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(54) **A continuous-cycle sterile bottling plant**

Anlage zum sterilen Füllen von Flaschen im Durchlaufverfahren

Installation de remplissage stérile de bouteilles suivant un cycle continu

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(73) Proprietor: **TETRA PAK PLASTICS LIMITED**
1213 Petit Lancy (Geneva) (CH)

(72) Inventors:
• **Catelli, Camillo**
43100 Parma (IT)

• **Bonetti, Leo**
43010 Pontetaro, (Parma) (IT)

(74) Representative: **Gotra, Stefano et al**
BUGNION S.p.A.
Via Emilia Est 25
41100 Modena (IT)

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Description

[0001] The invention relates to a continuous-cycle sterile bottling plant.

[0002] This kind of plant is already known, and comprises operative groups acting on bottles transiting along a feed line. In general these plants are provided with a number of successive operative groups, including a sterilizing group, a washing group, a filler group and a capping group.

[0003] To guarantee sterile functioning conditions, the whole plant is located in a slightly pressurized atmosphere, in which operators follow and check the operativity of the plant. Obviously the operators wear special garb to prevent contamination of the sterile environment.

[0004] At each plant start-up, the environment, or chamber, housing the plant has to be sterilized carefully, while the bottling plant itself has to be completely and scrupulously sterilized both internally and externally. The external parts are cleaned with sterilizing fluids while the internal parts are subject to a mock functioning cycle during which sterilizing fluid instead of product is circulated.

[0005] As during a normal plant cycle the filler group heads are opened by the bottle necks and mouths, in order to complete this mock cycle dummy bottles are used, whose function is to open the filler heads. The dummy bottles are loaded by hand by one or more operators; this operation therefore involves considerable preparation time as there is a considerable number of dummy bottles to be loaded.

[0006] The main drawbacks exhibited by known-type plants are represented, apart from the obvious irritation of the operators at having to wear overalls, by the complexity and lengthiness of the sterilizing operations at machine start-up, and the difficulty and expense incurred at having to keep the environment (of considerable size) containing the plant in conditions of sterility.

[0007] GB 2 280 669 discloses a plant as in the preamble of claim 1. In the plant of GB 2 280 669 each operative group comprises a sterile chamber crossed by the bottles. Each sterile chamber has walls and is kept slightly pressurized, and represents a sterile zone containing a part of a relative operative group. The various sterile chambers are interconnected. One of the operative groups is provided upstream for sterilizing bottles. Each of the operative groups downstream of the sterilizing group is kept slightly pressurized. This plant can obviate the above-mentioned drawbacks in the prior art, but it exhibits further drawbacks. In the first place the operators must don protective garb if they have to access to the motor and the mobile organs of the plant. In the second place the sterilization fluids injected into the sterile chamber can spread into the adjacent chambers.

[0008] The main aim of the invention is to obviate the above-mentioned drawbacks in the prior art by providing a sterile bottling plant which is rapidly and easily steri-

lizable and which can be kept sterile in a sure but relatively simple and economical way.

[0009] An advantage of the invention is that it relieves operators of the need to wear protective garb.

[0010] A further aim of the invention is to provide a sterilizing method for the bottle filler group which is both simple and economical, as well as a filler group for using with said method.

[0011] The above aims and advantage and others besides are all achieved by the plant, by the filler group and by the method of the present invention, as it is characterized in the claims that follow.

[0012] Further characteristics and advantages of the present invention will better emerge from the detailed description that follows, of an embodiment of the invention, illustrated in the form of a non-limiting example in the accompanying drawings, in which:

figure 1 shows a schematic plan view from above of the plant;

figure 2 is a schematic lateral view from below of figure 1;

figure 3 shows a detail of the filler group of figure 2 in enlarged scale;

figure 4 shows a detail of the capping group of figure 2 in enlarged scale.

[0013] With reference to the drawings, 1 denotes in its entirety a continuous-cycle sterile bottling plant comprising a feed line 2 of bottles 3. The bottles 3 are fed one after another to a plurality of operative groups 10, 20, 30, 40, each of which is provided with commandable mobile organs, for acting on the transiting bottles 3. Further, each operative group is provided with motorization for moving the bottles 3 as well as means for commanding the movement of the mobile organs. In the example the plant 1 comprises a sterilizing group 10, a washing group 20, a filler group 30 and a capping group 40. The motors, of known type, for each group are indicated by 5, 6, 7 and 8. Two tilting devices 6' are provided for tilting the bottles 3. The mobile organs of the various groups are also of known type and are denoted by 11, 21, 29 and 44. 11 denotes a vertical pipe for the passage of the sterilizing liquid and 21 denotes a further vertical pipe for the passage of the washing fluid. Each pipe 11 and 21 is vertically slidable with respect to a respective hub 12 and 22 with a sterile barrier. Each pipe 11 and 21 superiorly bears a nozzle which can be inserted into a bottle, and through which the relative sterilizing or washing fluid is injected therein by spraying.

