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(54) **A FILLING ARRANGEMENT, A FILLING STATION AND A METHOD FOR FILLING A LIQUID FOOD PRODUCT COMPRISING PARTICLES**

(57) A filling arrangement (100) for filling a liquid food product (FP) comprising particles into a package (200). The arrangement comprises a pipe (102) having a lower section (104) arranged to be fed into a main body (202) of the package (200) during a filling procedure, and an upper section (106) arranged to be placed above the main body (202) during the filling procedure, wherein the lower section (104) has an inner width (W-I), wherein a lower end (108) of the lower section (106) is provided with an opening (110) having an opening width (W-O), wherein the opening width (W-O) is smaller than the inner width (W-I), a stem (112) arranged to be movable along a center axis (C-A) of the pipe (102), said stem (112) being provided in a lower end (114) with a disc-shaped member (116), wherein a width (W-D) of the disc-shaped member (116) is smaller than the inner width (W-I) of the lower

section (108) of the pipe (102) and larger than the opening width (W-O), wherein the arrangement (110) is configured, in a closed state (CLOSE), to have the disc-shaped member (116) of the stem (112) pushed towards the opening (110) of the pipe (102) such that the product (FP) is hindered from passing the opening (110), and in an open state (OPEN), to have the disc-shaped member (116) placed at a distance (D-OS) from the opening (110) such that the product (FP) is released via the opening (110), wherein edges (118) of the opening (110) are arranged such that the particles of the product (FP) are cut and/or pushed away when the disc-shaped member (116) is pushed towards the opening (110) as the filling arrangement (100) is transferred from the open state (OPEN) to the closed state (CLOSE).

EP 4 574 688 A1

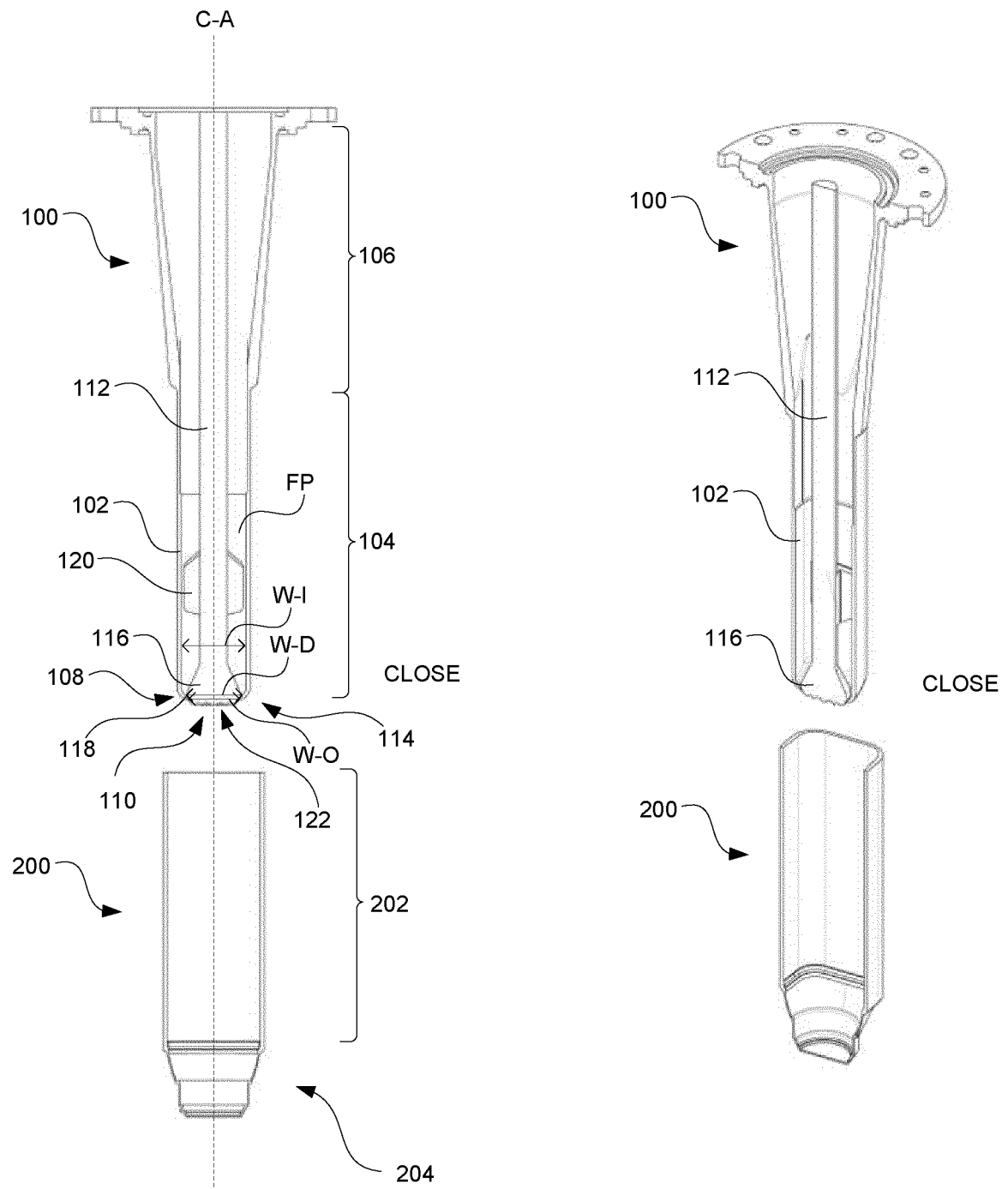


Fig. 1

Description

Technical Field

[0001] The invention generally relates to packaging technology. More particularly, it is related to a filling arrangement for filling a liquid food product into a package, a filling station comprising such filling arrangement, and a method related thereto.

Background Art

[0002] Today, it is increasingly popular to include particles in liquid food products. For instance, during the last couple of years, yoghurt products comprising berries or parts of berries are in many parts of the world a preferred choice instead of plain yoghurt products. Another example of a liquid food product comprising particles are fruit juices comprising pulp and/or seeds.

[0003] Processing liquid food products comprising particles comes with a number of challenges that food producers generally do not face when processing plain products, that is, products not comprising particles. One such challenge is heat treatment. By having the particles, being constituted in different way than the liquid product itself, there is a risk, if not having equipment and processes being adapted to handle products with particles, that the food product as a whole, that is, both the liquid product and the particles, is not heat treated properly. An effect of this may be that the food product is not safe to consume. Another effect could be that the product properties are negatively affected such that taste, texture etc do not meet expectations of the consumers.

[0004] An example of the liquid food product with particles is aseptic high viscous yoghurt with particles, sometimes referred to as drinking yoghurt. Aseptic yoghurt should herein be understood as that this has been heat treated using so called ultrahigh temperature (UHT) treatment or any other equivalent technology for reducing the number unwanted microorganisms. By doing so and also using a package that can efficiently shield of the food product from the surroundings once packaged, the food product can be stored in room temperature or, in some cases, be stored chilled, but with an extended shelf life.

