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(54) **A RECEPTACLE TREATMENT MACHINE AND A METHOD FOR OPERATING SUCH MACHINE**

(57) There is described a method for operating a receptacle treatment machine (1, 1') comprising at least one upstream treatment apparatus (5, 6, 7, 8), at least one downstream treatment apparatus (6, 7, 8, 53), each one adapted to treat the receptacles (2) and at least one accumulation unit (14) adapted to store receptacles (2). The method comprises the steps of detecting a normal or an atypical working condition of the downstream treatment apparatus (6, 7, 8, 53). In the case of the atypical

working condition the method further comprises the steps of suspending the treatment of the receptacles (2) during advancement of the receptacles (2) through the downstream treatment apparatus (6, 7, 8, 53), feeding the receptacles (2) to the accumulation unit (14) and feeding the receptacles (2) from the accumulation unit (14) back to the downstream treatment apparatus (6, 7, 8, 53) after recovery of the normal working condition.

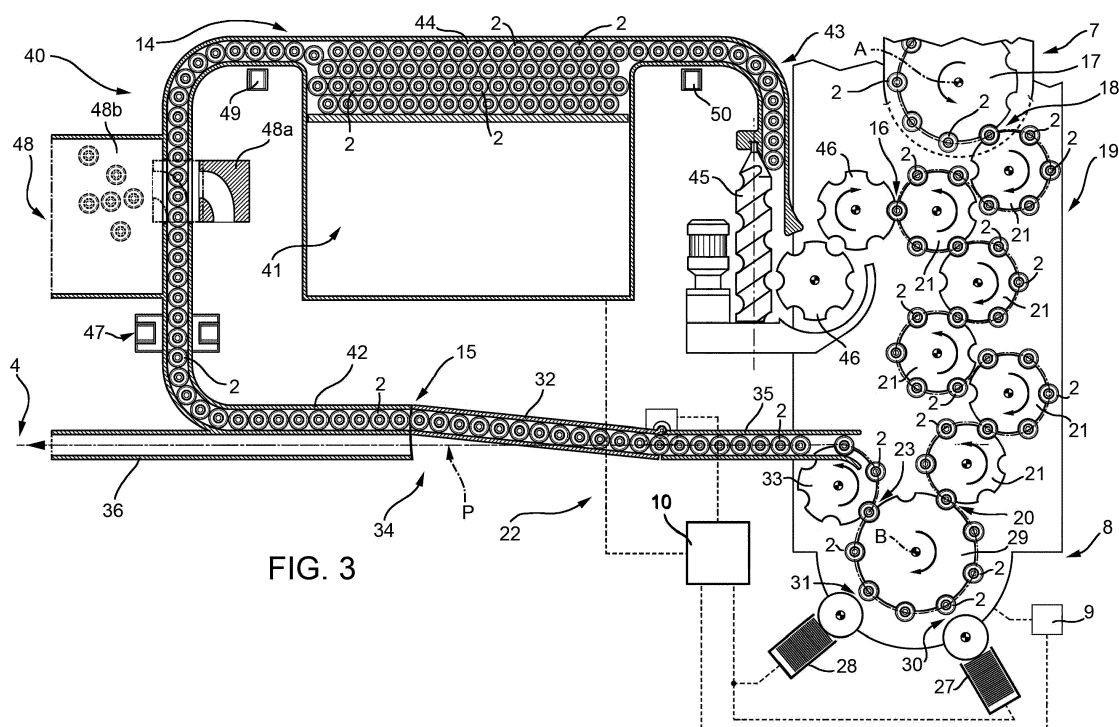


FIG. 3

Description

TECHNICAL FIELD

[0001] The present invention relates to a receptacle treatment machine and a method for operating such a receptacle treatment machine, in particular a receptacle treatment machine in which receptacles, in particular plastic bottles, are at least filled with a pourable product, capped and decorated.

[0002] The products poured in the receptacles include still (such as still water) or carbonated liquids (such as sparkling water, soft drinks and beer), beverages (including juices, teas, sport drinks, wine, etc.), liquid cleaners, emulsions, suspensions, high viscosity liquids, etc.

BACKGROUND ART

[0003] As known, receptacles such as plastic bottles, which the following description will refer to without any limitative scope, are formed from blanks or preforms, rinsed and sterilized, filled with a pourable product, capped with respective closures and are decorated in receptacle treatment machines. Thereby, the order of the varying treatments may be varied under certain limits; e.g. the receptacles can be formed, decorated, filled and capped or they can be formed, filled, capped and decorated.

[0004] Commonly, receptacle treatment machines for treating a wide range of plastic bottles comprise a variety of treatment apparatuses each for performing at least one distinct treatment process and a plurality of conveying units each arranged between two respective treatment apparatuses for conveying the bottles from one treatment apparatus to another one. In more detail, a typical receptacle treatment machine comprises a blow molding apparatus which forms the bottles themselves from typically preforms, a rinsing and sterilization apparatus for cleaning and sterilizing the bottles, a filling apparatus for filling the bottles with a pourable product, a capping apparatus for applying respective closures on the bottles and a decoration apparatus for applying a decoration or decorations on the bottles.

[0005] In even more detail, a typical blow-molding apparatus comprises a blow-molding carousel provided with a plurality of molds each of which being designed to accommodate one respective heated preform and to blow the preform during rotation of the carousel, under high pressure and high temperature to form the respective bottles.

[0006] The bottles exiting from the blow molding apparatus are then transferred to the rinsing and sterilization apparatus from where the cleaned and sterilized bottles are transferred to the filling apparatus.

[0007] Typically, the filling apparatus comprises a filling carousel provided with a plurality of filling units for filling the bottles with a pourable product during rotation of the filling carousel. Then from the filling apparatus the

filled bottles are fed to the capping apparatus.

[0008] The capping apparatus comprises a respective capping carousel provided with a plurality of capping units for applying closures on the bottles during rotation of the capping carousel. Then from the capping apparatus the bottles are transferred to the decoration apparatus.

[0009] The commonly known kinds of decoration apparatuses are apparatuses which apply one or more labels on the bottles, they print or write a decoration pattern on the bottles or they activate pigments arranged within the bottle.

[0010] The kind of decoration apparatus which applies one or more labels on the bottles typically comprises a labelling carousel provided with retaining units for retaining the bottles and at least one labelling unit for applying labels on the receptacles during rotation of the labelling carousel.

[0011] It is known to provide the receptacle treatment machines with conveying units arranged between the varying apparatuses which allow the transfer of the bottles from one apparatus to another one.

[0012] Additionally, it is known to provide buffering units arranged between at least some of the treatment apparatuses. These buffering units typically allow to buffer bottles exiting from one treatment apparatus and being directed to the successive treatment apparatus. The buffering of the bottles basically serves for compensating for the varying working speeds of the different treatment apparatuses and/or to compensate a possible problem compromising the correct treatment within the treatment apparatus downstream of the other one.

