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(54) **Spraying device**

(57) The invention relates to a spraying device (100) for washing items, comprising a main conduit (101) for the supply of a washing liquid and defining at least an outlet; a rotating body (102) defining at least a nozzle (103) through which said washing liquid is sprayed towards said items; and at least a junction element (104') fastened to said main conduit (101) at one of the relative outlets for fluidically connecting the at least one nozzle (103) in the rotating body with the main conduit (101), the junction element (104') defining a surface (111) facing, in use, the cylindrical rotating body (102) and adapted to cooperate with it in liquid-tight sliding contact at a relative first portion (112) extending annularly about a relative opening (113); the surface (111) comprising a second portion (114) adjacent to the first portion (112) and adapted to cooperate with play with the outer surface of the cylindrical rotating body (112), an annular gap (115) being thereby defined between the second portion (114) and the cylindrical body (102).

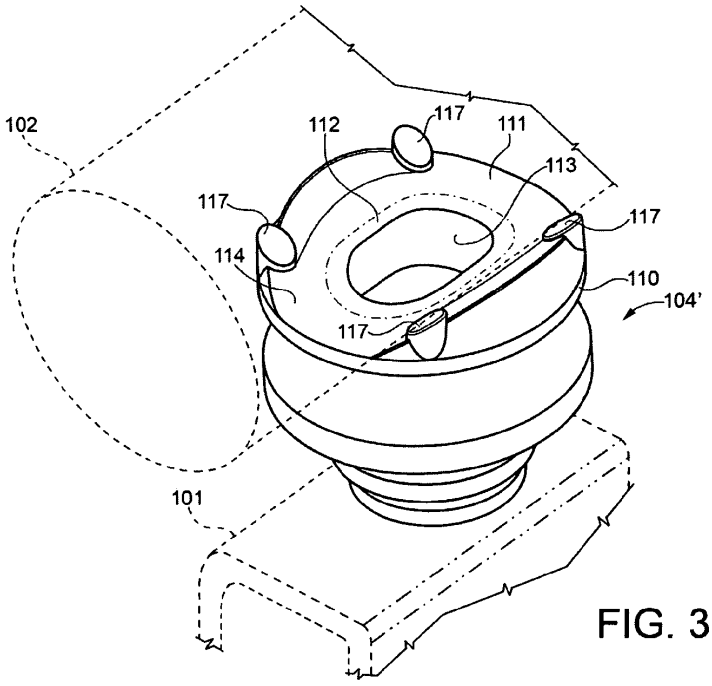

FIG. 3

EP 2 724 793 A1

Description

[0001] The present invention relates to a spraying device. In particular, the invention is concerned with a spraying device of the type used for the cleaning of bottles e. g. in bottling operations by which bottles are filled with a pourable product.

[0002] It is known, for example in the beverage industry, to treat the containers to be cleaned, which are most commonly bottles of plastics or glass, with chemicals, such as caustic solutions, typically in combination with the application of heat.

[0003] To this purpose, use is commonly made of cleaning units wherein bottles are soaked and sprayed with detergent solutions at a high temperature; rinsed and cooled with potable water; and, finally, drained. The goal of the process is not only ensuring that even traces of dirt and any microorganisms possibly present in the bottles are removed, but also eliminating from the surface of bottles labels or parts thereof, ideally without causing their defibration and kneading, which may bring about considerable drawbacks.

[0004] A typical unit for cleaning bottles in a beverage bottling plant comprises a plurality of operating stations, including one or more washing stations, a rinsing station and a cooling section. Furthermore, a cleaning unit of this type comprises transport means for: receiving the bottles to be cleaned at an input station; conveying the bottles along a bottle path which sequentially crosses each one of the operating stations; and for delivering cleaned bottles at an output station.

[0005] Washing stations and rinsing station are defined mostly by respective baths, wherein bottles are first brought into contact with cleaning agents (i.e. the chemicals in aqueous solution referred to above) and then rinsed for removing any possible residue of those chemicals. The speed at which the bottles are advanced along their path by the transport means is such that the permanence time of bottles in each bath is enough to achieve the desired cleaning effect.