[0005] An example processing line for producing drinking yoghurt with particles, sometimes referred to as particulates, can comprise a high shear mixer providing for texture and stability of the product, mixing tanks, pasteurizers, an inoculation unit for adding starter culture, a fermentation tank, a cooler to minimize viscosity breakdown, an indirect UHT system for heat treating the product while protecting viscosity, aseptic buffer tanks, a blending tank configured to blend the particulates into the yoghurt, and a packaging machine, such as Tetra Pak® TT/3 AD, which is an example of a carton bottle packaging machine.

[0006] Even though the drinking yoghurt with particles,

often having a viscosity of 50-400 cP, can be produced and packaged reliably today, there are challenges related to the particles. One such challenge is that during filling in the packaging machine, there is a risk that particles are caught in a valve mechanism of the filling machine. If this happens, the filling pipe cannot be closed adequately with the effect that there is an increased spillage when moving from one package to another in the packaging machine. A further effect of the spillage is that the particles end up in a sealing area of the packages being filled. If having the particles in the sealing area, there is an increased risk that the package cannot be adequately sealed, sometimes referred to as welded, in a sealing station placed downstream a filling station in the packaging machine.

Summary

[0007] It is an object of the invention to at least partly overcome one or more of the above-identified limitations of the prior art. In particular, it is an object to provide a filling mechanism that can handle particles such that adequate closing can be achieved such that in turn less dripping occurs when moving from one package to another.

[0008] According to a first aspect it is provided a filling arrangement for filling a liquid food product comprising particles into a package, said arrangement may comprise

a pipe having a lower section arranged to be fed into a main body of the package during a filling procedure, and an upper section arranged to be placed above the main body during the filling procedure, wherein the lower section has an inner width, wherein a lower end of the lower section may be provided with an opening having an opening width, wherein the opening width may be smaller than the inner width,

a stem arranged to be movable along a center axis of the pipe, said stem being provided in a lower end with a disc-shaped member, wherein a width of the disc-shaped member may be smaller than the inner width of the lower section of the pipe and larger than the opening width,

wherein the arrangement may be configured, in a closed state, to have the disc-shaped member of the stem pushed towards the opening of the pipe such that the product is hindered from passing the opening, and

in an open state, to have the disc-shaped member placed at a distance from the opening such that the product can be released via the opening, wherein edges of the opening can be arranged such that the particles of the product are cut and/or pushed away when the disc-shaped member is pushed towards the opening as the filling arrangement is transferred from the open state to the closed state.

[0009] An advantage with having the edges of the

opening arranged to cut and/or push away the particles during closing, that is, changing from the open state to the closed state, is that a risk of having the particles stuck between the disc-shaped member and the edges of the opening, thereby reducing dripping, but also reducing wear of the filling arrangement.

[0010] The lower section of the pipe may be have a rectangular cross-section.

[0011] An advantage with this is that a snug fit can be achieved with the package having a rectangular cross-section. An effect of having this snug fit is that less space will be provided between the package and the pipe during the filling procedure, which provides for that a more controlled filling can be achieved.

[0012] The stem may be provided with radially protruding and longitudinally extending guiding members such that a magnitude of horizontal movements between the pipe and the stem during the filling procedure can be reduced.

[0013] Having the guiding members provides for that a risk that the disc-shaped member is misaligned with respect to the opening of the pipe. This in turn provides for that a risk that the disc-shaped member is introduced offset with respect to the opening can be reduced.

[0014] The lower section of the pipe may have a substantially rectangular cross-section, and the stem may be provided with four guiding members, each of them extending into a respective corner of the rectangular cross-section of the lower section of the pipe during the filling procedure.

[0015] By having the pipe provided with the rectangular cross-section such that the snug fit with the package can be achieved and also have the guiding members arranged such that each of these is introduced into a respective corner provides for that reliable guidance can be achieved.

[0016] The pipe may have a substantially rectangular cross-section, and the opening may be a circular opening.

[0017] As described above, having a rectangular cross-section, or substantially rectangular cross-section, provides for that a snug fit with the package can be achieved. Having the opening made circular, even though the pipe is provided with the substantially rectangular cross-section, provides for that a risk of having food product, e.g. the particles, stuck, or entrapped, in the opening can be reduced.

[0018] The disc-shaped member may have a longitudinally rounded side surface, and the edges of the opening may be inclined downwards.

[0019] An advantage with having the disc-shaped member and the edges arranged in this way is that a likelihood of having the particles ending up between the edges and the disc-shaped member can be reduced due to flows formed in the food product as the disc-shaped member is moved towards the edges. Further, in the event that the particles do end up between the edges and the disc-shaped member, these may be cut effi-

ciently.

[0020] The edges of the opening may be tapered.

[0021] An advantage of having the edges tapered is that the particles can be cut in pieces more efficiently.

5 **[0022]** A bottom surface of the disc-shaped member may be provided with protrusions and/or dents for reducing dripping in the closed state.

[0023] By having a non-flat surface, an area of the surface may be increased, which may result in that less dripping occur.

10 **[0024]** According to a second aspect it is provided a filling station comprising

a filling arrangement according to the first aspect, a product pipe arranged to provide the liquid food product into the pipe of the filing arrangement, a first motor arrangement for providing a first relative vertical movement between the filling arrangement and the package,

20 a second motor arrangement for providing a second relative vertical movement between the stem and the pipe of the filing arrangement, a control unit for controlling the first and second motor arrangement, wherein the control unit may be, during the filling procedure, configured

25 to move the package relative to the filling arrangement such that the filling arrangement in the closed state is transferred into the package via an open end, to move the stem with respect to the pipe by using the second motor arrangement such that the filling arrangement is transferred from the closed state to the open state,

30 to move the package relative to the filling arrangement such that the filling arrangement in the open state is transferred away from the package by using the first motor arrangement, and

35 to move the stem with respect to the pipe by using the second motor such that the filling arrangement is transferred from the open state to the closed state.

[0025] As described above, the control unit may be configured to move the package relative to the filling arrangement such that the filling arrangement in the closed state is transferred into the package via an open end. The control unit may be set to provide this movement up until a lower end position is reached. Further, as described above, the control unit may be configured to move the package in the open state away from the package. The first arrangement may be set to provide this movement up until a point where a lower end of the pipe of the filling arrangement is outside the package.

45 **[0026]** Being able to both control a movement between the package and the filling arrangement and a movement between the stem and the pipe provides for that the filling procedure can be adapted to meet a large variety of different food products with different particles such that efficient filling can be achieved.

[0027] The filling station may further comprise

a conveyor arrangement arranged to transport at least one package holder holding the package, wherein the conveyor arrangement may be configured to intermittently move the package holder such that the package is horizontally held still during the filling procedure.

[0028] The first motor arrangement is arranged to be move the package holder vertically during the filling procedure.

[0029] The first motor arrangement may be arranged to move the package holder solely.