[0013] A receptacle treatment machine of this kind is known from EP-A-1681249. In particular, EP-A-1681249 discloses a buffering unit arranged between a rinsing-filling-capping apparatus and a labelling apparatus arranged downstream of the rinsing-filling-capping apparatus. The buffering unit is designed to compensate for variations in the production throughput of any one of the apparatuses. The buffering unit comprises a transfer lane and a buffering area.

[0014] It is disclosed that the buffering unit can e.g. be used in such a way that during a normal working condition of the rinsing-filling-capping apparatus and the labelling apparatus the bottles are directly transferred by the transfer lane from the rinsing-filling-capping apparatus to the labelling apparatus and in the case of an atypical working condition of the labelling apparatus at which the correct application of the labels is compromised the bottles are transferred into the buffering area of the buffering unit. Thus, in the case of an atypical working condition the bottles are not transferred to the labelling apparatus, but the bottles exiting from the rinsing-filling-capping apparatus are fed to the buffering area. Simultaneously, the overall operation of the receptacle treatment machine and accordingly of the rinsing-filling-capping apparatus is interrupted.

[0015] In the recent years, as the above-mentioned

kind of receptacle treatment machines require large spaces within a production plant, more compact receptacle treatment machines have been developed. These more compact receptacle treatment machines distinguish themselves from the above-mentioned machines in that the varying treatment apparatuses are in a so called blocked configuration. This means that the treatment apparatuses are synchronized with respect to each other. Hence, the treatment apparatuses have the same working speeds. The conveying units arranged between the treatment apparatuses serve for transferring the bottles from one treatment apparatus to the other, thereby also compensating for differing pitch sizes of the varying treatment apparatuses.

[0016] However, a drawback of these more compact receptacle treatment machines is that buffering units as disclosed in EP-A-1681249 are not suitable for being employed in the receptacle treatment machines having the treatment apparatuses in a blocked configuration. Thus, any malfunction of any one of the treatment apparatuses leads to significant production and economical losses.

[0017] E.g. a malfunction of the labelling apparatus means that bottles which have already been formed, rinsed and sterilized, filled with the valuable pourable product and capped leads to discarding not only the bottles, the closures, but also the pourable product filled into the bottles.

[0018] As well, any malfunction of any treatment apparatus leads to a complete interruption of the overall production process of these compact receptacle treatment machines which leads to a loss of the production over the time interval until the malfunction has been resolved.

DISCLOSURE OF INVENTION

[0019] It is therefore an object of the present invention to provide a receptacle treatment machine and a method of operating a receptacle treatment machine to overcome, in a straightforward manner, the aforementioned drawbacks.

[0020] According to the present invention, there is provided a method as claimed in claim 1.

[0021] According to the present invention, there is provided a receptacle treatment machine as claimed in claim 12.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Two non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a sketch of a first embodiment of a receptacle treatment machine according to the present invention being in a blocked configuration;

Figure 2 shows a first configuration of a detail of the receptacle treatment machine of Figure 1, with parts

removed for clarity;

Figure 3 shows a second configuration of the detail of the receptacle treatment machine of Figure 2, with parts removed for clarity;

Figure 4 shows a third configuration of the detail of the receptacle treatment machine of Figures 2 and 3, with parts removed for clarity; and

Figure 5 shows a second embodiment of a receptacle treatment machine according to the present invention, with parts removed for clarity.

BEST MODES FOR CARRYING OUT THE INVENTION

[0023] Number 1 in Figure 1 indicates a receptacle treatment machine for treating a succession of bottles 2 (see Figs. 2 to 4). Bottles 2 are fed into machine 1 at an inlet station 3 and are conveyed by conveying means of machine 1 known as such along a conveying path P towards an outlet station 4.

[0024] Machine 1 comprises a plurality of treatment apparatuses arranged along path P and each one adapted to perform at least one respective treatment process on bottles 2.

[0025] In particular, machine 1 is configured to be in a blocked configuration meaning that treatment apparatuses are configured to be synchronized with respect to each other and having the same working speeds; i.e. each treatment apparatus is configured to treat the same number of bottles 2 per hour as the other treatment apparatuses.

[0026] In the specific example of Figure 1, machine 1 comprises:

- a rinsing and sterilization apparatus 5 adapted to receive bottles 2 at station 3 and configured to rinse and sterilize the bottles 2 during advancement of bottles 2 through apparatus 5;
- a filling apparatus 6 arranged downstream of apparatus 5 along path P and configured to receive bottles 2 exiting from apparatus 5 and to fill bottles 2 with a pourable product in a manner known as such during advancement of bottles 2 through apparatus 6;
- a capping apparatus 7 placed downstream of apparatus 6 along path P and designed to receive bottles 2 exiting from apparatus 6 and to apply closures on bottles 2 during advancement of bottles 2 through apparatus 7; and
- a decoration apparatus 8 positioned downstream of capping apparatus 7 along path P and adapted to receive bottles 2 exiting from apparatus 7 and to decorate bottles 2 during advancement of bottles 2 through apparatus 8.

[0027] Furthermore, machine 1 comprises a detection unit 9 adapted to detect a normal working condition of decoration apparatus 8 at which decoration apparatus 8 is apt to correctly apply at least one respective decoration on each one of bottles 2 and an atypical working condition

at which apparatus 8 is unable to correctly apply at least one respective decoration at each one of bottles 2; i.e. the correct application of at least one respective decoration on each one of bottles 2 is compromised. As well, machine 1 has a control unit 10 configured to receive an input signal about the normal or atypical working condition from detection unit 9 and to control decoration apparatus 8 as a function of the input signal from detection unit 9, in particular as a function of the normal or atypical working condition.

[0028] Furthermore, machine 1 comprises an accumulation unit 14 adapted to at least temporarily accumulate/store bottles 2. Accumulation unit 14 is also configured to be controlled by control unit 10 as a function of the input signal from detection unit 9; i.e. as a function of the normal or atypical working condition of apparatus 8.

[0029] In the specific example shown in Figure 1, accumulation unit 14 is configured to receive bottles 2 at a transfer station 15 downstream of decoration apparatus 8 along path P. In particular, accumulation unit 14 is designed to receive bottles 2 at transfer station 15 in case of the atypical working condition of decoration apparatus 8. Additionally, accumulation unit 14 is configured to feed bottles 2 stored within accumulation unit 14 itself to a re-feeding station 16 arranged downstream of capping apparatus 7 and upstream of decoration apparatus 8 along path P for directing bottles 2 from re-feeding station 16 to decoration apparatus 8. In particular, accumulation unit 14 is configured to direct bottles 2 to re-feeding station 16 after a restoration of the normal working condition of decoration apparatus 8. Even more particularly, accumulation unit 14 is configured to advance bottles 2 to re-feeding station 16 up to the end of production and prior to shut-down of operation of machine 1.

