



(51) International Patent Classification:
B65B 1/24 (2006.01)

(21) International Application Number:
PCT/US2016/064913

(22) International Filing Date:
5 December 2016 (05.12.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
14/987,401 4 January 2016 (04.01.2016) US

(71) Applicant: **SIEMENS HEAL THCARE DIAGNOSTICS INC.** [US/US]; 511 Benedict Avenue, Tarrytown, NY 10591-5098 (US).

(72) Inventors: **MISHRA, Anant, Kumar**; 1489, 2 Floor, 9th A Main, Srinivasanagar, Banshankari, Bangalore, Karnataka 560050 (IN). **NAIR, Sudev**; #76, Pooja Residency, 13th Cross, Sarakki Main, Road J P Nagar 1st Phase,

Bangalore 560078 (IN). **SURESH, Suhas**; 961, 1st E Main Girinagar, 2nd Stage, Bangalore, 560085 (IN).

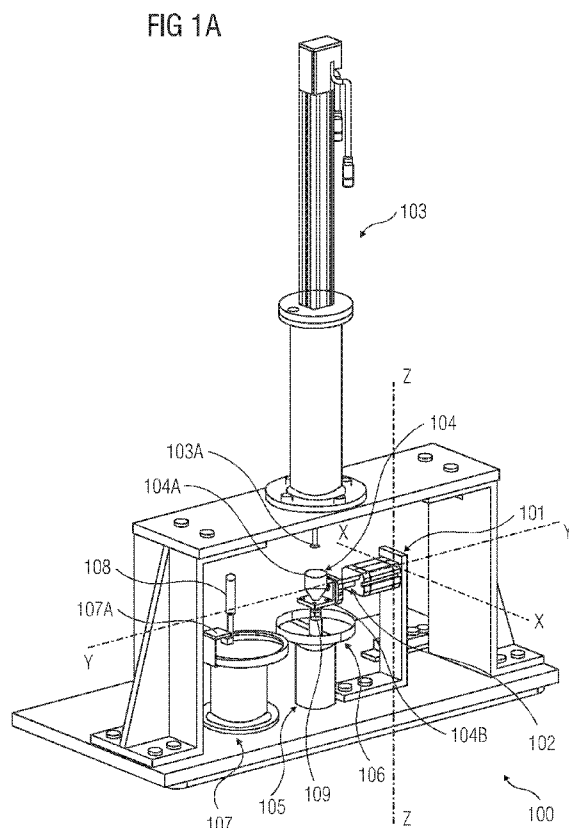
(74) Agent: **WEBB, Tyler, W.**; Lempia Summerfield Katz LLC, 20 S. Clark Street, Suite 600, Chicago, IL 60603 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: PACKING APPARATUS



(57) Abstract: A packing apparatus for packing a substance in a container includes a filling unit configured to facilitate filling of the substance in the container, and a compacting unit configured to compactly pack the filled substance in the container. The filling unit includes a moveable filling member moveable from at least a first filling position to a second filling position. The compacting unit includes a moveable compacting member moveable from at least a first compacting position to a second compacting position. At least one of the first compacting position and the second compacting position of the moveable compacting member is in relation to at least one of the first filling position and the second filling position of the moveable filling member. The moveable compacting member is moveable with a preconfigured compaction force that is a function of one or more properties of the container.



GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

PACKING APPARATUS

[0001] This application claims the benefit of U.S. Patent Application Serial No. 14/987,401, filed on January 6, 2016, which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Typically, packing a substance, especially a hazardous substance having micron sized nano particles, in a container is a cumbersome task due to high standards of safety and precision required while handling such substances. Also, probability of spillage and risk of inhalation of such substances is higher when compared to other substances such as cosmetic powders, edible powders, etc. Lack of precision while packing such substances may result in a compromised safety and an increased wastage, thereby increasing costs associated therewith. Lack of precision in terms of compactness when experienced while packing test samples (e.g., magnetic materials tested for magnetic hysteresis) results in a compromised quality of test results. Lack of precision while packing such substances in containers having low resistance to breakage and fracture may result in additional costs.

[0003] Conventional packing apparatuses (e.g., apparatuses used in food and beverage, pharmaceutical, or chemical industry setups) often are equipped with complex mechanisms and occupy large spaces. Such packing apparatuses may be configured for mass packing and therefore fail to cater to customized applications where the substances and/or the containers for which the packing apparatuses are configured, may vary frequently.

SUMMARY AND DESCRIPTION

[0004] This summary is provided to introduce a selection of concepts in a simplified form that are further disclosed in the detailed description. This summary is not intended to identify key or essential inventive concepts of the claimed subject matter, nor is the summary intended for determining the scope of the claimed subject matter.

[0005] A packing apparatus for packing a substance in a container is disclosed herein. The packing apparatus includes a filling unit and a compacting unit. The filling unit

includes a moveable filling member moveable from at least a first filling position to a second filling position. The filling unit is configured to facilitate filling of the substance in the container. The filling unit further includes a transferring assembly rigidly connected to the moveable filling member. The transferring assembly includes a transferring member positioned concentric to the moveable compacting member in one of the first filling position and the second filling position of the moveable filling member. The compacting unit includes a moveable compacting member moveable from at least a first compacting position to a second compacting position. The moveable compacting member is moveable from the first compacting position to the second compacting position with a preconfigured compaction force. The preconfigured compaction force is a function of one or more properties of the container. The compacting unit is configured to compactly pack the filled substance in the container. At least one of the first compacting position and the second compacting position of the moveable compacting member is in relation with at least one of the first filling position and the second filling position of the moveable filling member. A lower end of the moveable compacting member is tapered for enabling packing of a substance in a container with minimal spillage of the substance and minimal airlock between the moveable compacting member and the container.

[0006] The packing apparatus further includes a base assembly configured to receive the container and securely position the container concentric to the moveable compacting member of the compacting unit. The base assembly includes at least one container securing device including a mechanical device and an electrical device. The base assembly further includes an annular member rigidly connected to a tubular member. The tubular member is configured to define an inner void therewithin for receiving the container. In an embodiment, the packing apparatus further includes a collector assembly for collecting spilled substance. In this embodiment, the collector assembly includes a first collector tray removably connected to a second collector tray, and the first collector tray and the second collector tray, when connected, define a space therewithin for receiving the tubular member of the base assembly.

[0007] Also, disclosed herein is a method that employs the packing apparatus for packing a substance in a container. The packing apparatus including a filling unit and a compacting unit, as disclosed above, is provided. The filling unit includes a moveable

filling member moveable from at least a first filling position to a second filling position. The compacting unit includes a moveable compacting member moveable from at least a first compacting position to a second compacting position. The method includes filling a substance in the container securely positioned in a base assembly of the packing apparatus, via a transferring member of a transferring assembly of the filling unit, when the moveable filling member of the filling unit is in the second filling position. The method further includes compactly packing the filled substance in the container by the moveable compacting member when the moveable filling member is in the first filling position. The packing of the filled substance includes moving the moveable compacting member from at least the first compacting position to the second compacting position for a predefined number of times with a preconfigured compaction force. The preconfigured compaction force is a function of one or more properties of the container.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The foregoing summary, as well as the following detailed description of the invention, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, exemplary constructions of the invention are shown in the drawings. However, the invention is not limited to the specific methods and structures disclosed herein. The description of a method step or a structure referenced by a numeral in a drawing is applicable to the description of that method act or structure shown by that same numeral in any subsequent drawing herein.