[0006] The transport means typically consist of a conveyor which, in a cooling path portion P_{cool} of path P conveys the bottles head first, i.e. with the opening facing downwards. In greater detail, the conveyor comprises a plurality of bars, each of which carries a respective plurality of bottle holders. Commonly, bottle holders are in the form of bottle baskets, each of which is adapted to receive and convey a respective bottle.

[0007] As they travel across the cleaning unit, the bars are driven, typically by means of a pair of parallel chains arranged about respective drive systems, along a closed loop which substantially replicates, in a relative portion connecting the input and output stations, the bottle path P. The transport means are continuously cycled through the various parts of the cleaning unit to permit a substantially uninterrupted operation thereof and, thus, an essentially constant throughput of a substantial number of bottles to meet the needs of high-speed bottling plants (in certain instances, these machines may process as many as 150,000 bottles per hour).

[0008] Once picked up by the transport means at the input station, bottles are then conveyed through the different baths of the operating stations and reach the rinsing and cooling stations, where they are reached by jets of water aiming at rinsing both their inner and outer surface as well as at lowering their temperature in order to prepare them for subsequent operations (typically filling, labelling, capping).

[0009] To this purpose, a cleaning unit typically comprises (see, for reference, Figure 1) spraying devices 100 of the type comprising: a main conduit 101 for the supply of a washing liquid, said conduit 101 being fastened to a frame of the cleaning unit and hydraulically connected to a source of water (not shown); and a rotating body 102 defining a plurality of nozzles 103 through which water, supplied from conduit 101, is intermittently sprayed towards the bottles.

[0010] Main conduit 101 essentially consists of a manifold adapted to receive water at a given pressure and to distribute it at a number of outlets arranged along its length to which respective tubular junction elements 104 are fastened.

[0011] On the other hand, rotating body 102 generally consists of a radially bored cylinder, wherein each through hole defines a nozzle 103. In particular, rotating body 102 comprises a set of as many nozzles 103 as there are junction elements 104. Preferably, rotating body 102 contains a second set of as many nozzles 103 as there are junction elements 104, defined by through holes forming an angle smaller than 180° (e.g. of 90°) with the through holes defining the first set of nozzles 103.

[0012] As rotating body 102 rotates about its longitudinal axis, nozzles 103 are alternately put in and out of hydraulic connection with conduit 101, thereby alternately enabling and disabling the supply of respective jets of water.

[0013] Spraying devices of this type are known e.g. from EP1728565. In particular, EP1728565 discloses a spraying device wherein the junction elements 104 have a lateral surface 105, a surface 106 for contact with the manifold main conduit and a polished surface 107 for sliding contact with the cylindrical rotating body 102, and internally define a passage 108 for the washing liquid. In greater detail, the junction elements 104 are shaped so that the polished sliding contact surface 107 completely adheres to the outer surface of the rotating body 102, whereas it is substantially welded and joined to the main manifold conduit 101 at a relative outlet.

[0014] While rotating, cylindrical body 102 is pressed against junction elements 104 so as to obtain, at the relative sliding contact surface referred to above, a liquid-tight relative contact.

[0015] Accordingly, exit of the washing liquid through a given nozzle in the cylindrical rotating body is enabled solely when the cylindrical rotating body forms a given angle relative to the corresponding junction element, i.e.

upon alignment of the nozzle with the passage internally defined by the junction element. In particular, liquid-tight contact is achieved in the area surrounding the openings of nozzles 103 when they align with the channels internally defined by junction elements 104.

[0016] Spraying devices of this type, however, are often affected by drawbacks such as the accumulation of dirt and residues contained in the washing liquid. In fact, because the washing liquid is used for consecutive washing/rinsing cycles, dirt particles accumulate in it up to a threshold value.