[0030] More specifically, control unit 10 is configured to control the feeding of bottles 2 at transfer station 15 to accumulation unit 14 as a function of the input signal of detection unit 9. In particular, control unit 10 is designed to control continuous advancement of bottles 2 through decoration apparatus 8 along path P towards outlet station 4 in the case of the normal working condition of decoration apparatus 8 and to control feeding of bottles 2, in particular of not-correctly decorated bottles 2 at transfer station 15 to accumulation unit 14 in the case of the atypical working condition of decoration apparatus 8.

[0031] With particular reference to Figures 2 to 4, capping apparatus 7 comprises:

- at least one capping carousel 17 adapted to rotate around one respective rotation axis A and configured to advance bottles 2 during rotation of capping carousel 17 around axis A from a receiving station (not shown) to a first delivery station 18 downstream of the receiving station along path P; and
- a plurality of capping units (not shown and known as such) peripherally arranged on capping carousel 17 and equally spaced around axis A and adapted to apply and to fasten respective closures on bottles 2

during advancement of bottles 2 from the receiving station to station 18.

[0032] Machine 1 further comprises a conveyor device 19, in particular being part of the conveying means of machine 1, arranged between capping apparatus 7 and decoration apparatus 8 and configured to advance bottles 2 from station 18 to a second delivery station 20 at which bottles 2 are delivered to decoration apparatus 8. Conveyor device 19 comprises a plurality of star wheels 21 each one adapted to rotate around one respective rotation axis parallel to axis A and each one designed to advance bottles 2 around one respective arc-shaped portion of path P.

[0033] Furthermore, in the specific example shown in Figures 2 to 4, is adapted to apply at least one respective label on each one of bottles 2, in particular during advancement of bottles 2 through apparatus 8. In particular, apparatus 8 is configured to advance bottles 2 from station 20 to a third delivery station 23 downstream of station 20 and of apparatus 8 along path P and at least one respective label is applied to each one of bottles 2 during advancement of bottles 2 from station 20 to station 23.

[0034] In more detail, decoration apparatus 8 comprises at least one main labeling unit 27, in the specific example one, adapted to apply at least one respective label on each one of bottles 2 advancing through apparatus 8, in particular advancing from station 20 to station 23. Furthermore, decoration apparatus 8 comprises at least one auxiliary labeling unit 28, in the particular example shown one, being adapted to apply at least one respective label on each one of bottles 2 advancing through decoration apparatus 8.

[0035] Furthermore, main labeling unit 27 and auxiliary labeling unit 28 are apt to be selectively controllable between an operative configuration at which the application of at least one respective label on each one of bottles 2 is activated and a rest configuration at which the application of at least one respective label on each one of bottles 2 is deactivated.

[0036] More specifically, main labeling unit 27 and auxiliary labeling unit 28 are of the type which are configured to cut the labels of a predefined length and size from a web of labeling material and to successively apply a pattern of glue onto the labels prior to the application of the labels on bottles 2.

[0037] Furthermore, decoration apparatus 8 has a conveying carousel 29 configured to rotate around one respective rotation axis B and adapted to convey bottles 2 through decoration apparatus 8, in particular to advance bottles 2 from station 20 to station 23.

[0038] Apparatus 8 further comprises a plurality of retaining units (not shown and known as such) peripherally arranged on conveying carousel 29 and equally spaced around axis B and configured to retain bottles 2 during rotation of conveying carousel 29. In particular, the retaining units are designed to retain bottles 2 during advancement of bottles 2 from station 20 to station 23. Re-

taining units are further adapted to rotate bottles 2 around their respective longitudinal axes during advancement of bottles 2 from station 20 to station 23 to allow for the application of labels on bottles 2 through cooperation with main labeling unit 27 and/or auxiliary labeling unit 28.

[0039] Conveying carousel 29 is also configured to advance bottles 2 from station 20 to station 23 through a first labeling station 30 and a second labeling station 31.

[0040] More specifically, main labeling unit 27 is arranged peripherally adjacent to conveying carousel 29 at station 30 and auxiliary labeling unit 28 is positioned peripherally adjacent to conveying carousel 29 at station 31. Accordingly, main labeling unit 27 is configured to apply labels onto bottles 2 at station 30 and auxiliary labeling unit 28 is designed to apply labels onto bottles 2 at station 31.

[0041] Furthermore, control unit 10 is adapted to control main labeling unit 27 and auxiliary labeling unit 28 selectively in their respective operative or rest configurations. Detection unit 9 is configured to detect, in use, whether the correct application of labels on each one of bottles 2 advancing through apparatus 8 by main labeling unit 27 and/or auxiliary labeling unit 28 is compromised or not. In the case the correct application of labels on bottles 2 by main labeling unit 27 and/or auxiliary labeling unit 28 is compromised apparatus 8 presents an atypical working condition.

[0042] Control unit 10 is further configured to control main labeling unit 27 in its operative configuration and to control auxiliary labeling unit 28 in its rest configuration during the normal working condition of apparatus 8.

[0043] With particular reference to Figures 2 to 4, machine 1 comprises an outlet conveyor 22 adapted to receive bottles 2 from apparatus 8 at station 23 and to advance bottles 2 from station 23 to station 4, in particular in the case of the normal working condition of apparatus 8, or to advance bottles 2 from station 23 to station 15, in particular in the case of the atypical working condition of apparatus 8.

[0044] In more detail, outlet conveyor 22 is designed to be controlled between at least a first configuration at which outlet conveyor 22 is apt to continuously advance bottles 2 received from apparatus 8 at station 23 along path P to station 4 and a second configuration at which outlet conveyor 22 is apt to feed bottles 2 from station 23 to transfer station 15 for feeding bottles 2 to accumulation unit 14. In particular, control unit 10 is designed to control outlet conveyor 22 between the first and the second configuration as a function of the input signal of detection unit 9. More specifically, control unit 10 is configured to control outlet conveyor 22 in its first configuration in the case of the normal working condition of apparatus 8 and in its second configuration in the case of the atypical working condition of apparatus 8.

[0045] In more detail, outlet conveyor 22 comprises a switching portion 32 adapted to switch between a first orientation at which switching portion 32 is configured to direct bottles 2 towards station 4 and a second orientation

at which switching portion 32 is configured to feed bottles 2 to accumulation unit 14. In particular, control unit 10 controls the switching portion 32 between its first orientation and its second orientation as a function of the input signal of detection unit 9; i.e. as a function of the normal or atypical working condition of apparatus 8.

[0046] Outlet conveyor 22 further comprises:

- an inlet conveyor, in particular a star wheel 33 adapted to rotate about one respective rotation axis parallel to axes A and B and to receive bottles 2 at station 23 and to advance bottles 2 along an arc-shaped portion of path P; and
- a conveying lane 34 adapted to receive bottles 2 from star wheel 33 and carrying switching portion 32.

[0047] More specifically, conveying lane 34 further has an inlet portion 35 and an outlet portion 36 with switching portion 32 being interposed between inlet portion 35 and outlet portion 36. In particular, in its first orientation switching portion 32 is configured to feed bottles 2 from inlet portion 35 to outlet portion 36 and in its second orientation switching portion 32 is configured to advance bottles 2 from inlet portion 35 to accumulation unit 14.

