(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 512 726 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.02.2025 Bulletin 2025/09

(21) Application number: **24193909.9**

(22) Date of filing: **09.08.2024**

(51) International Patent Classification (IPC):
B65B 9/067 *(2012.01)* ***B65B 39/02*** *(2006.01)*
B65B 59/00 *(2006.01)* *B65B 39/00* *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B65B 9/067; B65B 39/02; B65B 59/001;
B65B 2039/009

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **18.08.2023 NL 2035632**

(71) Applicant: **Eme Engel Machinefabriek en Engineering B.V.**
1508 EV Zaandam (NL)

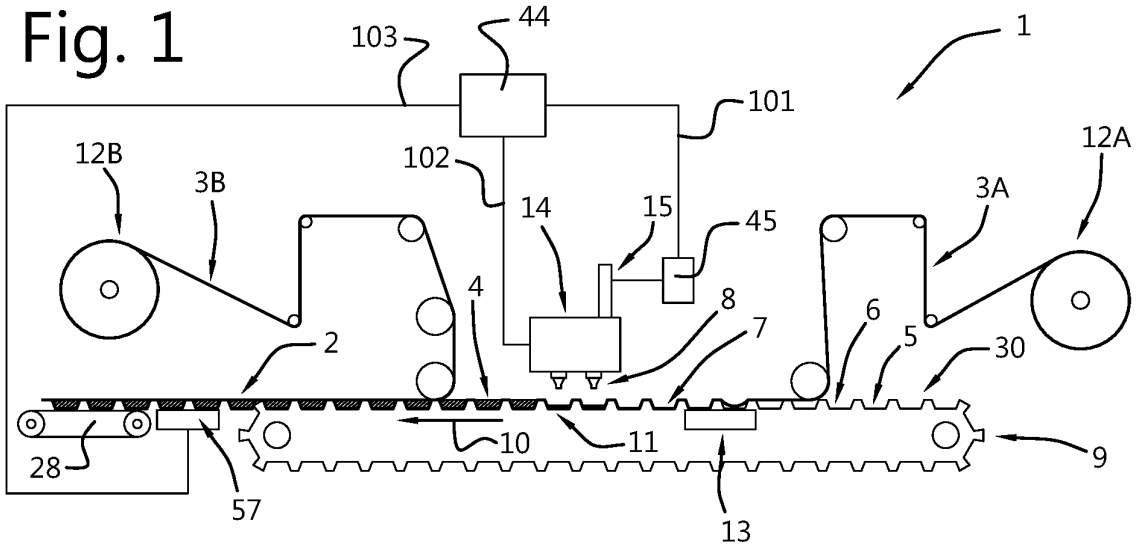
(72) Inventors:
- **DE RIDDER, Freek Willem Laurens**
  1411 GS NAARDEN (NL)
- **NUIJ, Maickel**
  8253 DL DRONTEN (NL)
- **TEN VELDE, Mike Johannes Egbertus**
  7665 SP ALBERGEN (NL)
- **BOONE, Ardjan**
  8269 AB REEVE (NL)

(74) Representative: **EP&C**
P.O. Box 3241
2280 GE Rijswijk (NL)

(54) **PACKAGING SYSTEM FOR PRODUCING POUCHES COMPRISING A WATER-SOLUBLE FILM AND A POWDER**

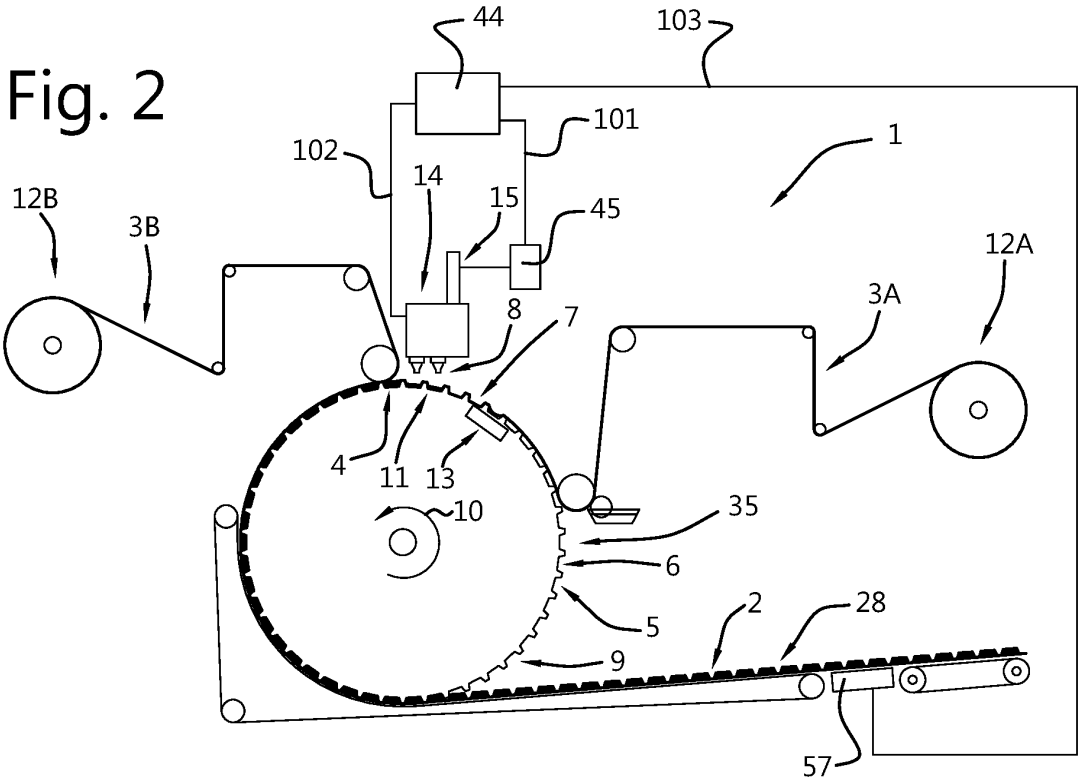
(57) Packaging system (1) for producing pouches (2) comprising a water-soluble film (3A, 3B) and a powder, such as a detergent powder, the packaging system comprising multiple moulds (5), each mould having a mould cavity (6) for forming a compartment in the film, and a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein the moulds are moved along a film supplying device (12A) configured to position the film on the moulds, a compartment forming device (13) configured to position parts of the film in the mould cavities to form the compartments in the film, and a powder filling device (14) comprising multiple powder dispensers (8) to dispense the powder in the compartments.

Fig. 1



EP 4 512 726 A1

Fig. 2



Description

FIELD OF THE INVENTION

[0001] The invention relates to a packaging system for producing pouches comprising a water-soluble film and a powder. More specifically, the packaging system may be used for producing pouches containing a detergent powder.

BACKGROUND OF THE INVENTION

[0002] The known packaging system has the disadvantage that the produced pouches differ from each other.

[0003] The invention is based on the insight that there is a need in the field of the art for a packing system which produces pouches having no differences, or at least a reduced degree of differences.

SUMMARY OF THE INVENTION

[0004] The invention has the objective to provide an improved, or at least alternative, packaging system for producing pouches comprising a water-soluble film and a powder.

[0005] This objective is achieved by a packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder. Said packaging system comprises:

- multiple moulds, each mould having a mould cavity for forming a compartment in the film, and
- a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein the moulds are moved along:

    -- a film supplying device configured to position the film on the moulds,
    -- a compartment forming device configured to position parts of the film in the mould cavities to form the compartments in the film,
    -- a powder filling device comprising multiple powder dispensers to dispense the powder in the compartments, and wherein:

        --- the packaging system comprises a powder supply for supplying the powder to the powder filing device,
        --- the powder filling device comprises multiple dosing chambers,
        --- each dosing chamber is configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film,
        --- each dosing chamber comprises at least one side wall forming an inner side wall surface surrounding a longitudinal chamber axis of the dosing chamber,
        --- said inner side wall surface defines a dosing volume of the dosing chamber,
        --- at least part of said at least one side wall is flexible and configured to allow deformation of said at least one side wall, and
        --- the powder filling device comprises for each of the dosing chambers a deformation unit configured to deform said at least one side wall and to move at least part of said inner side wall surface along an adjustment path extending transverse, preferable perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

[0006] The deformation units are configured to adjust said dosing volume in order to control the dose of powder supplied by the dosing chambers into the compartments of the film. Thereby, accurate control of the supplied dose is possible to match the desired end result of the pouches.

[0007] Powders contain particles which may differ from each other with respect to the particle size and/or the volumetric mass density and/or the particle shape and/or other properties. Detergent powders usually contain particles comprising different components due to which detergent powders tend to have a relatively high degree of differences between the particles.

[0008] In a packaging system for producing pouches comprising a water-soluble film and a powder, the powder in the powder stream of the powder supply is subject to segregation. For example, larger particles tend to behave differently in the powder stream than smaller particles, and the same applies to heavier and lighter particles. As a result, over the course of emptying a powder supply container to fill the powder in multiple subsequent pouches, the size and/or weight distribution of the powder particles supplied to the pouches may change over time.

[0009] If dosing chambers having a constant dosing volume are used, such differences in the size and/or weight distribution of the powder particles may lead to differences in pouch characteristics over time, for example varying pouch mass.

[0010] The properties of the powder supplied to the pouches may change over time due to other reasons as well, such as absorption of moisture by the powder or differences in powder properties between powder batches or within a powder batch.

[0011] An accurate adjustment of the dosing volume is achieved by the packaging system with the dosing chambers having the at least one deformable side wall and the deformation unit. This allows that the degree of differences between the pouches can be reduced.

[0012] In addition, the accurate adjustment of the dosing volume is achieved with a relatively simple construction having a low number of movable parts. Said dosing

chambers and deformation unit require a relatively low degree of maintenance.

[0013] In an embodiment of the packaging system according to the invention, said at least one side wall comprises a single side wall surrounding the longitudinal chamber axis, wherein said single side wall is preferably an endless wall surrounding the longitudinal chamber axis, and wherein said single side wall is preferably integrally formed.

[0014] In an embodiment of the packaging system according to the invention, the deformation unit is configured to move said at least part of the inner side wall surface from a first position in which the dosing chamber has a first dosing volume towards and/or into a second position in which the dosing chamber has a second dosing volume, and vice versa.

[0015] In an embodiment of the packaging system according to the invention, the adjustment path extends from, and including, the first position until, and including, the second position.

[0016] In an embodiment of the packaging system according to the invention, the deformation unit is configured to move said at least part of the inner side wall surface from the first position in a first direction along the adjustment path and towards and/or into the second position, the deformation unit is configured to move said at least part of the inner side wall surface from the second position in a second direction along the adjustment path and towards and/or into the first position, and the second direction is preferably opposite to the first direction.

[0017] In an embodiment of the packaging system according to the invention, the deformation unit is configured to hold said at least part of the inner side wall surface in multiple intermediate positions between the first position and the second position, which multiple intermediate positions form multiple intermediate dosing volumes between the first dosing volume and the second dosing volume.

[0018] In an embodiment of the packaging system according to the invention, the second dosing volume is smaller than the first dosing volume, wherein preferably the second dosing volume is smaller than the first dosing volume and larger than or equal to 70% of first dosing volume, wherein preferably the second dosing volume is between, and including, 60% and 80% of the first dosing volume, and wherein preferably the second dosing volume is about 70% of the first dosing volume.

[0019] In an embodiment of the packaging system according to the invention, the deformation unit is configured to push said at least one side wall to move said at least part of the inner side wall surface from the first position, along said adjustment path and towards the longitudinal chamber axis of the dosing chamber, and towards and/or into the second position.

[0020] In an embodiment of the packaging system according to the invention, the deformation unit is configured to let said at least one side wall elastically move back said at least part of the inner side wall surface from the second position, along said adjustment path and away from the longitudinal chamber axis of the dosing chamber, and into the first position.

[0021] In an embodiment of the packaging system according to the invention, said at least one side wall is configured to elastically move back said at least part of the inner side wall surface from the second position, along said adjustment path and away from the longitudinal chamber axis of the dosing chamber, and into the first position.

[0022] In an embodiment of the packaging system according to the invention, said at least one side wall is not deformed by the deformation unit when the inner side wall surface is located in the first position.

[0023] In an embodiment of the packaging system according to the invention said at least one side wall comprises a first wall part located at a first surface part of the inner side wall surface and a second wall part located at a second surface part of the inner side wall surface, the deformation unit is configured to move said first surface part and said second surface part from the first position towards and/or into the second position, and vice versa, said first direction of the second surface part is preferably opposite to said first direction of the first surface part, and said second direction of the second surface part is preferably opposite to said second direction of the first surface part.

[0024] In an embodiment of the packaging system according to the invention, said second surface part and said first surface part are facing each other.

[0025] In an embodiment of the packaging system according to the invention, the deformation unit comprises at least one movable deformation member configured to move said at least part of said inner side wall surface along said adjustment path.

[0026] In an embodiment of the packaging system according to the invention, the deformation unit comprises a movable first deformation member configured to move said first surface part of said inner side wall surface along said adjustment path.

[0027] In an embodiment of the packaging system according to the invention, the deformation unit comprises a movable second deformation member configured to move said second surface part of said inner side wall surface along said adjustment path.

[0028] In an embodiment of the packaging system according to the invention, said least one side wall is configured to allow repetitive deformation.

[0029] In an embodiment of the packaging system according to the invention, said at least part of said at least one side wall comprises a flexible material, such as spring steel or polypropylene.

[0030] In an embodiment of the packaging system according to the invention, said at least part of said at least one side wall is made of a flexible material, such as spring steel or polypropylene.

[0031] In an embodiment of the packaging system according to the invention, said at least one side wall

comprises a flexible material, such as spring steel or polypropylene.

[0032] In an embodiment of the packaging system according to the invention, said at least one side wall is made of a flexible material, such as spring steel or polypropylene.

[0033] In an embodiment of the packaging system according to the invention, the powder filling device is configured to discharge the powder from the dosing chambers in the direction of the respective longitudinal chamber axis.

[0034] In an embodiment of the packaging system according to the invention, each dosing chamber comprises a chamber filling opening to allow the powder to enter said dosing chamber and the inner side wall surface extends from said chamber filling opening.

[0035] In an embodiment of the packaging system according to the invention, the dosing volume of the dosing chamber is defined by the inner side wall surface and the chamber filling opening.

[0036] In an embodiment of the packaging system according to the invention, the powder filling device is configured to fill the dosing chamber up to the chamber filling opening.

[0037] In an embodiment of the packaging system according to the invention, the longitudinal chamber axis extends through the chamber filling opening.

[0038] In an embodiment of the packaging system according to the invention, each dosing chamber comprises a bottom forming an inner bottom surface and the inner side wall surface extends from said chamber filling opening until the inner bottom surface.

[0039] In an embodiment of the packaging system according to the invention, the dosing volume of the dosing chamber is defined by the inner side wall surface, the inner bottom surface and the chamber filling opening.

[0040] In an embodiment of the packaging system according to the invention, the powder filling device is configured to fill the dosing chamber from the inner bottom surface up to the chamber filling opening.

[0041] In an embodiment of the packaging system according to the invention, the longitudinal chamber axis extends through the inner bottom surface.

[0042] In an embodiment of the packaging system according to the invention, the inner side wall surface has a non-circular and curvilinear form in cross section perpendicular to the longitudinal chamber axis of the dosing chamber. The inner side wall surface being located in the first position may have an elliptical form. Said elliptical form may have an eccentricity being larger than 0 and smaller than 1.

[0043] In an embodiment of the packaging system according to the invention, the powder filling device comprises a filling control unit configured to control the deformation units in order to adjust the dosing volume of the dosing chambers.

[0044] In an embodiment of the packaging system according to the invention, the filling control unit is configured to equally adjust the dosing volume of all the dosing chambers.

[0045] In an embodiment of the packaging system according to the invention, the filling control unit is configured to individually adjust the dosing volume of each of the dosing chambers.

[0046] In an embodiment of the packaging system according to the invention, the filling control unit is configured to move for each of the dosing chambers at least part of the dosing chamber walls to adjust the dosing volume in order to control the supplied dose of the powder.

[0047] In an embodiment of the packaging system according to the invention, the packaging system comprises a density measurement device configured to measure a density of the powder upstream of the dosing chambers, the density measurement device is in communication with the filling control unit, and the filling control unit is configured to control the deformation units to adjust the dosing volume of the dosing chambers in order to supply the doses of the powder with a predetermined powder dose mass.

[0048] In an embodiment of the packaging system according to the invention, the density measurement device is configured to provide a density measurement output signal based on the measured density of the powder, and the filling control unit is configured to automatically control the deformation units on basis of the density measurement output signal from the density measurement device in order to supply the doses of the powder with a predetermined powder dose mass.

[0049] In an embodiment of the packaging system according to the invention, the density measurement device comprises a powder sample unit configured to provide a sample dose of the supplied powder upstream of the dosing chambers, and the density measurement device is configured to measure a density of the sample dose of the powder.

[0050] In an embodiment of the packaging system according to the invention, the powder sample unit comprises a powder branch channel configured to provide powder supplied upstream of the dosing chamber and a sample chamber having a predetermined sample volume, the powder sample unit is configured fill the sample chamber with powder in order to form a sample dose of the powder having the predetermined sample volume, the density measurement device comprises a weighing unit configured to determine a sample mass of the sample dose of the powder in the sample chamber, and the density measurement device is configured to determine a density of the sample dose of the powder on basis of the predetermined sample volume and the measured sample mass.

[0051] In an embodiment of the packaging system according to the invention, the density measurement device is configured to perform measurements of several sample doses of the powder and to calculate an average density of the powder supplied to the dosing chambers.

[0052] In an embodiment of the packaging system according to the invention, the density measurement device is configured to provide an indicative value of flowability of the powder upstream of the dosing chambers. Said indicative value of the flowability of the powder may be measured via the rate of the flow-in and/or flow-out of the density measurement device. Said rate of the flow-in / flow-out of the powder may be measured in cubical meter per second (m^3/s) or gram per second (g/s). The density measurement device may be configured to provide a flowability signal based on the measured via the rate of the flow-in / flow-out of the powder. Said flowability signal may be communicated to the filling control unit and/or another control unit of the packaging system via a communication connection.

[0053] In an embodiment of the packaging system according to the invention, the packaging system comprises a pouch measurement device configured to measure a characteristic of the pouches, the pouch measurement device is in communication with the filling control unit, and the filling control unit is configured to control the deformation units to adjust the dosing volume of the dosing chambers in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

[0054] In an embodiment of the packaging system according to the invention, the pouch measurement device is configured to provide a pouch measurement output signal based on the measured characteristic of the pouches, and the filling control unit is configured to automatically control the deformation units on basis of the pouch measurement output signal from the pouch measurement device in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

[0055] In an embodiment of the packaging system according to the invention, the characteristic measured by the pouch measurement device is a mass of the pouches.

[0056] In an embodiment of the packaging system according to the invention, the characteristic measured by the pouch measurement device is a volume of the pouches.

[0057] In an embodiment of the packaging system according to the invention, the powder filling device comprises a powder distribution unit which distributes the powder over multiple powder channels configured to transfer the powder towards the powder dispensers, the powder distribution unit comprises a powder distributor comprising a distributor discharging opening which is positioned along a distribution path, each powder channel comprises a channel receiving opening, the channel receiving openings are positioned along the distribution path and directed towards the distributor discharging opening to receive powder discharged from the distributor discharging opening, and the packaging system comprises a distribution drive configured to move the distributor discharging opening and the channel receiving openings relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels.

[0058] In an embodiment of the packaging system according to the invention, each of the powder channels is in fluid communication with only one of the dosing chambers.

[0059] In an embodiment of the packaging system according to the invention, each of the dosing chambers is in fluid communication with only one of the powder channels.

[0060] In an embodiment of the packaging system according to the invention, the powder channels have a non-circular and curvilinear form in cross section perpendicular to the longitudinal device axis of the filling device. The powder channels may have an elliptical form. Said elliptical form may have an eccentricity being larger than 0 and smaller than 1.

