



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.05.2011 Bulletin 2011/21

(51) Int Cl.:
B08B 9/42 (2006.01) F26B 15/18 (2006.01)

(21) Application number: **10191284.8**

(22) Date of filing: **16.11.2010**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **19.11.2009 IT GE20090088**

(54) **Apparatus for washing and drying bottles with a linear bottle transfer device**

(57) The invention relates to an apparatus for washing and drying bottles, wherein the bottles are picked up from a main feed line (12) and loaded onto a carousel washing machine (10), at the exit of which they are delivered to a subsequent drying station on a continuous conveyor (16).

For transferring the bottles from the washing mill turn machine to the continuous conveyor (16), the invention advantageously provides two rotary devices (14,15) arranged in series. The features of the invention allow to obtain a compact apparatus, wherein the dried bottles are evacuated along the same main feed line (12) as the one followed when entering the apparatus.

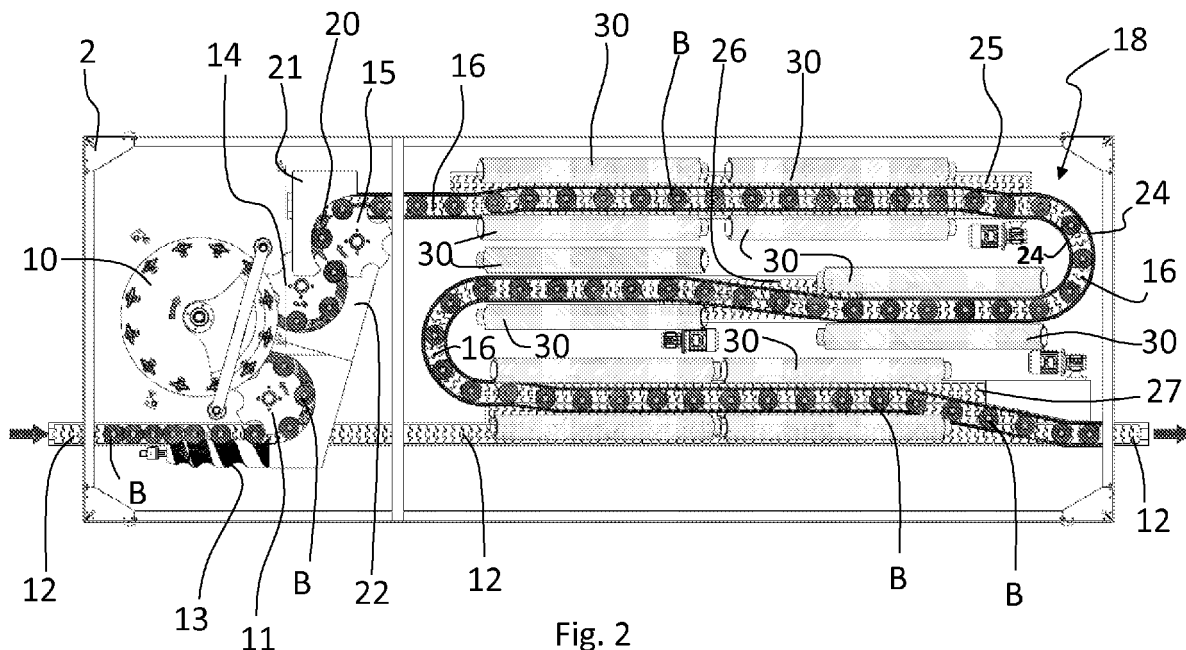


Fig. 2

Description

[0001] According to a more general aspect, the present invention relates to a bottle treating process in a bottling line.

[0002] As it is known, for the production of bottled beverages, especially those contained in glass bottles like wine, beer and similar, the filled and closed bottles are washed before being labeled; this is done in order to remove from their surfaces any deposits which might prevent label adhesion.

[0003] The bottle washing step necessarily involves a bottle drying step, without which the labels could not be properly applied.

[0004] At industrial level these steps are of course carried out by suitable machines which, in large production plants, are located along bottling lines where the bottles advance on continuous conveyors.

[0005] An example of an apparatus for preparing bottles to be labeled in accordance with this technology is known from the European patent granted under no. EP 1 357 082.

[0006] This apparatus is intended in particular for treating bottles of sparkling wine, which is bottled at low temperatures; during the production process carried out by the apparatus described in this prior art, the wine must be brought to ambient temperature before labeling and packaging the bottles.