[0048] With particular reference to Figures 2 to 4, accumulation unit 14 is adapted to be controlled among at least:

- a base configuration (see Figure 2) in which accumulation unit 14 is designed to await the feeding of bottles 2 to accumulation unit 14; and
- an accumulating configuration (see Figure 3) in which accumulation unit 14 is apt to receive bottles 2 at transfer station 15 and to accumulate bottles 2 received at station 15.

[0049] In particular, accumulation unit 14 is set in its base configuration in the case of the normal working condition of apparatus 8 and is set in its accumulating configuration in the case of the atypical working condition of apparatus 8.

[0050] Accumulation unit 14 is also adapted to be controlled in a feeding configuration (see Figure 4) in which accumulation unit 14 is designed to feed bottles 2 to re-feeding station 16. Preferably, accumulation unit 14 is set in its feeding configuration after restoration of the normal working condition of apparatus 8.

[0051] In more detail, accumulation unit 14 comprises:

- a conveyor device 40 adapted to receive bottles 2 at transfer station 15 and to direct bottles 2 from transfer station 15 towards re-feeding station 16; and
- an accumulation space 41 (e.g. of the belt-type) to receive bottles 2 and to at least temporarily store bottles 2.

[0052] More specifically, conveyor device 40 has:

- an inlet conveying assembly 42 for receiving the receptacles transferred at station 15 to conveyor device 40;
- an outlet conveying assembly 43 adapted to direct bottles 2 out of accumulation unit 14, in particular to station 16; and
- an intermediate conveying portion 44 interposed between assembly 42 and assembly 43 and configured to receive bottles 2 from assembly 42 and to direct bottles 2 to assembly 43.

[0053] Portion 44 is furthermore configured to selectively feed bottles 2 to accumulation space 41 and to selectively receive bottles 2 from accumulation space 41.

[0054] Furthermore, outlet conveying assembly 43 comprises:

- an outlet feed screw 45 adapted to actuate advancement of bottles 2 towards station 16; and
- a plurality of star wheels 46, in the specific example shown two, each adapted to rotate about one respective rotation axis parallel to axes A and B and to receive bottles 2 from outlet feed screw 45.

[0055] Machine 1 also comprises:

- an imaging and analyzing unit 47 adapted to determine the intactness of bottles 2 transferred to accumulation unit 14; and
- an expelling device 48 configured to expel defective bottles 2 from accumulation unit 14.

[0056] In particular, expelling device 48 comprises an expelling element 48a configured to direct receptacles 2 away from accumulation unit 14 and an expelling space 48b configured to collect receptacles 2 expelled from accumulation unit 14 by expelling element 48a.

[0057] It must be noted, that the atypical working condition of apparatus 8 does not necessarily mean that no decoration at all is applied. The atypical working condition can e.g. lead to an incorrect/incomplete decoration of bottles 2 advancing through apparatus 8 during the atypical working condition of apparatus 8. These bottles 2 having an incorrect/incomplete decoration are typically not suited to be sent to sales outlets and they must be discarded.

[0058] Therefore, imaging and analyzing unit 47 is configured to image and analyze the possible presence of a decoration or of a partially applied decoration of bottles 2 fed to accumulation unit 14. In particular, unit 47 is designed to detect falsely applied labels.

[0059] In the specific example, imaging and analyzing unit 47 is configured to detect the presence of possible incorrect/incomplete decorations, however, it may also be configured to analyze other parameters, such as the correct application of closures, deformations of bottles 2 and other defects.

[0060] In more detail, imaging and analyzing unit 47

and expelling device 48 are arranged in the area of inlet conveying assembly 42 and imaging and analyzing unit 47 being arranged upstream of expelling device 48 with regard to the advancement of bottles 2 from station 15 to station 16.

[0061] Furthermore, accumulation unit 14 has:

- a first sensor device 49 arranged adjacent to inlet conveying assembly 42 and adapted to determine the density of bottles 2 within inlet conveying assembly 42; and
- a second sensor device 50 arranged adjacent to outlet conveying assembly 43 and configured to determine the density of bottles 2 within outlet conveying assembly 43.

[0062] In particular, sensor device 49 is designed to determine the feeding of bottles 2 into accumulation unit 14. Sensor device 50 is configured to determine, in use, whether the maximum storing capacity of bottles 2 within outlet conveying assembly 43 is reached or not.

[0063] In use, bottles 2 are advanced along path P. During advancement of bottles 2 along path P bottles 2 are rinsed and sterilized, filled with a pourable product, sealed with respective closures and decorated with at least one respective decoration. In particular, during advancement along path P bottles 2 are generally directed through the plurality of treatment apparatuses of machine 1, each of which performing one distinct treatment step on bottles 2.

[0064] More specifically, bottles 2 are fed from station 3 to apparatus 5 in which bottles 2 are rinsed and sterilized. Then, bottles 2 are fed to apparatus 6, are advanced through apparatus 6 and are filled in a manner known as such with a pourable product in apparatus 6. Afterwards, bottles 2 are fed from apparatus 6 to apparatus 7 and are advanced through apparatus 7. Furthermore, closures are applied on bottles 2 during advancement through apparatus 7. Following the treatment in apparatus 7, bottles 2 are fed to apparatus 8. Then bottles 2 are advanced through apparatus 8.

[0065] The normal working condition or the atypical working condition of apparatus 8 is detected, in particular by means of detection unit 9. Detection unit 9 sends the input signal to control unit 10 for controlling operation of apparatus 8, outlet conveyor 22 and accumulation unit 14.

[0066] In particular, apparatus 8 is controlled, preferably by control unit 10, in such a way that main labeling unit 27 is set in its operative configuration and auxiliary labeling unit 28 is set in its rest configuration. Preferably, the working condition of main labeling unit 27 is detected for determining the normal or atypical working condition of apparatus 8.

[0067] In the case of the normal working condition bottles 2 are advanced through apparatus 8 and bottles 2 are decorated during advancement through apparatus 8. In particular, during advancement through apparatus

8 at least one respective label is applied to each one of bottles 2, preferably by main labeling unit 27. Then bottles 2 are further advanced along path P towards station 4. In particular, outlet conveyor 22 being in its first configuration receives bottles 2 at station 23 and advances bottles 2 to station 4.

[0068] During the normal working condition accumulation unit 14 is preferably set in its base configuration.

[0069] In the case of the atypical working condition of apparatus 8 the treatment of bottles 2 advancing through apparatus 8 is suspended. In particular, the application of at least one decoration, or even more particularly the application of at least one respective label on each one of bottles 2 is suspended. Furthermore, accumulation unit 14 is controlled from its base configuration into its accumulating configuration.