[0030] The second motor arrangement is arranged to move the stem solely.

[0031] According to a third aspect it is provided a method for filling a liquid food product comprising particles into a package by using a filling station according to the second aspect, said method comprising

moving the package relative to the filling arrangement such that the filling arrangement in the closed state is transferred into the package via an open end by using the first motor arrangement, moving the stem with respect to the pipe by using the second motor arrangement such that the filling arrangement is transferred from the closed state to the open state, moving the package relative to the filling arrangement such that the filling arrangement in the open state is transferred away from the package by using the first motor arrangement, and moving the stem with respect to the pipe by using the second motor such that the filling arrangement is transferred from the open state to the closed state.

[0032] The same features and advantages as described above also apply to this aspect.

[0033] According to a fourth aspect it is provided a computer program product comprising instructions which, when executed by a control unit, cause the control unit to carry out the method according to the third aspect.

[0034] The same features and advantages as described above also apply to this aspect.

[0035] Still other objectives, features, aspects and advantages of the invention will appear from the following detailed description as well as from the drawings.

Brief Description of the Drawings

[0036] Embodiments of the invention will now be described, by way of example, with reference to the accompanying schematic drawings, in which

Fig. 1 to fig. 5 illustrate cross-sectional views and perspective views, respectively, of a filling arrangement and a package in different steps of a filling

procedure.

Fig. 6 illustrates a lower end of the filling station in further detail.

Fig. 7 generally illustrates a filling station comprising the filling arrangement illustrated in fig. 1 to 5.

Fig. 8 is a flowchart illustrating a method for filling liquid food product comprising particles into the package using the filling arrangement.

Detailed Description

[0037] Fig. 1 illustrates by way of example a filling arrangement 100 comprising a pipe 102 having a lower section 104 and an upper section 106. A lower end 108 of the pipe 102 is provided with an opening 110. Inside the pipe 102, a stem 112 is provided. In a lower end 114 of the stem 112 a disc-shaped member 116 is provided. The disc-shaped member 116 is arranged such that this has a width W-D. This width W-D is less than an inner width W-I of the pipe 102, but greater than an opening width W-O, that is, the width of the opening 110. By having the stem 112 arranged in this way, the opening 110 of the pipe 102 can be closed by pushing the disc-shaped member 116 towards edges 118 of the opening 110. As will be further described below, the edges 118 of the opening 110 may be arranged such that any particles of a food product FP, such as yoghurt, are pushed away from the edges 118 before the disc-shaped member 116 meet the edges such that the pipe 102 is closed, or in other words enters a closed state CLOSE. In addition or instead, the edges 118 of the opening 110 and the disc-shaped member 116 may be arranged such that in case the particles end up between the edges 118 and the disc-shaped member 116, these are cut in parts, thereby providing for that an adequate closing can be made.

[0038] As illustrated, the pipe 102 and the stem 112 may extend along a center axis C-A. Guiding members 120 may be provided on the stem 112 such that this can be moved vertically with respect to the pipe 102 without substantially deviating from the center axis C-A.

[0039] A bottom surface 122 of the disc-shaped member 116 may be provided with dimples, also sometimes referred to as indentations or recesses. By having these, dripping that may occur after the filling arrangement 100 is closed, that is, transferred from an open state OPEN to the closed state CLOSE, can be reduced. One reason for this is that an area of the bottom surface 122, as an effect of having this provided with dimples, is extended.

[0040] During a filling procedure taking place in a filling station, the filling arrangement 100 can be placed above a package 200 as illustrated. The package 200 may, as illustrated, comprise main body 202 and a top section 204. The package 200, exemplified herein, has the top section 202 placed downwards and a bottom, facing upwards during filling, provided with an open end such that the food product FP can be provided into the package 200 via the bottom of the package 200. The package 200 may be embodied in various ways. For instance, as

illustrated, the top section 204 may be made of plastic material and also provided with a threaded neck such that a cap can be applied. An example of such package is Tetra Top® marketed by Tetra Pak®.

[0041] A filling procedure, sometimes referred to as a filling sequence, taking place in the filling station is illustrated by way of example in fig. 1 to fig. 5. In a first step, illustrated in fig. 1, the filling arrangement is in the closed state CLOSE, that is, the disc-shaped member 116 of the stem 112 is pushed against the opening 110 of the pipe 102 such that the food product FP is hindered from being released via the opening 110 of the pipe 102.

[0042] In a second step, illustrated in fig. 2, the filling arrangement 100, still being in the closed state CLOSE, is introduced into the package 200. The introduction of the filling arrangement 100 into the package 200 can be achieved by moving the filling arrangement 100 downwards, by moving the package 200 upwards or a combination of the two.

[0043] In a third step, illustrated in fig. 3, the filling arrangement 100 is fully inserted into the package 200. Even though being fully inserted, there may be a distance between the filling arrangement 100 and an inside of the package 200 such that the package 200 is not at risk of being damaged by the filling arrangement 100. When being fully inserted, the stem 112 can be moved upwards with respect to the pipe 102 such that the disc-shaped member 116 is placed at a distance D-O from the opening 110, thereby allowing the food product FP to be released from the pipe 102 into the package 200.

[0044] In a fourth step, illustrated in fig. 4, the filling arrangement 100 is moved away from the package 200, by moving the filling arrangement 100, by moving the package 200 or a combination thereof. As the filling arrangement 100 is moved away from the package 200, the filling arrangement 100 can be in the open state OPEN. An advantage with moving the filling arrangement 100 with respect to the package 200 with the filling arrangement 100 in the open state OPEN is that an efficient filling can be achieved. For instance, splashing and/or foaming can be reduced.

[0045] In a fifth step, illustrated in fig. 5, the filling arrangement 100 is moved away from the package 200 and the filling arrangement 100 has entered into the closed state CLOSE, that is, the disc-shaped member 116 is pushed towards the edges 118 of the opening 110. By having the filling arrangement 100 moved away from the package 200, the package 200, now being filled with the food product FP, can be moved horizontally and be replaced by a new package not yet being filled.

[0046] Fig. 6 illustrates the filling arrangement 100 in further detail. As illustrated, the edges 118 of the opening 110 may be sharpened, and/or tapered, to assure that the particles ending up between disc-shaped member 116 and the edges 118 when moving from the open state OPEN to the closed state CLOSE can be cut in pieces such that adequate closure of the filling arrangement 100 can be achieved. In addition or instead, the edges 110

may be inclined downwards. An advantage with having the edges 110 inclined in this way is that the particles can be pushed away from an interface between the disc-shaped member 116 and the edges 118 before the disc-shaped member 116 is closing the opening 110.