[0009] FIG. 1A illustrates an isometric view of one embodiment of a packing apparatus.

[0010] FIG. 1B exemplarily illustrates an elevation view of the packing apparatus.

[0011] FIG. 1C exemplarily illustrates an enlarged view of a portion of the packing apparatus marked "A" in FIG. 1B, showing an axis of alignment of a moveable compacting member, a transferring member, and a base assembly of the packing apparatus.

[0012] FIG. 1D exemplarily illustrates an isometric view of the packing apparatus showing the moveable filling member in a first filling position and the moveable compacting member in a second compacting position.

[0013] FIG. 1E exemplarily illustrates an embodiment of the packing apparatus showing multiple positions of the moveable compacting member.

[0014] FIG. 2 exemplarily illustrates an enlarged view of the moveable compacting member of the packing apparatus.

[0015] FIG. 3 exemplarily illustrates an enlarged isometric view of a collector assembly of the packing apparatus.

[0016] FIGS. 4A-4B exemplarily illustrate embodiments of the base assembly of the packing apparatus showing container securing devices.

[0017] FIG. 5 illustrates one embodiment of a method of packing a substance in a container.

DETAILED DESCRIPTION

[0018] FIG. 1A exemplarily illustrates an isometric view of a packing apparatus 100. The packing apparatus 100 is used for packing a substance in a container 109. The substance includes, for example, a solid substance such as powders, a liquid substance such as chemicals, or a gaseous substance being filled under pressure, etc. The substance is, for example, a nano powder such as chromium dioxide. The container 109 is, for example, a quartz tube. In an embodiment, the container 109 is a vial, a capsule, a bottle, etc. The packing apparatus 100 includes a filling unit 101 including a moveable filling member 102 moveable from at least a first filling position to a second filling position. As used herein, “first filling position” refers to a position in which the moveable filling member 102 is in a retracted state. Also, as used herein, “second filling position” refers to a position, as exemplarily illustrated in FIG. 1A, in which the moveable filling member 102 is in an extended state. The moveable filling member 102 is longitudinally moveable along YY axis. In an embodiment, the moveable filling member 102 is rotatably moveable about ZZ axis. In this embodiment, the moveable filling member 102 may be a non-extendable moveable filling member. In this embodiment, the first filling position of the moveable filling member 102 is a position aligned with XX axis, and the second filling position is a position aligned with the YY axis. A mechanical drive (e.g., a pneumatic drive) enables movement of the moveable filling member 102 from the first filling position to the second filling position and from the second filling position to the

first filling position. The filling unit 101 is configured to facilitate filling of the substance in the container 109.

[0019] The packing apparatus 100 further includes a compacting unit 103 including a moveable compacting member 103A moveable from at least a first compacting position to a second compacting position. As used herein, “first compacting position” refers to a position, as exemplarily illustrated in FIG. 1A, in which the moveable compacting member 103A is in a retracted state. Also, as used herein, “second compacting position” refers to a position in which the moveable compacting member 103A is in an extended state. A mechanical drive (e.g., a linear servo drive) enables movement of the moveable compacting member 103A from the first compacting position to the second compacting position and from the second compacting position to the first compacting position. The compacting unit 103 is configured to compactly pack the filled substance in the container 109. The moveable compacting member 103A moves from the first compacting position, which is a home position of the moveable compacting member 103A, to the second compacting position with a preconfigured compaction force. The preconfigured compaction force is a function of one or more properties of the container 109. The properties include, for example, hoop stresses of the container from which a capacity of the container 109 to sustain maximum load (e.g., weight of the substance) without breakage may be derived. For example, when the container 109 is a quartz tube having an inner diameter d_i of 8 millimeter (mm), an outer diameter d_o of 10 mm, and a length of the quartz tube L of 50 mm, then based on the hoop stresses (e.g., breaking stresses of the container 109) and based on iterative experimentation, a limiting force is calculated as 12.5 Newton (N). Thus, the moveable compacting member 103A is moved with the preconfigured compaction force of less than 12.5 N to avoid breakage of the container 109 (e.g., the quartz tube) for packing the filled substance with maximal compactness. The filling of the substance is performed in multiple steps followed by packing of the filled substance. The packing of the filled substance is performed at least thrice after each substance fill. The packing apparatus 100 thus packs the substance in the container 109 by employing a displacement force feedback mechanism based on the preconfigured compaction force of the moveable compacting member 103A.

[0020] As exemplarily illustrated in FIG. 1A, the moveable compacting member 103A is in a first compacting position (e.g., a retracted state) and the moveable filling member 102 is in a second filling position (e.g., in an extended state). At least one of the first compacting position and the second compacting position of the moveable compacting member 103A is in relation with at least one of the first filling position and the second filling position of the moveable filling member 102. For example, when the moveable filling member 102 is in the first filling position (e.g., a retracted state), the moveable compacting member 103A is in the second compacting position (e.g., an extended state), and when the moveable filling member 102 is in the second filling position (e.g., an extended state), the moveable compacting member 103A is in the first compacting position (e.g., a retracted state). In an embodiment, the moveable filling member 102 and the moveable compacting member 103A are in the first filling position and the first compacting position, respectively, (e.g., both are in a retracted state) at a given time instant.

[0021] For purposes of illustration, the detailed description refers to a first filling position and a second filling position of the moveable filling member 102 and a first compacting position and a second compacting position of the moveable compacting member 103A; however, the scope of the method and packing apparatus 100 disclosed herein is not limited to the above positions but may be extended to include more than two positions for the moveable filling member 102 and the moveable compacting member 103A, respectively, and an unlimited number of combinations of each of these positions for synchronization of movement of the moveable filling member 102 with the moveable compacting member 103A, as disclosed in the detailed description of FIG. 1E.

[0022] The filling unit 101 further includes a transferring assembly 104 rigidly connected to the moveable filling member 102. The transferring assembly 104 includes a transferring member 104A positioned concentric to the moveable compacting member 103A in one of the first filling position and the second filling position of the moveable filling member 102. As exemplarily illustrated in FIG. 1A, the transferring member 104A is concentric to the moveable compacting member 103A when the moveable filling member 102 is in the second filling position (e.g., in an extended state). The transferring member 104A is, for example, a funnel shaped member used to receive and transfer a

substance into the container 109. The transferring member 104A is rigidly connected to the moveable filling member 102 via a connection member 104B of the transferring assembly 104. In an embodiment, the transferring assembly 104 further includes a transfer enhancing device (e.g., a vibratory media configured to enable transfer of sticky substances to the container 109). The packing apparatus 100 further includes a base assembly 105 configured to receive the container 109 and securely position the container 109 concentric to the moveable compacting member 103A of the compacting unit 103. The packing apparatus 100 further includes a collector assembly 106 for collecting spilled substance being filled via the transferring member 104A of the filling unit 101 into the container 109.