[0070] Bottles 2 are continuously advanced through apparatus 8 and are directed to transfer station 15. Then bottles 2 are fed to accumulation unit 14. In particular, bottles 2 are advanced by outlet conveyor 22 from station 23 to transfer station 15. More specifically, this is achieved by setting outlet conveyor 22 in its second configuration, preferably by setting switching portion 32 in its second orientation.

[0071] Bottles 2 advanced to transfer station 15 are fed to accumulation unit 14, in particular to inlet conveying assembly 42. Bottles 2 are then advanced from inlet conveying assembly 42 to intermediate conveying portion 44 and then to outlet conveying assembly 43. As the capacity of outlet conveying assembly 43 is limited, the density of bottles 2 in outlet conveying assembly 43 is detected, in particular by means of second sensor device 50. If the maximum density of bottles 2 in outlet conveying assembly 43 is reached bottles 2 are transferred from inlet conveying assembly 42 to accumulation space 41 as long as further bottles 2 are fed to accumulation unit 14. The feeding of further bottles 2 to accumulation unit 14 is detected by first sensor device 49. In particular, first sensor device 49 detects the density of bottles 2 within inlet conveying assembly 42.

[0072] Furthermore, the intactness of bottles 2 fed to accumulation unit 14 is inspected by imaging and analyzing unit 47 and non-correctly decorated bottles 2 are expelled by expelling device 48 from accumulation unit 14.

[0073] Decoration of bottles 2 advancing through apparatus 8 is suspended and the feeding of bottles 2 to accumulation unit 14 is done until the normal working condition of apparatus 8 is restored.

[0074] During the atypical working condition of apparatus 8 operation of apparatus 7 is continued. Accordingly, also operation of apparatuses 5 and 6 is continued.

[0075] In the specific example of Figures 1 to 4, in the case of the atypical working condition, at which main labeling unit 27 is unable to correctly apply labels on each one of bottles 2, main labeling unit 27 is set from the operative configuration to the rest configuration and auxiliary labeling unit 28 is set from the rest configuration to

the operative configuration. Setting the auxiliary labeling unit 28 from the rest configuration to the operative configuration is not instantaneous. Setting the auxiliary labeling unit 28 from the rest configuration to the operative configuration requires some time, which is typically in the range of a few minutes. During this time bottles 2 are continued to be advanced through apparatus 8 and are transferred at transfer station 15 to accumulation unit 14. When auxiliary labeling unit 28 has reached its operative configuration apparatus 8 is in its normal working condition again and bottles 2 advancing through apparatus 8 can be decorated, in particular labeled again. Then, apparatus 8, in particular auxiliary labeling unit 28 applies at least one respective label on each bottle 2 advancing through apparatus 8 and bottles 2 are advanced from station 23 to station 4, in particular by outlet conveyor 22. Accordingly, outlet conveyor 22 is set in its first configuration again after restoration of the normal working condition of apparatus 8. As well, accumulation unit 14 is set in its base configuration again.

[0076] As well, bottles 2 accumulated/stored in accumulation unit 14 are fed back to apparatus 8, to advance bottles 2 through apparatus 8 and to decorate, preferably label bottles 2 during advancement of bottles 2 through apparatus 8 after recovery of the normal working condition. In particular, bottles 2 remain in accumulation unit 14 up to the end of production and prior to shut-down of operation of machine 1. Accordingly, bottles 2 are preferably fed back to apparatus 8 up to the end of production and prior to shut-down of operation of machine 1.

[0077] Therefore, accumulation unit 14 is set in its feeding configuration, in particular up to the end of production and prior to shut-down of operation of machine 1. Accumulation unit 14 advances bottles 2 to station 16 from where bottles 2 advance to apparatus 8. Preferably, screw 45 feeds bottles 2 to star wheels 46 which then fed bottles 2 to station 16 from where bottles 2 are conveyed to apparatus 8.

[0078] With reference to Figure 5, number 1' indicates a further embodiment of a receptacle treatment machine, only partially shown to the extent necessary for the comprehension; as receptacle treatment machine 1' is similar to receptacle treatment machine 1, the following description is limited to the differences between them, and using the same references, where possible, for identical or corresponding parts.

[0079] In particular, receptacle treatment machine 1' differs from receptacle treatment machine 1 basically by further comprising an end-of-line packaging apparatus 53 arranged downstream of apparatus 8 along path P and by having an outlet conveyor 22' and accumulation unit 14 of machine 1' having a conveyor device 40'.

[0080] End-of-line packaging apparatus 53 is adapted to form batches of bottles 2 and/or palletize bottles 2 and/or wrapping bottles 2. In particular, end-of-line packaging apparatus 53 is synchronized with respect to apparatuses 5, 6, 7 and 8 and has the same working speeds as apparatuses 5, 6, 7 and 8. Accordingly, receptacle

treatment machine 1' is provided in a blocked configuration.

[0081] Outlet conveyor 22' is adapted to be controlled between a first configuration at which outlet conveyor 22' is apt to continuously advance bottles 2 received from apparatus 8 at station 23 along path P to apparatus 53 and a second configuration at which outlet conveyor 22' is apt to feed bottles 2 from station 23 to transfer station 15. In particular, outlet conveyor 22' comprises a plurality of star wheels 54a, 54b, 54c and 54d, each one adapted to rotate around one respective rotation axis parallel to axes A and B.

[0082] In particular, in its second configuration outlet conveyor 22' is designed to advance bottles 2 by star wheels 54a and 54b. In its first configuration outlet conveyor 22' is configured to advance bottles 2 from station 23 to apparatus 53 by advancement of bottles 2 by star wheels 54a, 54b, 54c and 54d.

[0083] Conveyor device 40' differs from conveyor device 40 in having inlet conveying assembly 42'. Inlet conveying assembly 42' differs from inlet conveying assembly 42 by having:

- a conveying lane 55 adapted to direct bottles 2 to intermediate conveying portion 44; and
- a plurality of star wheels 56, in the specific example shown in Figure 5 two configured to advance bottles 2 from station 15 to conveying lane 55.

[0084] The function of machine 1' is substantially the same as the function of machine 1 which is why we refer to the description of the function of machine 1 as provided above. The differences regard the function of outlet conveyor 22' with respect to outlet conveyor 22 and the function of inlet conveying assembly 42' with respect to inlet conveying assembly 42.

[0085] The advantages of the receptacle treatment machine and the method of operating the receptacle treatment machine according to the present invention will be clear from the foregoing description.

[0086] In particular, bottles 2 which cannot be treated in a downstream treatment apparatus, in the specific example decoration apparatus 8, are temporarily stored in accumulation unit 14 and the missing treatment is done at a later stage of the overall production process. Thus, the losses of bottles, closures and pourable products are limited meaning an increase in the profitability of the production. Only bottles 2 having some kind of defect, such as an incorrectly applied decoration, are discarded.

[0087] Additionally, the method of operation of a receptacle treatment machine according to the present invention is suited for a receptacle treatment machine in blocked configuration.