[0061] In an embodiment of the packaging system according to the invention, the distributor discharging opening passes all the channel receiving openings during said cyclical movement of the distributor discharging opening and the channel receiving openings relative to each other.

[0062] In an embodiment of the packaging system according to the invention, the powder distribution unit is configured to provide a distribution dose of the powder to each of the powder channels, and the distribution dose is preferably smaller than the dose of the powder supplied by the dosing chambers.

[0063] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is smaller than or equal to 50% of the dose of the powder supplied by the dosing chambers.

[0064] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is smaller than or equal to 1/3rd of the dose of the powder supplied by the dosing chambers.

[0065] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is smaller than or equal to 25% of the dose of the powder supplied by the dosing chambers.

[0066] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is smaller than or equal to 20% of the dose of the powder supplied by the dosing chambers.

[0067] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is larger than or equal to 5% of the dose of the powder supplied by the dosing chambers.

[0068] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is larger than or equal to 10% of the dose of the powder supplied by the dosing chambers.

[0069] In an embodiment of the packaging system according to the invention, the distribution dose of the powder is larger than or equal to 20% of the dose of the powder supplied by the dosing chambers.

[0070] In an embodiment of the packaging system according to the invention, the powder distribution unit is configured to provide the distribution dose of the powder to each of the powder channels during one cycle of the cyclical movement of the powder distributor along the distribution path.

[0071] In an embodiment of the packaging system according to the invention, each of the powder channels comprises a distribution dose channel section located at the channel receiving opening, the distribution dose channel sections have a dose channel section volume which corresponds to the distribution dose of the powder, and the distribution dose channel sections are configured to receive the distribution dose of powder from the powder distributor during one cycle or multiple cycles of the cyclical movement of the distributor along the distribution path and to subsequently supply said distribution dose of powder further downstream the powder channels.

[0072] In an embodiment of the packaging system according to the invention, the distribution dose channel sections are movable from a first dose channel position in which the distribution dose channel sections are not in fluid communication with a downstream part of the powder channels into a second dose channel position in which the distribution dose channel sections are in fluid communication with the downstream part of the powder channels, and vice versa, and the powder distribution unit is configured to provide the distribution dose of the powder with the powder distributor to the distribution dose channel sections located in the first dose channel position and to subsequently move the distribution dose channel sections channel into the second dose channel position in order to supply said distribution dose of powder further downstream the powder channels.

[0073] In an embodiment of the packaging system according to the invention, the powder filling device comprises a first channel drive to move the distribution dose channel sections from the first dose channel position into the second dose channel position, and vice versa.

[0074] In an embodiment of the packaging system according to the invention, each of the powder channels comprises a first channel section and a second channel section, the first channel sections are located between the channel receiving openings and the second channel sections, the second channel sections are located between the first channel sections and the dosing chambers, and the second channel sections are movable from a first channel position in which the second channel sections receive powder from the first channel sections into a second channel position in which the second channel sections discharge powder in the dosing chambers, and vice versa.

[0075] In an embodiment of the packaging system according to the invention, the powder filling device is configured to completely fill the distribution dose channel sections with powder before said distribution dose channel sections supply said distribution dose of powder further downstream the powder channels.

[0076] In an embodiment of the packaging system according to the invention, the powder filling device comprises a second channel drive to move the second channel sections from the first channel position into the second channel position, and vice versa.

[0077] In an embodiment of the packaging system according to the invention, the first channel sections have a first channel section volume, which first channel section volume is preferably larger than the dose of powder.

[0078] In an embodiment of the packaging system according to the invention, the second channel sections have a second channel section volume, which second channel section volume is preferably larger than the dose of powder.

[0079] In an embodiment of the packaging system according to the invention, the first channel section volume and the second channel section volume are together larger than the dose of powder.

[0080] In an embodiment of the packaging system according to the invention, the powder filling device is configured to completely fill the first channel sections with powder before said first channel sections transfer said powder towards the second channel sections.

[0081] In an embodiment of the packaging system according to the invention, the powder filling device is configured to completely fill the second channel sections with powder before said second channel sections transfer said powder towards the powder dispensers, preferably the dosing chambers.

[0082] In an embodiment of the packaging system according to the invention, the packaging system comprises a distribution control unit configured to control the distribution drive, the first channel drive and/or the second channel drive.

[0083] In an embodiment of the packaging system according to the invention, the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to ensure a timely dispensing of the powder in the compartments, more specifically to ensure a timely dispensing the doses of powder in the compartments.

[0084] In an embodiment of the packaging system according to the invention, the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to ensure the first channel section and the second channel section of each of the powder channels together hold more powder than the dose of powder before transferring the powder towards one of the dosing chambers.

[0085] In an embodiment of the packaging system according to the invention, the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to ensure the first channel section and the second channel section of each of the powder channels each hold more powder than the dose of powder before to transferring the powder towards one of the dosing chambers.

[0086] In an embodiment of the packaging system

according to the invention, the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive in order to completely fill the distribution dose channel sections with powder before said distribution dose channel sections supply said distribution dose of powder further downstream the powder channels.

[0087] In an embodiment of the packaging system according to the invention, the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive in order to completely fill the first channel sections with powder before said first channel sections transfer said powder towards the second channel sections.

[0088] In an embodiment of the packaging system according to the invention, the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive in order to completely fill the second channel sections with powder before said second channel sections transfer said powder towards the powder dispensers, preferably the dosing chambers.

[0089] In an embodiment of the packaging system according to the invention, the second channel sections located in the first channel position are in fluid communication with the first channel sections and not in fluid communication with the dosing chambers, and the second channel sections located in the second channel position in fluid communication with the dosing chambers and not in fluid communication with the first channel sections.

[0090] In an embodiment of the packaging system according to the invention, the first channel sections and/or the dosing chambers are static.

[0091] In an embodiment of the packaging system according to the invention, the distribution dose channel sections are located between the channel receiving openings and the first channel sections, and the distribution dose channel sections located in the second dose channel position supply said distribution dose of powder to the first channel sections.

[0092] In an embodiment of the packaging system according to the invention, the first channel sections and the second channel sections are located at a first distance from each other to form a first powder space between the first channel sections and the second channel sections, and the powder filling device is configured to in use fill the first powder space with the powder in order to facilitate movement of the first channel sections and the second channel sections relative to each other.

[0093] In an embodiment of the packaging system according to the invention, the second channel sections are provided with upwardly extending first containment walls to hold the powder in the first powder space.

[0094] In an embodiment of the packaging system according to the invention, the second channel sections and the dosing chambers are located at a second distance from each other to form a second powder space between the second channel sections and the dosing chambers, and the powder filling device is configured to in use fill the second powder space with the powder in order to facilitate movement of the second channel sections and the dosing chambers relative to each other.

[0095] In an embodiment of the packaging system according to the invention, the dosing chambers are provided with upwardly extending second containment walls to hold the powder in the second powder space.

[0096] In an embodiment of the packaging system according to the invention, the distribution dose channel sections and the first channel sections are located at a third distance from each other to form a third powder space between the distribution dose channel sections and the first channel sections, and the powder filling device is configured to in use fill the third powder space with the powder in order to facilitate movement of the distribution dose channel sections and the first channel sections relative to each other.

[0097] In an embodiment of the packaging system according to the invention, the first channel sections are provided with upwardly extending third containment walls to hold the powder in the third powder space.

[0098] In an embodiment of the packaging system according to the invention, the distribution path is a circular path, and the channel receiving openings, the first channel sections, the second channel sections, and the dosing chamber are positioned in a circular configuration.

[0099] In an embodiment of the packaging system according to the invention, the distribution path, the channel receiving openings, the first channel sections, the second channel sections, and the dosing chambers surround a longitudinal device axis of the powder filling device.

[0100] In an embodiment of the packaging system according to the invention, the channel receiving openings, the first channel sections, the second channel sections, and the dosing chamber are coaxially positioned relative to a longitudinal device axis of the powder filling device.

[0101] In an embodiment of the packaging system according to the invention, the distribution drive is configured to move the distributor discharging opening relative to all the channel receiving openings at a same speed.

[0102] In an embodiment of the packaging system according to the invention, the distribution drive is configured to move the distributor discharging opening along all the channel receiving openings at a same speed.

[0103] In an embodiment of the packaging system according to the invention, the distribution drive is configured to move the distributor discharging opening with a cyclical circular movement.

[0104] In an embodiment of the packaging system according to the invention, the packaging system comprises a further film supplying device configured to position a water-soluble further film on the film and over the

powder in the compartments in order to form a web of pouches holding the powder between the film and the further film.

[0105] In an embodiment of the packaging system according to the invention, the packaging system comprises the powder filling device.

[0106] In an embodiment of the packaging system according to the invention, the packaging system comprises the film supplying device.

[0107] In an embodiment of the packaging system according to the invention, the packaging system comprises the compartment forming device.

[0108] The invention further relates to a packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, the packaging system comprising:

- multiple moulds, each mould having a mould cavity for forming a compartment in the film, and
- a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein the moulds are moved along:

    -- a film supplying device configured to position the film on the moulds,
    -- a compartment forming device configured to position parts of the film in the mould cavities to form the compartments in the film,
    -- a powder filling device comprising multiple powder dispensers to dispense the powder in the compartments, and wherein:

        --- the packaging system comprises a powder supply for supplying the powder to the powder filing device,
        --- the powder filing device comprises a powder distribution unit which distributes the powder over multiple powder channels configured to transfer the powder towards the powder dispensers,
        --- the powder distribution unit comprises a powder distributor comprising a distributor discharging opening which is positioned along a distribution path,
        --- each powder channel comprises a channel receiving opening,
        --- the channel receiving openings are positioned along the distribution path and directed towards the distributor discharging opening to receive powder discharged from the distributor discharging opening, and
        --- the packaging system comprises a distribution drive configured to move the distributor discharging opening and the channel receiving openings relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels, and
        ---- wherein optionally the powder filling device comprises multiple dosing chambers, each dosing chamber being configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film.

[0109] Powders contain particles which up to a certain extent differ from each other with respect to the particle size and/or the volumetric mass density and/or the particle shape. Detergent powders contain particles made from different components due to which detergent powders tend to have a relatively high degree of differences between the particles.

[0110] In a packaging system for producing pouches comprising a water-soluble film and a powder, the powder in the powder stream of the powder supply is subjected to segregation. For example, larger particles tend to behave differently in the powder stream than smaller particles, and the same applies to heavier and lighter particles. As a result, the powder channels of known packaging systems tend to receive powder with a different composition of the particles when the powder supply is split over the powder channels. The dispensers in fluid communication with these powder channels will therefore fill the compartments of the pouches with powders having a different composition of the particles. This leads to pouches having a relatively high degree of differences with respect to the powder in the pouches. Especially for detergent powders it is essential that the powder in the pouches have no differences, or a relatively low degree of differences, with respect to the powder in the pouches in order to ensure that each pouch achieves a good cleaning effect.

[0111] The powder distribution unit of the packaging system according to the invention ensures that the powder channels receive powder having no differences, or at least a relatively low degree of differences, in the composition of the particles of the powder. Hence, the produced pouches have no differences, or at least a relatively low degree of differences.

[0112] In an embodiment of the packaging system according to the invention, the packaging system comprises the features of any combination of any number of the above defined embodiments of the packaging system.

[0113] The invention further relates to a method for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, with the packaging system according to the invention, said method comprising deforming said at least one side wall and moving at least part of said inner side wall surface along the adjustment path extending transverse, preferable about perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

[0114] The invention further relates to a method for

producing pouches comprising a water-soluble film and a powder, such as a detergent powder, with the packaging system according to the invention, said method comprising moving the distributor discharging opening of the powder distributor and the channel receiving openings of the powder channels relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels.

BRIEF DESCRIPTION OF THE INVENTION

[0115] Embodiments of the packaging system according to invention and the method according to the invention will be described by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, and in which:

Figure 1 schematically shows an overview of a first example of the packaging system according to the invention,
Figure 2 schematically shows an overview of a second example of the packaging system according to the invention,
Figure 3A schematically shows a view in perspective of an embodiment of the powder filling device of the packaging system of the figures 1 and 2,
Figure 3B schematically shows an exploded view of the powder filling device figure 3A,
the Figures 4A, 4B and 4C show a schematical representation of part of a cross sectional view of the dosing chambers along line IV of figure 3B and parallel to the longitudinal device axis of the powder filling device,
the Figures 5A and 5B schematically show part of a cross sectional view of the dosing chambers along line V of figure 3B and perpendicular to the longitudinal device axis of the powder filling device,
the Figures 6-8 schematically show exploded views of part of a further embodiment of the powder filling device of the packaging system of the figures 1 and 2,
Figure 9 schematically shows a side view of said part of the powder filling device of the figures 6-8,
the Figures 10A and 10B show a schematical representation of a cross sectional view of the powder filling device along the distribution path of figure 7 and parallel to the longitudinal device axis of the powder filling device,
Figure 11A schematically shows another further embodiment of the powder filling device of the packaging system of the figures 1 and 2,
Figure 11B schematically shows an exploded view of the powder filling device of figure 11A, the Figures 11C and 11D show a schematical representation of a cross sectional view of the powder filling device along the distribution path of figure 11A and parallel to the longitudinal device axis of the powder filling device, and
Figure 12 schematically shows a cross sectional view along the longitudinal device axis of an alternative configuration of the powder filling device 11A.

DETAILED DESCRIPTION OF THE INVENTION

[0116] Figure 1 shows an overview of a first example of the packaging system 1 according to the invention. The packaging system 1 is configured to produce pouches 2 comprising a water-soluble film 3A, B and a powder 4.

[0117] The packaging system 1 comprises multiple moulds 5. Each mould 5 has a mould cavity 6 for forming a compartment 7 in the film 3A.

[0118] A mould conveyor 9 moves the moulds 5 in a conveying direction 10 along a mould trajectory, more specifically an endless mould trajectory. The mould conveyor 9 is configured as a mould conveyor belt 30.

[0119] The moulds 5 are moved along a film supplying device 12A configured to position the film 3A on the moulds 5. Subsequently, a compartment forming device 13 positions parts of the film 3A in the mould cavities 6 to form the compartments 7 in the film 3A. After that, a powder filling device 14 having multiple powder dispensers 8 fills the compartments 7 with the powder 4. A powder supply 15 supplies the powder 4 to the powder filing device 14. A further film supplying device 12B positions a water-soluble further film 3B on the film 3A and over the powder 4 in the compartments 7 in order to form a web 28 of pouches 2 holding the powder between the film 3A and the further film 3B. The web 28 of pouches 2 can be cut to form individualised pouches 2.

[0120] Figure 2 shows an overview of a second example of the packaging system 1 according to the invention. The main difference with respect to the packaging system 1 of figure 1 is that the mould conveyor 9 is configured as a mould rotary drum 35.

[0121] Figure 3A shows a view in perspective of an embodiment of the powder filling device 14 of the packaging system 1 of the figures 1 and 2. Figure 3B shows an exploded view of the powder filling device 14 figure 3A.

[0122] The powder filling device 14 comprises multiple dosing chambers 16. Each dosing chamber 16 is configured to supply a dose of the powder 4 via one of the powder dispensers 8 into one of the compartments 7 of the film 3. In the shown embodiment, each dosing chamber 16 supplies the dose of powder 4 to a dispensing channel 37 leading to one of the powder dispensers 8.

[0123] The figures 4A, 4B and 4C show a schematical representation of part of a cross sectional view of the dosing chambers 16 along line IV of figure 3B and parallel to the longitudinal device axis 75 of the powder filling device 14. The figures 5A and 5B show part of a cross sectional view of the dosing chambers 16 along line V of figure 3B and perpendicular to the longitudinal device axis 75 of the powder filling device 14.

[0124] Each dosing chamber 16 comprises at least one

side wall 19 forming an inner side wall surface 20 surrounding a longitudinal chamber axis 21 of the dosing chamber 16. Said inner side wall surface 20 defines a dosing volume 22A, B of the dosing chamber 16. At least part of said at least one side wall 19 is flexible and configured to allow deformation of said at least one side wall 19. The powder filling device 14 comprises for each of the dosing chambers 16 a deformation unit 23 configured to deform said at least one side wall 19 and to move at least part of said inner side wall surface 20 along an adjustment path 24 extending transverse, preferable perpendicular, to the longitudinal chamber axis 21 in order to adjust said dosing volume 22.

[0125] The skilled person understands that the terms indicating that the adjustment path 24 extends perpendicular to the longitudinal chamber axis 21 does not only cover that the adjustment path 24 extends 100% perpendicular to the longitudinal chamber axis 21. In practise this also covers that the adjustment path 24 extends as functionally perpendicular to the longitudinal chamber axis 21.

[0126] The deformation units 23 are configured to adjust said dosing volume 22 in order to control the dose of the powder 4 supplied by the dosing chambers 16 into the compartments 7 of the film 3. Thereby, accurate control of the supplied dose is possible to match the desired end result of the pouches 2.

[0127] Powders contain particles which may differ from each other with respect to the particle size and/or the volumetric mass density and/or the particle shape and/or other properties. Detergent powders usually contain particles comprising different components due to which detergent powders tend to have a relatively high degree of differences between the particles.

[0128] In a packaging system for producing pouches comprising a water-soluble film and a powder, the powder in the powder stream of the powder supply is subject to segregation. For example, larger particles tend to behave differently in the powder stream than smaller particles, and the same applies to heavier and lighter particles. As a result, over the course of emptying a powder supply container to fill the powder in multiple subsequent pouches, the size and/or weight distribution of the powder particles supplied to the pouches may change over time.

[0129] If dosing chambers having a constant dosing volume are used, such differences in the size and/or weight distribution of the powder particles may lead to differences in pouch characteristics over time, for example varying pouch mass.

[0130] The properties of the powder supplied to the pouches may change over time due to other reasons as well, such as absorption of moisture by the powder or differences in powder properties between powder batches or within a powder batch.

[0131] An accurate adjustment of the dosing volume 22A-B is achieved by the packaging system 1 according to the invention with the dosing chambers 16 having the at least one deformable side wall 19 and the deformation unit 23. This allows that the degree of differences between the pouches 2 can be reduced.

[0132] In addition, the accurate adjustment of the dosing volume 22A-B is achieved with a relatively simple construction having a low number of movable parts. Said dosing chambers 16 and deformation unit 23 require a relatively low degree of maintenance.

[0133] Said at least one side wall 19 comprises a single side wall 26 surrounding the longitudinal chamber axis 21, wherein said single side wall 26 is preferably an endless wall surrounding the longitudinal chamber axis 21, and wherein said single side wall 26 is preferably integrally formed.

[0134] The deformation unit 23 is configured to move said at least part of the inner side wall surface 20 from a first position 27 in which the dosing chamber 16 has a first dosing volume 22A towards and/or into a second position 29 in which the dosing chamber 16 has a second dosing volume 22B, and vice versa. The adjustment path 24 extends from, and including, the first position 27 until, and including, the second position 29.

[0135] The inner side wall surface 20 has a non-circular and curvilinear form in cross section perpendicular to the longitudinal chamber axis 21 of the dosing chamber 16. This reduces the risk of bridging of the powder 4 in the dosing chambers 16. The inner side wall surface 20 being located in the first position 27 has an elliptical form. Said elliptical form has an eccentricity being larger than 0 and smaller than 1.

[0136] The deformation unit 23 is configured to move said at least part of the inner side wall surface 20 from the first position 27 in a first direction 31 along the adjustment path 24 and towards and/or into the second position 29. The deformation unit 23 is configured to move said at least part of the inner side wall surface 20 from the second position 29 in a second direction 32 along the adjustment path 24 and towards and/or into the first position 27. The second direction 32 is opposite to the first direction 31.

[0137] The deformation unit 23 is configured to hold said at least part of the inner side wall surface 20 in multiple intermediate positions between the first position 27 and the second position 29. Said multiple intermediate positions form multiple intermediate dosing volumes 22 between the first dosing volume 22A and the second dosing volume 22B.