[0014] Each operative group comprises a respective sterile chamber 10a, 20a, 30a, 40a which is crossed by the bottles 3. Each sterile chamber is enclosed by walls 4 and is kept slightly pressurized, and constitutes a sterile zone containing part of the relative operative group. At least one wall 4a of the walls 4 of each sterile chamber sealedly separates a relative sterile zone from the motor for the movement of the bottles 3 as well as the means

for commanding the movement of the bottles 3 and the means for commanding the mobile organs of the relative operative group. The motor and the means for commanding are thus outside the sterile zone. The various sterile chambers for each operative group are interconnected. The sterile chamber 10a of the sterilizing group 10 is kept at a slightly lower pressure than the sterile chambers of the other operative groups. An aperture 13 is provided for placing the sterile chamber 10a for sterilizing in communication with the external atmosphere.

[0015] The filler group 30 is rotary and comprises an entrance 31 and an exit 32 for the bottles 3. The filler group 30 is provided with a vertical-axis rotating shaft 25 which rotates a plurality of support organs 33, each of which transports, at each rotation, a bottle 3 from the entrance 31 to the exit 32. Each support organ 33 is vertically mobile on command. A filler head 34 is associated to each support organ 33, which filler head 34 is connected to means for dispensing the product destined to fill the bottles 3. The means for dispensing comprise a plurality of product dispensing pipes 35. Each filler head 34 opens, dispensing the product, by means of upwards pressure thereon. An annular cam 36 acts on the support organs 33, following a rotation of the latter, to command vertical displacements thereof. The cam 36 acts by means of a plurality of vertical-axis shafts 29, one for each support organ 33, which slide vertically in a hub 28 with a sterile barrier. Each shaft 29 is superiorly solidly connected to a respective support organ 33 and is coupled inferiorly with the cam 36 by means of a wheel 27.

[0016] Means for positioning 37 are provided for positioning (on command) the cam 36 in a vertical direction. Further, fixed superiorly to each support organ 33 a contact element 39 is arranged such as to exert an upward pressure on the respective filler head 34 when contact is made there-between, which upward pressure is sufficient to cause the filler head 34 to open. The contact element 39 is preferably forked, and a bottle neck 5' of a bottle to be filled is inserted into the fork. The means for positioning comprise one or more vertical-axis jacks 37 arranged below the cam 36 externally of the sterile zone 30a. Each jack 37 is provided with a vertical-axis rack and a command mechanism, not illustrated. The mechanism can be operated by hand using a gripping organ or crank 38. The upper end of the rack presses on the base of the cam 36 to be lifted. The cam 36 acts on the support organs 33 and consequently on the contact element 39 provided for interacting with the respective filler head 34, opening same.

[0017] The capping group 40 comprises a vertical-axis central drive shaft 41 and a disc 42 which latter is fixed coaxially to the drive shaft 41 and is provided at a periphery thereof with means for sealing 43 with an upper wall 4b of the relative sterile chamber 40a. The capping group 40 comprises a plurality of rods 44 inferiorly provided with a chuck 45 for capping a respective bottle 3. Each rod 44 is set in rotation by the drive shaft 41 and

is mobile on command in a vertical direction passing sealedly through a respective hub 48 with sterile barrier solidly mounted on the disc 42. The capping group 40 is further provided with a cap feed line 46 along which the caps 47 undergo a sterilization operation.

[0018] To sterilize the filler group 30, when it is restarted after a pause, the following procedure is observed. The filler heads 34 are supplied with a sterilization fluid. The cam 36 is lifted in order to raise the relative support organs 33 and, consequently, the contact elements 39 which latter exert an upwards pressure against the filler heads 34 which is sufficient to open the filler heads 34. The group is operated in this manner for the length of time necessary for sterilizing the dispensing pipes 35 through which during normal functioning the product to be bottled passes. The sterilization fluid flows into the chamber 30a and is collected at the bottom thereof. If necessary more than one sterilization and washing liquid can be dispensed. During the course of normal functioning of the filler group 30 the jacks 37 are brought into a lowered position so that the contact elements 39 do not interact with the filler heads 34.

[0019] The operators stay out of the sterile zones and can thus gain easy access to the motor and the mobile organs of the plant without having to don protective garb.