[0088] As well, production of the upstream treatment apparatuses, in the specific examples disclosed of apparatuses 5, 6 and 7 is not influenced by the atypical working condition of apparatus 8.

[0089] Furthermore, feeding of the bottles 2 accumu-

lated/stored in accumulation unit 14 up to the end of production and prior to shut-down of operation of machine 1 or 1' allows to avoid the need to create gaps within the advancement of bottles 2 for feeding the incorrectly treated bottles 2 from accumulation unit 14 back to apparatus 8. Bottles 2 accumulated/stored in accumulation unit 14 are simply reintegrated into the advancement of bottles 2 from station 16 along path P forming the last bottles 2 to be treated at the very end of the production.

[0090] It also allows limiting the production losses in the specific case that apparatus 8 has at least one main labeling unit 27 and at least one auxiliary labeling unit 28. Preferably, during the normal working condition only main labeling unit 27 is in its operative configuration and auxiliary labeling unit 28 allows to compensate for a programmed change of main labeling unit 27 into its rest configuration. Such a programmed change can be necessary in the case that e.g. the label material available is to be consumed. In such a case it is possible to control auxiliary labeling unit 28 from its rest configuration to its operative configuration in time allowing to continue labeling of each one of bottles 2 without any interruption. However, the time needed to control auxiliary labeling unit 28 from its rest configuration to its operative configuration does not allow to apply at least one label to each one of the bottles 2 advancing through apparatus 8 during the change of auxiliary labeling unit 28 from its rest configuration to its operative configuration in the case of the non-foreseen need to set main labeling unit 27 in its rest configuration due to a non-foreseen malfunction. The method and the machine 1, 1' disclosed allows to avoid production losses in the case of a non-foreseeable malfunction of main labeling unit 27.

[0091] Clearly, changes may be made to machine 1 and machine 1' as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

[0092] In one alternative embodiment, transfer station 15 may be positioned downstream of one respective downstream treatment apparatus 6, 7, or 53 different from apparatus 8 along path P. In such an alternative embodiment accumulation unit 14 can accumulate/store bottles 2 which cannot be correctly treated by the respective downstream treatment apparatus 5, 6, 7 or 53 due to an atypical working condition of the downstream treatment apparatus 6, 7 or 53. Accordingly, detection unit 9 is configured to detect a normal or atypical working condition of the respective downstream treatment apparatus 6, 7 or 53 and control unit 10 is adapted to control the respective downstream treatment apparatus as a function of the normal or atypical working condition.

[0093] In a further alternative embodiment, machine 1 or 1' comprises a plurality of accumulation units 14 each one adapted to receive bottles 2 from one respective transfer station 15. Each one of the respective transfer stations 15 is positioned downstream of one respective downstream treatment apparatus 5, 6, 7, 8, 53.

[0094] In an even further alternative embodiment, ma-

chine 1 or 1' comprises a plurality of transfer stations 15 each one arranged downstream of one respective apparatus 6, 7, 8, 53 along path P. Furthermore, accumulation unit 14 is configured to receive bottles 2 at the plurality of transfer stations 15, in particular in the case of an atypical working condition of the respective apparatus 6, 7, 8, 53.

In an additional alternative embodiment, machine 1 or 1' also comprises a blow molding apparatus arranged upstream of apparatus 5 and configured to receive preforms and to transform the preforms into bottles prior to being fed to apparatus 5. The blow molding apparatus is also synchronized with respect to apparatuses 5, 6, 7, 8 or 5, 6, 7, 8 and 53 and has the same working speed as the other apparatuses 5, 6, 7, 8 or 5, 6, 7, 8 and 53.

In an even other embodiment, the receptacle treatment machine may vary in the number of apparatuses which are built in blocked configuration. E.g. the receptacle treatment machine may only comprise a filling apparatus, a capping apparatus and a decoration apparatus. Other configurations of the receptacle treatment machine as known to the person skilled in the art are possible too.

Claims

1. Method for operating a receptacle treatment machine (1, 1') comprising at least one upstream treatment apparatus (5, 6, 7, 8) and at least one downstream treatment apparatus (6, 7, 8, 53) being synchronized with and having the same working speed as the upstream treatment apparatus (5, 6, 7, 8) and the upstream treatment apparatus (5, 6, 7, 8) and the downstream treatment apparatus (6, 7, 8, 53) being arranged along a conveying path (P) of receptacles (2); the upstream treatment apparatus (5, 6, 7, 8) and downstream treatment apparatuses (6, 7, 8, 53) being configured to treat the receptacles (2) and the receptacle treatment machine (1, 1') further comprises at least one accumulation unit (14) adapted to store receptacles (2); the method comprises the steps of:

- advancing the receptacles (2) along said conveying path (P);
- treating the receptacles (2) in the upstream treatment apparatus (5, 6, 7, 8);
- feeding the receptacles (2) from the upstream treatment apparatus (5, 6, 7, 8) to the downstream treatment apparatus (6, 7, 8, 53);
- advancing the receptacles (2) through the downstream treatment apparatus (6, 7, 8, 53); and
- detecting a normal working condition of the downstream treatment apparatus (6, 7, 8, 53) at which the downstream treatment apparatus (6, 7, 8, 53) is apt to correctly treat the receptacles

(2) or an atypical working condition at which the correct treatment of the receptacles (2) by the downstream treatment apparatus (6, 7, 8, 53) is compromised;

wherein in the case of the normal working condition the method comprises the further steps of:

- treating the receptacles (2) in the downstream treatment apparatus (6, 7, 8, 53) during advancement of the receptacles (2) through the downstream treatment apparatus (6, 7, 8, 53); and
- further advancing the receptacles (2) along the conveying path (P);

the method being **characterized in that** in the case of the atypical working condition the method further comprises the steps of:

- suspending the treatment of the receptacles (2) during advancement of the receptacles (2) through the downstream treatment apparatus (6, 7, 8, 53);
- feeding the receptacles (2) at a transfer station (15) downstream of the downstream treatment apparatus (6, 7, 8, 53) along the conveying path (P) to the accumulation unit (14); and
- feeding the receptacles (2) from the accumulation unit (14) back to the downstream treatment apparatus (6, 7, 8, 53), to advance the receptacles (2) through the downstream treatment apparatus (6, 7, 8, 53) and to treat the receptacles (2) during said advancement of the receptacles (2) through the downstream treatment apparatus (6, 7, 8, 53) after recovery of the normal working condition.