[0017] Dirt and residues tend to pile up within the passage internally defined by the junction element and, even more undesirably, at the sliding contact surface.

[0018] This fouling often causes a permanent damage of the junction element, which typically leads to an imprecise coupling of the two surfaces. Consequently, the fluid-tight coupling is lost and the washing liquid seeps out of the junction element instead of being fed to the nozzles.

[0019] Besides, the need to achieve and ensure a proper liquid-tight adherence between junction element and rotating body makes manufacture of the sliding contact surface of a junction element very complex and costly, because of the high precision standards required. It is necessary that the materials used for the manufacture of these parts be highly rigid, therefore, whenever the two parts are not perfectly matching, leaks are bound to occur.

[0020] Therefore, the need is felt in the art for a spraying device by means of which the drawbacks described above may be overcome.

[0021] In particular, the need is felt in the art for a spraying device by virtue of which damages to junction elements due to accumulation of dirt particles at the interface with the rotating body are significantly less likely to occur, the lifespan of the spraying device being thereby increased.

[0022] Furthermore, it would be highly desirable that the costs and complexity of the manufacture of a spraying device for use in washing/cleaning units for containers, e.g. in bottling plants, were reduced.

[0023] It is an object of the present invention to provide a spraying device, in particular, of the type used for the cleaning of bottles in beverage bottling operations, which makes it possible to meet the above needs in a straightforward and low-cost manner. This object is achieved by a spraying device as claimed in claim 1.

[0024] Further features and advantages of the present invention will be better understood from the description of a preferred embodiment, which is given below by way of a non-limiting illustration, with reference to the accompanying drawings, in which:

Figure 1 shows a schematic transverse section of a spraying device for use in a beverage bottling plant according to the prior art;

Figure 2 shows a schematic larger-scale partial transverse section of a spraying device according to the invention showing, in particular, the relative junction element; and

Figure 3 shows a schematic perspective view of the junction element of Figure 2.

[0025] Figures 2 and 3 illustrate schematically a junction element 104' operatively coupled with a manifold conduit 101 and a cylindrical rotating body 102 in a spraying device 1' of the type described above. For the sake of conciseness and simplicity, the description given in the following shall not cover in detail certain constructional aspects of the spraying device 1' which virtually reproduce corresponding features already described above with reference to spraying device 1 according to the prior art. Therefore, wherever possible, when describing spraying device 1', the same reference numbers shall be used for parts that are identical or functionally alternative to corresponding parts of spraying device 1 described above.

[0026] Junction element 104' has a tubular structure extending along a relative axis H and internally defining a passage 108 of the same axis.

[0027] In greater detail, junction element 104' has a first open end 109 adapted to cooperate with, and releasably fixable to (e.g. in snap-on fashion), manifold conduit 101 at a relative outlet, so that washing liquid flowing in manifold conduit 101 can be received into passage 108. Preferably, first open end 109 is adapted to receive and hold an O-ring for sealing purposes, so that a liquid-tight connection can be achieved between junction element 104' and manifold conduit 101.

[0028] Furthermore, junction element 104' has, opposite first open end 109, a second open end 110 defining a surface 111 facing, in use, cylindrical rotating body 102 and adapted to cooperate with it in liquid-tight sliding contact at least at a relative first portion 112 extending annularly about the relative opening 113.

[0029] In greater detail, first portion 112 of surface 111 is substantially cylindrical, so as to match and completely adhere to the outer surface of cylindrical rotating body 102 and has a polished finish.

[0030] While rotating, cylindrical body 102 is pressed against junction elements 104' so as to obtain, at the relative first portions 112, a liquid-tight contact. Accordingly, exit of the washing liquid through a given nozzle 103 in cylindrical rotating body 102 is enabled solely when cylindrical rotating body 102 forms a given angle relative to the corresponding junction element 104', i.e. upon alignment of nozzle 103 with the passage internally defined by junction element 104', i.e. with the relative opening 113.