[0020] Thanks to the fact that the sterile chamber 10a of the sterilizing group is kept at a slightly lower temperature with respect to the other sterile chambers, the eventuality of passage of gas into the other chambers can be precluded. This prevents the sterilization fluids injected into the sterile chamber 10a from spreading into the adjacent chambers.

Claims

1. A continuous-cycle sterile bottling plant, comprising:

a feed line (2) of bottles (3);
a plurality of operative groups (10, 20, 30, 40), each of which is provided with commandable mobile organs for acting on bottles (3) transiting on said feed line (2) and a motor for commanding said mobile organs;
each of said plurality of operative groups (10, 20, 30, 40) comprises a sterile chamber (10a, 20a, 30a, 40a) crossed by said bottles (3), which sterile chamber (10a, 20a, 30a, 40a) has walls (4) and represents a sterile zone containing a part of a relative operative group (10, 20, 30, 40), the various sterile chambers for each operative group being interconnected;
one of said operative groups (10) is provided for sterilizing bottles (3), the other operative groups being kept slightly pressurized;

characterizes in that:

at least a wall (4a) of each said sterile chamber sealedly separates a relative sterile zone from said motor and from said means for commanding said mobile organs of said relative operative group;
the sterile chamber (10a) of said sterilizing group is kept slightly pressurized at a slightly lower pressure than the sterile chambers for other operative groups.

2. A plant as in claim 1, **characterized in that** an aperture (13) is provided for placing the sterile chamber (10a) of the group for sterilizing in communication with the external atmosphere.

3. A plant as in claim 1 or 2, comprising an operative group for filling bottles (3) comprising:

a plurality of support organs (33) for the bottles (3), mobile on command in a vertical direction, to each of which support organ (33) a filler head (34) is associated, which filler head (34) is connected to a dispensing pipe (35) of a product destined to fill said bottles (3), which filler head (34) opens for dispensing said product following an upwards-directed pressure thereon;
a cam (36) acting on said support organs (33) for commanding a vertical-direction displacement thereof;

characterized in that it comprises:

a contact element (39), solidly constrained to each of said support organs (33), conformed and arranged such as to exert on a respective filler head (34) on contact there-with an upwards-directed pressure which is sufficient to cause opening thereof;
means (37) for positioning on command said cam (36) in a vertical direction.

4. A plant as in claim 3, **characterized in that** said means for positioning comprise at least one vertical-axis jack (37) operatively associated with said cam (36).

5. A plant as in claim 3 or 4, **characterized in that** said contact element (39) is fork-shaped, and **in that** a mouth (5') of a bottle (3) to be filled houses therein.

6. A plant as in any one of the preceding claims, **characterized in that**:

it comprises an operative group for capping,

which comprises a central and vertical-axis drive shaft (41) and a disc (42) which is fixed coaxially to said drive shaft (41) and which is provided at a periphery thereof with means for sealing (43) with an upper wall (4b) of a relative sterile chamber (40a);

a plurality of rods (44) each inferiorly provided with a chuck (45) for capping a bottle (3) and which are drawn in rotation by said drive shaft (41), which are mobile on command in a vertical direction, each thereof passing sealedly through a respective hub (48) provided with a sterile barrier, mounted solidly to said disc (42).

7. A plant as in any one of the preceding claims, **characterized in that** one of said operative group is a filler group for bottles, comprising:

an entrance (31) and an exit (32) for said bottles (3);

a plurality of support organs (33), each of which moves cyclically on command to transport a bottle (3) from said entrance (31) to said exit (32), each of said plurality of support organs (32) being mobile on command in a vertical direction; a plurality of filler heads (34) each of which is associated to one of said support organs (33), each of which filler heads (34) is connected to a dispensing pipe (35) of a product destined to fill the bottles (3), each of which filler heads (34) opens to dispense said product by means of an upwards pressure thereon;
a cam (36) which acts on said support organs (33) to cause displacements thereof in a vertical direction;

a contact element (39), solidly constrained to each of said support organs (33) and conformed and arranged such as to exert on a respective filler head (34), on contact there-with, an upwards-directed pressure which is sufficient to cause opening thereof;
means (37) for positioning on command said cam (36) in a vertical direction.