2. The method according to claim 1, wherein the downstream treatment apparatus (6, 7, 8, 53) is a decoration apparatus (8) being adapted to decorate the receptacles (2) advancing through the decoration apparatus (8); wherein in the case of the normal working condition the method comprises the step of decorating the receptacles (2) during their advancement through the decoration apparatus (8); wherein in the case of the atypical working condition of the decoration apparatus (8) at which the decoration apparatus (8) is unable to correctly decorate the receptacles (2) the method comprises the step of suspending the decoration of the receptacles (2) during advancement of the receptacles (2) through the decoration apparatus (8).
3. The method according to claim 2, wherein the decoration apparatus (8) comprises at least one main labeling unit (27) adapted to apply at least one respective label on each one of receptacles (2) ad-

vancing through the decoration apparatus (8); wherein in the case of the normal working condition the method comprises the step of applying at least one respective label on each one of receptacles (2) advancing through the decoration apparatus (8) by the at least one main labeling unit (27); and wherein in the case of the atypical working condition of the decoration apparatus (8) at which the main labeling unit (27) is unable to correctly apply at least one respective label on each one of receptacles (2) the method comprises the step of suspending the application of one respective label on each one of receptacles (2) by the main labeling unit (27).

4. The method according to claim 3, wherein the decoration apparatus (8) further comprises at least one auxiliary labeling unit (28) being adapted to apply at least one respective label on each one of the receptacles (2) advancing through the decoration apparatus (8); wherein the main labeling unit (27) and the auxiliary labeling unit (28) are apt to be selectively controllable between an operative configuration at which the application of at least one respective label on each one of the receptacles (2) is activated and a rest configuration at which the application of at least one respective label on each one of the receptacles (2) is deactivated; wherein the method comprises the step of controlling the main labeling unit (27) in its operative configuration and of controlling the auxiliary labeling unit (28) in its rest configuration; wherein in case of the normal operation condition the method comprises the step of the main labeling unit (27) applying at least one respective label on each one of receptacles (2); and wherein in the case of the atypical working condition at which the main labeling unit (27) is unable to apply at least one respective label on each one of receptacles (2) the method comprises the steps of:

- controlling the main labeling unit (27) from the operative configuration to the rest configuration;
- controlling the auxiliary labeling unit (28) from the rest configuration to the operative configuration; and
- feeding the receptacles (2) advancing through the decoration apparatus (8) during the time required to control the auxiliary labeling unit (28) from the rest configuration to the operative configuration at the transfer station (15) to the accumulation unit (14).

5. The method according to any one of claims 2 to 4 further comprising the steps of:

- feeding the receptacles (2) from the decoration apparatus (8) to an outlet conveyor (22, 22') of the receptacle treatment machine (1); and
- controlling outlet conveyor (22, 22') between a

first configuration at which the outlet conveyor (22, 22') continuously advances the receptacles (2) received from the decoration apparatus (8) along the conveying path (P) during the normal working condition of the decoration apparatus (8) and a second configuration at which the outlet conveyor (22, 22') feeds the receptacles (2) to the transfer station (15) for transferring the receptacles (2) to the accumulation unit (14) during the atypical working condition of the decoration apparatus (8).

6. The method according to any one of claims 2 to 5 further comprising the steps of:

- in the case of the normal working condition feeding the receptacles (2) from the decoration apparatus (8) to an end-of line packaging apparatus (53) synchronized with and having the same processing speed as the decoration apparatus (8); and
- in the case of the atypical working condition feeding the receptacles (2) from the decoration apparatus (8) to the accumulation unit (14) and to decorate the receptacles (2) and to feed the receptacles (2) to the end-of line packaging apparatus (53) after restoration of the normal working condition of the decoration apparatus (8).

7. The method according to any one of the preceding claims further comprising the step of controlling the accumulation unit (14) at least among:

- a base configuration at which the accumulation unit (14) awaits the feeding of the receptacles (2) to the accumulation unit (14);
- an accumulating configuration at which the accumulation unit (14) receives the receptacles (2) at the transfer station (15); and
- a feeding configuration at which the accumulation unit (14) feeds the receptacles (2) to a re-feeding station (16) downstream of the upstream apparatus (5, 6, 7, 8) and upstream of the downstream apparatus (6, 7, 8, 53).

wherein said step of controlling comprises the steps of:

- setting the accumulation unit (14) in the accumulating configuration in the case of the atypical working condition of the downstream treatment apparatus (6, 7, 8, 53); and
- setting the accumulation unit (14) in the feeding configuration after recovery of the normal working configuration of the downstream treatment apparatus (6, 7, 8, 53).

8. The method according to claim 7, wherein when the

accumulation unit (14) is set in the accumulating configuration the method further comprises the steps of:

- feeding the receptacles (2) at the transfer station (15) to an inlet conveying assembly (42, 42') of a conveyor device (40, 40') of the accumulation unit (14); 5
 - feeding the receptacles (2) from the inlet conveying assembly (42, 42') to an intermediate portion (44) of the conveyor device (40, 40'); 10
 - feeding the receptacles (2) from the intermediate portion (44) to an outlet conveying assembly (43) of the conveyor device (40, 40') from which the receptacles (2) are transferred to the re-feeding station (16) when the accumulation unit (14) is controlled to be in its re-feeding configuration; 15
 - determining the density of the receptacles (2) present in the outlet conveying assembly (43); 20
 - feeding the receptacles (2) to an accumulation space (41) of the accumulation unit (14) in the case the maximum density of the receptacles (2) present in the outlet conveying assembly (43) is reached and receptacles (2) continue to be transferred from the transfer station (15) to accumulation unit (14). 25
9. The method according to any one of the preceding claims further comprising the step of determining the intactness of the receptacles (2) transferred to the accumulation unit (14) and expelling defective non-correctly treated receptacles (2) from the accumulation unit (14). 30
10. The method according to any one of the preceding claims, wherein, during the atypical working condition of the downstream treatment apparatus (6, 7, 8, 53), operation of the upstream treatment apparatus (5, 6, 7, 8) is continued. 35
11. The method according to any one of the preceding claims, wherein the untreated receptacles (2) are fed back from the accumulation unit (14) to the downstream treatment apparatus (6, 7, 8, 53) up to the end of production and prior to shut-down of operation of the receptacle treatment machine (1, 1'). 40 45
12. A receptacle treatment machine (1, 1') for treating receptacles (2) comprising: 50
- at least one upstream treatment apparatus (5, 6, 7, 8) adapted to perform one respective treatment process on the receptacles (2);
 - at least one downstream treatment apparatus (6, 7, 8, 53) adapted to perform one respective treatment process on the receptacles (2), the downstream treatment apparatus (6, 7, 8, 53) being arranged downstream of the upstream 55

treatment apparatus (5, 6, 7, 8) along a conveying path (P) and the downstream treatment apparatus (6, 7, 8, 53) being synchronized with and having the same working speed as the upstream treatment apparatus (5, 6, 7, 8);

- at least one accumulation unit (14) adapted to store receptacles (2);

- at least one detection unit (9) adapted to detect a normal working condition of the downstream treatment apparatus (6, 7, 8, 53) at which the downstream treatment apparatus (6, 7, 8, 53) is adapted to correctly treat the receptacles (2) or an atypical working condition at which the correct treatment of the receptacle (2) by the downstream treatment apparatus (6, 7, 8, 53) is compromised;