[0007] This is due to the fact that the low temperature of the wine may cause condensate to form on the bottle, which may prevent label adhesion and damage the cardboard of the bottle packaging boxes.

[0008] For this reason, in the above-mentioned European patent the cold bottles coming from the bottling and closing stations travel along a line section upstream of a washing and heating apparatus and reach a washing station integrated therein.

[0009] To this purpose, the bottles are picked up by a so-called "star" transfer device that loads them onto a carousel washing machine; both the transfer device and the carousel washing machine comprise a vertical-axis rotary circular platform (similar to a carousel) peripherally equipped with compartments for the bottles: these compartments give the apparatus an appearance similar to a star (hence the name of the transfer device).

[0010] The trajectories of rotation of the compartments of the transfer device and of the carousel washing machine are tangential and the respective revolution speeds are synchronous, so that when a bottle reaches the point where the trajectories meet, it moves from the transfer device to the washing mill turn machine, where it occupies a corresponding peripheral compartment.

[0011] Downstream of the washing station there is another transfer device that picks up the washed bottles and loads them onto a continuous conveyor, which then delivers them to the downstream drying and heating stations; afterwards, the bottles are evacuated on another conveyor and subjected to the next steps of the produc-

tion cycle (labeling, packaging, etc.). Such an apparatus can ensure high productivity levels, but nevertheless it has some limitations inherent to its design.

[0012] The first limitation is that the transfer device operating downstream of the carousel washing machine cannot directly transfer the bottles onto the adjacent conveyor belt, since it is arranged alongside the belt and cannot therefore be too close thereto to avoid the risk of interference.

[0013] In practice, because the conveyor belt passes through two star transfer devices (one for loading and the other for unloading the washing machine), the latter must operate alongside it, and each bottle is loaded onto the belt, after being washed, by the thrust exerted by the bottle immediately following it; the inevitable collision between the bottles may cause some of them to break or fall down.

[0014] Furthermore, the above-mentioned apparatus of EP 1 357 082 takes much space because it requires a separation of the upstream and downstream sections of the production line.

[0015] The presence of these two separate line sections also limits the room available for drying and heating the bottles: in fact, the drying and heating areas must be contained within the space comprised between the upstream section and the downstream section of the line, so that it is necessary to provide a suitable continuous transport system in order to obtain a bottle feeding path which is sufficiently long to perform both functions.

[0016] For this reason, the prior art includes parallel sections of single conveyor belts arranged side by side in order to obtain a sufficiently long path where the bottles can be dried and heated to the desired temperature.

[0017] However, in addition to a very complex transport system (in practice, many independent conveyor belts), this also implies little room available for positioning the drying means, typically consisting of hot-air fans.

[0018] It is a first object of the present invention to provide a bottle washing and drying apparatus having such structural and operating features that allow to overcome the above-mentioned drawbacks.

[0019] It is a second object of the present invention to provide an improved star transfer device which allows the bottles to be transferred onto a downstream conveyor while avoiding any risk of collision or fall due to points where the bottles stop or to discontinuity between the device support surface and the conveyor.

[0020] The idea allowing to achieve said objects is to provide a bottle transfer system which also comprises, among other features, one pair of star devices arranged in series.

[0021] In this way it is possible to create a washing and drying machine that does not require two separate bottle transport line sections, i.e. one for feeding the bottles and the other for evacuating them.

[0022] All other conditions being equal, thanks to this feature the carousel washing machine can be made more compact than the prior art.

[0023] Further structural and functional features of the invention will be set out in the appended claims; such features and the advantages deriving therefrom will become more apparent from the following description of a preferred but non-limiting embodiment of the invention, shown in the annexed drawings, wherein:

- Fig. 1 is a front view of a machine according to the present invention;
- Fig. 2 is a plan view of the machine of Fig. 1;
- Fig. 3 is a detail of the apparatus of the preceding figures;
- Fig. 4 is a variant of the apparatus of the preceding figures.

[0024] Referring now to the above-listed drawings, reference numeral 1 designates as a whole a bottle washing apparatus in accordance with the invention.

[0025] Said apparatus comprises a rectangular containment structure 2, with a base 3 that houses the components necessary for the operation of the various devices, which will be described more in detail hereafter; the structure 2 rests on the floor through feet 4 and is fitted with side curtain panels 5 made of transparent material (glass, polycarbonate or the like). According to some preferred possible embodiments, the latter can be opened and may therefore be provided in the form of leaf doors or sliding windows.

[0026] Within the structure 2, the apparatus comprises a carousel washing machine 10 of a per se known type, which is fed with bottles to be washed via a first star transfer device 11.