[0031] Advantageously, surface 111 comprises a second portion 114 substantially adjacent to first portion 112 and adapted to cooperate with play with the outer surface of cylindrical rotating body 112, a segment 115 of an annular gap being thereby defined between said second portion 114 and the cylindrical body 102.

[0032] Thus, impurities and dirt particles which tend to accumulate at the interface between junction element 104 and rotating body 102 can conveniently be removed by water or washing liquid flowing into gap 115. Furthermore, because of gap 115 and second portion 114, less strict requirements need to met during the manufacturing process, especially in terms of surface finish and machining tolerances. This results in a significant reduction of production costs and complexity.

[0033] By way of example, as in the embodiment illustrated in Figures 2 and 3, second portion 114 may comprise a surface having a substantially cylindrical structure with a diameter slightly greater than the diameter of cylindrical body 102.

[0034] It should be noted that, in the embodiment illustrated in Figures 2 and 3, opening 113 has an oval-shaped cross-section, which is designed to be operatively coupled with a pair of nozzles 103 defined by corresponding through holes in rotating body 102, the relative axes of the through holes forming an angle smaller than 180° and lying in respective parallel planes slightly apart from one another, as in the prior art arrangement illustrated in Figure 1. It shall be understood that the cross-section of opening 113 may have a different shape, e.g. circular, especially in the case where only one nozzle 103 is provided for every outlet in main conduit 101.

[0035] Furthermore, junction element 104' preferably comprises, at second open end 110, anti-rotation means 117 symmetrically arranged relative to axis H and configured to cooperate with play with the outer surface of rotating body 102 so that proper positioning of surface 112 of junction element 104' relative to rotating body 102 is ensured upon rotation of the latter. In practice, should the first portion 112 of surface 111 not be correctly positioned relative to rotating body 102, i.e. were the relative cylindrical surface not properly matching and in misalignment, cooperation of anti-rotation means 117 with rotating body 102 upon rotation of the latter would cause the rotation of junction element 104' about the relative axis H until achievement of the correct positioning, without any intervention on the part of an operator. At the same time, proper alignment of opening 113 of second open end 110 with the axis of a corresponding nozzle 103 is ensured upon rotation of rotating body 102.

[0036] In greater detail, anti-rotation means 117 may substantially consist, as in the embodiment shown in Figures 2 and 3, of two pairs of projections arranged on opposite sides of second portion 114. Each projection 117 defines a respective end cylindrical surface. Each end cylindrical surface lies substantially in a plane transversal to axis H. When junction element 104' is properly positioned relative to manifold conduit 101 and rotating body 102 - i.e. when the cylindrical surfaces of surface 111 and rotating body 102 are properly matching and in relative alignment (and, if present, the major axis of opening 113 is substantially parallel to the longitudinal axis of rotating body 102), there is some mechanical play between rotating body 102 and the surface of projections 117. When junction element 104' and rotating body 102 are not properly aligned, rotating body 102 shall cooperate with anti-rotation means 117 thereby causing a rotation of junction element 104' about the relative axis H.

[0037] When a spraying device 100' is assembled, therefore, there is no need for the operator to check that junction elements 104' are fastened to (e.g. snapped on) manifold conduit 101 in perfect alignment relative to the longitudinal axis thereof. As long as junction elements 104' are fastened to manifold conduit 101 with anti-rotation means 117 arranged on both sides of rotating body 102, as soon as the spraying device is activated - i.e. as soon as motor means initiate rotation of body 102 about its axis - junction elements 104' shall be, accordingly, rotated to assume the proper alignment relative to nozzles 103 of rotating body 102.

[0038] Furthermore, anti-rotation means 117 ensure that, in use, the correct alignment is maintained, which also results in the gap 115 between second open end 111 of junction element 104' and rotating body 102 to be maintained. Accordingly, dirt particles and impurities which tend to accumulate there may easily be removed without the operator needing to turn the spraying device off and to disassemble rotating body 102 and junction elements 104' for accessing the relative interface at which dirt and impurities have accumulated.