Patentansprüche

1. Anlage zum sterilen Füllen von Flaschen im Durchlaufverfahren, enthalten:

eine Zuführbahn (2) für die Flaschen (3);
eine Anzahl von Arbeitsgruppen (10, 20, 30, 40), von denen jede mit aktivierbaren beweglichen Elementen zum Einwirken auf die auf der genannten Zuführbahn (2) durchlaufenden Flaschen (3) versehen ist, sowie mit einem Motor zum Antrieb der genannten beweglichen Elemente; wobei jede der genannten Arbeitsgrup-

pen (10, 20, 30, 40) eine sterile Kammer (10a, 20a, 30a, 40a) enthält, die von den genannten Flaschen (3) durchlaufen wird, welche sterile Kammer (10a, 20a, 30a, 40a) Wände (4) hat und einen sterilen Bereich bildet, der einen Teil der entsprechenden Arbeitsgruppe (10, 20, 30, 40) enthält,

wobei die verschiedenen sterilen Kammern für jede Arbeitsgruppe miteinander verbunden sind; wobei eine der genannten Arbeitsgruppen (10) zum Sterilisieren der Flaschen (3) vorgesehen ist, während die anderen Arbeitsgruppen leicht unter Druck gehalten werden;

dadurch gekennzeichnet, dass wenigstens eine Wand (4a) einer jeden sterilen Kammer abdichtend einen entsprechenden sterilen Bereich von dem genannten Motor und von den genannten Mitteln für den Antrieb der genannten beweglichen Elemente einer jeden entsprechenden Arbeitsgruppe trennt; wobei die sterile Kammer (10a) der genannten Sterilisiergruppe leicht unter Druck gehalten wird, und zwar mit einem leicht geringeren Druck als der in den sterilen Kammer der anderen Arbeitsgruppen.

2. Anlage nach Patentanspruch 1, **dadurch gekennzeichnet, dass** eine Öffnung (13) vorgesehen ist, um die sterile Kammer (10a) der Sterilisiergruppe mit dem Aussenbereich in Verbindung zu bringen.

3. Anlage nach Patentanspruch 1 oder 2, umfassend eine Arbeitsgruppe zum Füllen der Flaschen (3), enthaltend:

eine Anzahl von Trägerelementen (33) für die Flaschen (3), die auf einen Antrieb hin in vertikaler Richtung beweglich sind, wobei jedem dieser Trägerelemente (33) ein Füllkopf (34) zugeordnet ist, welcher Füllkopf (34) an eine Abgabelleitung (35) für ein in die genannte Flasche (3) zu füllendes Produkt angeschlossen ist, und welcher Füllkopf (34) sich zur Abgabe des genannten Produktes infolge eines nach oben auf diesen gerichteten Druckes öffnet; eine Nocke (36), die auf die genannten Trägerelemente (33) wirkt, um die Verschiebung derselben in vertikaler Richtung auszulösen;

dadurch gekennzeichnet, dass sie wie folgt enthält:

ein Kontaktelement (39), das fest mit jedem der genannten Trägerelemente (33) verbunden ist, so ausgelegt und angeordnet, dass es auf einen jeweiligen Füllkopf (34) im Kontakt mit diesem einen nach oben gerichteten Druck ausübt, der ausreichend ist, das Öffnen desselben zu bewirken;

Mittel (37) zum Positionieren, auf Antrieb hin, der genannten in einer vertikalen Richtung.

4. Anlage nach Patentanspruch 3, **dadurch gekennzeichnet, dass** die genannten Mittel zum Positionieren wenigstens eine Hebewinde mit vertikaler Achse enthalten, die im Betrieb der genannten Nocke (36) zugeordnet ist.

5. Anlage nach Patentanspruch 3 oder 4, **dadurch gekennzeichnet, dass** das genannte Kontaktelement (39) gabelförmig ist, und dadurch, dass der Hals (5') einer zu füllenden Flasche (3) in diesem aufgenommen wird.

6. Anlage nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet, dass** sie wie folgt enthält:

eine Arbeitsgruppe zum Verschliessen, welche eine mittlere Antriebswelle (41) mit vertikaler Achse hat und eine Scheibe (42), die koaxial zu der genannten Antriebswelle (41) befestigt und an ihrem Umlauf mit Mitteln zum Abdichten (43) mit einer oberen Wand (4b) einer entsprechenden sterilen Kammer (40a) versehen ist; eine Anzahl von Stangen (44), von denen jede am unteren Ende mit einem Spannelement (45) zum Verschliessen einer Flasche (3) versehen ist, welches durch die genannte Antriebswelle (41) in Umdrehung versetzt wird und auf einen Befehl hin in vertikaler Richtung verschiebbar ist,

wobei jedes dicht abschliessend durch eine jeweilige, fest an der genannten Scheibe (42) montierten Nabe (48) geführt wird, die mit einer sterilen Barriere versehen ist.