[0047] Fig. 7 illustrates a filling station 700 by way of example. As illustrated, the filling station 700 can comprise the filling arrangement 100 described above. In addition, the filling station 700 can comprise a product pipe 702 arranged to provide the food product FP into the pipe 102 of the filling arrangement 100. A first motor arrangement 704 can be provided for moving the package 200 with respect to the filling arrangement 100. A second arrangement 706 can be provided for moving the stem 112, and also the disc-shaped member 116, with respect to the pipe 102, and also the opening 110. A control unit 708 communicatively connected to the first and second motor arrangement 704, 706 can be provided such that control data can be provided to the motor arrangements. As illustrated, a conveyor arrangement 710, such as a conveyor belt, can be provided for transporting the package 200. The package 200 may, as illustrated, be placed in a package holder 712. The package holder 712, holding the package 200, may be moved horizontally to a gripper 714. Once the package holder 712 reaches the gripper 714, the gripper 714 may grip the package holder 712. Once gripped, the package holder 714 with the package 200 can be lifted, by using the first motor arrangement 704 connected to the gripper 714, towards the filling arrangement 100 such that the package 200 can be filled with the food product FP in accordance to the filling procedure illustrated in fig. 1 to fig. 5.

[0048] Fig. 8 is a flow chart illustrating a method 800 for filling the liquid food product FP comprising particles into the package 200 by using the filling station 700 described above. The method can comprise

moving 802 the package 200 relative to the filling arrangement 100 such that the filling arrangement 100 in the closed state CLOSE is transferred into the package 200 via an open end by using the first motor arrangement 704,

moving 804 the stem 112 with respect to the pipe 102 by using the second motor arrangement 706 such that the filling arrangement 100 is transferred from the closed state CLOSE to the open state OPEN, moving 806 the package 200 relative to the filling arrangement 100 such that the filling arrangement 100 in the open state OPEN is transferred away from the package 200 by using the first motor arrangement 704, and

moving 808 the stem 112 with respect to the pipe 102 by using the second motor 706 such that the filling arrangement 100 is transferred from the open state OPEN to the closed state CLOSE.

[0049] From the description above follows that, although various embodiments of the invention have

been described and shown, the invention is not restricted thereto, but may also be embodied in other ways within the scope of the subject-matter defined in the following claims.

Claims

1. A filling arrangement (100) for filling a liquid food product (FP) comprising particles into a package (200), said arrangement comprising

a pipe (102) having a lower section (104) arranged to be fed into a main body (202) of the package (200) during a filling procedure, and an upper section (106) arranged to be placed above the main body (202) during the filling procedure, wherein the lower section (104) has an inner width (W-I), wherein a lower end (108) of the lower section (106) is provided with an opening (110) having an opening width (W-O), wherein the opening width (W-O) is smaller than the inner width (W-I),

a stem (112) arranged to be movable along a center axis (C-A) of the pipe (102), said stem (112) being provided in a lower end (114) with a disc-shaped member (116), wherein a width (W-D) of the disc-shaped member (116) is smaller than the inner width (W-I) of the lower section (108) of the pipe (102) and larger than the opening width (W-O),

wherein the arrangement (110) is configured, in a closed state (CLOSE), to have the disc-shaped member (116) of the stem (112) pushed towards the opening (110) of the pipe (102) such that the product (FP) is hindered from passing the opening (110), and

in an open state (OPEN), to have the disc-shaped member (116) placed at a distance (D-OS) from the opening (110) such that the product (FP) is released via the opening (110),

wherein edges (118) of the opening (110) are arranged such that the particles of the product (FP) are cut and/or pushed away when the disc-shaped member (116) is pushed towards the opening (110) as the filling arrangement (100) is transferred from the open state (OPEN) to the closed state (CLOSE).

2. The filling arrangement (100) according to claim 1, wherein the lower section (108) of the pipe (102) has a rectangular cross-section.
3. The filling arrangement (100) according to claim 1 or 2, wherein the stem (112) is provided with radially protruding and longitudinally extending guiding members (120) such that a magnitude of horizontal movements between the pipe (102) and the stem

(112) during the filling procedure can be reduced.

4. The filling arrangement (100) according to claim 3, wherein the lower section (108) of the pipe (102) has a substantially rectangular cross-section, and wherein the stem (112) is provided with four guiding members (120), each of them extending into a respective corner of the rectangular cross-section of the lower section (108) of the pipe (102) during the filling procedure.

5. The filling arrangement (100) according to any one of the preceding claims, wherein the pipe (102) has a substantially rectangular cross-section, and the opening (110) is a circular opening.

6. The filling arrangement (100) according to any one of the preceding claims, wherein the disc-shaped member (116) has a longitudinally rounded side surface, and the edges (118) of the opening (110) are inclined downwards.

7. The filling arrangement (100) according to any one of the preceding claims, wherein the edges (118) of the opening (110) are tapered.

8. The filling arrangement (100) according to any one of the preceding claims, wherein a bottom surface (122) of the disc-shaped member (116) is provided with protrusions and/or dents for reducing dripping in the closed state (CLOSE).

9. A filling station (700) comprising

a filling arrangement (100) according to any one of the claims 1 to 8,

a product pipe (702) arranged to provide the liquid food product (FP) into the pipe (102) of the filling arrangement (100),

a first motor arrangement (704) for providing a first relative vertical movement between the filling arrangement (100) and the package (200), a second motor arrangement (706) for providing a second relative vertical movement between the stem (112) and the pipe (102) of the filling arrangement (100),

a control unit (708) for controlling the first and second motor arrangement (704, 706),

wherein the control unit (708) is, during the filling procedure, configured to move the package (200) relative to the filling arrangement (100) such that the filling arrangement (100) in the closed state (CLOSE) is transferred into the package (200) via an open end,

to move the stem (112) with respect to the pipe (102) by using the second motor arrangement (706) such that the filling arrangement (100) is transferred from the closed state (CLOSE) to the

open state (OPEN),
to move the package (200) relative to the filling
arrangement (100) such that the filling arrange-
ment (100) in the open state (OPEN) is trans-
ferred away from the package (200) by using the
first motor arrangement (706), and
to move the stem (112) with respect to the pipe
(102) by using the second motor (708) such that
the filling arrangement (100) is transferred from
the open state (OPEN) to the closed state
(CLOSE).

that the filling arrangement (100) is transferred
from the open state (OPEN) to the closed state
(CLOSE).

10. The filling station (700) according to claim 9, further
comprising

a conveyor arrangement (710) arranged to
transport at least one package holder (712)
holding the package (200),
wherein the conveyor arrangement (710) is con-
figured to intermittently move the package
holder (712) such that the package (200) is
horizontally held still during the filling procedure.

11. The filling station (700) according to claim 10, where-
in the first motor arrangement (704) is arranged to be
move the package holder (712) vertically during the
filling procedure.

12. The filling station (700) according to claim 11, where-
in the first motor arrangement (704) is arranged to
move the package holder (712) solely.

13. The filling station (700) according to any one of claim
9 to 12, wherein the second motor arrangement
(708) is arranged to move the stem (112) solely.