[0138] The second dosing volume 22B is smaller than the first dosing volume 22A, wherein preferably the second dosing volume 22B is smaller than the first dosing volume 22A and larger than or equal to 70% of first dosing volume 22A. The second dosing volume 22B is preferably between, and including, 60% and 80% of the first dosing volume 22A. The second dosing volume 22B is preferably about 70% of the first dosing volume 22A.

[0139] The deformation unit 23 is configured to push said at least one side wall 19 to move said at least part of the inner side wall surface 20 from the first position 27, along said adjustment path 24 and towards and/or to-

wards the longitudinal chamber axis 21 of the dosing chamber 16, and into the second position 29.

[0140] The deformation unit 23 is configured to let said at least one side wall 19 elastically move back said at least part of the inner side wall surface 20 from the second position 29, along said adjustment path 24 and away from the longitudinal chamber axis 21 of the dosing chamber 16, and into the first position 27.

[0141] Said at least one side wall 19 is configured to elastically move back said at least part of the inner side wall surface 20 from the second position 29, along said adjustment path 24 and away from the longitudinal chamber axis 21 of the dosing chamber 16, and into the first position 27.

[0142] Said at least one side wall 19 is not deformed by the deformation unit 23 when the inner side wall surface 20 is located in the first position 27.

[0143] Said at least one side wall 19 comprises a first wall part 33 located at a first surface part 34 of the inner side wall surface 20 and a second wall part 36 located at a second surface part 43 of the inner side wall surface 20. The deformation unit 23 is configured to move said first surface part 34 and said second surface part 43 from the first position 27 towards and/or into the second position 29, and vice versa. Said first direction 31 of the second surface part 43 is opposite to said first direction 31 of the first surface part 34. Said second direction 32 of the second surface part 43 is opposite to said second direction 32 of the first surface part 34. Said second surface part 43 and said first surface part 34 are facing each other.

[0144] The deformation unit 23 comprises at least one movable deformation member 38, 39 configured to move said at least part of said inner side wall surface 20 along said adjustment path 24.

[0145] The deformation unit 23 comprises a movable first deformation member 38 configured to move said first surface part 34 of said inner side wall surface 20 along said adjustment path 24. The deformation unit 23 comprises a movable second deformation member 39 configured to move said second surface part 43 of said inner side wall surface 20 along said adjustment path 24.

[0146] Said least one side wall 19 is configured to allow repetitive deformation. Said side wall 19 is made of a flexible material, such as spring steel or polypropylene. In other examples, said at least one side wall 19 comprises a flexible material, such as spring steel or polypropylene. In yet other examples, said at least part of said at least one side wall 19 comprises a flexible material, such as spring steel or polypropylene or said at least part of said at least one side wall 19 is made of a flexible material, such as spring steel or polypropylene.

[0147] The powder filling device 14 is configured to discharge the powder 4 from the dosing chambers 16 in the direction of the respective longitudinal chamber axis 21.

[0148] Each dosing chamber 16 comprises a chamber filling opening 41 to allow the powder to enter said dosing chamber 16 and the inner side wall surface 20 extends from said chamber filling opening 41. The dosing volume 22 of the dosing chamber 16 is defined by the inner side wall surface 20 and the chamber filling opening 41. The powder filling device 14 is configured to fill the dosing chamber 16 up to the chamber filling opening 41. The longitudinal chamber axis 21 extends through the chamber filling opening 41.

[0149] Each dosing chamber 16 comprises a bottom 17 forming an inner bottom surface 18 and the inner side wall surface 20 extends from said chamber filling opening 41 until the inner bottom surface 18. The dosing volume 22 of the dosing chamber 16 is defined by the inner side wall surface 20, the inner bottom surface 18 and the chamber filling opening 41. The powder filling device 14 is configured to fill the dosing chamber 16 from the inner bottom surface 18 up to the chamber filling opening 41. The longitudinal chamber axis 21 extends through the inner bottom surface 18.

[0150] The bottom 17 is formed by a valve 46 having two valve doors 47 which are closed during the filling of the dosing chambers 16 with the powder (see figures 4A and 4B) and are opened to release the powder 4 from the dosing chambers 16 (see figure 4C).

[0151] As shown in the figures 1, 2, 3A, 5A and 5B, the powder filling device 14 comprises a filling control unit 44 configured to control the deformation units 23 in order to adjust the dosing volume 22 of the dosing chambers 16.

[0152] The filling control unit 44 is configured to equally adjust the dosing volume 22 of all the dosing chambers 16. In other examples, the filling control unit 44 is configured to individually adjust the dosing volume 22 of each of the dosing chambers 16.

[0153] The filling control unit 44 is configured to move for each of the dosing chambers 16 at least part of the dosing chamber 16 walls to adjust the dosing volume 22 in order to control the supplied dose of the powder 4.

[0154] The packaging system 1 comprises a density measurement device 45 configured to measure a density of the powder 4 upstream of the dosing chambers 16. The density measurement device 45 is in communication with the filling control unit 44 via a first communication connection 101. The filling control unit 44 is configured to control the deformation units 23 to adjust the dosing volume 22 of the dosing chambers 16 in order to supply the doses of the powder with a predetermined powder dose mass. The deformation units 23 are in communication with the filling control unit 44 via a second communication connection 102.

[0155] The density measurement device 45 is configured to provide a density measurement output signal based on the measured density of the powder, and the filling control unit 44 is configured to automatically control the deformation units 23 on basis of the density measurement output signal from the density measurement device 45 in order to supply the doses of the powder with a predetermined powder dose mass. Since the density measurement output signal from the density measurement device 45 is representative of the powder 4 which is

still upstream from the dosing chambers, the filling control unit 44 will wait with a required deformation of the inner side wall surface 20 to adjust the dosing volume 22 until said powder reaches the dosing chambers 16.

[0156] The density measurement device 45 comprises a powder sample unit 48 configured to provide a sample dose of the supplied powder upstream of the dosing chambers 16, and the density measurement device 45 is configured to measure a density of the sample dose of the powder.

[0157] The powder sample unit 48 comprises a powder branch channel 51 configured to provide powder supplied upstream of the dosing chamber 16 and a sample chamber 52 having a predetermined sample volume 53. The powder sample unit 48 is configured fill the sample chamber 52 with powder in order to form a sample dose of the powder having the predetermined sample volume 53. The density measurement device 45 comprises a weighing unit 54 configured to determine a sample mass of the sample dose of the powder in the sample chamber 52. The density measurement device 45 is configured to determine a density of the sample dose of the powder on basis of the predetermined sample volume 53 and the measured sample mass.

[0158] The density measurement device 45 is configured to perform measurements of several sample doses of the powder and to calculate an average density of the powder supplied to the dosing chambers 16.

[0159] The density measurement device 45 may also be configured to provide an indicative value of flowability of the powder upstream of the dosing chambers 16. Said indicative value of the flowability of the powder 4 may be measured via the rate of the flow-in and/or flow-out of the density measurement device 45. Said rate of the flow-in / flow-out of the powder may be measured in cubical meter per second (m^3/s) or gram per second (g/s). The density measurement device 45 may be configured to provide a flowability signal based on the measured via the rate of the flow-in / flow-out of the powder. Said flowability signal may be communicated to the filling control unit 44 and/or another control unit of the packaging system 1 via a communication connection.

[0160] As indicated in the figures 1 and 2, the packaging system 1 comprises a pouch measurement device 57 configured to measure a characteristic of the pouches 2. The pouch measurement device 57 is in communication with the filling control unit 44 via a third communication connection 103. The filling control unit 44 is configured to control the deformation units 23 to adjust the dosing volume 22 of the dosing chambers 16 in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

[0161] The pouch measurement device 57 is configured to provide a pouch measurement output signal based on the measured characteristic of the pouches 2, and the filling control unit 44 is configured to automatically control the deformation units 23 on basis of the pouch measurement output signal from the pouch measurement device 57 in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

[0162] The characteristic measured by the pouch measurement device 57 is a mass of the pouches 2. In other examples, the characteristic measured by the pouch measurement device 57 is a volume of the pouches 2.

[0163] Turning back to the figures 3A and 3B, the powder filing device comprises a powder distribution unit 61 which distributes the powder over multiple powder channels 62 configured to transfer the powder towards the powder dispensers 8 via the dispensing channels 37. The powder distribution unit 61 comprises a powder distributor 63 comprising a distributor discharging opening 64 which is positioned along a distribution path 65. Each powder channel comprises a channel receiving opening 66. The channel receiving openings 66 are positioned along the distribution path 65 and directed towards the distributor discharging opening 64 to receive powder discharged from the distributor discharging opening 64. The packaging system 1 comprises a distribution drive 67 configured to move the distributor discharging opening 64 and the channel receiving openings 66 relative to each other with a cyclical movement 68 along the distribution path 65 to supply powder from the powder distributor 63 to all the powder channels 62.

[0164] Powders contain particles which up to a certain extent differ from each other with respect to the particle size and/or the volumetric mass density and/or the particle shape. Detergent powders contain particles made from different components due to which detergent powders tend to have a relatively high degree of differences between the particles.

[0165] In a packaging system for producing pouches comprising a water-soluble film and a powder, the powder in the powder stream of the powder supply is subjected to segregation. For example, larger particles tend to behave differently in the powder stream than smaller particles, and the same applies to heavier and lighter particles. As a result, the powder channels of known packaging systems tend to receive powder with a different composition of the particles when the powder supply is split over the powder channels. The dispensers in fluid communication with these powder channels will therefore fill the compartments of the pouches with powders having a different composition of the particles. This leads to pouches having a relatively high degree of differences with respect to the powder in the pouches. Especially for detergent powders it is essential that the powder in the pouches have no differences, or a relatively low degree of differences, with respect to the powder in the pouches in order to ensure that each pouch achieves a good cleaning effect.

[0166] The powder distribution unit 61 of the packaging system 1 according to the invention ensures that the powder channels 62 receive powder having no differences, or at least a relatively low degree of differences, in the composition of the particles of the powder. Hence, the

produced pouches 2 have no differences, or at least a relatively low degree of differences.

[0167] Each of the powder channels 62 is in fluid communication with only one of the dosing chambers 16. Each of the dosing chambers 16 is in fluid communication with only one of the powder channels 62.

[0168] The powder channels 62 may have a non-circular and curvilinear form in cross section perpendicular to the longitudinal device axis of the filling device. The powder channels 62 may have an elliptical form. Said elliptical form may have an eccentricity being larger than 0 and smaller than 1.

[0169] The distributor discharging opening 64 passes all the channel receiving openings 66 during said cyclical movement 68 of the distributor discharging opening 64 and the channel receiving openings 66 relative to each other.

[0170] The powder distribution unit 61 is configured to provide a distribution dose of the powder to each of the powder channels 62. The distribution dose is preferably smaller than the dose of the powder supplied by the dosing chambers 16.

[0171] The distribution dose of the powder is smaller than or equal to 50% of the dose of the powder supplied by the dosing chambers 16. The distribution dose of the powder is preferably smaller than or equal to 1/3rd of the dose of the powder supplied by the dosing chambers 16. The distribution dose of the powder is preferably smaller than or equal to 25% of the dose of the powder supplied by the dosing chambers 16. The distribution dose of the powder is preferably smaller than or equal to 20% of the dose of the powder supplied by the dosing chambers 16.

[0172] The distribution dose of the powder is larger than or equal to 5% of the dose of the powder supplied by the dosing chambers 16. The distribution dose of the powder is preferably larger than or equal to 10% of the dose of the powder supplied by the dosing chambers 16. The distribution dose of the powder is preferably larger than or equal to 20% of the dose of the powder supplied by the dosing chambers 16.

[0173] The powder distribution unit 61 is configured to provide the distribution dose of the powder to each of the powder channels 62 during one cycle of the cyclical movement 68 of the power distributor 63 along the distribution path 65. The distributor discharging opening 64 is moved along all the channel receiving openings 66 during said one cycle.

[0174] Each of the powder channels 62 comprises a first channel section 69 and second channel section 70. The first channel sections 69 are located between the channel receiving openings 66 and the second channel sections 70. The second channel sections 70 are located between the first channel sections 69 and the dosing chambers 16.

[0175] The second channel sections 70 are movable from a first channel position 71 in which the second channel sections 70 receive powder from the first channel sections 69 into a second channel position 72 in which the second channel sections 70 discharge powder in the dosing chambers 16, and vice versa. The second channel sections 70 located in the first channel position 71 are in fluid communication with the first channel sections 69 and not in fluid communication with the dosing chambers 16. The second channel sections 70 located in the second channel position 72 in fluid communication with the dosing chambers 16 and not in fluid communication with the first channel sections 69. The first channel sections 69 and the dosing chambers 16 are static. This will be shown more in detail in the figures 10A and 10B.

[0176] The powder filling device 14 comprises a second channel drive 78 to move the second channel sections 70 from the first channel position 71 into the second channel position 72, and vice versa. The second channel drive 78 is the same as shown in figure 12.

[0177] The first channel sections 69 have a first channel section volume 73. The second channel sections 70 have a second channel section volume 74. The first channel section volume 73 is preferably larger than the dose of powder. The second channel section volume 74 is preferably larger than the dose of powder. This reduces the risk of air entrapment between the particles of the powder, which negatively affects the dosing of said powder. This way a more uniform flow behaviour of the powder is achieved. This all contributes to a further reduction of differences between the produced pouches.

[0178] The powder filling device 14 is configured to completely fill the first channel sections 69 with powder before said first channel sections 69 transfer said powder towards the second channel sections 70. The powder filling device 14 is also configured to completely fill the second channel sections 70 with powder before said second channel sections 70 transfer said powder towards the powder dispensers 8, more specifically the dosing chambers 16. This further reduces the risk of air entrapment between the particles of the powder.

[0179] The packaging system 1 comprises a distribution control unit 49 configured to control the distribution drive 67 and the second channel drive 78 to ensure a timely dispensing of the powder in the compartments 7. The distribution control unit 49 is in communication with the distribution drive 67 via a fourth communication connection 104. The distribution control unit 49 is in communication with the second channel drive 78 via a sixth communication connection 106.

[0180] The distribution control unit 49 is configured to control the distribution drive 67 and the second channel drive 78 to ensure the first channel section 69 and the second channel section 70 of each of the powder channels 62 each hold more powder than the dose of powder before transferring the powder towards one of the dosing chambers 16.

[0181] The distribution control unit 49 is configured to control the distribution drive 67, the first channel drive 77 and/or the second channel drive 78 in order to completely fill the first channel sections 69 with powder before said first channel sections 69 transfer said powder towards

the second channel sections 70.

[0182] The distribution control unit 49 is configured to control the distribution drive 67, the first channel drive 77 and/or the second channel drive 78 in order to completely fill the second channel sections 70 with powder before said second channel sections 70 transfer said powder towards the powder dispensers 8, more specifically the dosing chambers 16.

[0183] The distribution path 65 is a circular path. The channel receiving openings 66, the first channel sections 69, the second channel sections 70, and the dosing chamber 16 are positioned in a circular configuration.

[0184] The distribution path 65, the channel receiving openings 66, the first channel sections 69, the second channel sections 70, and the dosing chambers 16 surround a longitudinal device axis 75 of the powder filling device 14.

[0185] The channel receiving openings 66, the first channel sections 69, the second channel sections 70, and the dosing chamber 16 are coaxially positioned relative to a longitudinal device axis 75 of the powder filling device 14.

[0186] The distribution drive 67 is configured to move the distributor discharging opening 64 relative to all the channel receiving openings 66 at the same speed. The distribution drive 67 is configured to move the distributor discharging opening 64 along all the channel receiving openings 66 at the same speed. Said speed of the powder distributor 63 may be adjusted over time.

[0187] The distribution drive 67 is configured to move the distributor discharging opening 64 with a cyclical circular movement.

[0188] The figures 6-8 show exploded views of part of a further embodiment of the powder filling device 14 of the packaging system 1 of the figures 1 and 2. Said further embodiment of the powder filling device 14 operates in a similar manner as the powder filling device 14 of figure 3A. Said further embodiment of the powder filling device 14 has in the same way as the powder filling device 14 of figure 3A a circular distribution path 65. The channel receiving openings 66, the first channel sections 69, the second channel sections 70, and the dosing chamber 16 are positioned in a circular configuration. The distribution path 65, the channel receiving openings 66, the first channel sections 69, the second channel sections 70, and the dosing chambers 16 surround a longitudinal device axis 75 of the powder filling device 14. The channel receiving openings 66, the first channel sections 69, the second channel sections 70, and the dosing chamber 16 are coaxially positioned relative to a longitudinal device axis 75 of the powder filling device 14. Only part of the circularly positioned channel receiving openings 66, first channel sections 69, second channel sections 70, and dosing chamber 16 are shown. Figure 9 shows a side view of said part of the powder filling device 14 of the figures 6-8.

[0189] The figures 10A and 10B show a schematical representation of a cross sectional view of the powder filling device 14 along the distribution path 65 of figure 7 and parallel to the longitudinal device axis 75 of the powder filling device 14.

[0190] The second channel sections 70 are movable from a first channel position 71 (see fig. 10A) in which the second channel sections 70 receive powder from the first channel sections 69 into a second channel position 72 (see fig. 10B) in which the second channel sections 70 discharge powder in the dosing chambers 16, and vice versa. The second channel sections 70 located in the first channel position 71 are in fluid communication with the first channel sections 69 and not in fluid communication with the dosing chambers 16. The second channel sections 70 located in the second channel position 72 in fluid communication with the dosing chambers 16 and not in fluid communication with the first channel sections 69. The first channel sections 69 and the dosing chambers 16 are static.

[0191] Figure 11A shows another further embodiment of the powder filling device 14 of the packaging system 1 of the figures 1 and 2. Figure 11B shows an exploded view of the powder filling device 14 of figure 11A.

[0192] The first channel sections 69, the second channel sections 70, and the dosing chamber 16 of said another further embodiment of the powder filling device 14 operates in a similar manner as the powder filling devices 14 of the figure 3A and 9.

[0193] Said another further embodiment of the powder filling device 14 differs from the powder filling devices 14 of the figure 3A and 9 in that each of the powder channels 62 comprises a distribution dose channel section 81 located at the channel receiving opening 66. The distribution dose channel sections 81 have a dose channel section volume 82 which corresponds to the distribution dose of the powder 4. The distribution dose channel sections 81 are configured to receive the distribution dose of powder from the powder distributor 63 during one cycle or multiple cycles of the cyclical movement 68 of the powder distributor 63 along the distribution path 65 and to subsequently supply said distribution dose of powder further downstream the powder channels 62.

[0194] The figures 11C and 11D show a schematical representation of a cross sectional view of the powder filling device 14 along the distribution path 65 of figure 11A and parallel to the longitudinal device axis 75 of the powder filling device 14.

[0195] The distribution dose channel sections 81 are movable from a first dose channel position 83 in which the distribution dose channel sections 81 are not in fluid communication with a downstream part 85 of the powder channels 62 into a second dose channel position 84 in which the distribution dose channel sections 81 are in fluid communication with the downstream part 85 of the powder channels 62, and vice versa. The powder distribution unit 61 is configured to provide the distribution dose of the powder with the powder distributor 63 to the distribution dose channel sections 81 located in the first dose channel position 83 and to subsequently move the

distribution dose channel sections 81 channel into the second dose channel position 84 in order to supply said distribution dose of powder further downstream the powder channels 62.

[0196] The powder filling device 14 comprises a first channel drive 77 to move the distribution dose channel sections 81 from the first dose channel position 83 into the second dose channel position 84, and vice versa. The first channel drive 77 is the same as shown in figure 12. The powder filling device 14 comprises a second channel drive 78 to move the second channel sections 70 from the first channel position 71 into the second channel position 72, and vice versa. The second channel drive 78 is the same as shown in figure 12.

[0197] The powder filling device 14 is configured to completely fill the distribution dose channel sections 81 with powder before said distribution dose channel sections 81 supply said distribution dose of powder further downstream the powder channels 62.