[0027] As can be seen in the plan view of Fig. 2, the bottles arriving from the upstream stations (not shown in the drawings) of the bottling line that includes the apparatus 1, advance on a continuous conveyor 12 along which there is a timing auger 13: the latter is a known mechanism used in bottling machines for spacing the bottles at a distance corresponding to the pitch of the loading star 11.

[0028] According to the invention, downstream of the carousel washing machine 10 there is a pair of star devices 14, 15 arranged in series, so that the bottles on the first device are transferred onto the second device, which in turn places them on a continuous conveyor belt 16 that will be described more in detail later on.

[0029] As shown more clearly in Fig. 3, which illustrates a detail of the apparatus region where the second star 15 is located, the latter moves the bottles B resting on a support surface 20 along a trajectory having the shape of an arc of circumference delimited laterally by a guide or sideboard 21.

[0030] It must be pointed out that a similar guide or sideboard 22 is also present at the first star transfer device 14.

[0031] In accordance with a preferred embodiment, in this example of an apparatus according to the invention brushes 23 for cleaning the underside of the bottles are

arranged on the support surface 20: in fact, as the bottles advance on the surface 20, they come to meet the areas where the brushes remove any deposits from their underside.

[0032] As aforementioned, downstream of the second star device 15 the bottles arrive at the conveyor 16, which moves them along a drying station 18; to this end, the support surface 20 extends adjacent to the conveyor, so that there is no surface discontinuity.

[0033] As clearly shown in the plan view, the transfer device 15 accompanies the bottles B, with the help of the guide 21, until they reach the conveyor 16; this is made possible by the fact that the second star device 15 is located at a distance from the carousel washing machine 10, thanks to the presence of the first device 14 therebetween.

[0034] This provides room for the guide 21 that embraces the end of the continuous conveyor 16, the support surface 20 and the second star 15, which can extend to the conveyor itself since there is no risk of interference with the carousel washing machine 10 and the structure thereof; this also applies when the carousel washing machine is smaller, all other conditions being equal, than a carousel machine of a traditional plant with just one downstream transfer star, such as the one described in EP 1 357 082.

[0035] As far as the conveyor 16 is concerned, it is of the linked belt type and can follow, without solution of continuity, a serpentine path as shown in Fig. 2, along which the bottles are stabilized laterally by sideboards 24; linked belts like the one taken into account herein are known in the art and are available, for example, from company System Plast based in Telgate (Italy).

[0036] As can be seen, the horizontal sections of the serpentine advantageously have a certain pitch, i.e. they are not attached to one another as in the plant known from the prior European patent previously referred to.

[0037] Furthermore, in the solution shown the horizontal sections of the belt 16 (with reference to Fig. 2) are flanked by respective counter-belts 25, 26, 27, i.e. continuous conveyors moving at a different speed than the main belt 16; the speeds of the counter-belts may have opposite direction or else they may have the same direction as the main belt speed but with a different modulus, so that the bottles are turned relative to their vertical axis in accordance with a technique already well known in the art.

[0038] It must be pointed out that the spaced arrangement of the serpentine sections is not however detrimental to the drying of the bottles, which takes place while the latter are advancing on the belt 16, since the total feed path is made sufficiently long by the presence of the second transfer star 15.

[0039] In other words, by appropriately positioning the latter (i.e. more to the left or to the right than shown in Fig. 2, while still keeping the distance from the first device 14 unchanged), it is possible to free up the room necessary for a path long enough to allow the bottles to dry. In

this regard, it should also be remarked that, according to the preferred embodiment shown in the drawings, the path of the belt conveyor 16 includes diagonal deviations that lengthen its extension slightly without however jeopardizing the important result it attains, i.e. advancing the bottles from beginning to end without solution of continuity.

[0040] For this purpose, the conveyor 16 may be provided as a single linked belt or as two (or more) independent sections (i.e. each having its own drive) arranged one following the other as shown in the drawings, so that the bottles will move on without ever stopping along the serpentine path defined by the belt(s).

[0041] This is not possible in the solution disclosed in EP 1 357 082, wherein the serpentine curves simply consist of fixed guides (i.e. not belonging to one single advancing belt), which act as junctions between the single sections of the parallel and independent conveyors.

[0042] In such curves the bottles tend to stop, and only the arrival of other bottles from the upstream belt causes them to advance and reach the downstream belt; this however involves collisions between the bottles along each curve of the serpentine, which collisions would be best avoided to prevent possible breaks.