7. Anlage nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet, dass** eine der genannten Arbeitsgruppen eine Füllgruppe für Flaschen ist, die wie folgt enthält:

einen Eingang (31) und einen Ausgang (32) für die genannten Flaschen (3); eine Anzahl von Trägerelementen (33), von denen sich ein jedes auf einen Befehl hin zyklisch bewegt, um eine Flasche (3) von dem genannten Eingang (31) an den genannten Ausgang (32) zu transportieren, wobei jedes der genannten Trägerelementen (33) auf einen Befehl hin in vertikaler Richtung verschiebbar ist; eine Anzahl von Füllköpfen (34), jeder von diesen einem genannten Trägerelement (33) zugeordnet, welche Füllköpfe (34) jeweils an eine Abgabelleitung (35) für ein Produkt angeschlossen

sen sind, mit dem die Flaschen (3) gefüllt werden sollen, und welche Füllköpfe (34) sich mit Hilfe eines Druckes nach oben auf diese selbst öffnen, um das genannte Produkt abzugeben; eine Nocke (36), welche auf die genannten Träger-
 5 gerelemente (33) wirkt, um die Verschiebungen derselben in einer vertikalen Richtung zu bewirken;
 ein Kontaktelement (39), das fest mit einem jeden der genannten Trägerelemente (33) verbunden und so ausgebildet und angeordnet ist,
 10 dass es auf einen jeweiligen Füllkopf (34), mit dem es sich im Kontakt befindet, einen nach oben gerichteten Druck ausübt, welcher ausreichend ist, das Öffnen desselben zu bewirken;
 15 Mittel (37), die auf einen Befehl hin die genannte Nocke (36) in einer vertikalen Richtung positionieren.

Revendications

1. Une installation de remplissage stérile de bouteilles suivant un cycle continu, comprenant:

- une ligne d'alimentation (2) de bouteilles (3);
- une pluralité de groupes opératifs (10, 20, 30, 40), chacun desquels est pourvu d'organes mobiles sur commande pour agir sur les bouteilles (3) transitant sur ladite ligne d'alimentation (2) et d'un moteur pour commander lesdits organes mobiles;
- pour chacun des groupes opératifs (10, 20, 30, 40), une chambre stérile (10a, 20a, 30a, 40a) traversée par les bouteilles (3), laquelle chambre stérile (10a, 20a, 30a, 40a) est délimitée par des parois (4) et représente une zone stérile contenant une partie du relatif groupe opératif (10, 20, 30, 40), les différentes chambres stériles pour chaque groupe opératif étant interconnectées;
- un desdits groupes opératifs (10) étant prévu pour stériliser les bouteilles (3), les autres groupes opératifs étant maintenus légèrement pressurisés;

caractérisée en ce que:

- au moins une paroi (4a) de chaque chambre stérile sépare de manière étanche une relative zone stérile dudit moteur et desdits moyens pour commander lesdits organes mobiles du relatif groupe opératif;
- la chambre stérile (10a) dudit groupe de stérilisation est maintenue légèrement pressurisée à une pression légèrement inférieure à celle de la chambre stérile d'autres groupes opératifs.

2. Une installation selon la revendication 1, **caractérisée en ce qu'une** ouverture (13) est prévue pour placer la chambre stérile (10a) du groupe de stérilisation en communication avec l'atmosphère externe.

3. Une installation selon la revendication 1 ou 2, comprenant un groupe opératif pour remplir les bouteilles (3) comprenant:

- une pluralité d'organes de support (33) pour les bouteilles (3), mobiles sur commande dans une direction verticale, à chacun desquels est associée une tête de remplissage (34), laquelle est reliée à un conduit d'alimentation (35) d'un produit destiné à remplir lesdites bouteilles (3), laquelle tête de remplissage (34) s'ouvre pour délivrer ledit produit au moyen d'une pression vers le haut;
- une came (36) agissant sur lesdits organes de support (33) pour commander des déplacements verticaux;

caractérisée en ce qu'elle comprend:

- un élément de contact (39), solidaire de chacun desdits organes de support (33), conformé et disposé de manière à exercer sur une respective tête de remplissage (34), lorsqu'il entre en contact avec celle-ci, une pression vers le haut suffisante pour causer son ouverture;
- des moyens (37) pour positionner sur commande ladite came (36) dans une direction verticale.

4. Une installation selon la revendication 3, **caractérisée en ce que** lesdits moyens de positionnement comprennent au moins un vérin (37) à axe vertical opérativement associé à ladite came (36).

5. Une installation selon la revendication 3 ou 4, **caractérisée en ce que** ledit élément de contact (39) est en forme de fourche, et **en ce que** ce dernier accueille un col (5') d'une bouteille (3) devant être remplie.