[0023] The packing apparatus 100 further includes a storage unit 107 positioned proximal to the base assembly 105. The storage unit 107 stores the substance to be packed into the container 109. The substance may be transferred from the storage unit 107 to the transferring member 104A, for being filled into the container 109, using a substance carrier 108. The substance carrier 108 is, for example, a ladle, a spatula, a spoon, etc. To preclude spillage of the substance after collecting the substance in the substance carrier 108, the substance in the substance carrier 108 may be leveled against a leveler 107A of the storage unit 107. The leveler 107A provides that an equal quantity of substance is transferred from the storage unit 107 to the container 109 in every fill.

[0024] FIG. 1B exemplarily illustrates an elevation view of the packing apparatus 100 including the filling unit 101. The filling unit 101 includes the moveable filling member 102 and the transferring assembly 104. The packing apparatus 100 also includes the compacting unit 103, which includes the moveable compacting member 103A, and the base assembly 105. In an embodiment, the moveable filling member 102 includes two or more parallel shafts 102A and 102B moveable from the first filling position to the second filling position, as disclosed in the detailed description of FIG. 1A. FIG. 1C exemplarily illustrates an enlarged view of a portion of the packing apparatus 100 marked “A” in FIG. 1B, showing an axis CC of alignment of the moveable compacting member 103A, the transferring member 104A of the transferring assembly 104, and the base assembly 105 of the packing apparatus 100. In this alignment, the moveable filling member 102, to which the transferring member 104A is attached via the connection member 104B of the

transferring assembly 104, is in the second filling position. The base assembly 105 includes an annular member 111 and a tubular member 110. The container 109 is securely positioned inside the tubular member 110 aligned with the axis CC and concentric to the transferring member 104A and the moveable compacting member 103A. The collector assembly 106 is positioned on the base assembly 105 such that the collector assembly 106 is concentric to the transferring member 104A and the moveable compacting member 103A along the axis CC.

[0025] FIG. 1D exemplarily illustrates an isometric view of the packing apparatus 100 showing the moveable filling member 102 in a first filling position and the moveable compacting member 103A in a second compacting position. When the moveable filling member 102 is in the first filling position (e.g., in a retracted state), the moveable compacting member 103A is in the second compacting position (e.g., in an extended state). This synchronization between the moveable filling member 102 and the moveable compacting member 103A provides safety of operation while packing a substance in the container 109. To achieve this synchronization, two proximity sensors (not shown) that detect a position of the moveable compacting member 103A and communicate the detected position to a control unit (not shown) that controls movement of the moveable filling member 102 based on the detected position of the moveable compacting member 103A may be fitted on the moveable filling member 102. In an embodiment, the moveable filling member 102 remains in the second filling position (e.g., an extended state), and the moveable compacting member 103A moves from the first compacting position to the second compacting position through the transferring member 104A of the transferring assembly 104 connected to the moveable filling member 102, along the axis CC as exemplarily illustrated in FIG 1C. In this embodiment, a cross sectional size of the transferring member 104A is configured such that the moveable compacting member 103A may move through the transferring member 104A to the second compacting position.

[0026] FIG. 1E exemplarily illustrates an embodiment of the packing apparatus 100 exemplarily illustrated in FIGS. 1A, 1B, and 1D, showing multiple positions of the moveable compacting member 103A. In this embodiment, the moveable compacting member 103A moves from the first compacting position, which is a home position P₁, to

an intermediate position P_2 , and from the intermediate position P_2 to the second compacting position, which is an end position P_3 , along the axis CC. The intermediate position P_2 is a transitional position at which the moveable compacting member 103A is proximal to the container 109 (e.g., about to enter the container 109) for compactly packing the filled substance in the container 109. In this embodiment, the moveable compacting member 103A moves from position P_1 to P_2 at a speed higher than that from position P_2 to P_3 . This transition of speed at which the moveable compacting member 103A moves from position P_2 to P_3 (e.g., after entering the container 109) is determined based on the preconfigured compaction force in order to preclude breakage of the container 109.

[0027] FIG. 2 exemplarily illustrates an enlarged view of the moveable compacting member 103A of the packing apparatus 100 exemplarily illustrated in FIGS. 1A, 1B, and 1D. A cross sectional size of the moveable compacting member 103A is in relation with a cross sectional size of the container 109 exemplarily illustrated in FIGS. 1A and 1C. The moveable compacting member 103A may be of a circular cross section, a spherical cross section, a triangular cross section, etc. such that the moveable compacting member 103A packs the filled substance into the container 109 with maximal compactness. A lower end 103B of the moveable compacting member 103A is tapered for enabling packing of the substance in the container 109 with minimum spillage of the substance and minimal airlock between the moveable compacting member 103A and the container 109. In order to reduce the spillage during the packing, the lower end 103B is back tapered at an angle α of 5° . This back taper precludes vacuum creation in the container 109 when the moveable compacting member 103A has packed the filled substance and is moving back from the second compacting position to the first compacting position of the moveable compacting member 103A. In an embodiment, the moveable compacting member 103A is replaceable and may be replaced after packing the substance in a predefined number of containers 109.

[0028] FIG. 3 exemplarily illustrates an enlarged isometric view of a collector assembly 106 of the packing apparatus 100 exemplarily illustrated in FIGS. 1A, 1B, and 1D. The collector assembly 106 collects spilled substance. The collector assembly 106 includes a first collector tray 106A removably connected to a second collector tray 106B. This split

type configuration of the collector assembly 106 enables ease of cleaning of the collector assembly 106. The first collector tray 106A and the second collector tray 106B, when connected, define a space 106C therewithin for receiving the tubular member 110 of the base assembly 105, exemplarily illustrated in FIG 1C. The container 109 is positioned inside this tubular member 110. To provide minimum spillage of substance while the substance is being filled in the container 109 via the transferring member 104A of the transferring assembly 104 exemplarily illustrated in FIGS. 1A-1D, the transferring member 104A and the container 109 are positioned with maximal proximity therebetween. However, if the substance spills while being filled into the container 109, this spilled substance is collected in the collector assembly 106. This spilled substance may later be transferred from the collector assembly 106 to the storage unit 107 exemplarily illustrated in FIG. 1A.