[0043] The distance between the various sections of the conveyor 16 also makes it possible to place sufficiently powerful fans 30 therebetween.

[0044] Advantageously, in the embodiment example shown in the drawings the fans preferably consist of ducts 30 arranged with a downward slope in the feeding direction of the bottles B, and having side nozzles (not shown in the drawings) for distributing hot air onto the bottles.

[0045] The downward orientation of the ducts 30 causes the hot air to be distributed onto the advancing bottles in a progressive manner for the whole height thereof, thus ensuring that they are dried evenly; the bottles then pass onto the main line belt 12.

[0046] As can be seen, the step of transferring the bottles from the belt 16 that goes through the drying station 18 to the main line belt 12 is accomplished in a very simple manner by having the former converge towards the latter, without needing any additional star devices or the like.

[0047] The above-described apparatus operates as follows.

[0048] The bottles previously filled and corked/capped in the upstream stations of the apparatus 1 advance on the main line 12 up to the auger device 13 that feeds the star transfer device 11.

[0049] The latter rotates in the direction indicated by the arrow in Fig. 2 and loads the bottles onto the carousel washing machine 10 in a per se known manner; the bottles, which in the case of sparkling wine are at low temperature, are carried along the section comprised between the loading device 11 and the unloading device 14, where they are washed with brushes and water jets.

[0050] The star unloading device 14 picks up the washed bottles and delivers them onto the second transfer device 15: the latter receives the bottles and transfers

them onto the belt 16 of the drying station 18.

[0051] This step takes place in a quick and reliable manner because, as already explained, the bottles laid onto the support surface 20 of the star transfer device 15 are pushed tangentially onto the conveyor 16, at the end thereof.

[0052] There are therefore no significant speed differences between the bottles pushed by the device 15 and the belt 16, so that the belt can be loaded in a reliable manner even at high production rates (up to 20,000 bottles/h).

[0053] The bottles thus enter the drying station, where the wash water is evaporated by jets blown by the ducts 30; in this respect, it is worth pointing out that, unlike the machine described in EP 1 357 082, the apparatus 1 does not include a heating station to bring the filled bottles to ambient temperature (18-22 °C).

[0054] In fact, the apparatus 1 is only used for washing and removing the water from the bottle surface: at the exit of the drying station 18 they do not reach ambient temperature because the hot air blown by the jets essentially provides the heat necessary for the water to evaporate.

[0055] For this purpose, the apparatus 1 includes a temperature control system of a per se known type which comprises, for example, probes and a system that will stop the machine in the event that thermal values higher than desired are sensed, so as to prevent the bottles from overheating. Of course, such a control system uses an electronic controller (e.g. a PLC or the like) and all the components, whether electronic or not, required for this purpose, which will not be described any further herein since they are well known in the art.

[0056] The bottles go through the drying station 18 carried by the belt 16 and, as already explained, advance without solution of continuity because the belt 16 covers the entire path within the station 18.

[0057] In the latter, the bottles are dried evenly for their whole height by hot air jets, also due to the action of counter-belts 25, 26 and 27 which cause them to rotate axially.

[0058] In this regard, it must be pointed out that in the apparatus 1 the bottles enter and exit on the main line 12; in other words, the apparatus 1 is essentially a "bypass" of the main line, thus requiring no particular modifications to the latter.

[0059] It follows that the apparatus according to the invention can be easily installed on existing lines, and is therefore particularly advantageous in this respect.

[0060] From the above description it can be understood that the apparatus 1 for washing and drying bottles achieves the objects initially set forth herein.

[0061] First of all, this is implied by the fact that the bottles, as previously described, enter and exit on the line 12, which is not divided into two separate sections.

[0062] This feature simplifies the structure of the apparatus, since there are no longer any room limitations for the drying station downstream of the washing station

due to the presence of the upstream and downstream sections of the transport line.

[0063] Furthermore, the use of the three star transfer devices 11, 14 and 15 makes it possible to optimize the operation of the washing carousel machine 10 with a significant dead time reduction; for instance, a 14-compartment carousel machine can indicatively offer the same performance, in terms of washing times, as an 18-compartment carousel machine employed in an apparatus like the one described in EP 1 357 082.

[0064] This is due to the fact that in said prior art the loading and unloading star devices of the washing carousel machine are installed between the latter and the conveyors, respectively upstream and downstream thereof.

[0065] It follows that, in order to have sufficient room, the washing carousel machine is normally very big, so as to allow the loading and unloading star devices to be sufficiently distant from each other.