6. Une installation selon n'importe laquelle des revendications précédentes, **caractérisée en ce que:**

- elle comprend un groupe opératif pour boucher, comprenant un arbre moteur (41) central à axe vertical et un disque (42) fixé coaxialement audit arbre moteur (41) et étant pourvu sur sa périphérie de moyens d'étanchéité (43) avec une paroi supérieure (4b) d'une relative chambre stérile (40a);
- une pluralité de tiges (44), munies inférieurement d'un mandrin (45) pour boucher une bou-

teille (3) et entraînées en rotation par ledit arbre moteur (41), sont mobiles sur commande dans une direction verticale et chacune desquelles passant de manière étanche au travers d'un moyeu (48) pourvu d'une barrière stérile, monté solidairement dudit disque (42). 5

7. Une installation selon n'importe laquelle des revendications précédentes, **caractérisée en ce que** l'un desdits groupes opératifs est un groupe de remplissage des bouteilles, comprenant: 10

- une entrée (31) et une sortie (32) pour lesdites bouteilles (3);
- une pluralité d'organes de support (33), chacun desquels se déplace cycliquement sur commande pour transporter une bouteille (3) de ladite entrée (31) à ladite sortie (32), chacun desdits organes de support (32) étant mobile sur commande dans une direction verticale; 15 20
- une pluralité de têtes de remplissage (34), chacune desquelles étant associée à l'un des organes de support (33), étant reliée à un conduit d'alimentation (35) d'un produit destiné à remplir les bouteilles (3), et s'ouvrant pour délivrer ledit produit au moyen d'une pression vers le haut; 25
- une came (36) qui agit sur lesdits organes de support (33) pour causer leur déplacement en direction verticale; 30
- un élément de contact (39), solidaire de chacun desdits organes de support (33), conformé et disposé de manière à exercer sur une respective tête de remplissage (34), lorsqu'il est en contact avec celle-ci, une pression vers le haut suffisante pour causer son ouverture; 35
- des moyens (37) pour positionner sur commande ladite came (36) dans une direction verticale. 40