[0029] FIGS. 4A-4B exemplarily illustrate embodiments of the base assembly 105 of the packing apparatus 100 exemplarily illustrated in FIGS. 1A, 1B, and 1D showing container securing devices 112 and 114. The base assembly 105 includes at least one container securing device 112 and 114 including mechanical device 112 and electrical device 114. The container securing devices 112 and 114 secure the container 109 inside the tubular member 110 to preclude suctioning of the container 109 during movement of the moveable compacting member 103A from the second compacting position to the first compacting position, exemplarily illustrated in FIGS. 1A-1D. FIG. 4A exemplarily illustrates the base assembly 105 including a mechanical container securing device 112. The mechanical container securing device 112 includes, for example, two or more ring members 112 positioned in parallel to one another in an inner void 110A defined within the tubular member 110 of the base assembly 105. The ring members 112 may be positioned in multiple configurations along the length L of the tubular member 110. For example, the ring members 112 may be positioned proximal to one another towards a bottom end 110B of the tubular member 110 or towards a top end 110C of the tubular member 110, or one of the ring members 112 may be positioned proximal to the bottom end 110B and other ring member 112 may be positioned proximal to the top end 110C of the tubular member 110. The tubular member 110 is configured to define the inner void 110A therewithin for receiving the container 109. Each of the ring members 112 may be

configured of a material (e.g., rubber, silicon, etc.) that enables the container 109 to be securely positioned inside the tubular member 110 and also increases breaking stress capacity of the container 109. In an embodiment, a cushion 113 is placed at the bottom end 110B of the tubular member 110 to enable the container 109 to sustain load of the moveable compacting member 103A without breakage, by absorbing the impact of the moveable compacting member 103A. The cushion 113 is configured of, for example, rubber, silicon, paper, foam, or any combinations thereof. FIG. 4B exemplarily illustrates the base assembly 105 including an electrical container securing device 114. The electrical container securing device 114 includes, for example, a vacuum unit 114. The vacuum unit 114 creates a negative air pressure in the inner void 110A of the tubular member 110 to secure the container 109 in a position concentric to the moveable compacting member 103A. The container securing devices 112 and 114 secure the container 109 such that the container 109 is maintained in an original position when the moveable compacting member 103A is moving back from the second compacting position to the first compacting position.

[0030] FIG. 5 illustrates one embodiment of a method of packing a substance in a container 109 exemplarily illustrated in FIGS. 1A, 1C, 4A, and 4B. In the method disclosed herein, at act 501, the packing apparatus 100 exemplarily illustrated in FIGS. 1A, 1B, and 1D including the filling unit 101, which includes the moveable filling member 102 moveable from at least a first filling position to a second filling position, and the compacting unit 103, which includes the moveable compacting member 103A moveable from at least a first compacting position to a second compacting position, is provided. In the method disclosed herein, at act 502, a substance is filled in the container 109 securely positioned in a base assembly 105 of the packing apparatus 100, via the transferring member 104A of a transferring assembly 104 of the filling unit 101, exemplarily illustrated in FIGS. 1A-1D, when the moveable filling member 102 of the filling unit 101 is in the second filling position. At act 503 of the method disclosed herein, the filled substance is compactly packed in the container 109 by the moveable compacting member 103A of the compacting unit 103 when the moveable filling member 102 is in the first filling position. This packing of the filled substance includes moving the moveable compacting member 103A from at least the first compacting position to the

second compacting position for a predefined number of times with a preconfigured compaction force. This preconfigured compaction force is a function of one or more properties of the container 109, as disclosed in the detailed description of FIG. 1A.

[0031] The different embodiments of the packing apparatus 100 disclosed in the detailed descriptions of FIGS. 1A-5, may be used in an industrial setup for packing a substance in a container 109 with maximum compactness in a semi-automatic process and in minimal time.

[0032] The foregoing examples have been provided merely for the purpose of explanation and are in no way to be construed as limiting of the method and the packing apparatus disclosed herein. While the method and the packing apparatus have been described with reference to various embodiments, it is understood that the words, which have been used herein, are words of description and illustration, rather than words of limitation. Further, although the method and the packing apparatus have been described herein with reference to particular means, materials, and embodiments, the method and the packing apparatus are not intended to be limited to the particulars disclosed herein. Rather, the method and the packing apparatus extend to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims. Those skilled in the art, having the benefit of the teachings of this specification, may effect numerous modifications thereto, and changes may be made without departing from the scope and spirit of the method and the packing apparatus disclosed herein in respective aspects.

CLAIMS

1. A packing apparatus for packing a substance in a container, the packing apparatus comprising:

a filling unit comprising a moveable filling member moveable from at least a first filling position to a second filling position, wherein the filling unit is configured to facilitate filling of the substance in the container; and

a compacting unit comprising a moveable compacting member moveable from at least a first compacting position to a second compacting position,

wherein at least one of the first compacting position and the second compacting position of the moveable compacting member is in relation with at least one of the first filling position and the second filling position of the moveable filling member, and

wherein the compacting unit is configured to pack the filled substance in the container.

2. The packing apparatus of claim 1, wherein the filling unit further comprises a transferring assembly rigidly connected to the moveable filling member, the transferring assembly comprising a transferring member positioned concentric to the moveable compacting member in one of the first filling position and the second filling position of the moveable filling member.

3. The packing apparatus of claim 1, further comprising a base assembly configured to receive the container and securely position the container concentric to the moveable compacting member of the compacting unit.

4. The packing apparatus of claim 3, wherein the base assembly comprises at least one container securing means comprising mechanical means and electrical means.

5. The packing apparatus of claim 3, wherein the base assembly further comprises an annular member rigidly connected to a tubular member, and

wherein the tubular member is configured to define an inner void therewithin for the receiving of the container.

6. The packing apparatus of claim 5, further comprising a collector assembly for collecting a spilled portion of the substance,

wherein the collector assembly comprises a first collector tray removably connected to a second collector tray, and

wherein the first collector tray and the second collector tray, when connected, define a space therewithin for receiving the tubular member of the base assembly.

7. The packing apparatus of claim 1, wherein a lower end of the moveable compacting member is tapered for enabling the packing of the substance in the container with minimal spillage of the substance and minimal airlock between the moveable compacting member and the container.

8. The packing apparatus of claim 1, wherein the moveable compacting member is moveable from the first compacting position to the second compacting position with a preconfigured compaction force, and

wherein the preconfigured compaction force is a function of one or more properties of the container.

9. A method of packing a substance in a container, the method comprising:
providing a packing apparatus comprising:

a filling unit comprising a moveable filling member moveable from at least a first filling position to a second filling position; and

a compacting unit comprising a moveable compacting member moveable from at least a first compacting position to a second compacting position;

filling the substance in the container securely positioned in a base assembly of the packing apparatus, via a transferring member of a transferring assembly of the filling unit, when the moveable filling member of the filling unit is in the second filling position; and

compactly packing the filled substance in the container by the moveable compacting member of the compacting unit when the moveable filling member is in the first filling position.

10. The method of claim 9, further comprising moving the moveable compacting member from at least the first compacting position to the second compacting position for a predefined number of times with a preconfigured compaction force.

11. The method of claim 10, wherein the preconfigured compaction force is a function of one or more properties of the container.