[0066] In the invention, instead, the latter can be placed closer to each other, since the adjacent continuous conveyors have a different layout.

[0067] Another advantageous effect achieved by the invention is that it does not require an additional star device for returning the bottles from the conveyor 16 in the drying area to the main line conveyor 12.

[0068] This is due to the belt 16 (made as one section or formed by multiple sections), which, as aforesaid, extends without solution of continuity along the serpentine path up to the end where it converges towards the line 12.

[0069] Of course, the invention may be subject to many possible variations with respect to the above description.

[0070] In the first place, it must be pointed out that, although the invention is suited to washing glass bottles and is therefore intended mainly for bottling plants for wine, beer and the like, the above principles are also applicable to plastic bottles, or more in general to bottling plants for any liquids, whether or not for food use (e.g. detergents or the like).

[0071] Referring more in detail to the various parts of the machine, the presence of the counter-belts 25, 26 and 27, although preferable because they promote the axial rotation of the bottles, is not however absolutely necessary; it follows that one or more (or even all) of these counter-belts may be eliminated.

[0072] Likewise, the inclined or diagonal sections deviating the path of the conveyor 16 may be omitted as well; also, the bottles may be dried by using solutions other than the inclined ducts 30.

[0073] In general, as an alternative to or in combination with the latter it is possible to use radiant heating systems (infrared rays, microwaves, etc.).

[0074] It should also be highlighted that the provision of the three star transfer devices 11, 14 and 15 makes the machine 1 more flexible and compact as a whole; however, it may have a different layout than shown herein, which may even lack the third star device 15.

[0075] In fact, the third device 15 has a direction of

rotation (opposite to that of the second device 14) that allows the bottles to exit at the same speed as that of the downstream belt 16; the latter extends horizontally, so that the machine as a whole will have an horizontally extending layout like the one shown in Fig. 2, with the bottles entering and exiting along the same directrix defined by the main transport line 12.

[0076] However, should a vertical extension of the apparatus according to the invention be desired, it could be possible to eliminate the third transfer device 15 and arrange the first section of the belt 16 vertically, with the other sections parallel thereto, as shown in Fig. 4. In all other respects this variant of the apparatus is identical to the one previously described, and therefore reference should be made to the above description as regards the other structural and functional aspects thereof; to this end, Fig. 4 maintains the same reference numerals as the previous example.

[0077] Finally, it must be pointed out that the principles of operation and the advantages of a dual rotary transfer device like the star device referred to above are also applicable to machines other than the washing and drying apparatuses taken into account herein.

[0078] For example, it may also be applied to bottle corking/capping or filling stations, not shown in the drawings.

[0079] All of these variants will still fall within the scope of the following claims.

Claims

1. An apparatus for washing and drying bottles, comprising a carousel washing machine (10), a first and a second rotary devices (11, 14) for transferring the bottles (B), respectively adapted to load and unload the carousel washing machine, a drying station (18), **characterized in that** the bottles enter and exit the apparatus along the same feed directrix (12), respectively upstream and downstream thereof.
2. An apparatus according to claim 1, comprising a continuous conveyor belt (16) extending without solution of continuity downstream of the second transfer device (15) up to the bottle exit end of the feed directrix (12).
3. An apparatus according to claim 2, wherein the conveyor belt (16) follows a serpentine path that goes through the bottle drying station (18).
4. An apparatus according to claim 2 or 3, comprising a third transfer rotary device (15) interposed between the second device (14) and the conveyor belt (16) for loading the bottles onto the latter.
5. An apparatus according to claim 4, wherein the third transfer rotary device (15) pushes the bottles in a

direction substantially tangential to the conveyor belt (16) at one end thereof.

6. An apparatus according to any one of claims 2 to 5, comprising one or more counter-belts (25, 26, 27) adjacent to corresponding sections of the conveyor (16), which move at a differential speed relative to the conveyor for providing axial rotation of the bottles. 5 10
7. An apparatus according to one or more of claims 2 to 6, comprising ventilation means (30) arranged in intermediate positions between the serpentine sections of the conveyor (16). 15
8. An apparatus according to any one of the preceding claims, wherein the transfer devices (11, 14, 15) are of the star type.
9. A method for transferring bottles from a carousel machine (10) to a continuous conveyor (16), **characterized by** comprising an operational step implemented through a pair of startype transfer devices (14, 15) arranged in series relative to each other. 20 25