[0198] The powder filling device 14 is configured to completely fill the first channel sections 69 with powder before said first channel sections 69 transfer said powder towards the second channel sections 70.

[0199] The powder filling device 14 is configured to completely fill the second channel sections 70 with powder before said second channel sections 70 transfer said powder towards the powder dispensers 8, more specifically the dosing chambers 16.

[0200] The packaging system 1 comprises a distribution control unit 49 configured to control the distribution drive 67, the first channel drive 77, and the second channel drive 73 to ensure a timely dispensing of the powder in the compartments 7.

[0201] The distribution control unit 49 is configured to control the distribution drive 67, the first channel drive 77, and the second channel drive 78 to ensure the first channel section 69 and the second channel section 70 of each of the powder channels 62 each hold more powder than the dose of powder before transferring the powder towards one of the dosing chambers 16.

[0202] The distribution control unit 49 is configured to control the distribution drive 67, the first channel drive 77 and/or the second channel drive 78 in order to completely fill the distribution dose channel sections 81 with powder before said distribution dose channel sections 81 supply said distribution dose of powder further downstream the powder channels 62.

[0203] The distribution control unit 49 is configured to control the distribution drive 67, the first channel drive 77 and/or the second channel drive 78 in order to completely fill the first channel sections 69 with powder before said first channel sections 69 transfer said powder towards the second channel sections 70.

[0204] The distribution control unit 49 is configured to control the distribution drive 67, the first channel drive 77 and/or the second channel drive 78 in order to completely fill the second channel sections 70 with powder before said second channel sections 70 transfer said powder towards the powder dispensers 8, more specifically the dosing chambers 16.

[0205] The distribution control unit 49 is in communication with the distribution drive 67 via a fourth communication connection 104. The distribution control unit 49 is in communication with the first channel drive 77 via a fifth communication connection 105. The distribution control unit 49 is in communication with the second channel drive 78 via a sixth communication connection 106.

[0206] The distribution dose channel sections 81 are located between the channel receiving openings 66 and the first channel sections 69. The distribution dose channel sections 81 located in the second dose channel position 84 supply said distribution dose of powder to the first channel sections 69.

[0207] Figure 12 shows a cross sectional view along the longitudinal device axis 75 of an alternative configuration of the powder filling device 14 of figure 11A.

[0208] The first channel sections 69 and the second channel sections 70 are located at a first distance 91 from each other to form a first powder space 92 between the first channel sections 69 and the second channel sections 70. The powder filling device 14 is configured to in use fill the first powder space 92 with the powder 4. The second channel sections 70 are provided with upwardly extending first containment walls 93 to hold the powder 4 in the first powder space 92.

[0209] The second channel sections 70 and the dosing chambers 16 are located at a second distance 94 from each other to form a second powder space 95 between the second channel sections 70 and the dosing chambers 16. The powder filling device 14 is configured to in use fill the second powder space 95 with the powder 4. The dosing chambers 16 are provided with upwardly extending second containment walls 96 to hold the powder 4 in the second powder space 95. The second containment walls 96 extends further and at least partly surrounds the distribution dose channel sections 81, the first channel sections 69 and the second channel sections 70 to hold the powder inside the powder filling device 14.

[0210] The distribution dose channel sections 81 and the first channel sections 69 are located at a third distance 97 from each other to form a third powder space 97 between the distribution dose channel sections 81 and the first channel sections 69. The powder filling device 14 is configured to in use fill the third powder space 97 with the powder 4. The first channel sections 69 are provided with upwardly extending third containment walls 99 to hold the powder 4 in the third powder space 97.

[0211] The distribution dose channel sections 81 are moved from the first dose channel position 83 into the second dose channel position 84, and vice versa, via a first channel drive 77.

[0212] The second channel sections 70 are moved from the first channel position 71 into a second channel position 72, and vice versa, via a second channel drive 78.

[0213] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. Further, the terms and phrases used herein are not intended to be limiting, but rather, to provide an understandable description of the invention.

[0214] The terms "a" or "an", as used herein, are defined as one or more than one. The term plurality, as used herein, is defined as two or more than two. The term another, as used herein, is defined as at least a second or more. The terms including and/or having, as used herein, are defined as comprising (i.e., open language, not excluding other elements or steps). Any reference signs in the claims should not be construed as limiting the scope of the claims or the invention.

[0215] The invention further relates to any one of the following clauses.

1. Packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, the packaging system comprising:

- multiple moulds, each mould having a mould cavity for forming a compartment in the film, and
- a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein the moulds are moved along:

-- a film supplying device configured to position the film on the moulds,
-- a compartment forming device configured to position parts of the film in the mould cavities to form the compartments in the film,
-- a powder filling device comprising multiple powder dispensers to dispense the powder in the compartments, and wherein:

--- the packaging system comprises a powder supply for supplying the powder to the powder filing device,
--- the powder filling device comprises multiple dosing chambers,
--- each dosing chamber is configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film,
--- each dosing chamber comprises at least one side wall forming an inner side wall surface surrounding a longitudinal chamber axis of the dosing chamber,
--- said inner side wall surface defines a dosing volume of the dosing chamber,
--- at least part of said at least one side wall is flexible and configured to allow deformation of said at least one side wall, and
--- the powder filling device comprises for each of the dosing chambers a deformation unit configured to deform said at least one side wall and to move at least part of said inner side wall surface along an adjustment path extending transverse, preferable perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

2. Packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, the packaging system comprising a powder filling device comprising multiple powder dispensers to dispense the powder in compartments provided in the film, and wherein:

- the powder filling device comprises multiple dosing chambers,
- each dosing chamber is configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film,
- each dosing chamber comprises at least one side wall forming an inner side wall surface surrounding a longitudinal chamber axis of the dosing chamber,
- said inner side wall surface defines a dosing volume of the dosing chamber,
- at least part of said at least one side wall is flexible and configured to allow deformation of said at least one side wall, and
- the powder filling device comprises for each of the dosing chambers a deformation unit configured to deform said at least one side wall and to move at least part of said inner side wall surface along an adjustment path extending transverse, preferable perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

3. Packaging system according to clause 1 or 2, wherein said at least one side wall comprises a single side wall surrounding the longitudinal chamber axis, wherein said single side wall is preferably an endless wall surrounding the longitudinal chamber axis, and wherein said single side wall is preferably integrally formed.

4. Packaging system according to any one of the preceding clauses, wherein the deformation unit is

configured to move said at least part of the inner side wall surface from a first position in which the dosing chamber has a first dosing volume towards and/or into a second position in which the dosing chamber has a second dosing volume, and vice versa.

5. Packaging system according to clause 4, wherein the adjustment path extends from, and including, the first position until, and including, the second position.

6. Packaging system according to clause 4 or 5, wherein

- the deformation unit is configured to move said at least part of the inner side wall surface from the first position in a first direction along the adjustment path and towards and/or into the second position,
- the deformation unit is configured to move said at least part of the inner side wall surface from the second position in a second direction along the adjustment path and towards and/or into the first position, and
- the second direction is preferably opposite to the first direction.

7. Packaging system according to any one of the clauses 4 - 6, wherein the deformation unit is configured to hold said at least part of the inner side wall surface in multiple intermediate positions between the first position and the second position, which multiple intermediate positions form multiple intermediate dosing volumes between the first dosing volume and the second dosing volume.

8. Packaging system according to any one of the clauses 4 - 7, wherein the second dosing volume is smaller than the first dosing volume, wherein preferably the second dosing volume is smaller than the first dosing volume and larger than or equal to 70% of first dosing volume, wherein preferably the second dosing volume is between, and including, 60% and 80% of the first dosing volume, and wherein preferably the second dosing volume is about 70% of the first dosing volume.

9. Packaging system according to any one of the clauses 4 - 8, wherein the deformation unit is configured to push said at least one side wall to move said at least part of the inner side wall surface from the first position, along said adjustment path and towards the longitudinal chamber axis of the dosing chamber, and towards and/or into the second position.

10. Packaging system according to any one of the clauses 4 - 9, wherein the deformation unit is configured to let said at least one side wall elastically move back said at least part of the inner side wall surface back from the second position, along said adjustment path and away from the longitudinal chamber axis of the dosing chamber, and into the first position.

11. Packaging system according to any one of the clauses 4 - 10, wherein said at least one side wall is configured to elastically move back said at least part of the inner side wall surface from the second position, along said adjustment path and away from the longitudinal chamber axis of the dosing chamber, and into the first position.

12. Packaging system according to any one of the clauses 4 - 11, wherein said at least one side wall is not deformed by the deformation unit when the inner side wall surface is located in the first position.

13. Packaging system according to any one of the clauses 4 - 12, wherein:

- said at least one side wall comprises a first wall part located at a first surface part of the inner side wall surface and a second wall part located at a second surface part of the inner side wall surface,
- the deformation unit is configured to move said first surface part and said second surface part from the first position towards and/or into the second position, and vice versa,
- said first direction of the second surface part is preferably opposite to said first direction of the first surface part, and
- said second direction of the second surface part is preferably opposite to said second direction of the first surface part.

14. Packaging system according to clause 13, wherein said second surface part and said first surface part are facing each other.

15. Packaging system according to any one of the preceding clauses, wherein the deformation unit comprises at least one movable deformation member configured to move said at least part of said inner side wall surface along said adjustment path.

16. Packaging system according to clause 13 - 15, wherein the deformation unit comprises a movable first deformation member configured to move said first surface part of said inner side wall surface along said adjustment path.

17. Packaging system according to any one of the clauses 13 - 16, wherein the deformation unit comprises a movable second deformation member configured to move said second surface part of said

inner side wall surface along said adjustment path.

18. Packaging system according to any one of the preceding clauses, wherein said least one side wall is configured to allow repetitive deformation.

19. Packaging system according to any one of the preceding clauses, wherein said at least part of said at least one side wall comprises a flexible material, such as spring steel or polypropylene.

20. Packaging system according to any one of the preceding clauses, wherein the powder filling device is configured to discharge the powder from the dosing chambers in the direction of the respective longitudinal chamber axis.

21. Packaging system according to any one of the preceding clauses, wherein each dosing chamber comprises a chamber filling opening to allow the powder to enter said dosing chamber and the inner side wall surface extends from said chamber filling opening.

22. Packaging system according to clause 21, wherein the dosing volume of the dosing chamber is defined by the inner side wall surface and the chamber filling opening.

23. Packaging system according to clause 21 or 22, wherein the powder filling device is configured to fill the dosing chamber up to the chamber filling opening.

24. Packaging system according to any one of the clauses -21 - 23, wherein the longitudinal chamber axis extends through the chamber filling opening.

25. Packaging system according to any one of the preceding clauses, wherein the powder filling device comprises a filling control unit configured to control the deformation units in order to adjust the dosing volume of the dosing chambers.

26. Packaging system according to clause 25, wherein the filling control unit is configured to equally adjust the dosing volume of all the dosing chambers.

27. Packaging system according to clause 25 or 26, wherein the filling control unit is configured to individually adjust the dosing volume of each of the dosing chambers.

28. Packaging system according to any one of the clauses 25 - 27, wherein the filling control unit is configured to move for each of the dosing chambers at least part of the dosing chamber walls to adjust the dosing volume in order to control the supplied dose of the powder.

29. Packaging system according to any one of the clauses 25 - 28, wherein:

- the packaging system comprises a density measurement device configured to measure a density of the powder upstream of the dosing chambers,
- the density measurement device is in communication with the filling control unit, and
- the filling control unit is configured to control the deformation units to adjust the dosing volume of the dosing chambers in order to supply the doses of the powder with a predetermined powder dose mass.

30. Packaging system according to clause 29, wherein the density measurement device is configured to provide a density measurement output signal based on the measured density of the powder, and the filling control unit is configured to automatically control the deformation units on basis of the density measurement output signal from the density measurement device in order to supply the doses of the powder with a predetermined powder dose mass.

31. Packaging system according to clause 29 or 30, wherein the density measurement device comprises a powder sample unit configured to provide a sample dose of the supplied powder upstream of the dosing chambers, and the density measurement device is configured to measure a density of the sample dose of the powder.

32. Packaging system according to clause 31, wherein:

- the powder sample unit comprises a powder branch channel configured to provide powder supplied upstream of the dosing chamber and a sample chamber having a predetermined sample volume,
- the powder sample unit is configured fill the sample chamber with powder in order to form a sample dose of the powder having the predetermined sample volume,
- the density measurement device comprises a weighing unit configured to determine a sample mass of the sample dose of the powder in the sample chamber, and
- the density measurement device is configured to determine a density of the sample dose of the powder on basis of the predetermined sample volume and the measured sample mass.

33. Packaging system according to any one of the clauses 29 - 32, wherein the density measurement

device is configured to perform measurements of several sample doses of the powder and to calculate an average density of the powder supplied to the dosing chambers.

34. Packaging system according to any one of the clauses 25 - 33, wherein:

- the packaging system comprises a pouch measurement device configured to measure a characteristic of the pouches,
- the pouch measurement device is in communication with the filling control unit, and
- the filling control unit is configured to control the deformation units to adjust the dosing volume of the dosing chambers in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

35. Packaging system according to clause 34, wherein the pouch measurement device is configured to provide a pouch measurement output signal based on the measured characteristic of the pouches, and the filling control unit is configured to automatically control the deformation units on basis of the pouch measurement output signal from the pouch measurement device in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

36. Packaging system according to clause 34 or 35, wherein the characteristic measured by the pouch measurement device is a mass of the pouches.

37. Packaging system according to any one of the clauses 34 - 36, wherein the characteristic measured by the pouch measurement device is a volume of the pouches.

38. Packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, the packaging system comprising:

- multiple moulds, each mould having a mould cavity for forming a compartment in the film, and
- a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein the moulds are moved along:

    -- a film supplying device configured to position the film on the moulds,
    -- a compartment forming device configured to position parts of the film in the mould cavities to form the compartments in the film,
    -- a powder filling device comprising multiple powder dispensers to dispense the powder in the compartments, and wherein:

        --- the packaging system comprises a powder supply for supplying the powder to the powder filing device,
        --- the powder filing device comprises a powder distribution unit which distributes the powder over multiple powder channels configured to transfer the powder towards the powder dispensers,
        --- the powder distribution unit comprises a powder distributor comprising a distributor discharging opening which is positioned along a distribution path,
        --- each powder channel comprises a channel receiving opening,
        --- the channel receiving openings are positioned along the distribution path and directed towards the distributor discharging opening to receive powder discharged from the distributor discharging opening, and
        --- the packaging system comprises a distribution drive configured to move the distributor discharging opening and the channel receiving openings relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels, and
        ---- wherein optionally the powder filling device comprises multiple dosing chambers, each dosing chamber being configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film.

39. Packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, the packaging system comprising a powder filling device comprising multiple powder dispensers to dispense the powder in compartments provided in the film, and wherein:

- the powder filing device comprises a powder distribution unit which distributes the powder over multiple powder channels configured to transfer the powder towards the powder dispensers,
- the powder distribution unit comprises a powder distributor comprising a distributor discharging opening which is positioned along a distribution path,
- each powder channel comprises a channel re-

ceiving opening,

- the channel receiving openings are positioned along the distribution path and directed towards the distributor discharging opening to receive powder discharged from the distributor discharging opening, and
- the packaging system comprises a distribution drive configured to move the distributor discharging opening and the channel receiving openings relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels, and

-- wherein optionally the powder filling device comprises multiple dosing chambers, each dosing chamber being configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film.

40. Packaging system according to any of the clauses 1 - 37, wherein:

--- the powder filling device comprises a powder distribution unit which distributes the powder over multiple powder channels configured to transfer the powder towards the powder dispensers,
--- the powder distribution unit comprises a powder distributor comprising a distributor discharging opening which is positioned along a distribution path,
--- each powder channel comprises a channel receiving opening,
--- the channel receiving openings are positioned along the distribution path and directed towards the distributor discharging opening to receive powder discharged from the distributor discharging opening, and
-- the packaging system comprises a distribution drive configured to move the distributor discharging opening and the channel receiving openings relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels.

41. Packaging system according to clause 38 - 40, wherein each of the powder channels is in fluid communication with only one of the dosing chambers.

42. Packaging system according to any one of the clauses 38 - 41, wherein each of the dosing chambers is in fluid communication with only one of the powder channels.

43. Packaging system according to any one of the clauses 38 - 42, wherein the distributor discharging opening passes all the channel receiving openings during said cyclical movement of the distributor discharging opening and the channel receiving openings relative to each other.

44. Packaging system according to any one of the clauses 38 - 43, wherein:

- the powder distribution unit is configured to provide a distribution dose of the powder to each of the powder channels, and
- the distribution dose is preferably smaller than the dose of the powder supplied by the dosing chambers.

45. Packaging system according to clause 44, wherein the distribution dose of the powder is smaller than or equal to 50% of the dose of the powder supplied by the dosing chambers, wherein the distribution dose of the powder is preferably smaller than or equal to 1/3rd of the dose of the powder supplied by the dosing chambers, wherein the distribution dose of the powder is preferably smaller than or equal to 25% of the dose of the powder supplied by the dosing chambers, wherein the distribution dose of the powder is preferably smaller than or equal to 20% of the dose of the powder supplied by the dosing chambers.

46. Packaging system according to clause 44 or 45, wherein the distribution dose of the powder is larger than or equal to 5% of the dose of the powder supplied by the dosing chambers, wherein the distribution dose of the powder is preferably larger than or equal to 10% of the dose of the powder supplied by the dosing chambers, and wherein the distribution dose of the powder is preferably larger than or equal to 20% of the dose of the powder supplied by the dosing chambers.

47. Packaging system according to any one of the clauses 44 - 46, wherein the powder distribution unit is configured to provide the distribution dose of the powder to each of the powder channels during one cycle of the cyclical movement of the powder distributor along the distribution path.

48. Packaging system according to any one of the claims 44 - 47, wherein:

- each of the powder channels comprises a distribution dose channel section located at the channel receiving opening,
- the distribution dose channel sections have a dose channel section volume which corresponds to the distribution dose of the powder, and

- the distribution dose channel sections are configured to receive the distribution dose of powder from the powder distributor during one cycle or multiple cycles of the cyclical movement of the powder distributor along the distribution path and to subsequently supply said distribution dose of powder further downstream the powder channels, and
- wherein optionally the powder filling device is configured to completely fill the distribution dose channel sections with powder before said distribution dose channel sections supply said distribution dose of powder further downstream the powder channels.

49. Packaging system according to clause 48, wherein:

- the distribution dose channel sections are movable from a first dose channel position in which the distribution dose channel sections are not in fluid communication with a downstream part of the powder channels into a second dose channel position in which the distribution dose channel sections are in fluid communication with the downstream part of the powder channels, and vice versa, and
- the powder distribution unit is configured to provide the distribution dose of the powder with the powder distributor to the distribution dose channel sections located in the first dose channel position and to subsequently move the distribution dose channel sections channel into the second dose channel position in order to supply said distribution dose of powder further downstream the powder channels, and
- wherein optionally the powder filling device comprises a first channel drive to move the distribution dose channel sections from the first dose channel position into the second dose channel position, and vice versa.

50. Packaging system according to any one of the clauses 38 - 49, wherein:

- each of the powder channels comprises a first channel section and a second channel section,
- the first channel sections are located between the channel receiving openings and the second channel sections,
- the second channel sections are located between the first channel sections and the dosing chambers, and
- the second channel sections are movable from a first channel position in which the second channel sections receive powder from the first channel sections into a second channel position in which the second channel sections discharge powder in the dosing chambers, and vice versa, and
- wherein optionally the powder filling device comprises a second channel drive to move the second channel sections from the first channel position into the second channel position, and vice versa,
- wherein optionally the first channel sections have a first channel section volume, which first channel section volume is preferably larger than the dose of powder, and
- wherein optionally the second channel sections have a second channel section volume, which second channel section volume is preferably larger than the dose of powder, and
- wherein optionally the first channel section volume and the second channel section volume are together larger than the dose of powder, and
- wherein optionally the powder filling device is configured to completely fill the first channel sections with powder before said first channel sections transfer said powder towards the second channel sections, and
- wherein optionally the powder filling device is configured to completely fill the second channel sections with powder before said second channel sections transfer said powder towards the powder dispensers, preferably the dosing chambers.