FIG 1B

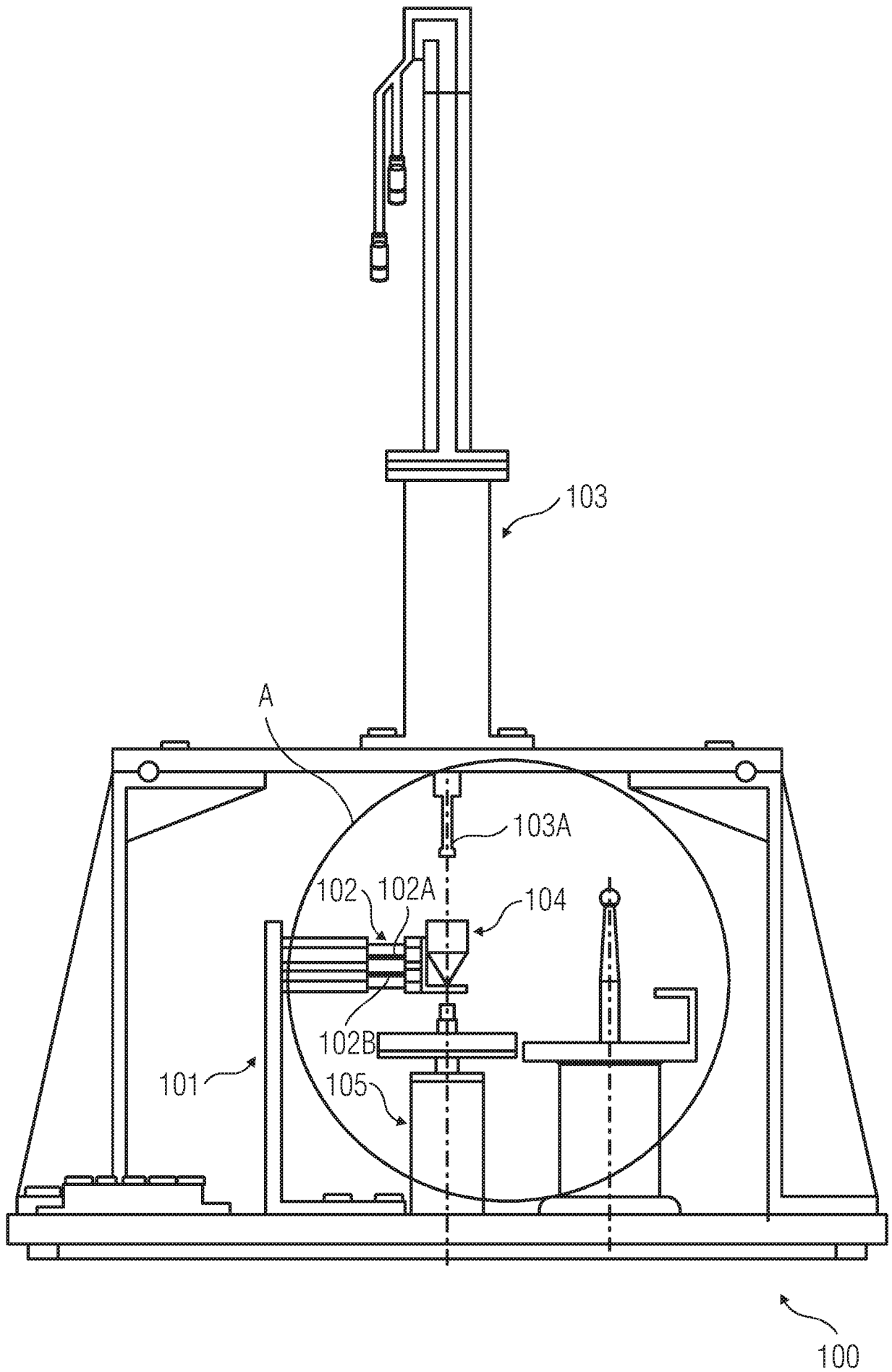


FIG 1C

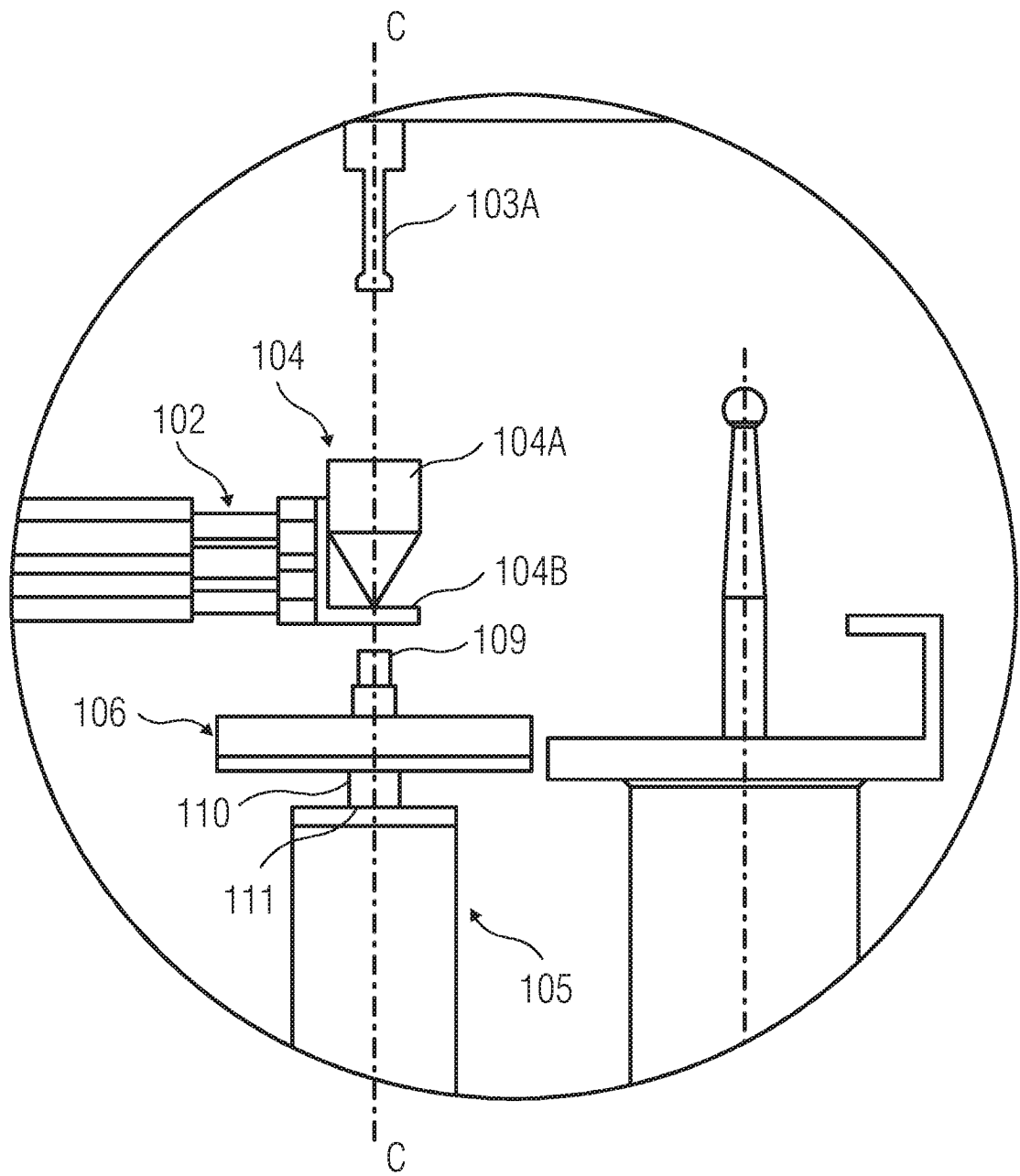


FIG 1D

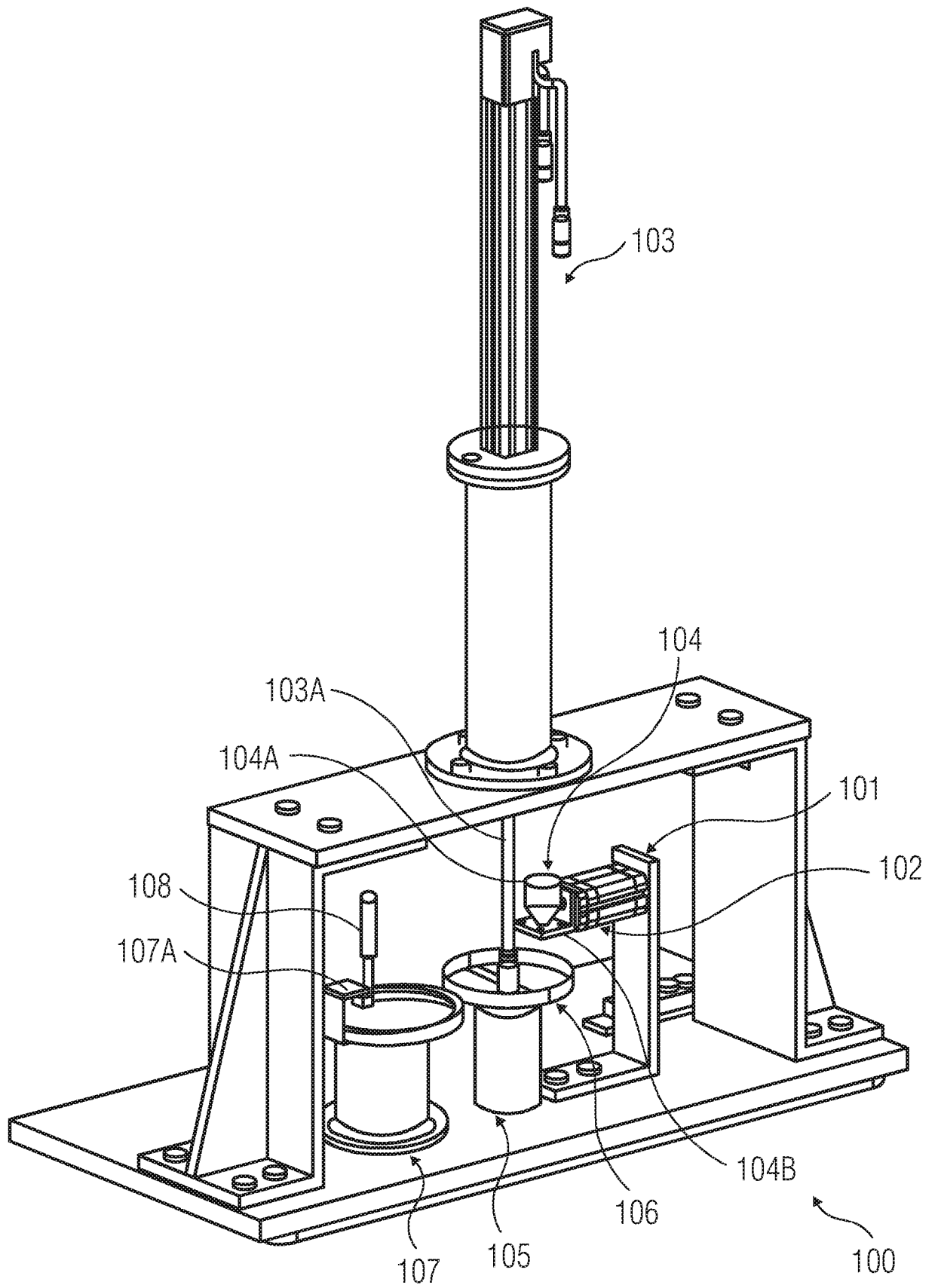


FIG 1E

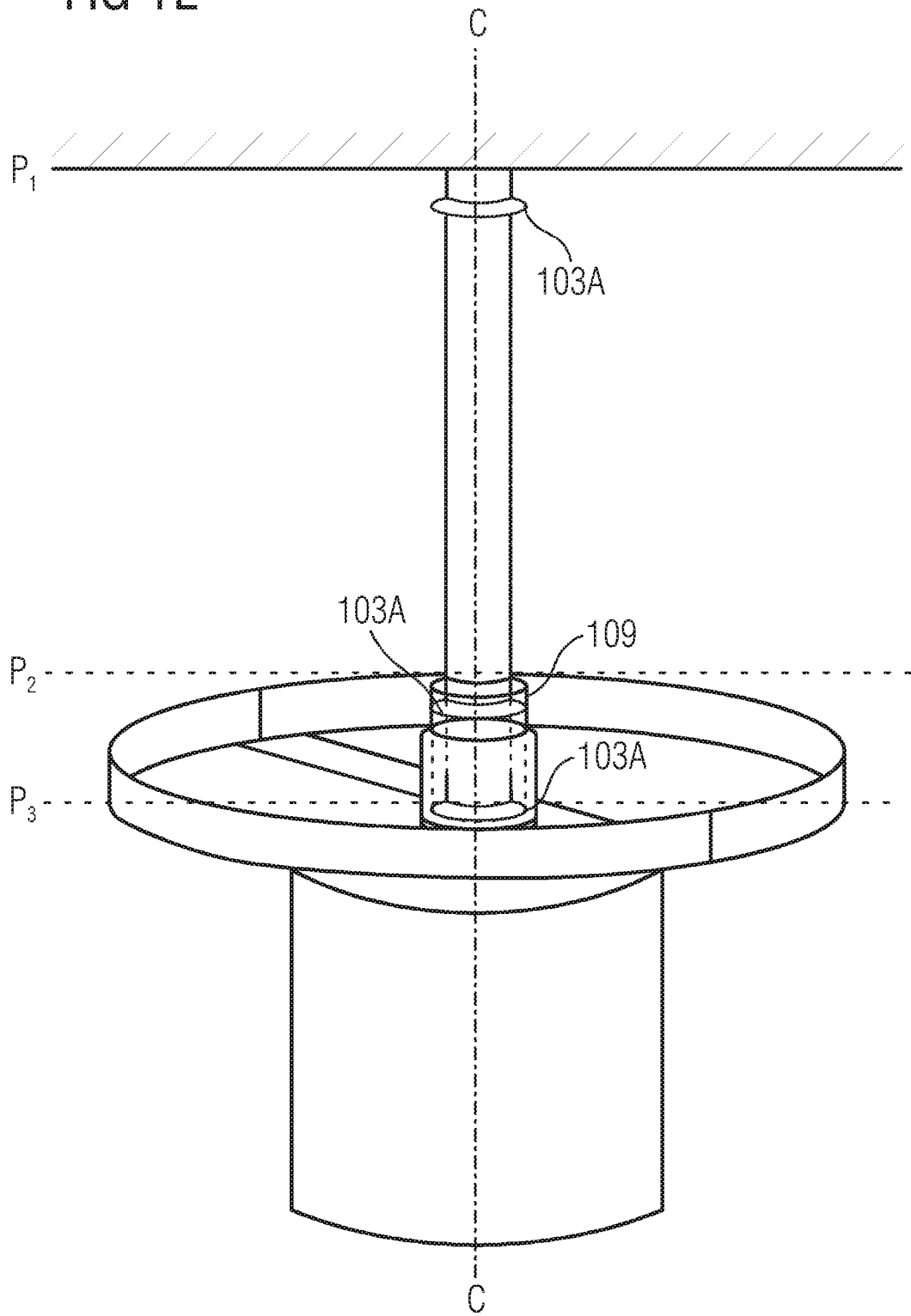


FIG 2

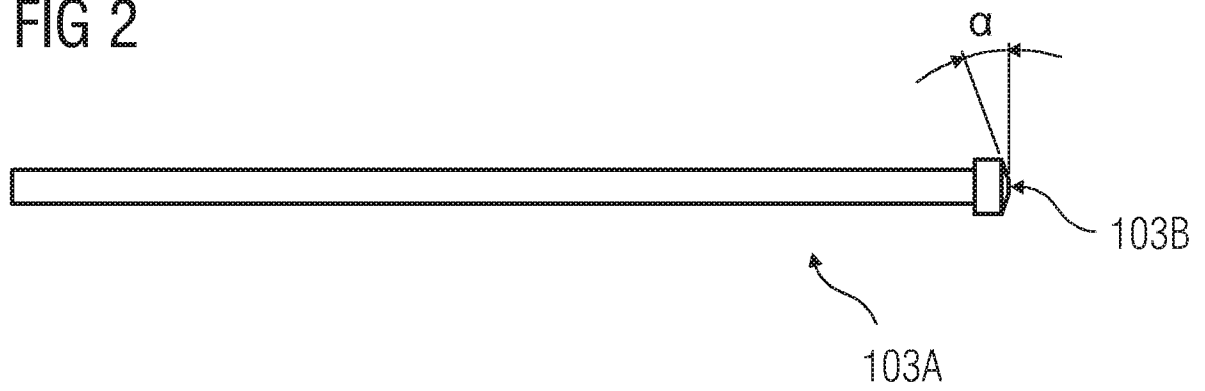


FIG 3

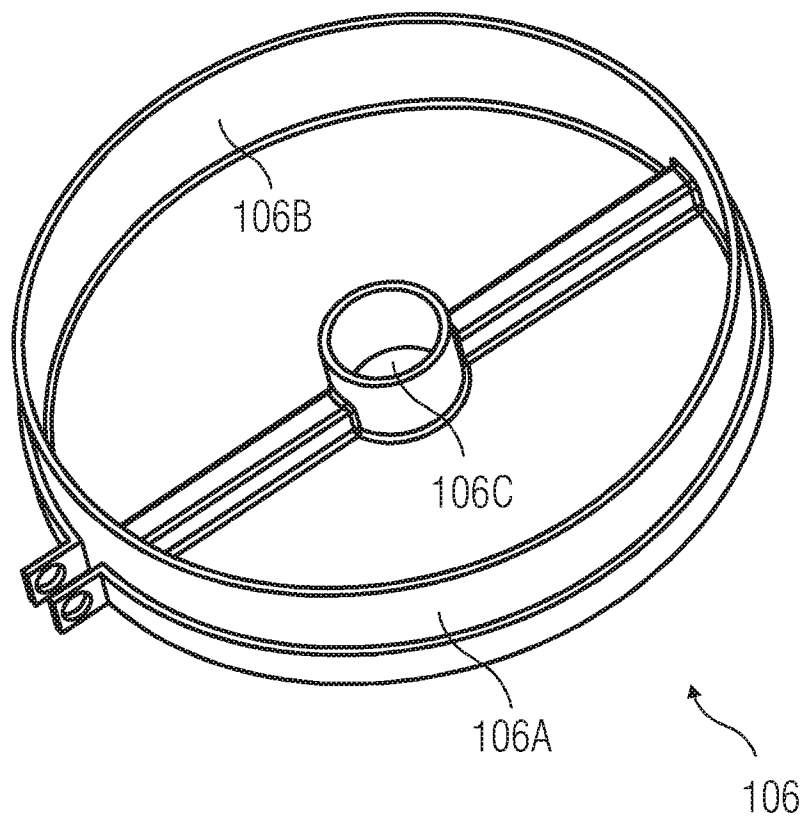


FIG 4A

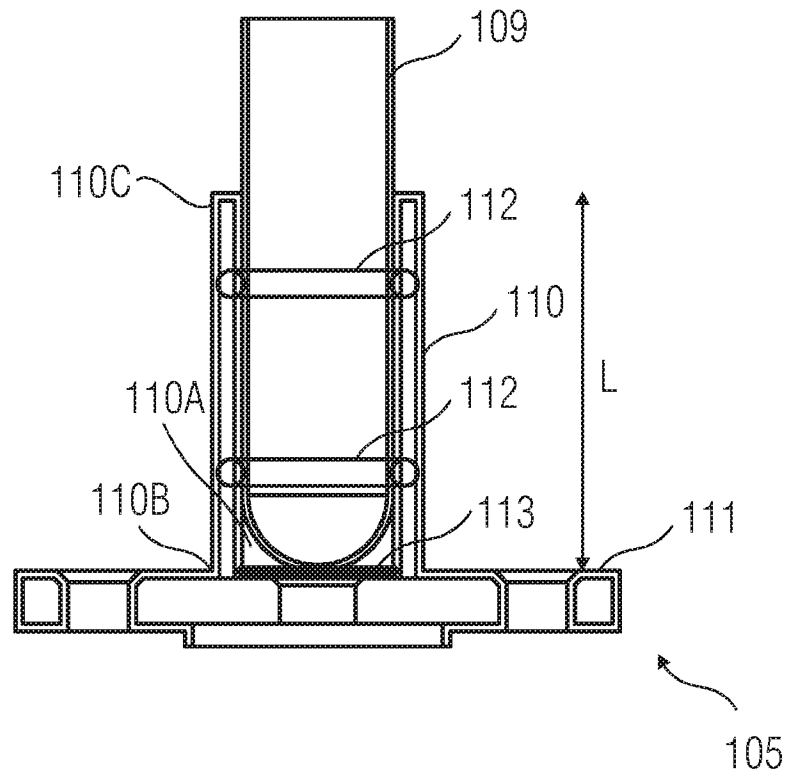


FIG 4B