[0039] The advantages of the spraying device according to the present invention will be clear from the above description.

[0040] In particular, with the spraying device 100' according to the invention, the undesirable effects of fouling at the interface between rotating body and junction elements are virtually eliminated, whilst preserving the relative fluid-tight coupling which ensures proper functioning of the spraying device. Besides, the complexity of, and the costs associated to, the manufacture of a spraying device of this type are significantly reduced. In fact, junction elements 104' according to the description given above can conveniently be manufactured by moulding, 3-D printing and similar processes.

[0041] Clearly, changes may be made to the spraying device 100' as described and illustrated herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. A spraying device (100) for washing items, comprising:

   - a main conduit (101) for the supply of a washing liquid and defining at least an outlet;
   - a rotating body (102) defining at least a nozzle (103) through which said washing liquid is sprayed towards said items; and
   - at least a junction element (104') fastened to said main conduit (101) at a said relative outlet

for fluidically connecting said nozzle (103) in said rotating body with said main conduit (101), the junction element (104') defining a surface (111) facing, in use, said cylindrical rotating body (102) and adapted to cooperate with it in liquid-tight sliding contact at a relative first portion (112) extending annularly about a relative opening (113);
characterised in that said surface (111) comprises a second portion (114) adjacent to said first portion (112) and adapted to cooperate with play with the outer surface of said cylindrical rotating body (112), an annular gap (115) being thereby defined between said second portion (114) and said cylindrical body (102).

2. The spraying device according to Claim 1, **characterised in that** said junction element (104') has a tubular structure extending along a relative axis (H) and internally defining a passage (108); said junction element (104') having a first open end (109) adapted to cooperate with, and releasably fixable to said manifold conduit (101) at a said relative outlet, so that washing liquid flowing in said manifold conduit (101) can be received into said passage (108).

3. The spraying device according to Claim 1 or 2, **characterised in that** said first portion (112) of said surface (111) is substantially cylindrical, so as to match and completely adhere to the outer surface of said cylindrical rotating body (102) and has a polished finish.

4. The spraying device according to any one of Claims 1 to 3, **characterised in that** said second portion (114) of said surface (111) comprise a surface having a substantially cylindrical structure with a diameter slightly greater than the diameter of said cylindrical body (102).

5. The spraying device according to any one of Claims 2 to 4, **characterised by** further comprising anti-rotation means (117) symmetrically arranged relative to said axis (H) and configured to cooperate with play with the outer surface of said rotating body (102) so that proper positioning of said surface (111) of junction element (104') relative to said rotating body (102) is ensured upon rotation of the latter.

6. The spraying device of Claim 5, **characterised in that** said anti-rotation means (117) comprise two pairs of projections arranged on opposite sides of rotating body 102, each projection defining an end surface which, when the junction element (104') is properly positioned relative to said rotating body (102), only cooperates with play with said rotating body (102), whereas, when the junction element (104') and said rotating body (102) are not properly aligned, rotating body (102) shall cooperate with said anti-rotation means (117) thereby causing a rotation of the junction element (104') about said axis (H).