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Fig.1

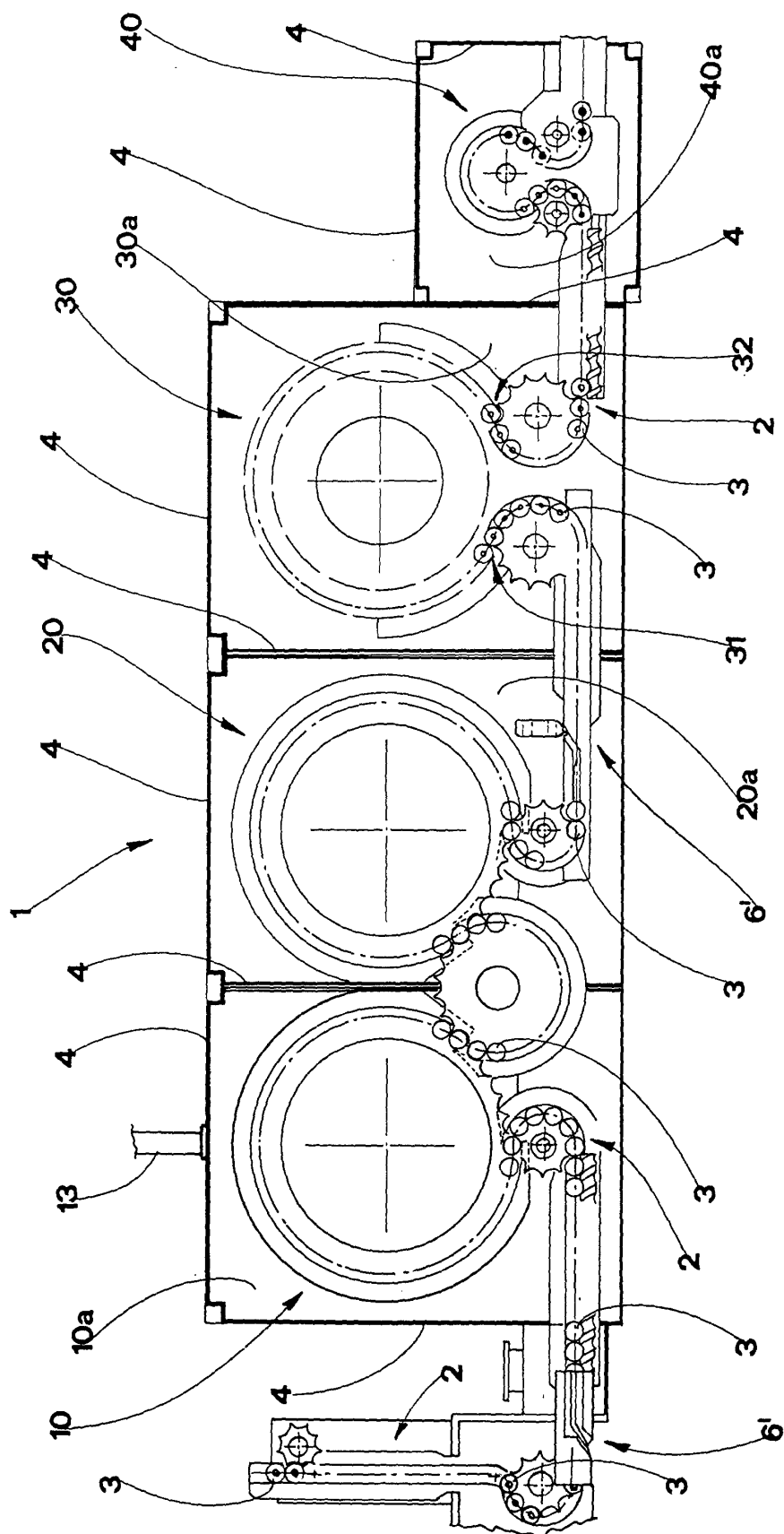