51. Packaging system according to clause 50, wherein:

- the second channel sections located in the first channel position are in fluid communication with the first channel sections and not in fluid communication with the dosing chambers, and
- the second channel sections located in the second channel position in fluid communication with the dosing chambers and not in fluid communication with the first channel sections.

52. Packaging system according to clause 50 or 51, wherein the first channel sections and/or the dosing chambers are static.

53. Packaging system according to any one of the clauses 50 - 52, wherein:

- the distribution dose channel sections are located between the channel receiving openings and the first channel sections, and
- the distribution dose channel sections located in the second dose channel position supply said distribution dose of powder to the first channel sections.

54. Packaging system according to any one of the

clauses 50 - 53, wherein:

- the first channel sections and the second channel sections are located at a first distance from each other to form a first powder space between the first channel sections and the second channel sections, and
- the powder filling device is configured to in use fill the first powder space with the powder.

55. Packaging system according to the preceding clause, wherein the second channel sections are provided with upwardly extending first containment walls to hold the powder in the first powder space.

56. Packaging system according to any one of the clauses 50 - 55, wherein:

- the second channel sections and the dosing chambers are located at a second distance from each other to form a second powder space between the second channel sections and the dosing chambers, and
- the powder filling device is configured to in use fill the second powder space with the powder.

57. Packaging system according to the preceding clause, wherein the dosing chambers are provided with upwardly extending second containment walls to hold the powder in the second powder space.

58. Packaging system according to any one of the clauses 50 - 57, wherein:

- the distribution dose channel sections and the first channel sections are located at a third distance from each other to form a third powder space between the distribution dose channel sections and the first channel sections, and
- the powder filling device is configured to in use fill the third powder space with the powder.

59. Packaging system according to the preceding clause, wherein the first channel sections are provided with upwardly extending third containment walls to hold the powder in the third powder space.

60. Packaging system according to any one of the clauses 50 - 59, wherein:

- the distribution path is a circular path, and
- the channel receiving openings, the first channel sections, the second channel sections, and the dosing chamber are positioned in a circular configuration.

61. Packaging system according to any one of the clauses 50 - 60, wherein the distribution path, the channel receiving openings, the first channel sections, the second channel sections, and the dosing chambers surround a longitudinal device axis of the powder filling device.

62. Packaging system according to any one of the clauses 50 - 61, wherein the channel receiving openings, the first channel sections, the second channel sections, and the dosing chamber are coaxially positioned relative to a longitudinal device axis of the powder filling device.

63. Packaging system according to any of the clauses 38 - 62, wherein the distribution drive is configured to move the distributor discharging opening relative to all the channel receiving openings at a same speed.

64. Packaging system according to any of the clauses 38 - 63, wherein the distribution drive is configured to move the distributor discharging opening along all the channel receiving openings at a same speed.

65. Packaging system according to any of the clauses 38 - 64, wherein the distribution drive is configured to move the distributor discharging opening with a cyclical circular movement.

66. Packaging system according to any one of the preceding clauses, wherein the packaging system comprises a further film supplying device configured to position a water-soluble further film on the film and over the powder in the compartments in order to form a web of pouches holding the powder between the film and the further film.

67. Packaging system according to any one of the preceding clauses, wherein the packing system comprises multiple moulds, each mould having a mould cavity for forming a compartment in the film.

68. Packaging system according to any one of the preceding claims, wherein the packing system comprises a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein optionally the moulds are moved along a film supplying device configured to position the film on the moulds and/or a compartment forming device configured to position parts of the film in the mould cavities to form the compartments in the film and/or the powder filling device.

69. Packaging system according to any one of the preceding clauses, wherein the packing system comprises a film supplying device configured to position the film on the moulds.

70. Packaging system according to any one of the preceding clauses, wherein the packing system comprises a compartment forming device configured to position parts of the film in the mould cavities to form the compartments in the film.

71. Packaging system according to any one of the preceding clauses, wherein the packing system comprises the packaging system comprises a powder supply for supplying the powder to the powder filing device.

72. Packaging system according to any one of the preceding clauses, and in combination with clause 49 or 50, wherein the packaging system comprises a distribution control unit configured to control the distribution drive, the first channel drive and/or the second channel drive.

73. Packaging system according to clause 72, wherein the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to ensure a timely dispensing of the powder in the compartments, more specifically to ensure a timely dispensing the doses of powder in the compartments.

74. Packaging system according to clause 72 or 73, wherein the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to ensure the first channel section and the second channel section of each of the powder channels together hold more powder than the dose of powder before transferring the powder towards one of the dosing chambers.

75. Packaging system according to clause 72 or 73, wherein the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to ensure the first channel section and the second channel section of each of the powder channels each hold more powder than the dose of powder before to transferring the powder towards one of the dosing chambers.

76. Packaging system according to any one of the clauses 72 - 75, wherein the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to completely fill the distribution dose channel sections with powder before said distribution dose channel sections supply said distribution dose of powder further downstream the powder channels.

77. Packaging system according to any one of the clauses 72 - 76, wherein the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to completely fill the first channel sections with powder before said first channel sections transfer said powder towards the second channel sections.

78. Packaging system according to any one of the clauses 72 - 77, wherein the distribution control unit is configured to control the distribution drive, the first channel drive and/or the second channel drive to completely fill the second channel sections with powder before said second channel sections transfer said powder towards the powder dispensers, preferably the dosing chambers.

79. Method for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, with the packaging system according to any one of the preceding clauses, said method comprising deforming said at least one side wall and moving at least part of said inner side wall surface along the adjustment path extending transverse, preferable perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

80. Method for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, with the packaging system according any one of the clauses 1 - 78 and in combination with any one of the clauses 38 - 40, said method comprising moving the distributor discharging opening of the powder distributor and the channel receiving openings of the powder channels relative to each other with a cyclical movement along the distribution path to supply powder from the powder distributor to all the powder channels.

It will be apparent to those skilled in the art that various modifications can be made to the packaging system and the method disclosed in the figures without departing from the scope as defined in the claims.

Claims

1. Packaging system for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, the packaging system comprising:

- multiple moulds, each mould having a mould cavity for forming a compartment in the film, and
- a mould conveyor configured to move the moulds in a conveying direction along a mould trajectory, such as an endless mould trajectory, and wherein the moulds are moved along:

-- a film supplying device configured to position the film on the moulds,
-- a compartment forming device configured

to position parts of the film in the mould cavities to form the compartments in the film,
-- a powder filling device comprising multiple powder dispensers to dispense the powder in the compartments, and wherein:

--- the packaging system comprises a powder supply for supplying the powder to the powder filing device,
--- the powder filling device comprises multiple dosing chambers,
--- each dosing chamber is configured to supply a dose of the powder via one of the powder dispensers into one of the compartments of the film,
--- each dosing chamber comprises at least one side wall forming an inner side wall surface surrounding a longitudinal chamber axis of the dosing chamber,
--- said inner side wall surface defines a dosing volume of the dosing chamber,
--- at least part of said at least one side wall is flexible and configured to allow deformation of said at least one side wall, and
--- the powder filling device comprises for each of the dosing chambers a deformation unit configured to deform said at least one side wall and to move at least part of said inner side wall surface along an adjustment path extending transverse, preferable perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

2. Packaging system according to claim 1, wherein the deformation unit is configured to move said at least part of the inner side wall surface from a first position in which the dosing chamber has a first dosing volume towards and/or into a second position in which the dosing chamber has a second dosing volume, and vice versa.

3. Packaging system according to claim 2, wherein

- the deformation unit is configured to move said at least part of the inner side wall surface from the first position in a first direction along the adjustment path and towards and/or into the second position,
- the deformation unit is configured to move said at least part of the inner side wall surface from the second position in a second direction along the adjustment path and towards and/or into the first position, and
- the second direction is preferably opposite to the first direction.

4. Packaging system according to claim 2 or 3, wherein the deformation unit is configured to hold said at least part of the inner side wall surface in multiple intermediate positions between the first position and the second position, which multiple intermediate positions form multiple intermediate dosing volumes between the first dosing volume and the second dosing volume.

5. Packaging system according to any one of the claims 2 - 4, wherein:

- said at least one side wall comprises a first wall part located at a first surface part of the inner side wall surface and a second wall part located at a second surface part of the inner side wall surface,
- the deformation unit is configured to move said first surface part and said second surface part from the first position towards and/or into the second position, and vice versa,
- said first direction of the second surface part is preferably opposite to said first direction of the first surface part, and
- said second direction of the second surface part is preferably opposite to said second direction of the first surface part.

6. Packaging system according to claim 5, wherein said second surface part and said first surface part are facing each other.

7. Packaging system according to any one of the preceding claims, wherein the powder filling device comprises a filling control unit configured to control the deformation units in order to adjust the dosing volume of the dosing chambers.

8. Packaging system according to claim 7, wherein:

- the packaging system comprises a density measurement device configured to measure a density of the powder upstream of the dosing chambers,
- the density measurement device is in communication with the filling control unit, and
- the filling control unit is configured to control the deformation units to adjust the dosing volume of the dosing chambers in order to supply the doses of the powder with a predetermined powder dose mass.

9. Packaging system according to claim 8, wherein the density measurement device is configured to provide a density measurement output signal based on the measured density of the powder, and the filling control unit is configured to automatically control the deformation units on basis of the density measure-

ment output signal from the density measurement device in order to supply the doses of the powder with a predetermined powder dose mass.

10. Packaging system according to claim 8 or 9, wherein the density measurement device comprises a powder sample unit configured to provide a sample dose of the supplied powder upstream of the dosing chambers, and the density measurement device is configured to measure a density of the sample dose of the powder.

11. Packaging system according to any one of the claims 7 - 10, wherein:

- the packaging system comprises a pouch measurement device configured to measure a characteristic of the pouches,
- the pouch measurement device is in communication with the filling control unit, and
- the filling control unit is configured to control the deformation units to adjust the dosing volume of the dosing chambers in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

12. Packaging system according to claim 11, wherein the pouch measurement device is configured to provide a pouch measurement output signal based on the measured characteristic of the pouches, and the filling control unit is configured to automatically control the deformation units on basis of the pouch measurement output signal from the pouch measurement device in order to supply the doses of the powder required to achieve a predetermined value of the measured characteristic.

13. Packaging system according to claim 11 or 12, wherein the characteristic measured by the pouch measurement device is a mass of the pouches.

14. Packaging system according to any one of the claims 11 - 13, wherein the characteristic measured by the pouch measurement device is a volume of the pouches.

15. Method for producing pouches comprising a water-soluble film and a powder, such as a detergent powder, with the packaging system according to any one of the preceding claims, said method comprising deforming said at least one side wall and moving at least part of said inner side wall surface along the adjustment path extending transverse, preferable perpendicular, to the longitudinal chamber axis in order to adjust said dosing volume.