7. A machine for washing containers, comprising a spraying device according to any one of Claims 1 to 6.

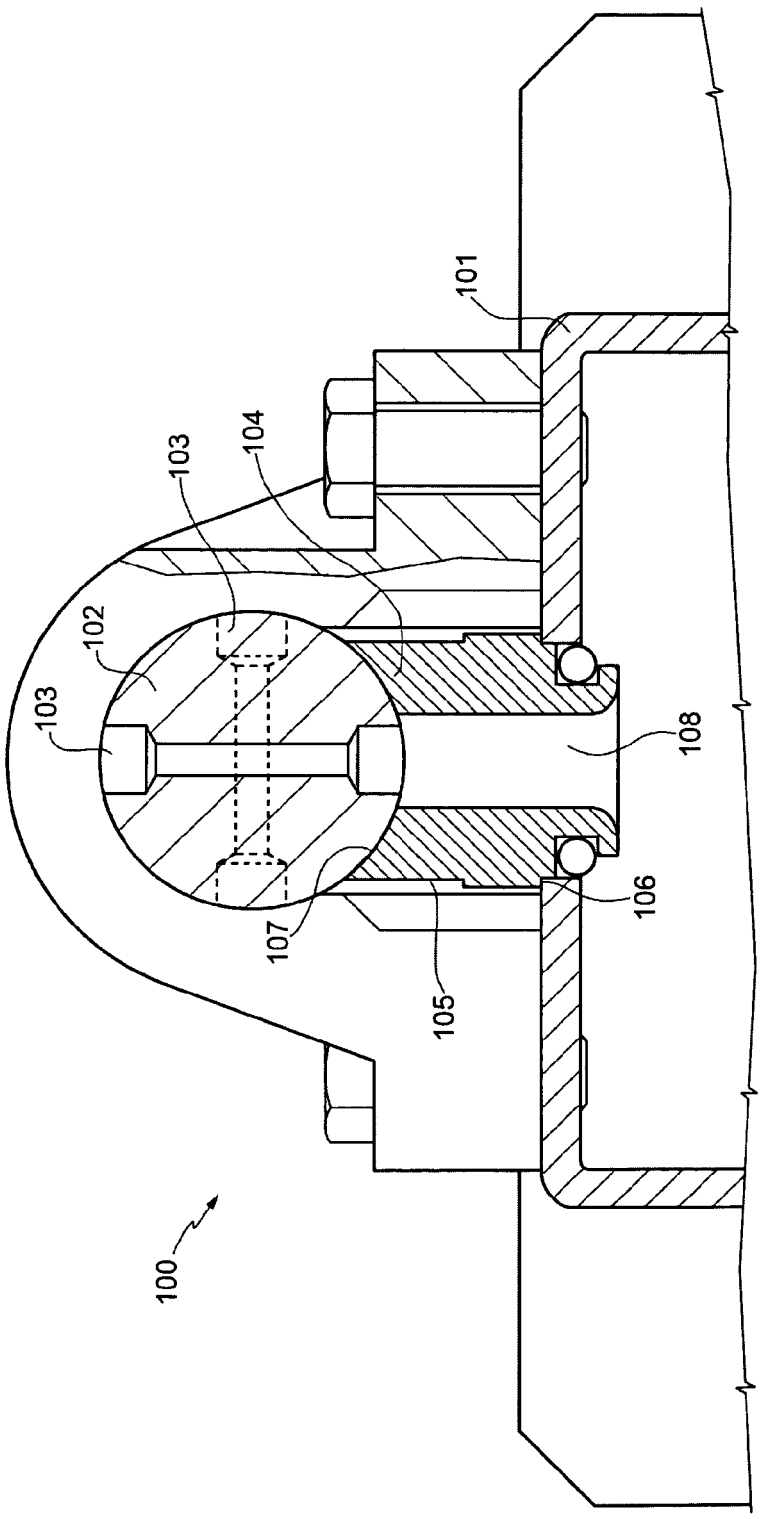

FIG. 1 (prior art)