14. A method (800) for filling a liquid food product (FP)
comprising particles into a package (200) by using a
filling station (700) according to any one of claim 9 to
13, said method comprising

moving (802) the package (200) relative to the
filling arrangement (100) such that the filling
arrangement (100) in the closed state (CLOSE)
is transferred into the package (200) via an open
end by using the first motor arrangement (704),
moving (804) the stem (112) with respect to the
pipe (102) by using the second motor arrange-
ment (706) such that the filling arrangement
(100) is transferred from the closed state
(CLOSE) to the open state (OPEN),
moving (806) the package (200) relative to the
filling arrangement (100) such that the filling
arrangement (100) in the open state (OPEN)
is transferred away from the package (200) by
using the first motor arrangement (704), and
moving (808) the stem (112) with respect to the
pipe (102) by using the second motor (706) such

15. A computer program product comprising instructions
which, when executed by a control unit (708), cause
the control unit (708) to carry out the method accord-
ing to claim 14.

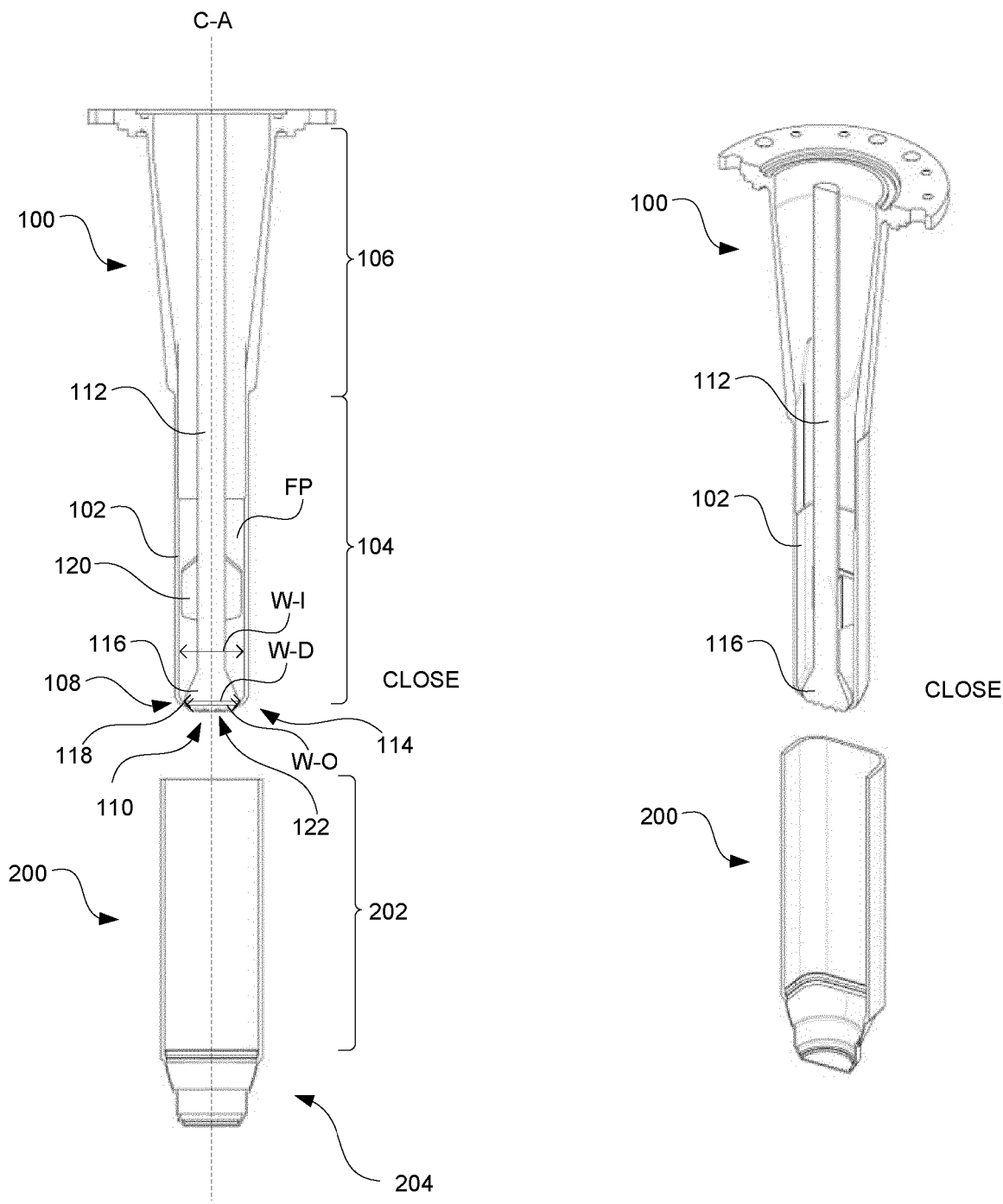


Fig. 1

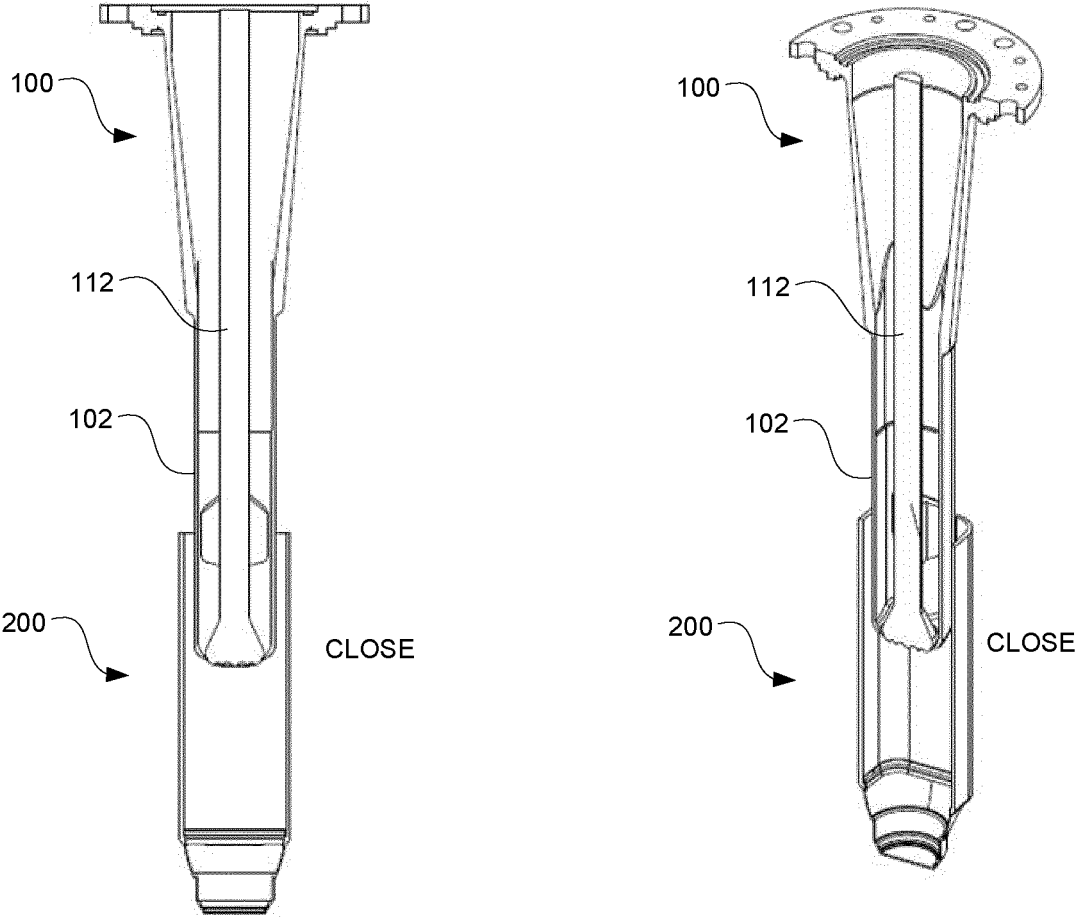


Fig. 2

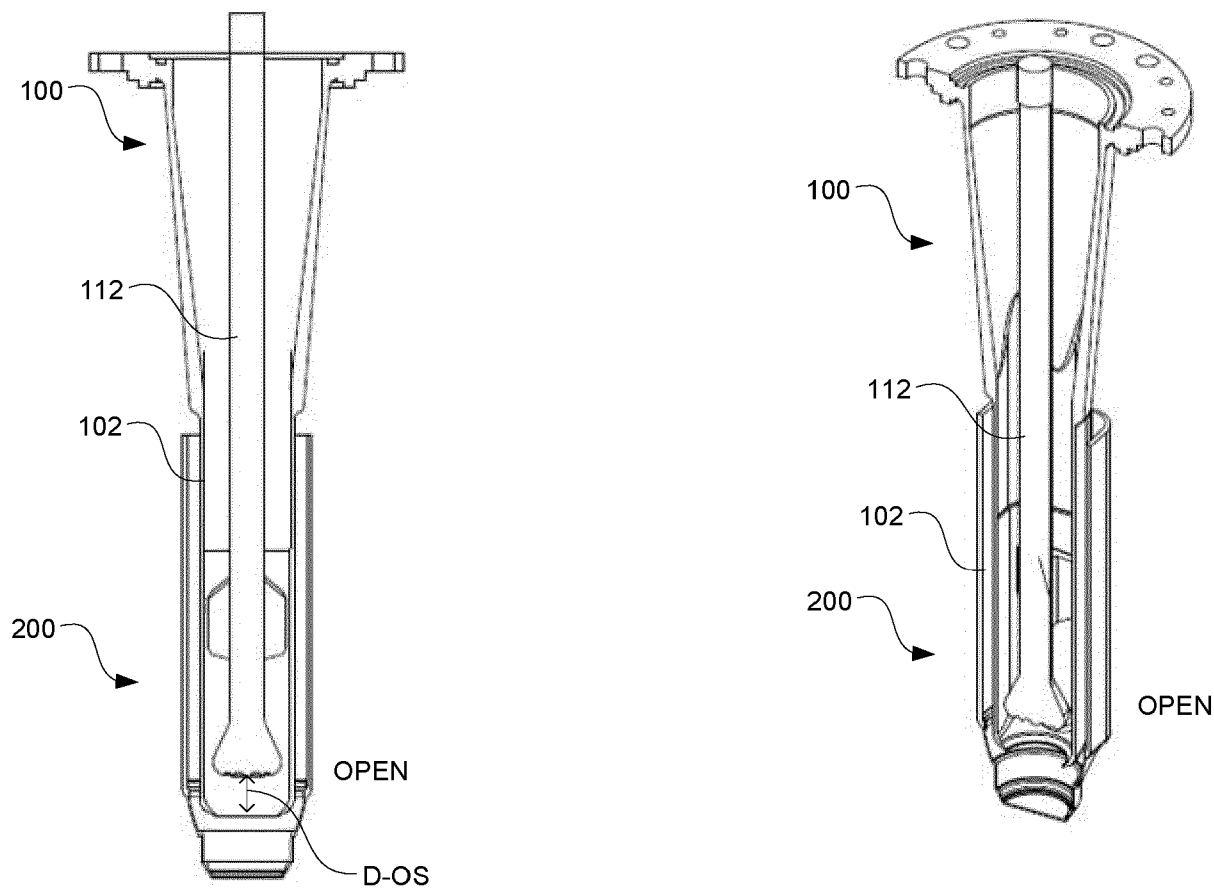


Fig. 3

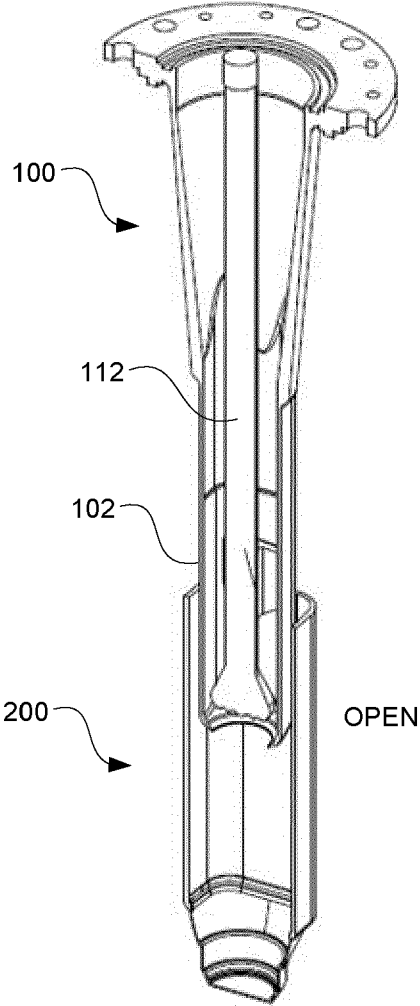
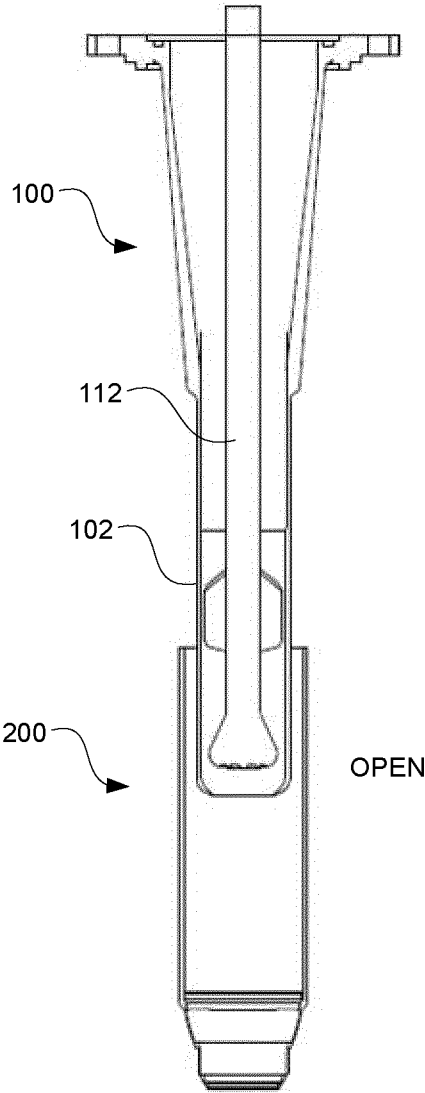