Fig.2

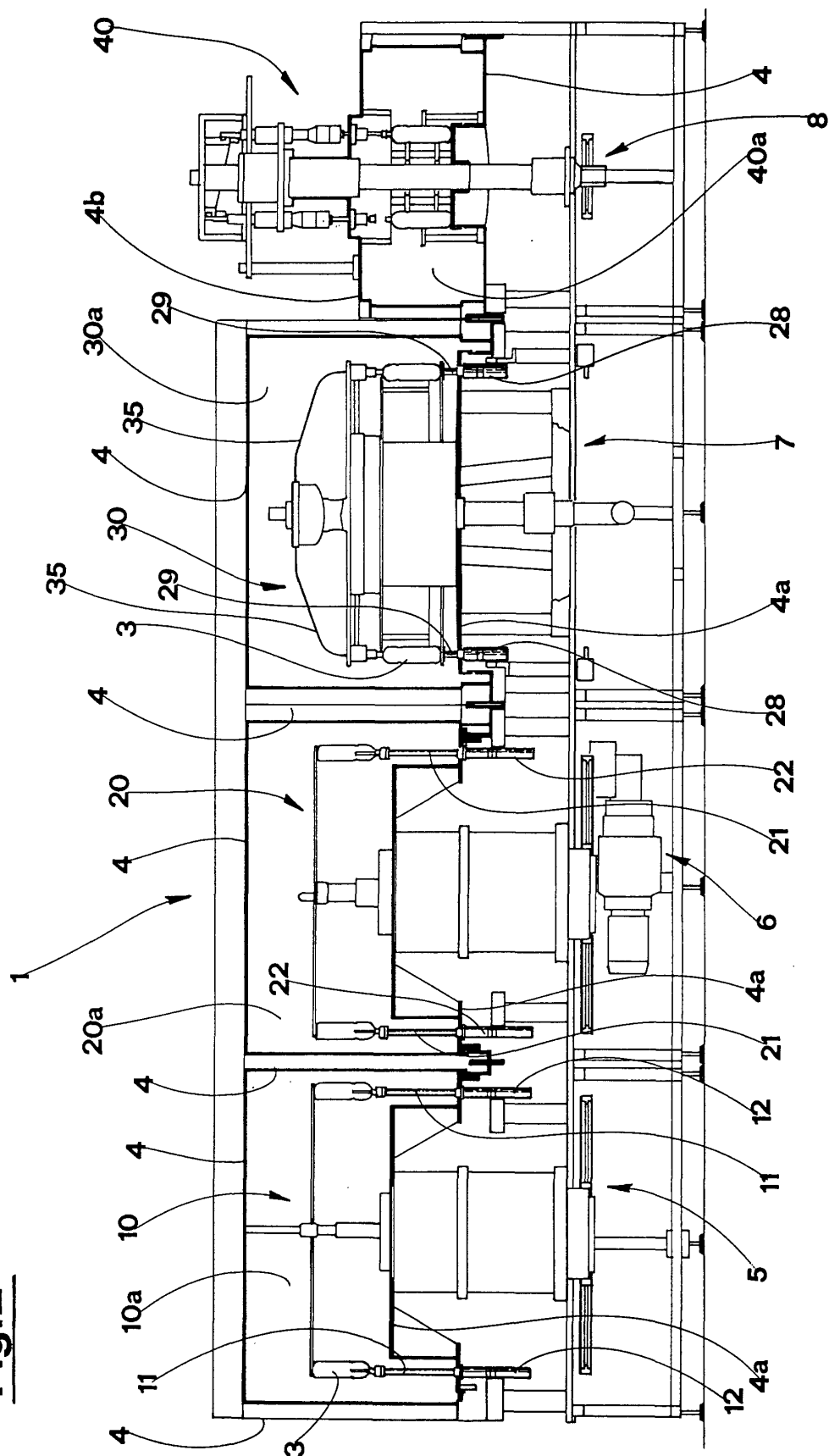


Fig.3

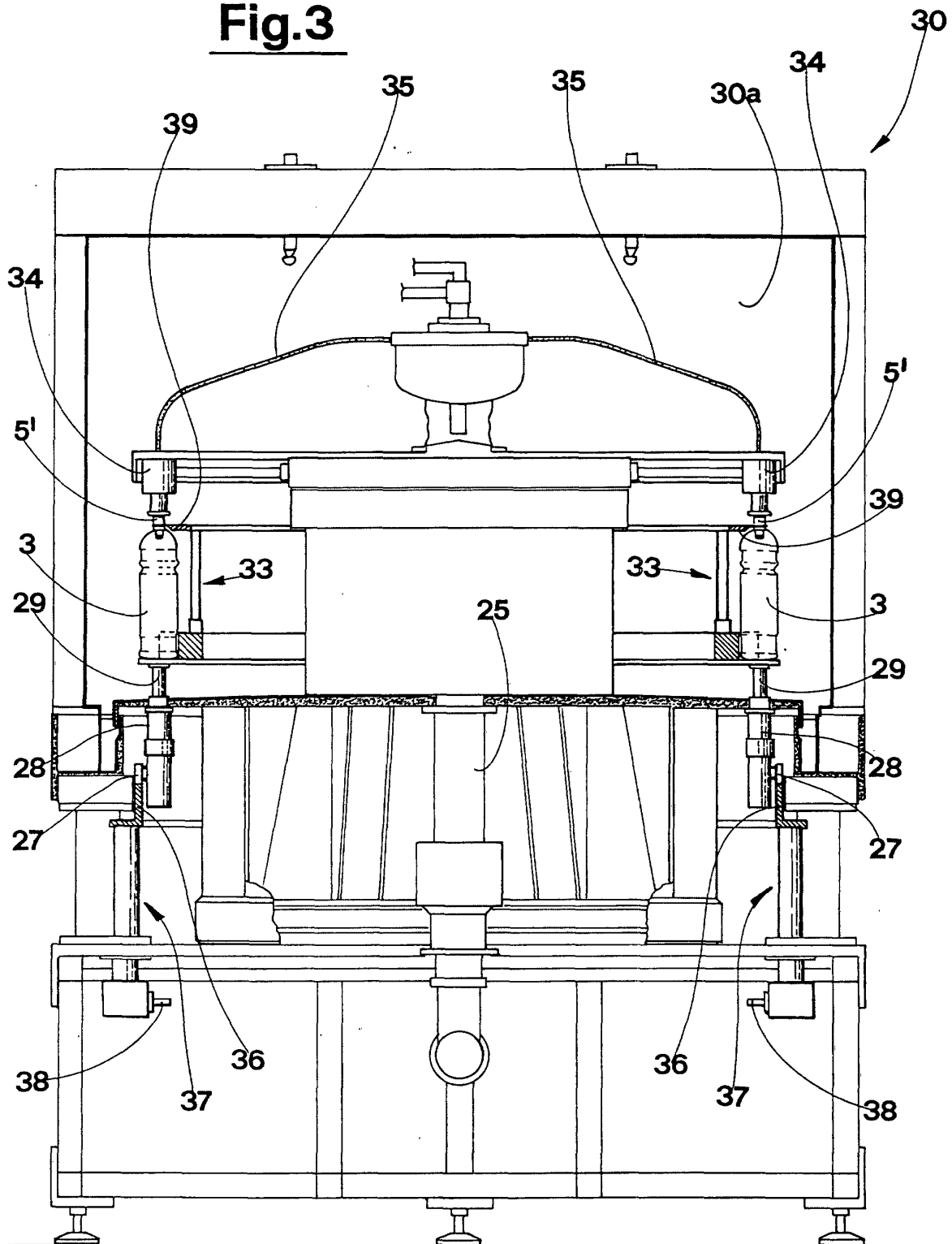


Fig.4