Fig. 1

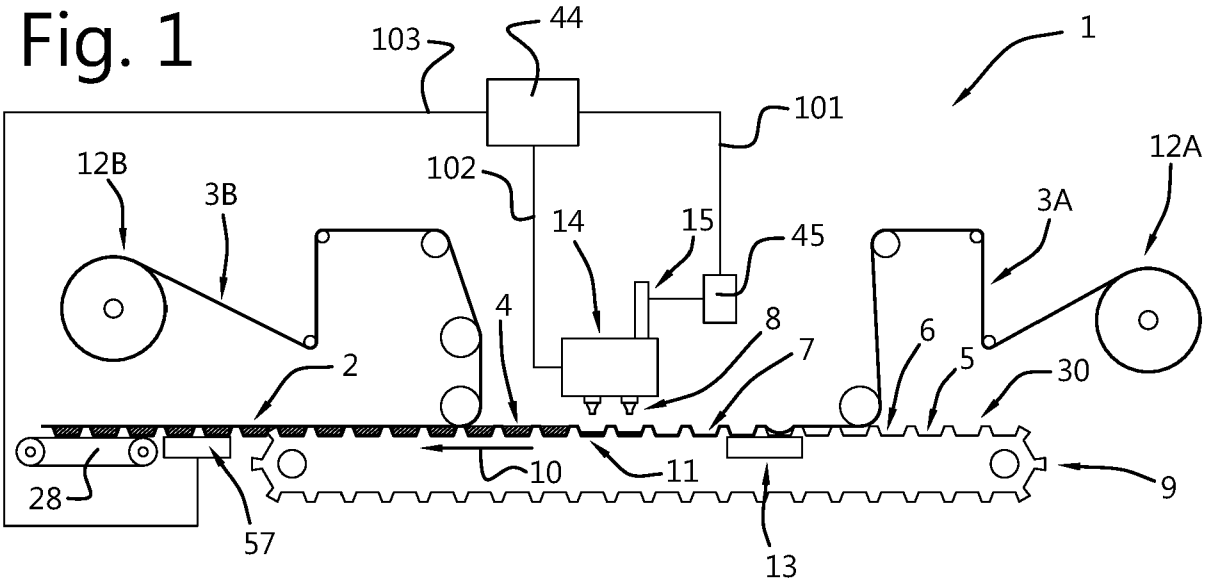

103
44
1
101
12B
3B
102
14
15
45
12A
3A
4
8
7
6
5
30
2
10
11
9
28
57
13

Fig. 2

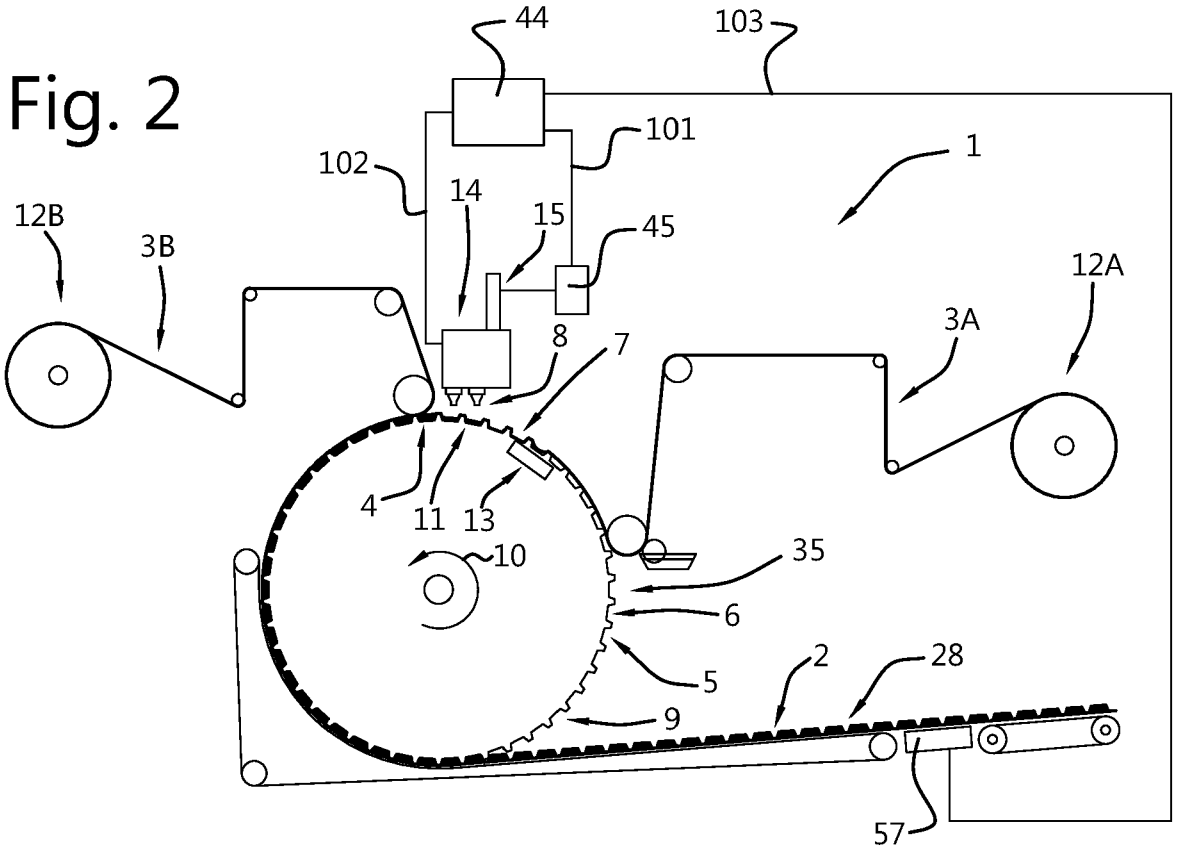

44
103
101
1
102
14
15
45
12B
3B
12A
3A
8
7
4
11
13
10
35
6
5
2
28
9
57

Fig. 3A

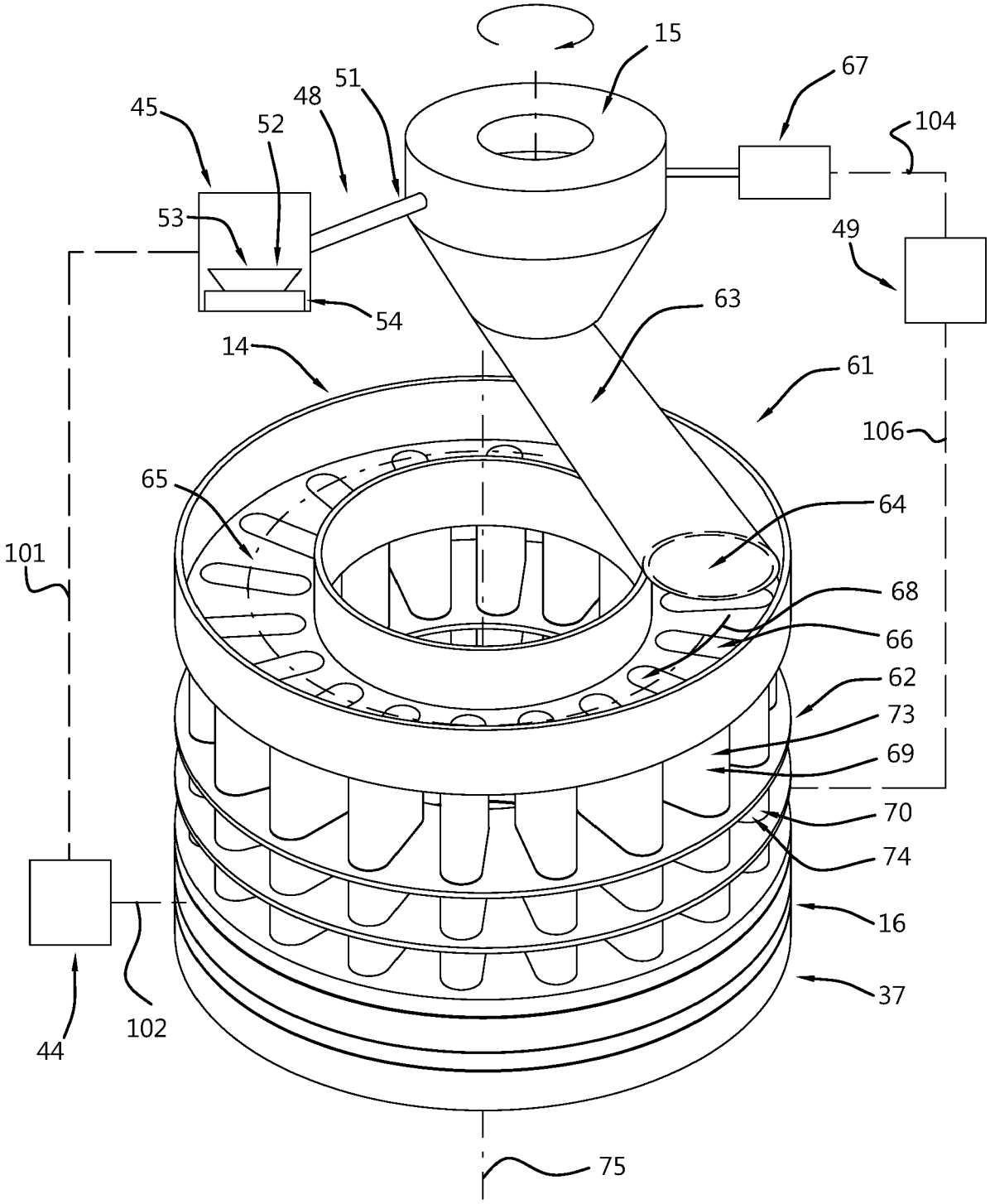
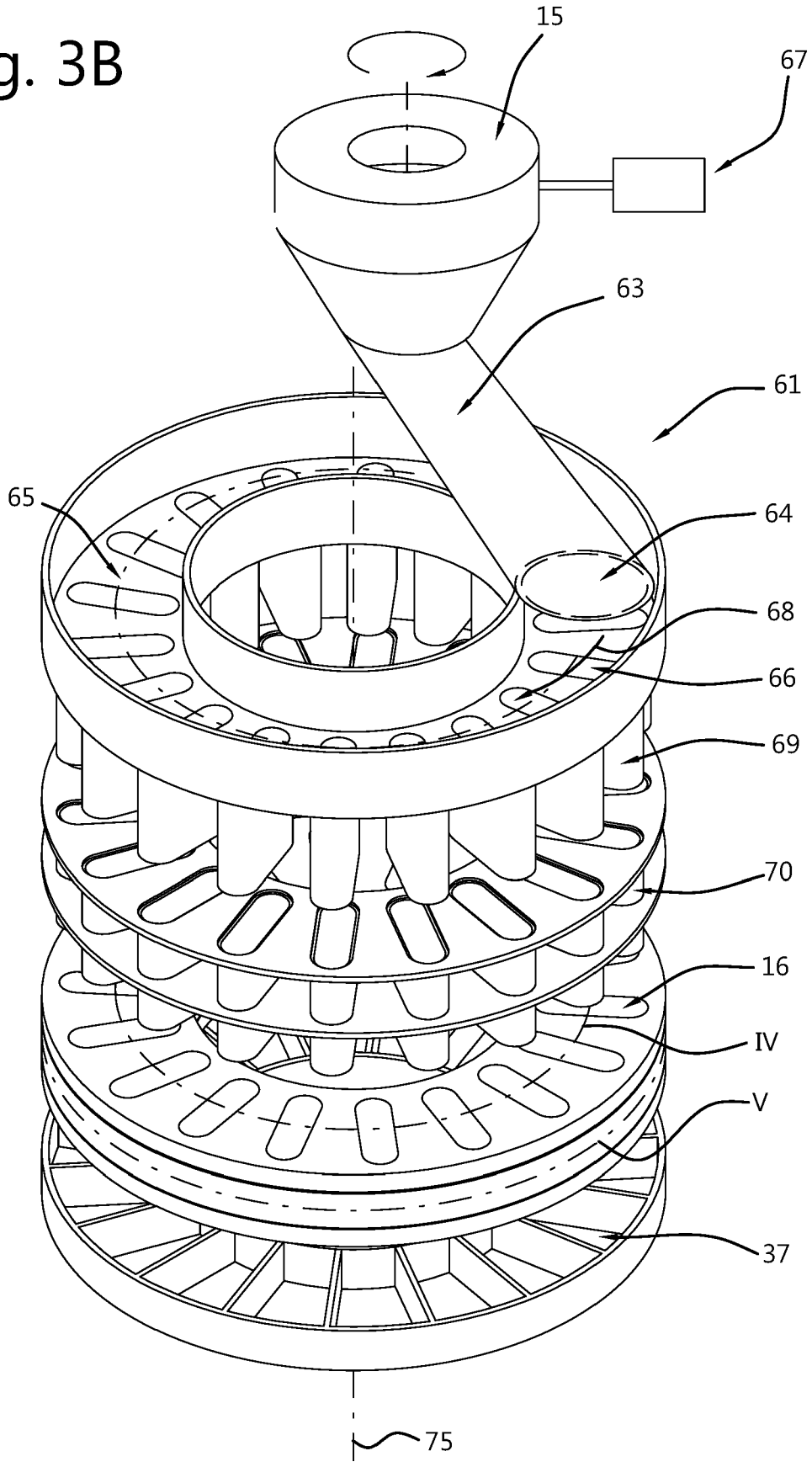

15
67
104
45
52
48
51
53
49
54
63
14
61
106
65
64
101
68
66
62
73
69
70
74
16
37
44
102
75