Fig. 4

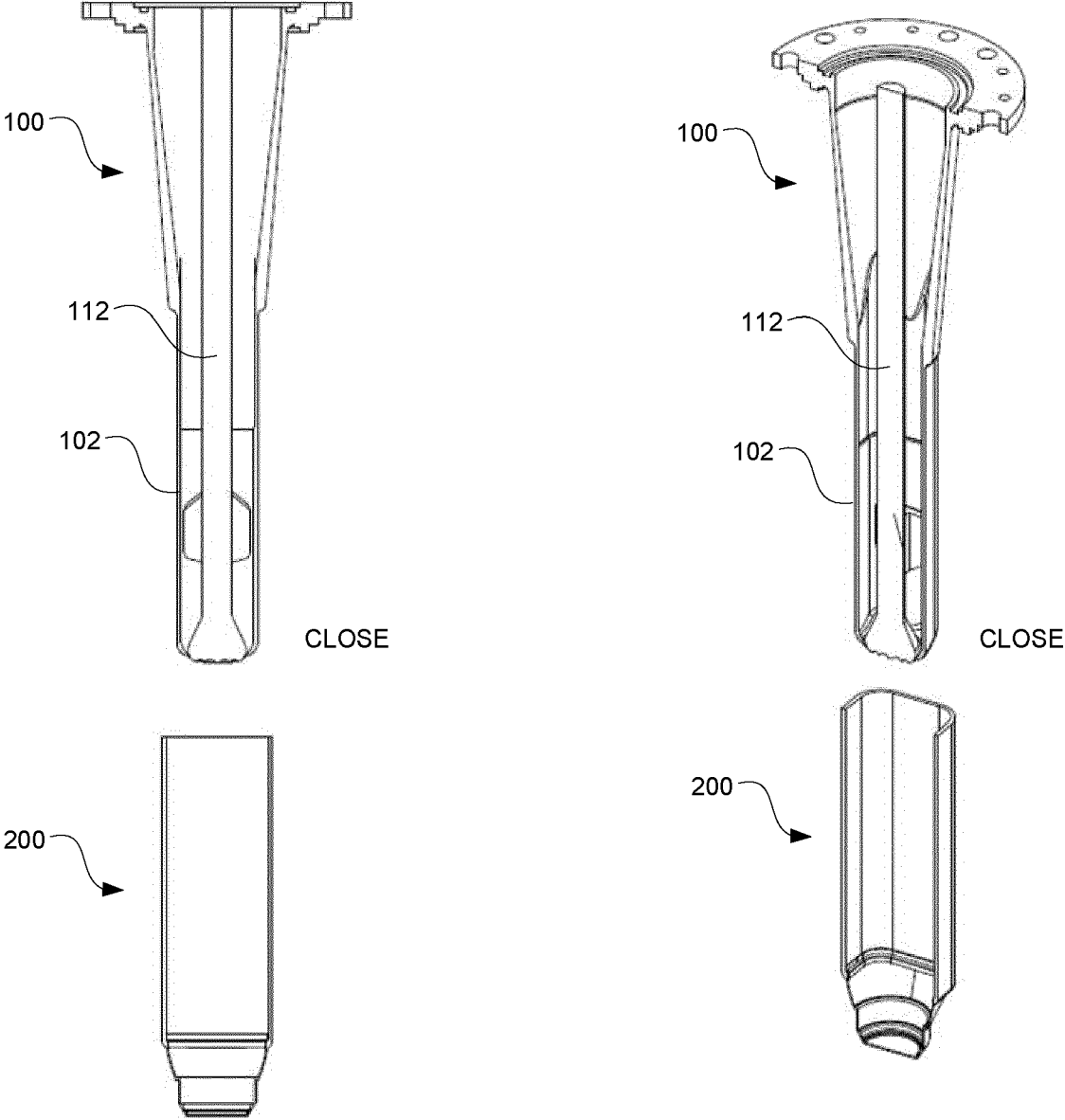


Fig. 5

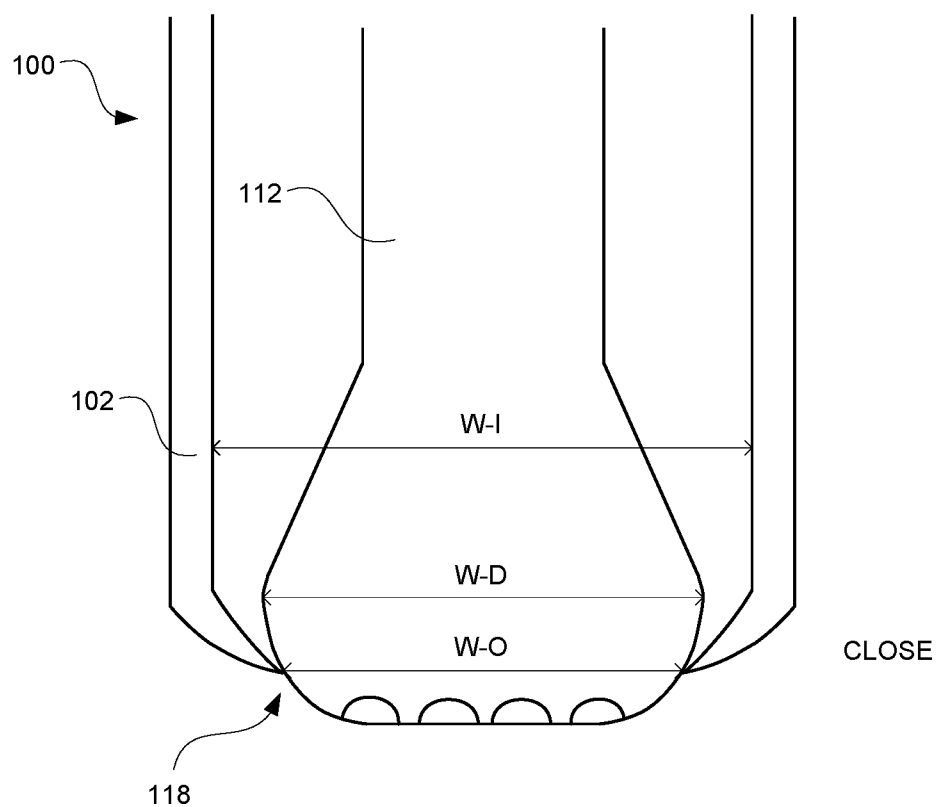


Fig. 6

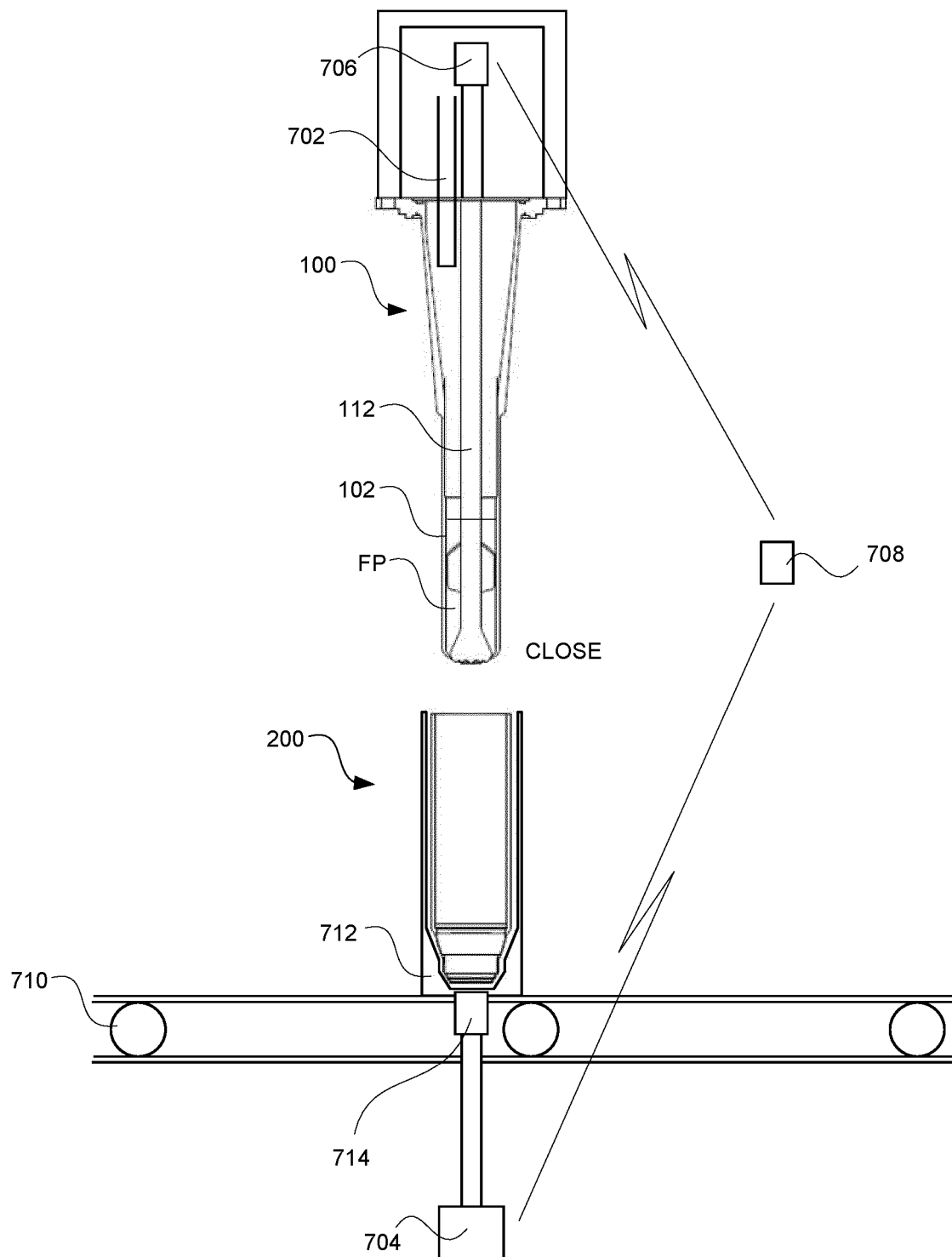


