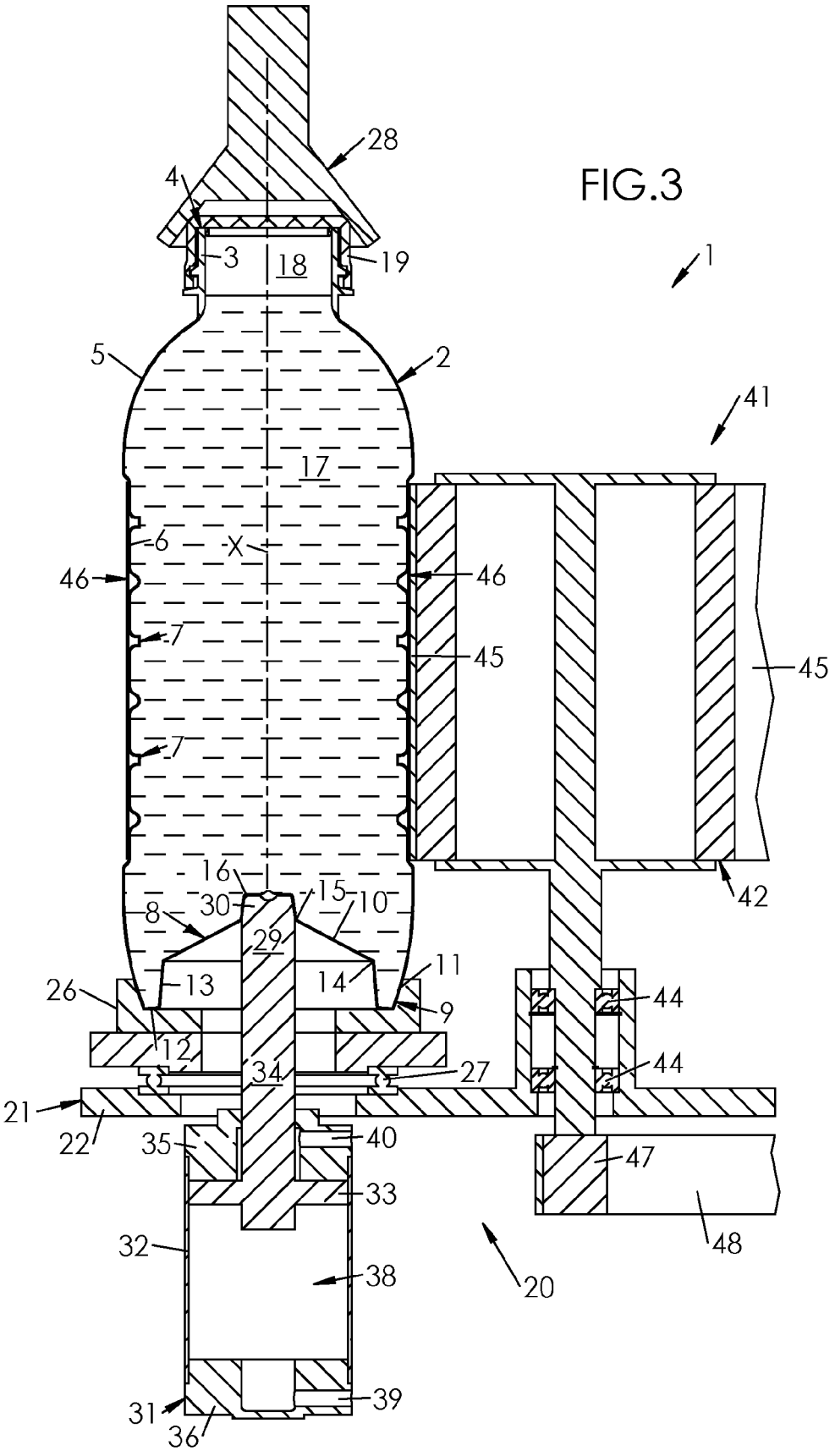
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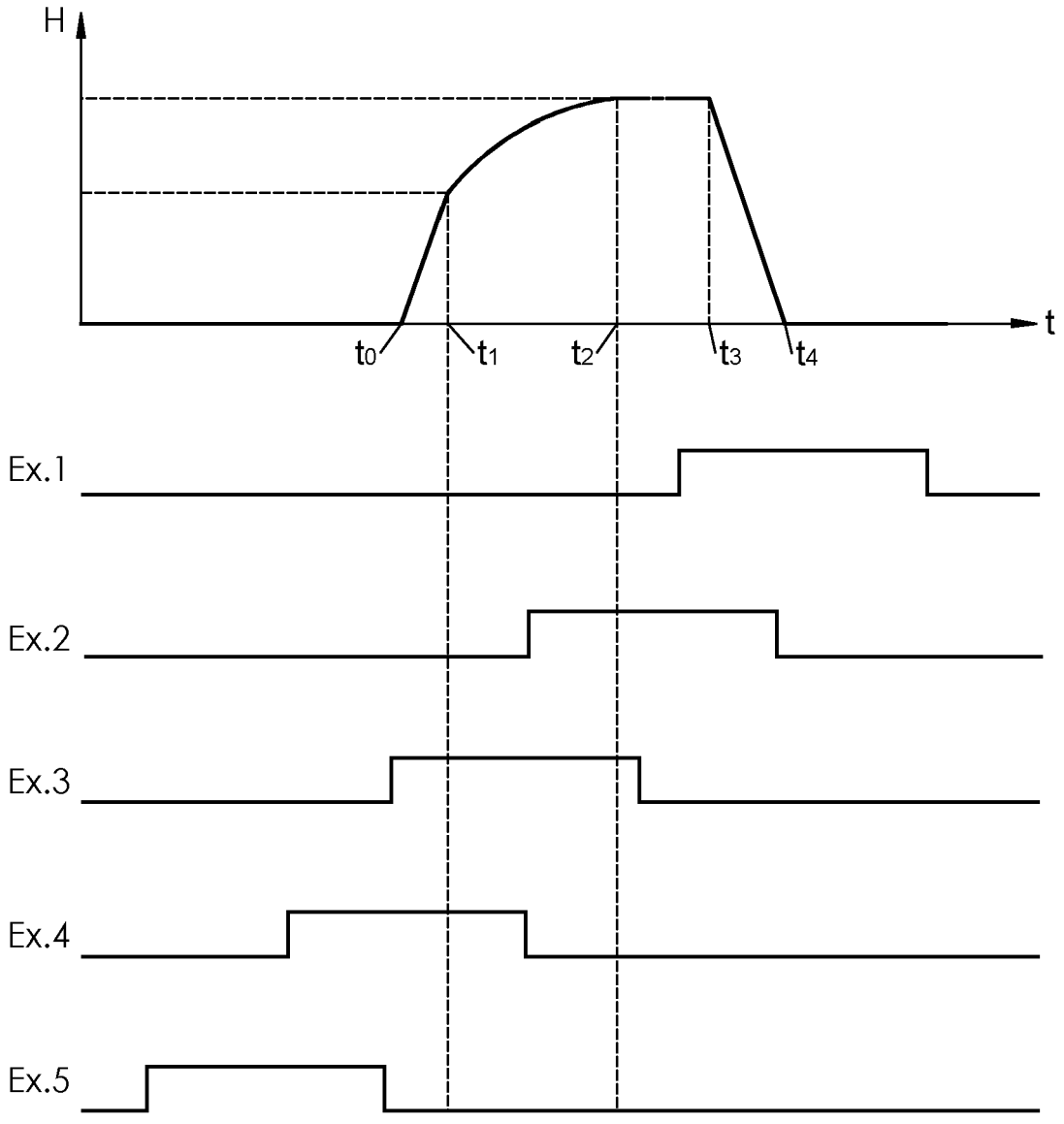
FIG.4



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EUROPEAN SEARCH REPORT

Application Number
EP 15 30 5660

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 851 333 A1 (SIDEL SPA CON SOCIO UNICO [IT]) 25 March 2015 (2015-03-25) * paragraphs [0025], [0049], [0085], [0089] - [0093], [0097]; figures 1,2 * -----	1-7	INV. B67C3/04
A	DE 10 2008 026244 A1 (KRONES AG [DE]) 3 December 2009 (2009-12-03) * paragraphs [0011], [0040]; figure 4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B67C
B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 October 2015	Wartenhorst, Frank

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 30 5660

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-10-2015

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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