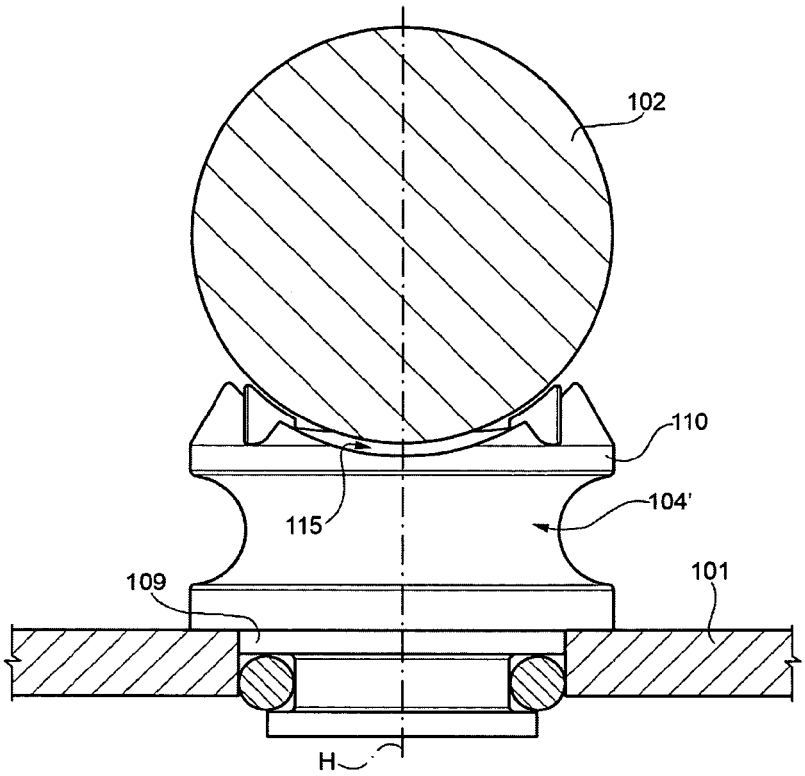
102
110
104'
115
109
101
H

FIG. 2

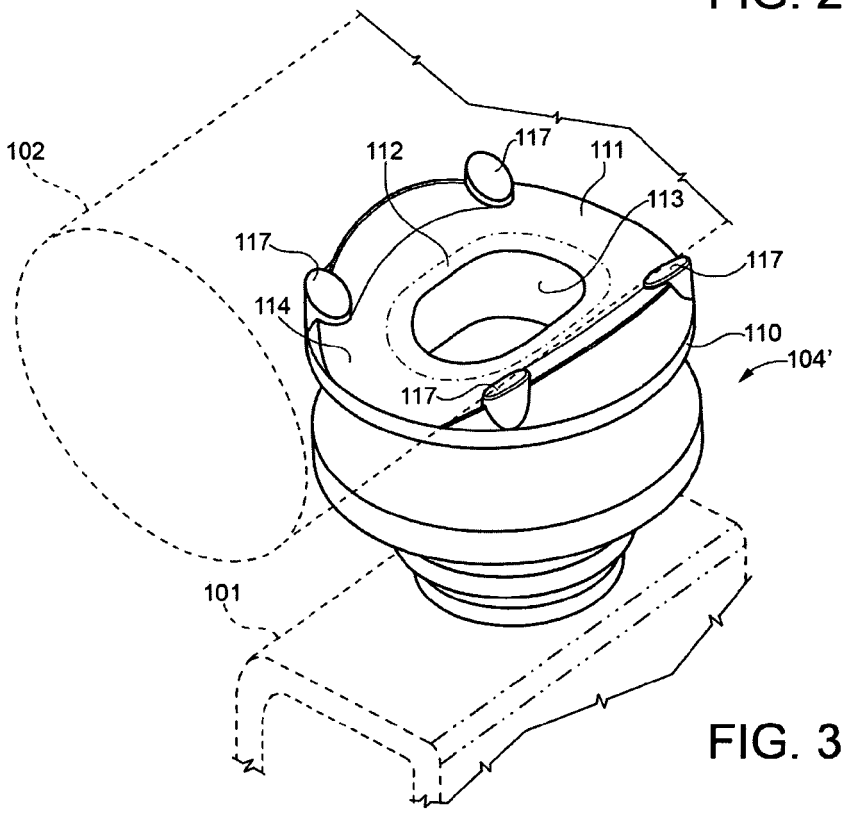
102
112
117
111
113
117
117
114
110
104'
117
101

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 12 42 5173

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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
The Hague	27 March 2013	van der Zee, Willem

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 42 5173

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27-03-2013

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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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