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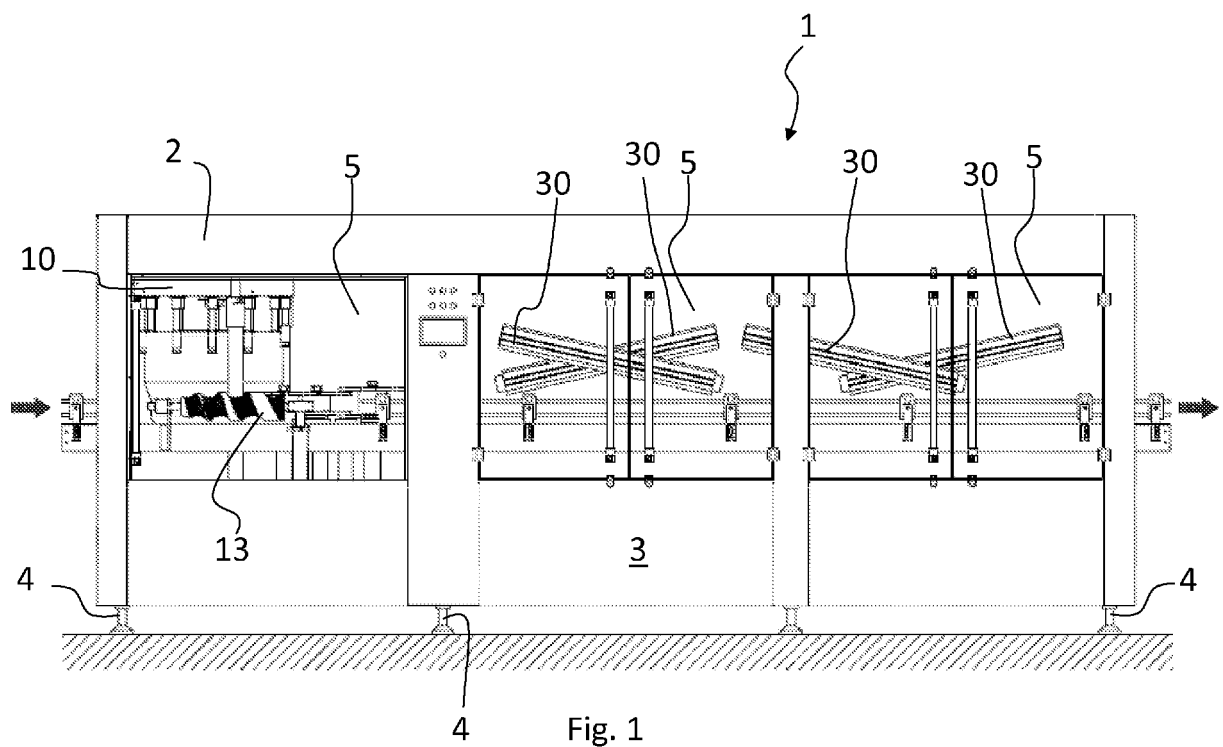
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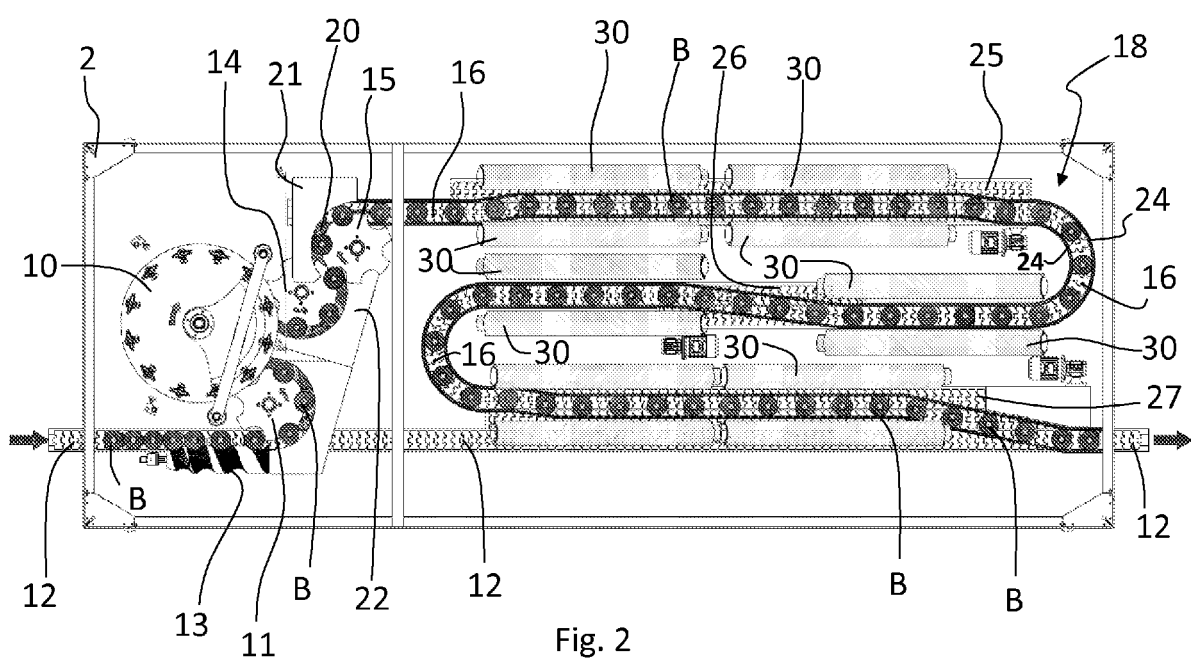
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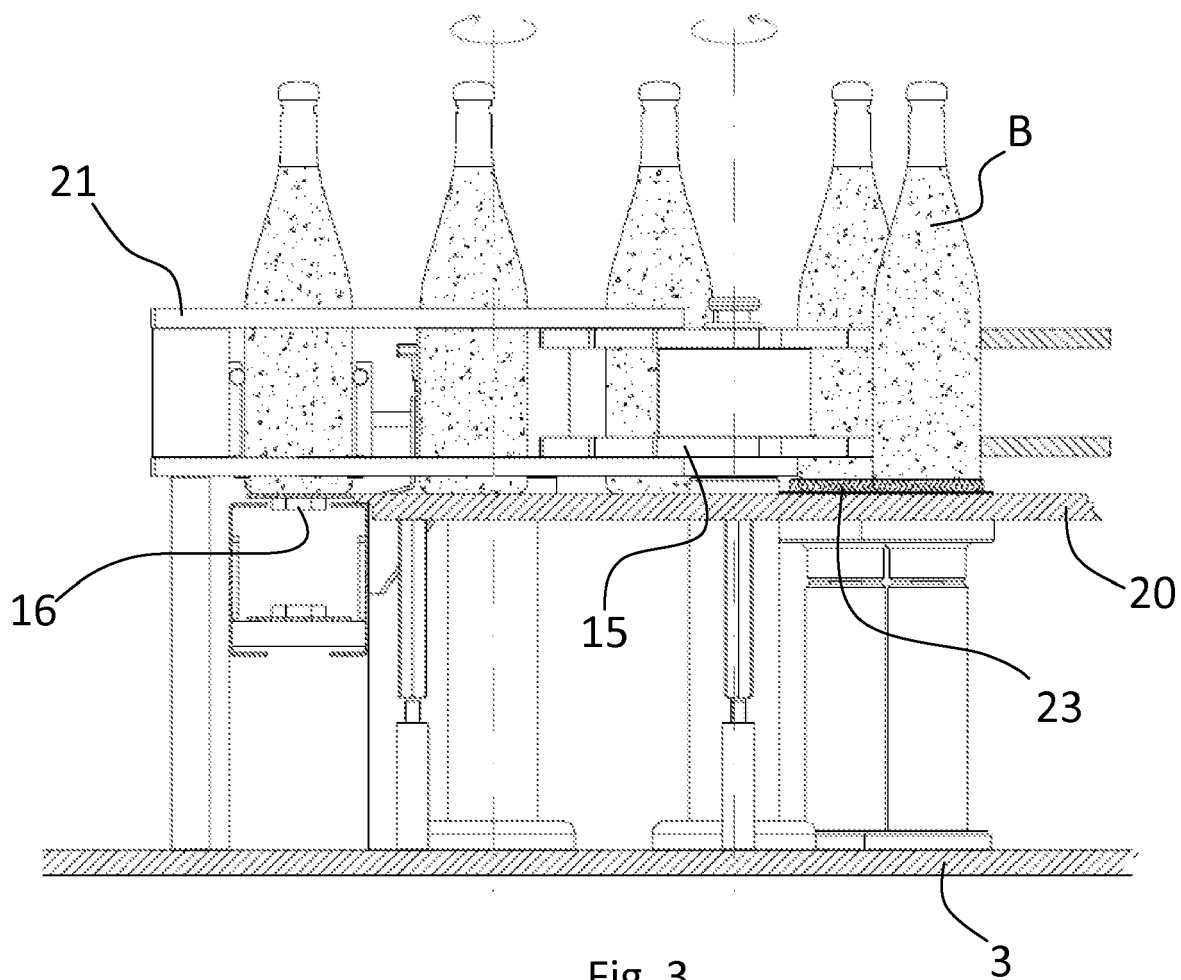