Fig. 3B



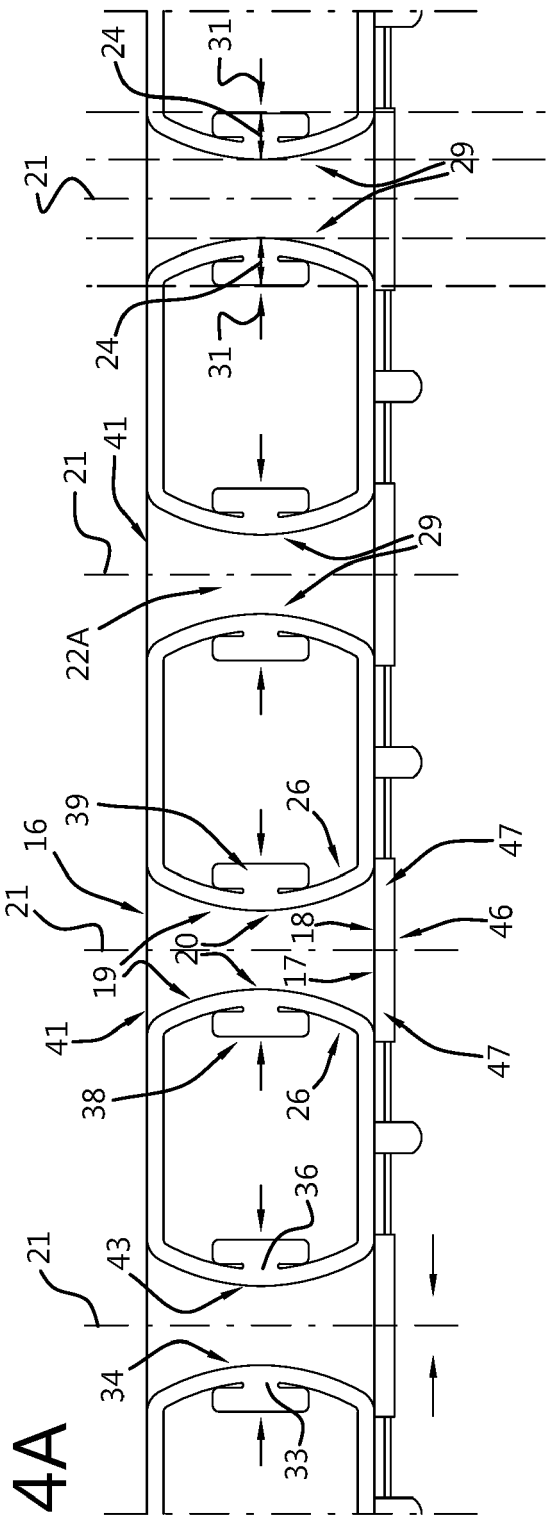

21
24
31
29
22A
41
16
39
26
47
46
18
20
19
17
38
36
43
34
33

Fig. 4A

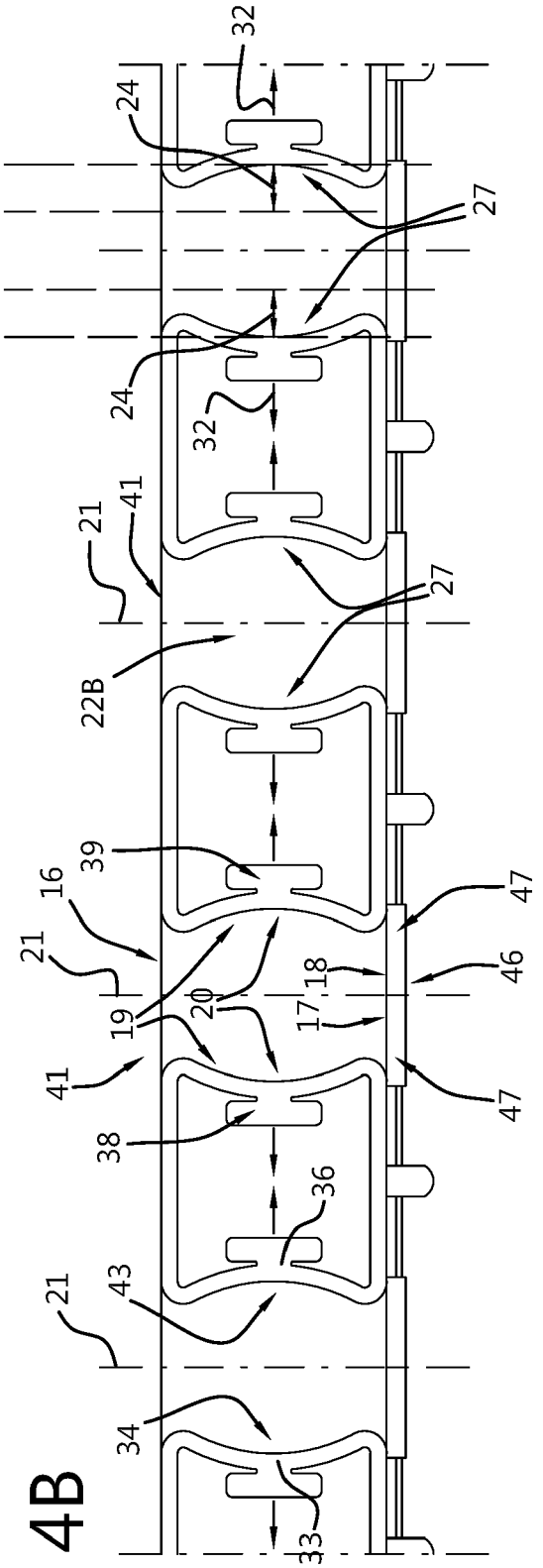

32
24
27
22B
41
21
39
16
47
46
18
20
19
17
38
36
43
34
33

Fig. 4B

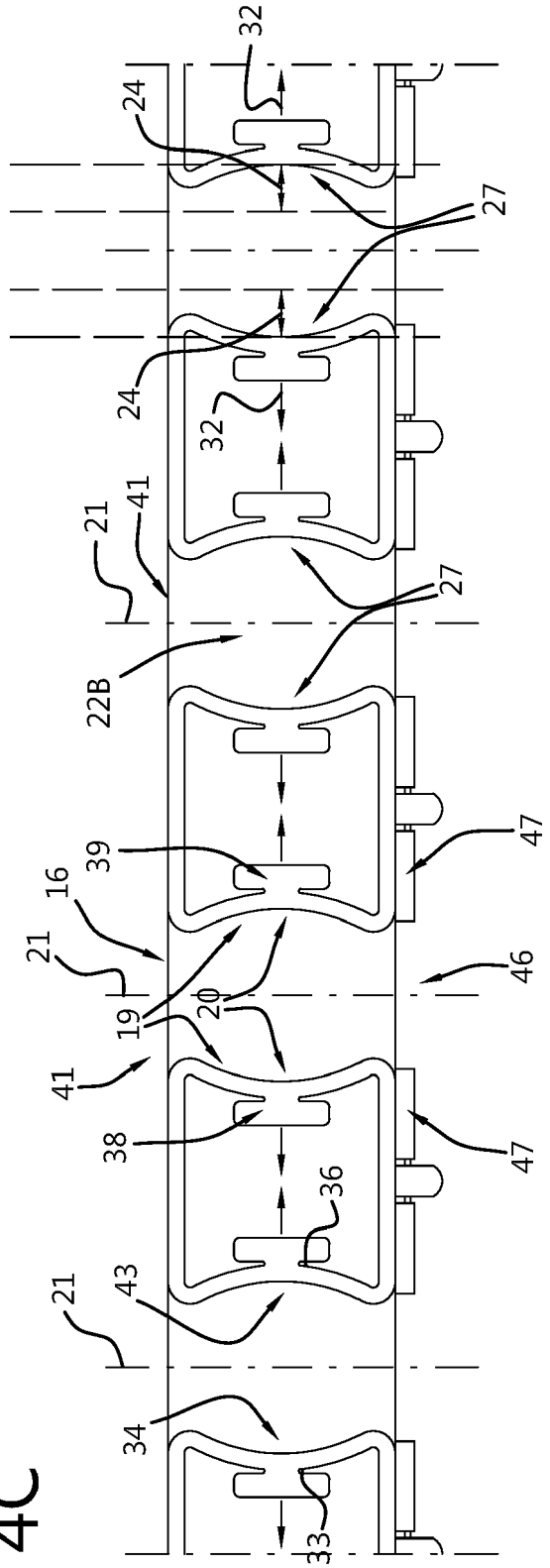


Fig. 4C

Fig. 5A

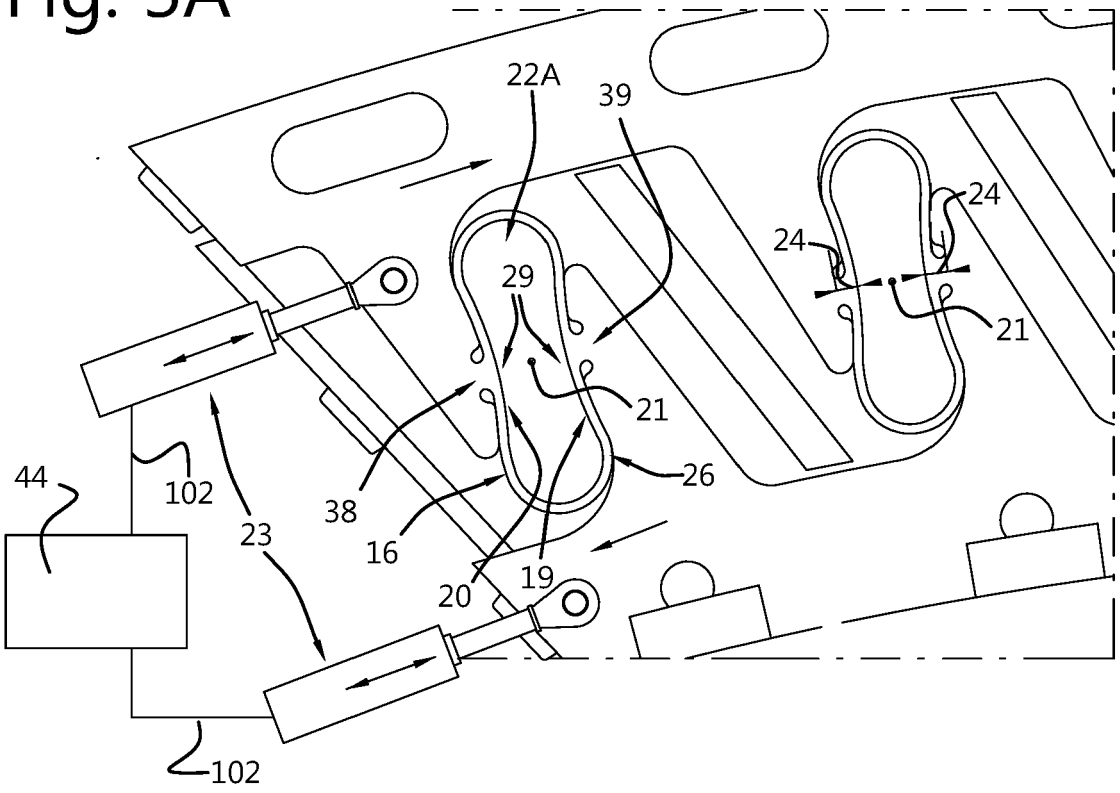

22A
39
24
24
29
21
21
26
44
102
38
23
16
19
20
102

Fig. 5B

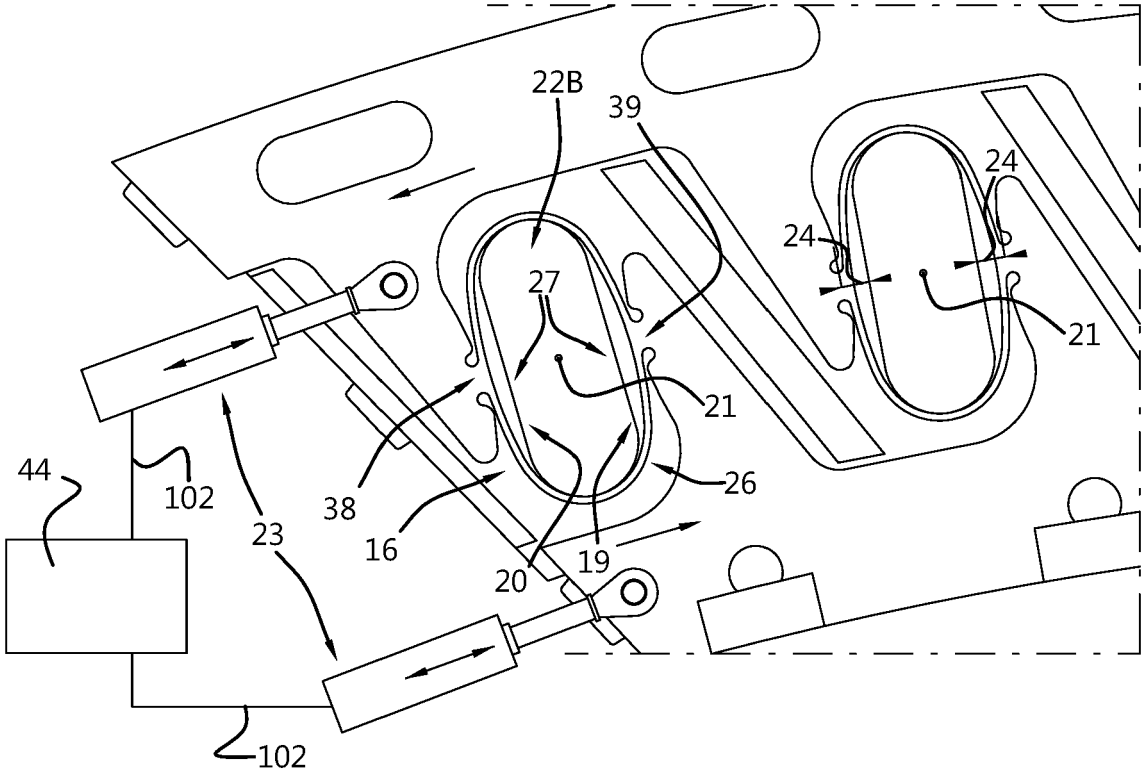

22B
39
24
24
27
21
21
26
44
102
38
23
16
19
20
102

Fig. 6

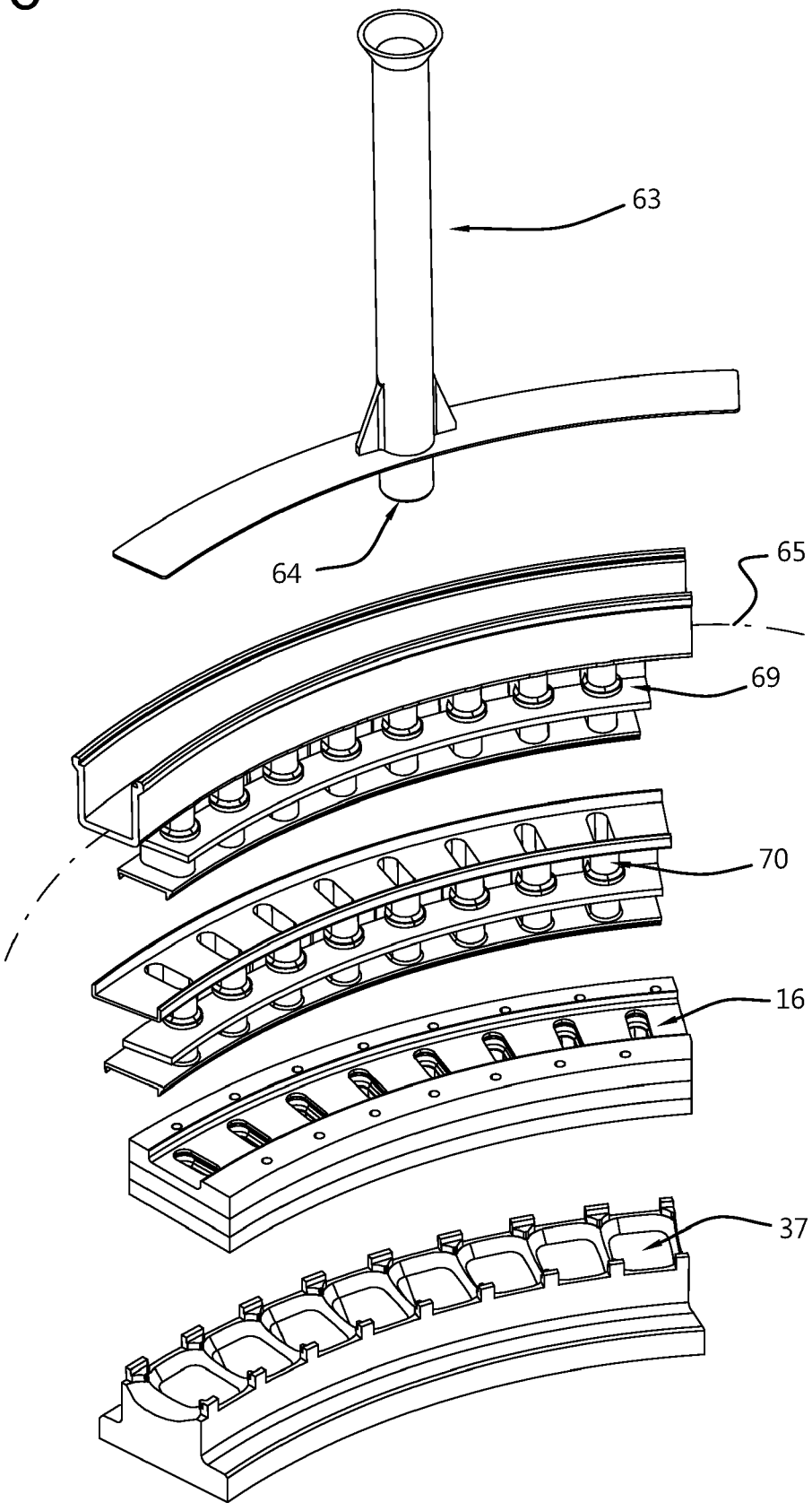


Fig. 7

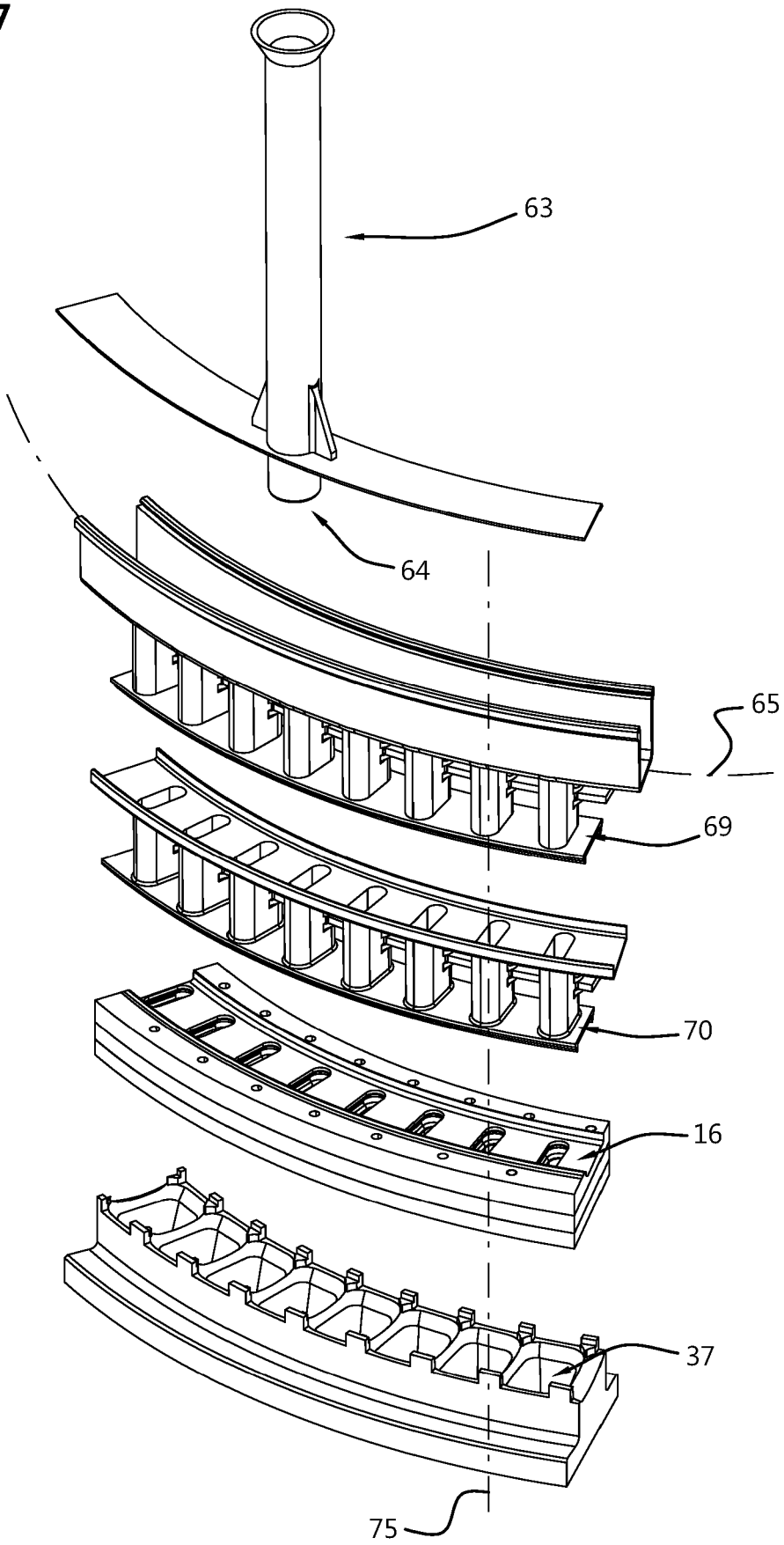


Fig. 8

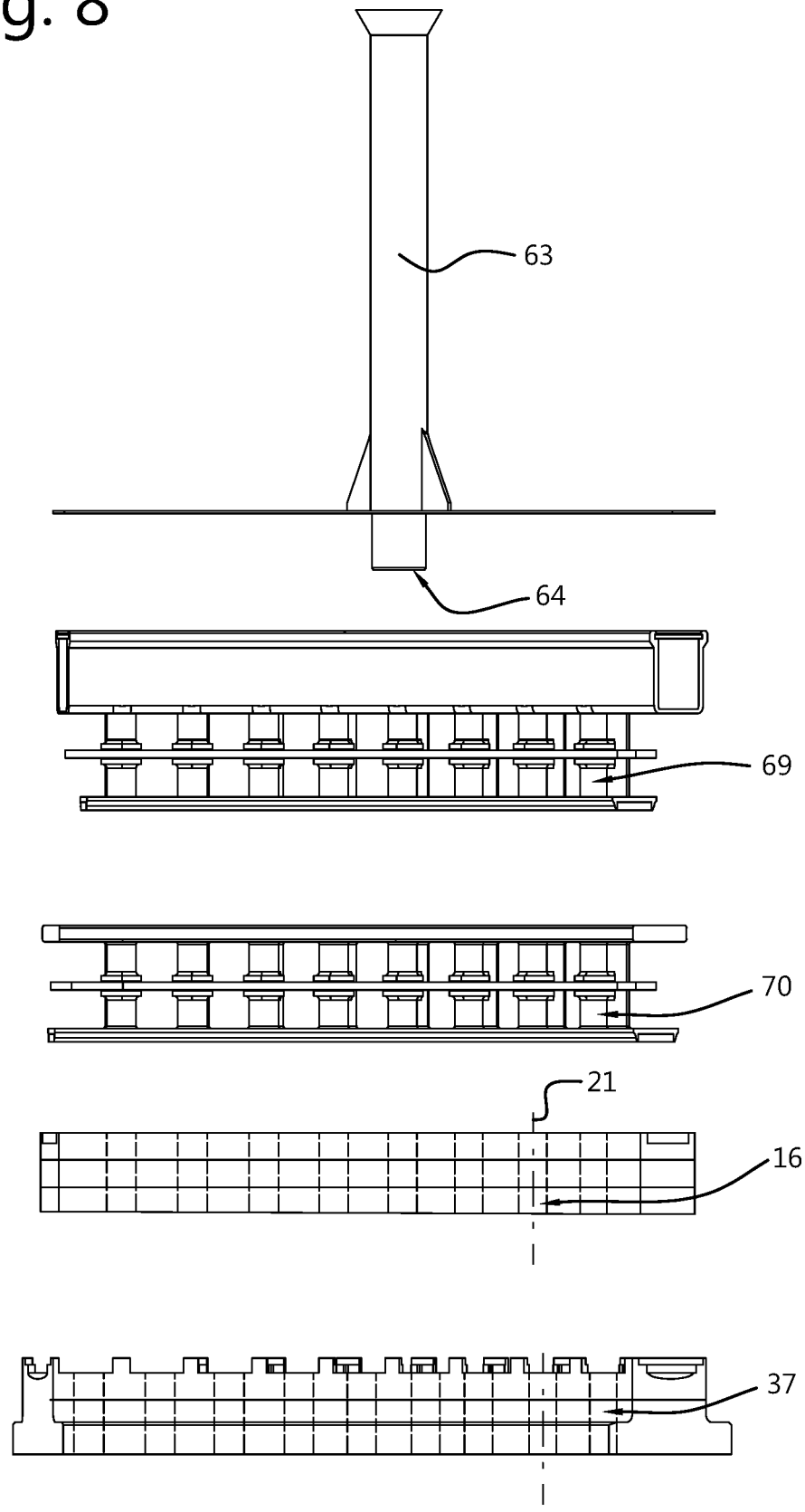


Fig. 9

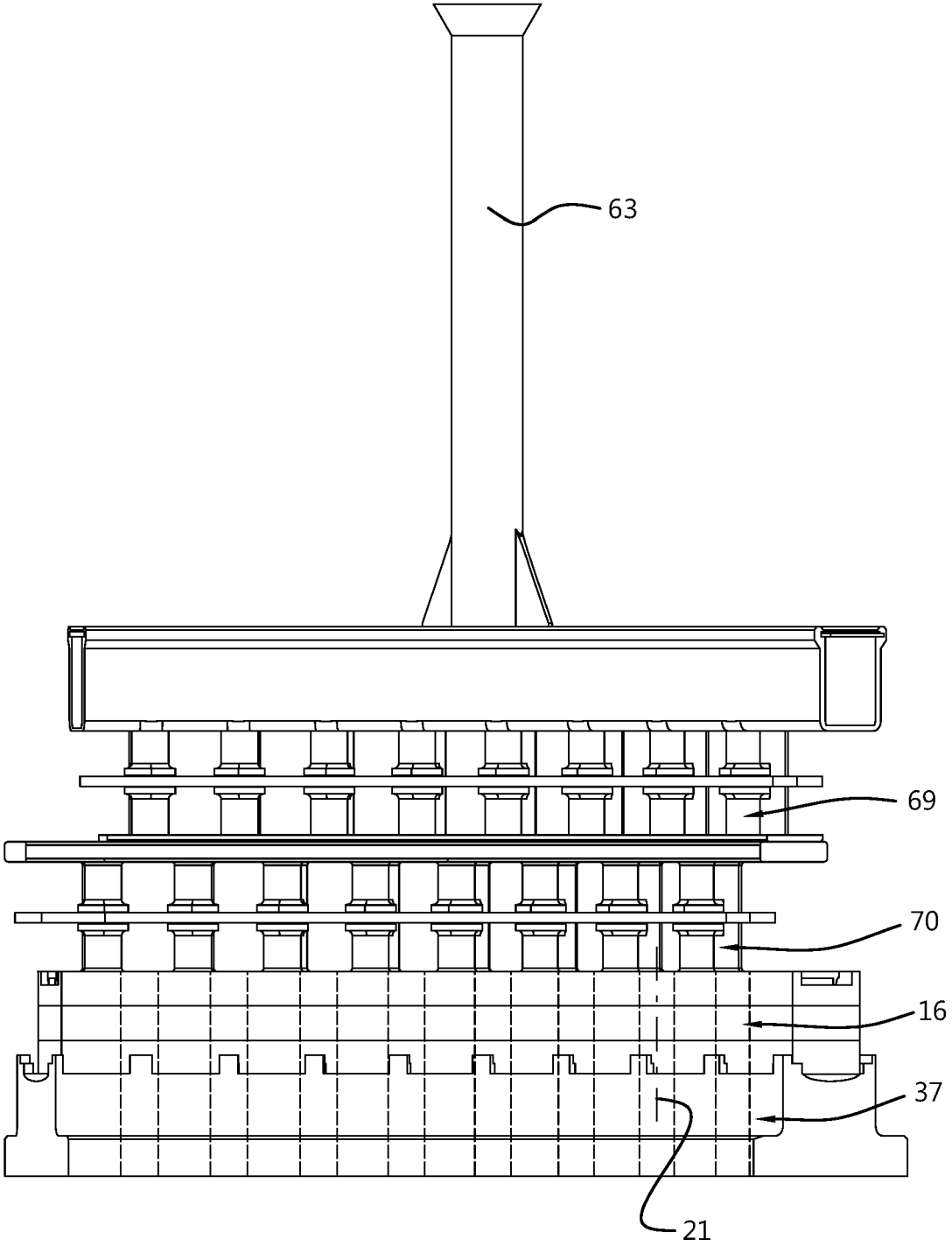


Fig. 10B

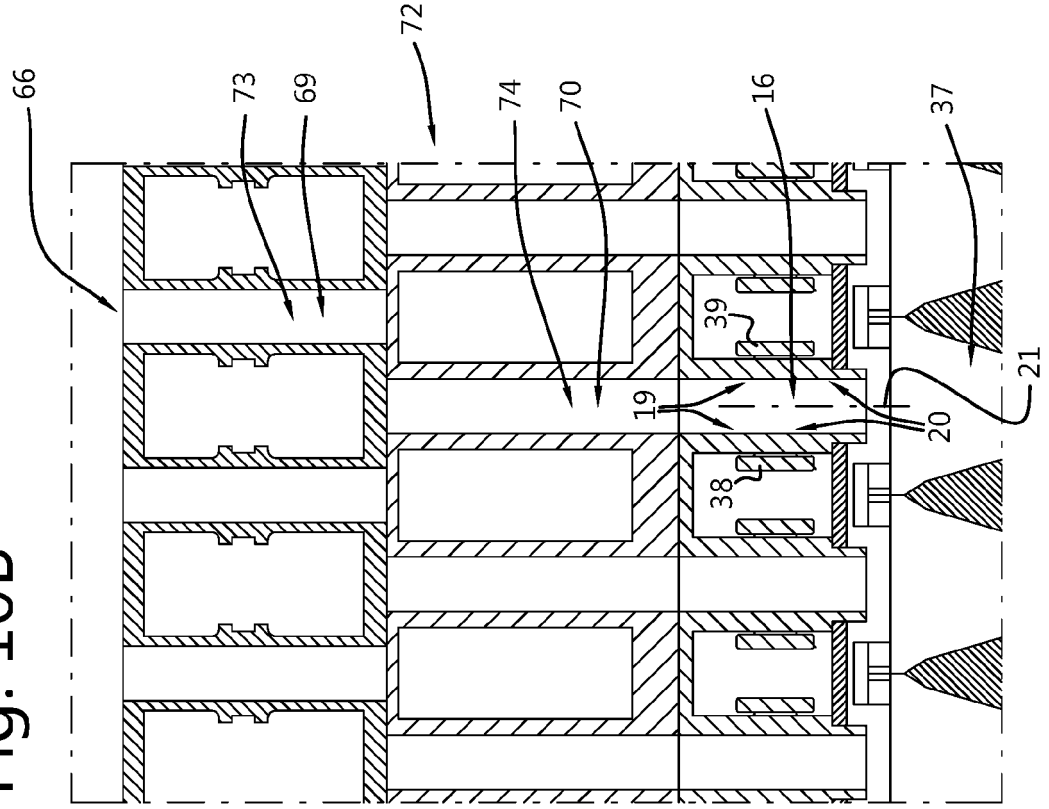


Fig. 10A

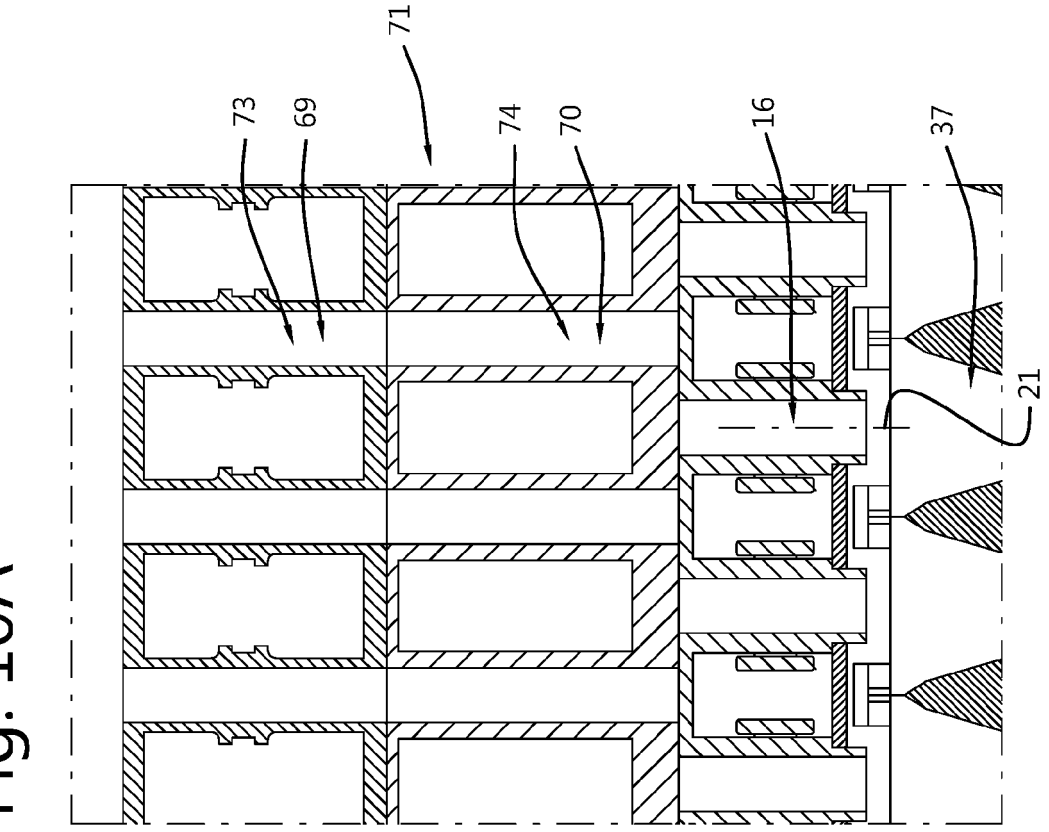


Fig. 11A

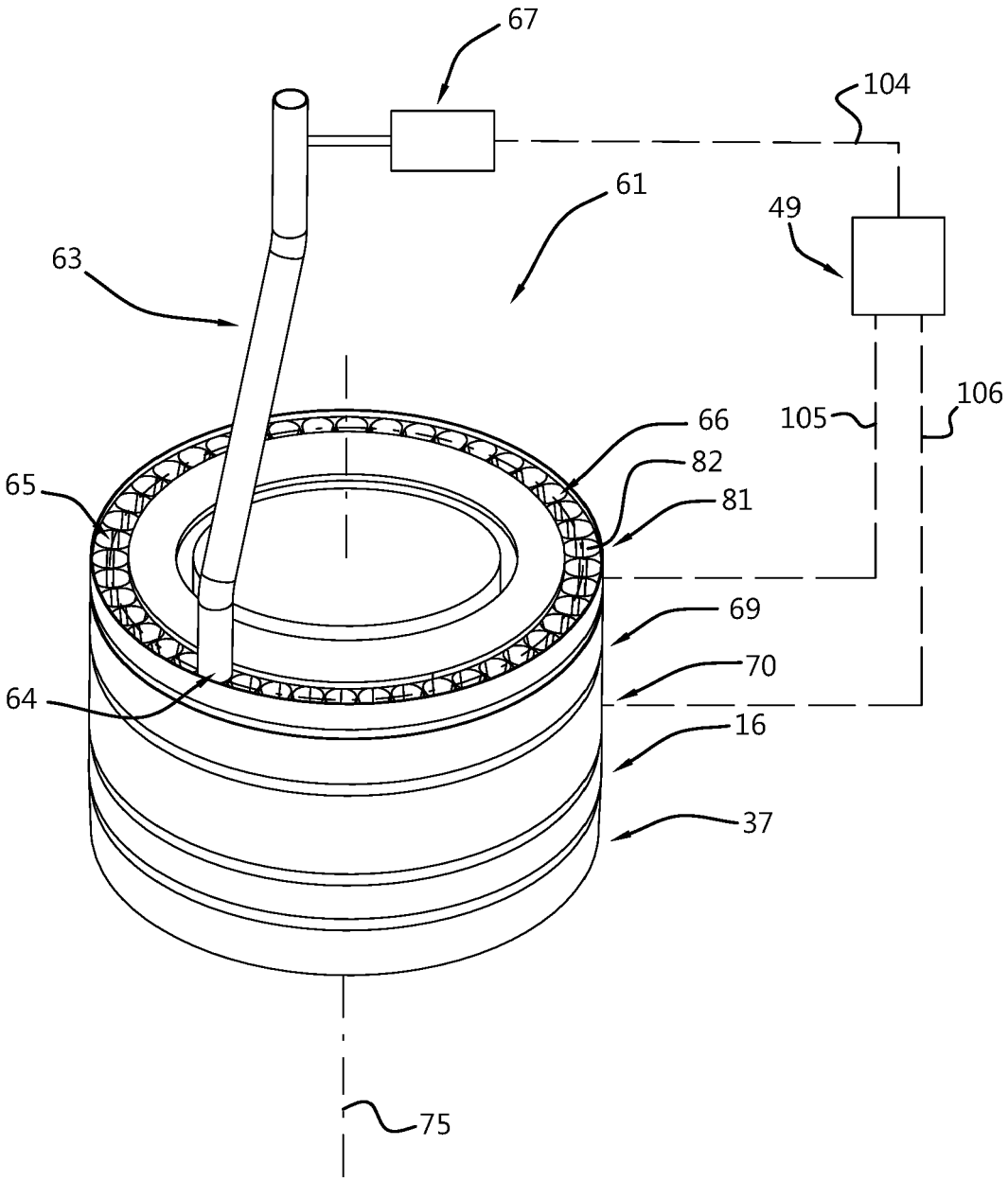
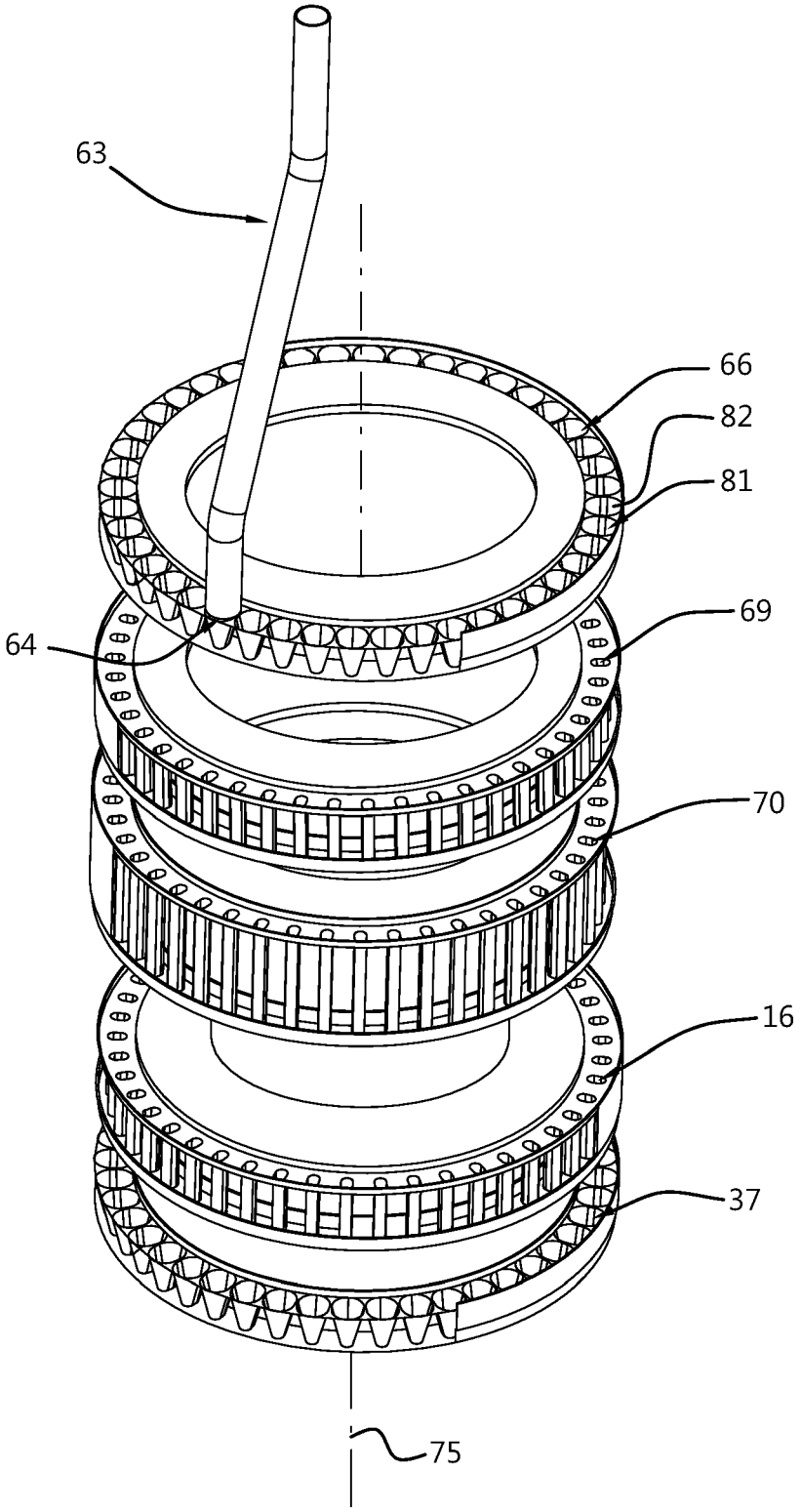


Fig. 11B



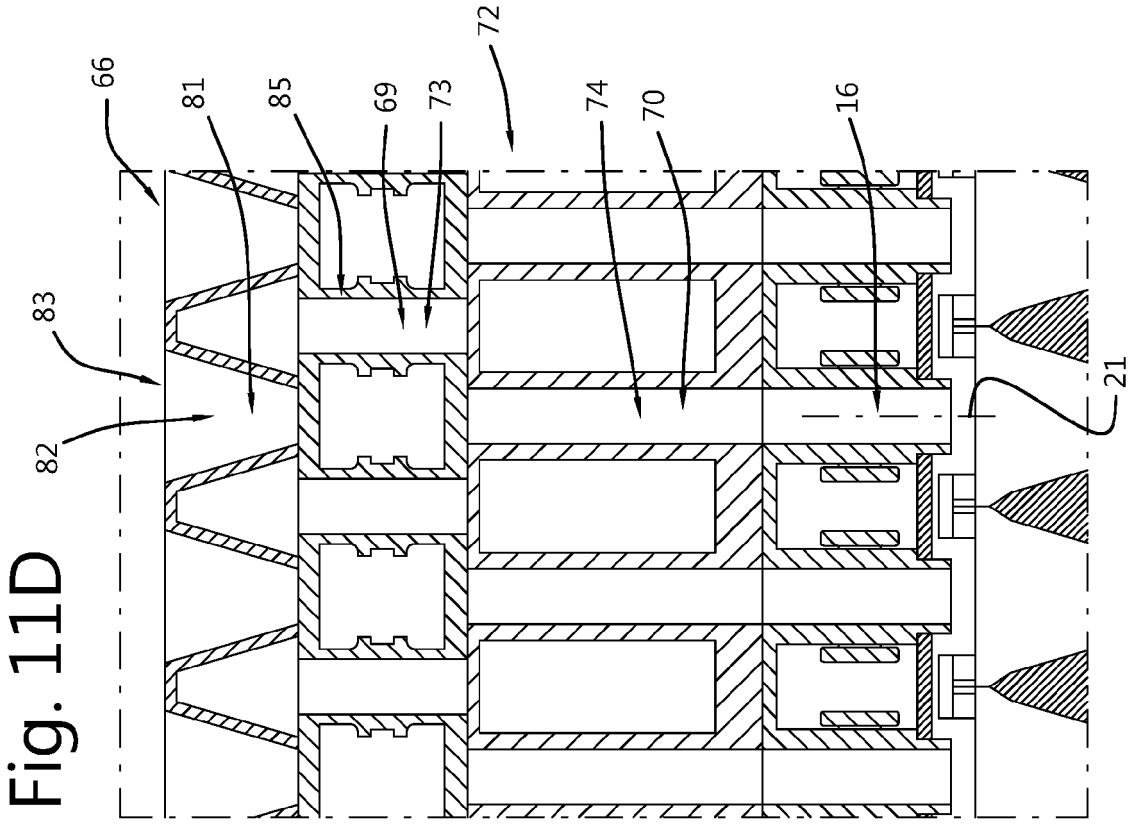


Fig. 11D

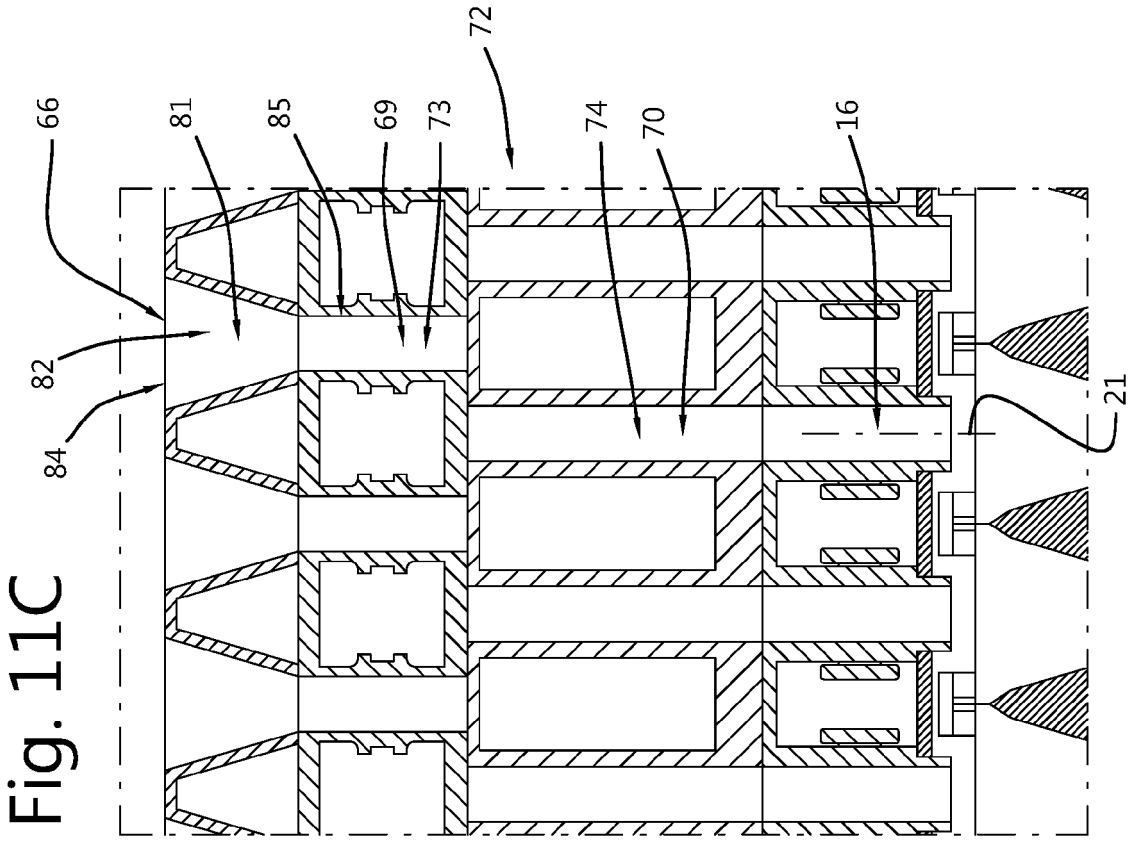
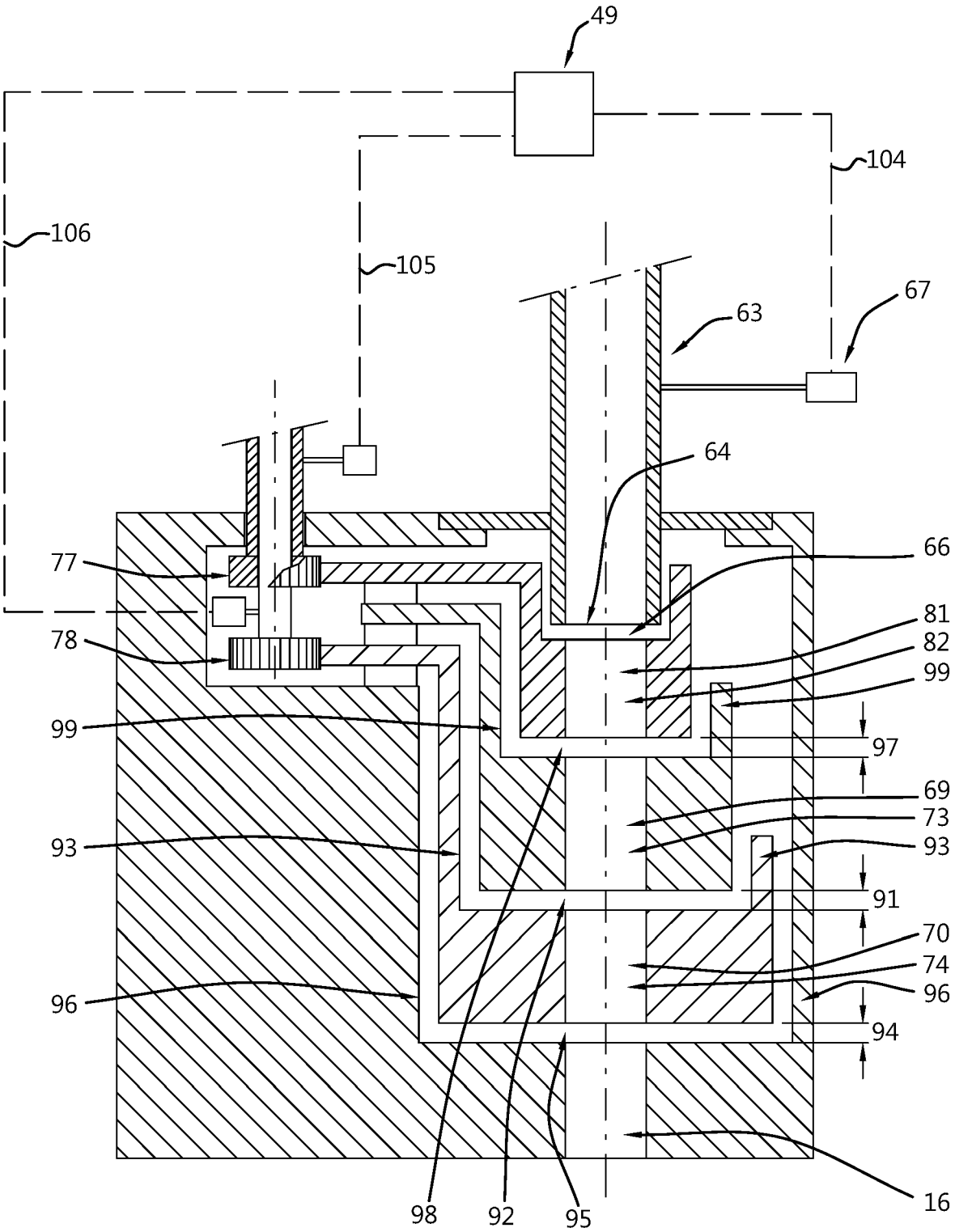


Fig. 11C

Fig. 12


49
104
106
105
67
63
64
66
77
78
81
82
99
99
97
69
73
93
93
91
70
74
96
96
94
16
98
92
95

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 19 3909

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2018/190708 A1 (EME ENGEL MACHF EN ENGINEERING B V [NL]) 18 October 2018 (2018-10-18) * page 11, lines 25-29; figures 1A, 8A, 9A, 10C * * page 7, lines 10-11 *	1-15	INV. B65B9/067 B65B39/02 B65B59/00 ADD. B65B39/00
A	US 2017/088298 A1 (MCLENITHAN THOMAS M [US] ET AL) 30 March 2017 (2017-03-30) * figures 13-18 *	1-15	