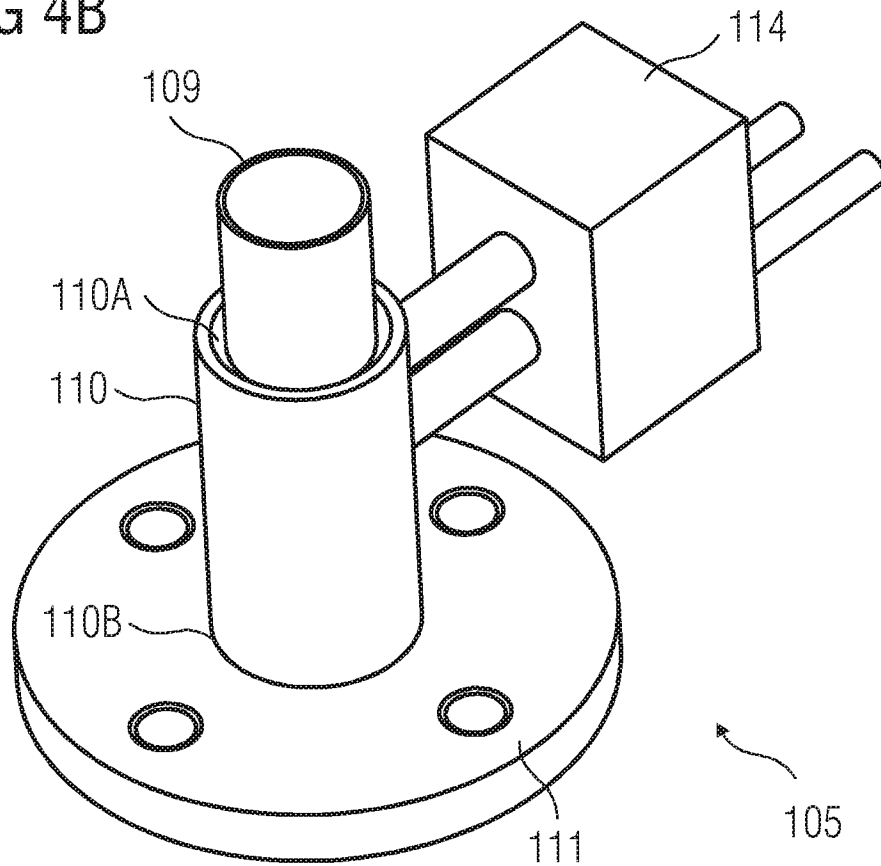
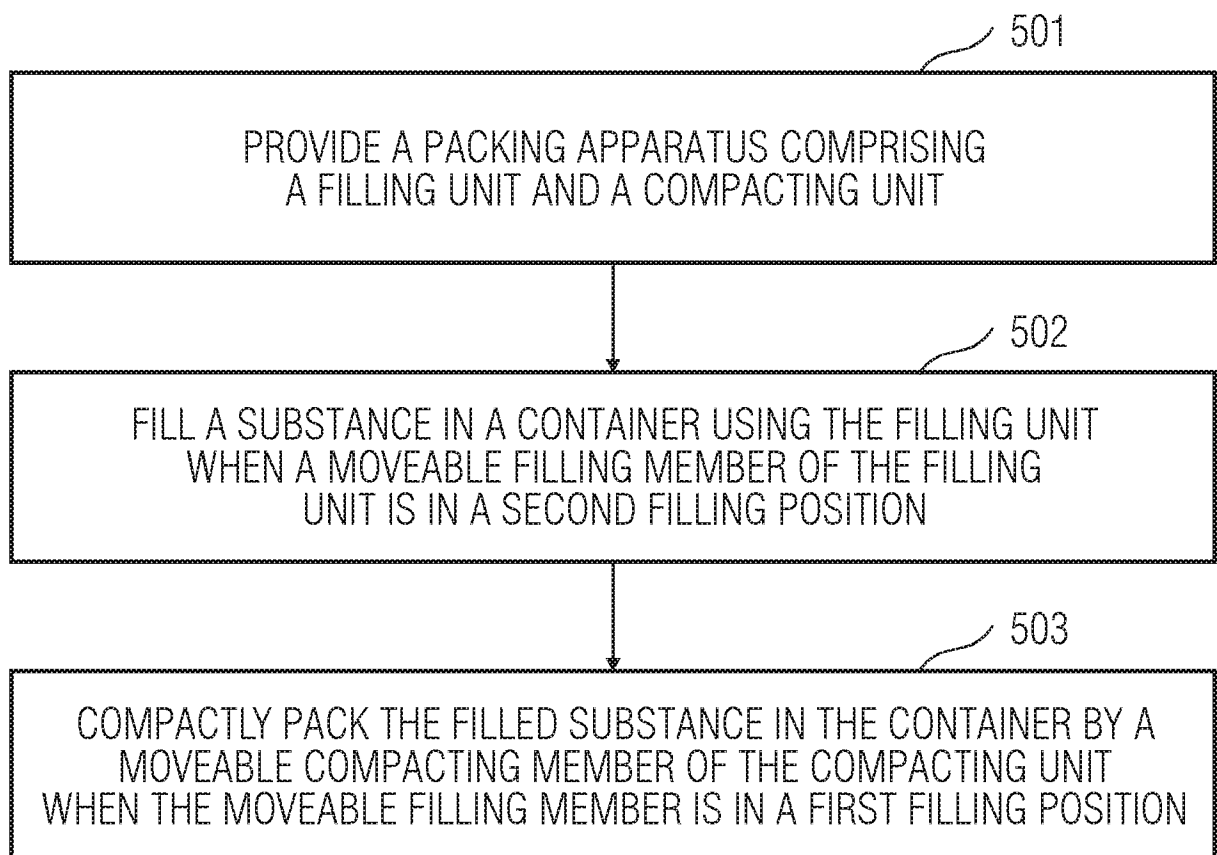


FIG 5



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/064913

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B1/24
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B B01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 405 744 A (BOWMAN BENJAMIN P) 15 October 1968 (1968-10-15) column 2; figures -----	1-3,9
A	US 2 522 884 A (MANN WARREN W) 19 September 1950 (1950-09-19) figures -----	1-11
A	FR 338 845 A (CHARLES DELTON [FR]) 4 August 1904 (1904-08-04) figures -----	1-11
A	US 5 177 938 A (MAYERSBETH ROBERT E [GB]) 12 January 1993 (1993-01-12) figures -----	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

13 April 2017

Date of mailing of the international search report

28/04/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Lawder, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/064913

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3405744	A	15-10-1968	NONE
US 2522884	A	19-09-1950	NONE
FR 338845	A	04-08-1904	NONE
US 5177938	A	12-01-1993	GB 2247660 A 11-03-1992 US 5177938 A 12-01-1993