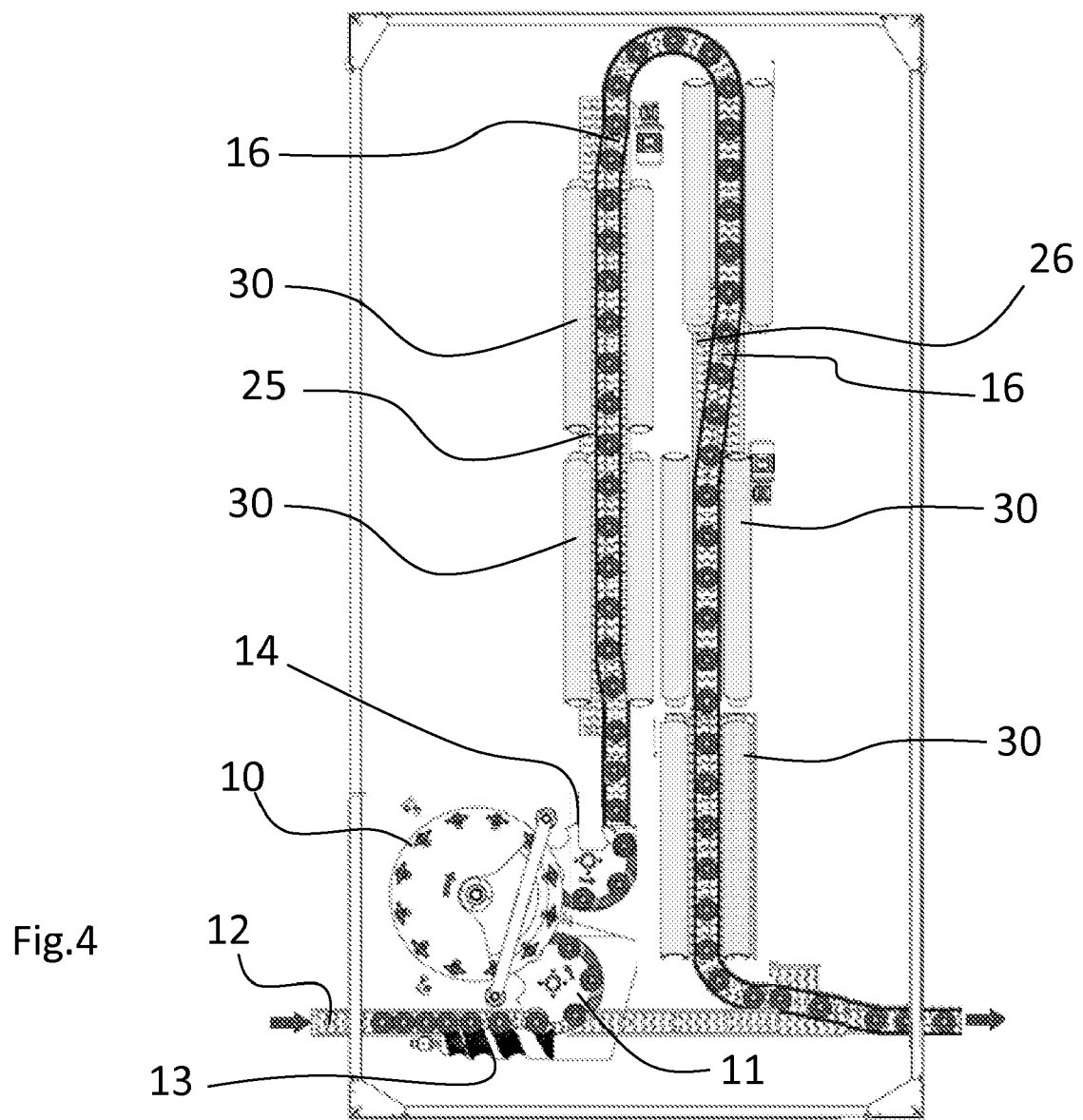


Fig. 3





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Application Number
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Place of search The Hague		Date of completion of the search 27 January 2011	Examiner Appelt, Lothar
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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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
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