A	WO 2013/058236 A1 (TAKAZONO TECHNOLOGY INC [JP]) 25 April 2013 (2013-04-25) * figures 1-6 *	1	
A	EP 0 932 030 A1 (UNILEVER NV [NL]; UNILEVER PLC [GB]) 28 July 1999 (1999-07-28) * paragraph [0003]; figures 1-10 *	1	
A	US 3 308 898 A (ALLEN KENNETH M ET AL) 14 March 1967 (1967-03-14) * figures 1-4 *	1	TECHNICAL FIELDS SEARCHED (IPC) B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 December 2024	Garlati, Timea

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 19 3909

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-12-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018190708 A1	18-10-2018	CA 3057426 A1	18-10-2018
		EP 3609789 A1	19-02-2020
		ES 2731236 A2	14-11-2019
		ES 2900165 T3	16-03-2022
		PL 3609789 T3	21-02-2022
		RS 62745 B1	31-01-2022
		US 2021163160 A1	03-06-2021
		WO 2018190708 A1	18-10-2018
US 2017088298 A1	30-03-2017	CA 2943138 A1	25-03-2017
		US 2017088298 A1	30-03-2017
		US 2021229842 A1	29-07-2021
		US 2023106482 A1	06-04-2023
WO 2013058236 A1	25-04-2013	AU 2012327145 A1	22-05-2014
		CA 2852894 A1	25-04-2013
		CN 103796920 A	14-05-2014
		EP 2769920 A1	27-08-2014
		EP 3042855 A1	13-07-2016
		JP 6244076 B2	06-12-2017
		JP 2013086869 A	13-05-2013
		KR 20140080476 A	30-06-2014
		US 2014239016 A1	28-08-2014
		WO 2013058236 A1	25-04-2013
EP 0932030 A1	28-07-1999	CA 2257027 A1	21-07-1999
		EP 0932030 A1	28-07-1999
		US 6253968 B1	03-07-2001
US 3308898 A	14-03-1967	NONE	

EPO FORM P0459

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