Fig. 7

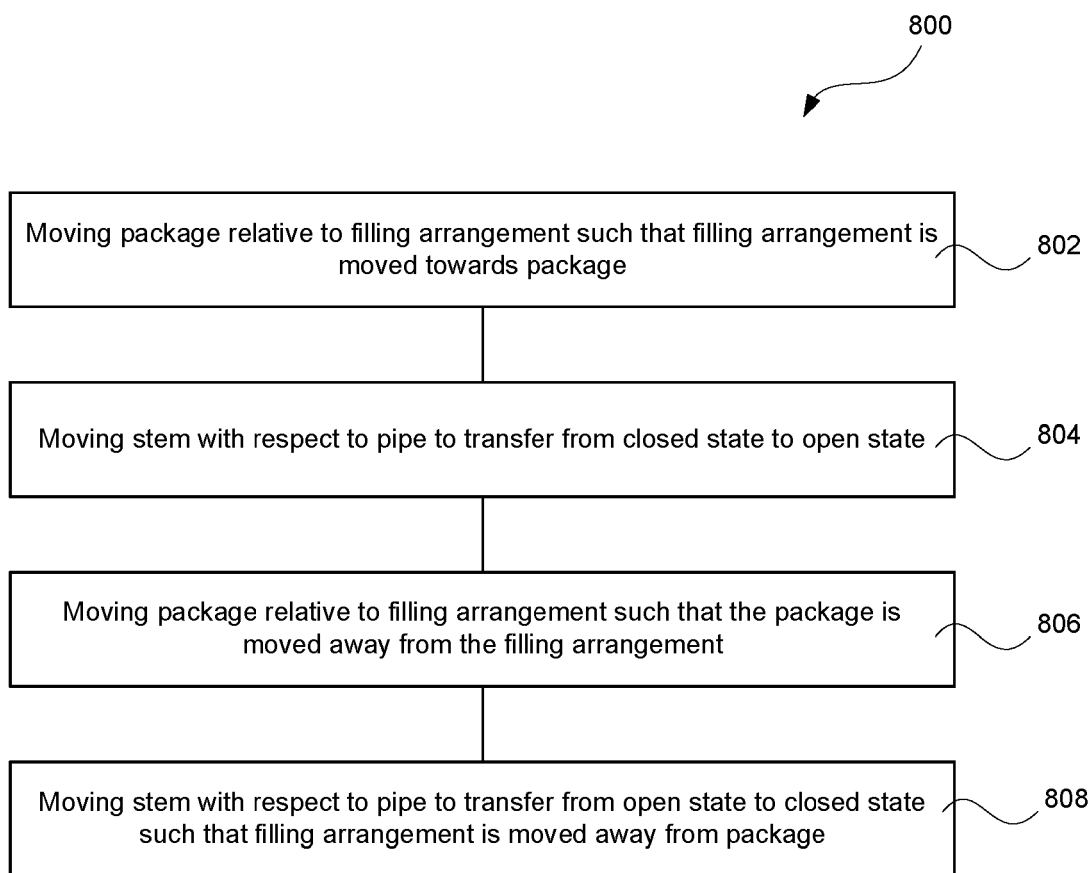


Fig. 8



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