- a control unit (10) adapted to receive an input signal from the detection unit (9) about the normal working condition or the atypical working condition of the downstream treatment apparatus (6, 7, 8, 53) and configured to control the downstream treatment apparatus (6, 7, 8, 53) in function of the input signal; and

- an outlet conveyor (22, 22') adapted to receive the receptacles (2) from the downstream treatment apparatus (6, 7, 8, 53) and being settable between at least a first configuration at which the outlet conveyor (22, 22') is adapted to advance the receptacles (2) to an outlet station (4) of the receptacle treatment machine (1, 1') downstream of the downstream treatment apparatus (6, 7, 8, 53) along the conveying path (P) and a second configuration at which the outlet conveyor (22, 22') is configured to advance the receptacles (2) to a transfer station (15) downstream of the downstream treatment apparatus (6, 7, 8, 53) along the conveying path (P);

the receptacle treatment machine (1, 1') being **characterized in that:**

- in the case of the detection unit (9) detects the normal working condition of the downstream treatment apparatus (6, 7, 8, 53), the control unit (10) is configured to control the downstream treatment apparatus (6, 7, 8, 53) in such a manner to treat the receptacles (2) and to set the outlet conveyor (22, 22') in its first configuration; and

- in the case the detection unit (9) detects the atypical working condition of the downstream treatment apparatus (6, 7, 8, 53), the control unit (10) is configured to control the downstream treatment apparatus (6, 7, 8, 53) to suspend the treatment of the receptacles (2), to set the outlet conveyor (22, 22') in its second configuration and to control the accumulation unit (14) as so

to be apt to receive the receptacles (2) at the transfer station (15);

and wherein the accumulation unit (14) is controlled by the control unit to feed the receptacles (2) from the accumulation unit (14) to a re-feeding station (16) downstream of the downstream treatment apparatus (8) along the conveying path (P) after recovery of the normal working condition.

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13. The receptacle treatment machine (1, 1') according to claim 12, wherein the downstream treatment apparatus is a decoration apparatus (8) being adapted to decorate the receptacles (2); wherein, in the normal working condition, the decoration apparatus (8) is apt to correctly decorate each one of the receptacles (2) and wherein, in the atypical working condition, the correct decoration of the receptacles (2) is compromised.

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14. The receptacle treatment machine (1, 1') according to claim 13, wherein the decoration apparatus (8) comprises at least one main labeling unit (27) adapted to apply at least one respective label on each one of the receptacles (2); wherein, in the normal working condition, the main labeling unit (27) is apt to correctly apply at least one respective label on each one of the receptacles (2); and wherein, in the atypical working condition, the correct application of at least one label by the main labeling unit (27) is compromised.

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15. The receptacle treatment machine (1, 1') according to claim 14, wherein the decoration apparatus (8) further comprises at least one auxiliary labeling unit (28) being adapted to apply at least one respective label on each one of the receptacles (2); wherein the main labeling unit (27) and the auxiliary labeling unit (28) are apt to be selectively set between an operative configuration, at which the application of at least one respective label on each one of the receptacles (2) is activated, and a rest configuration, at which the application of at least one respective label on each one of the receptacles (2) is deactivated.

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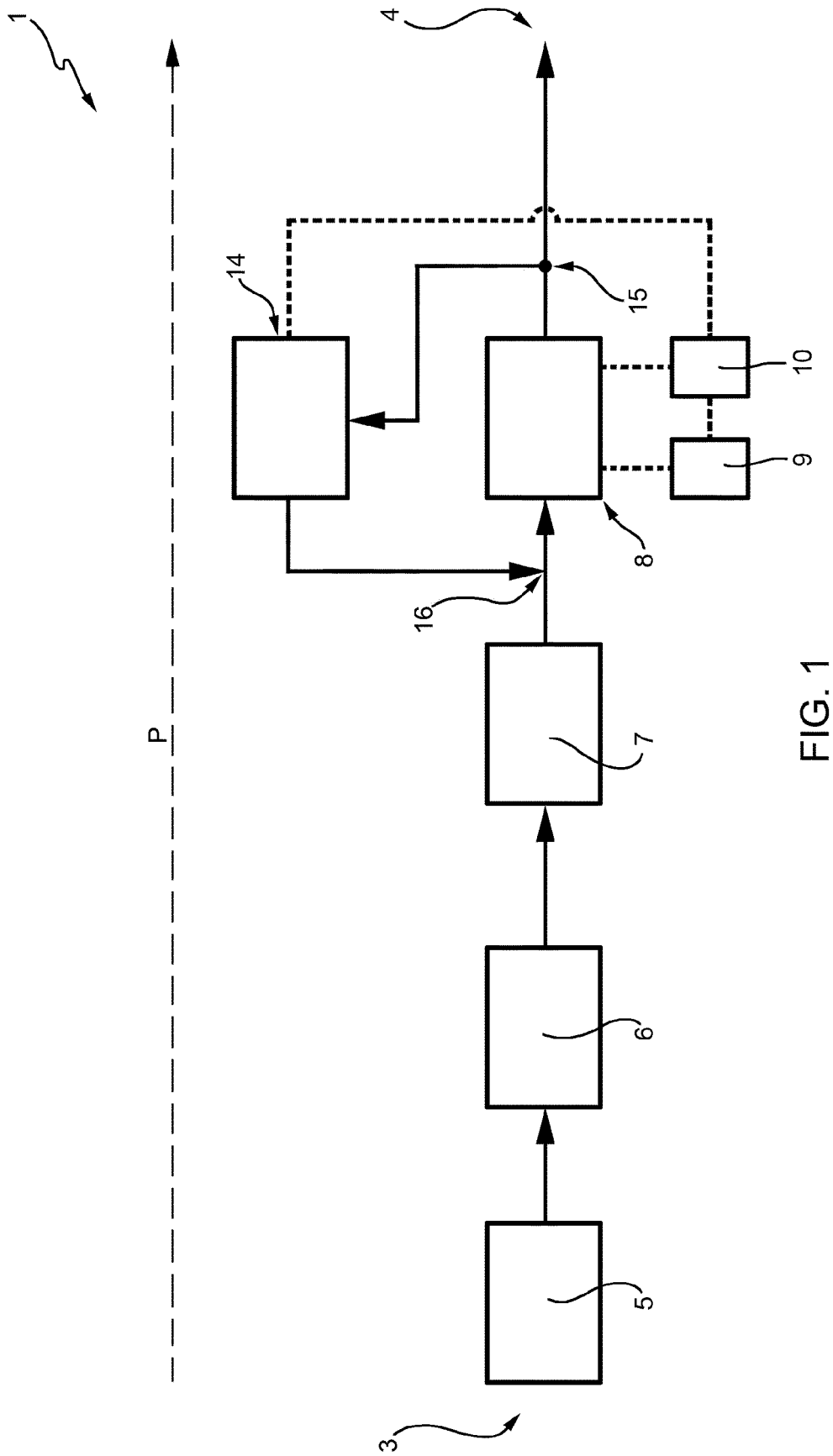


FIG. 1

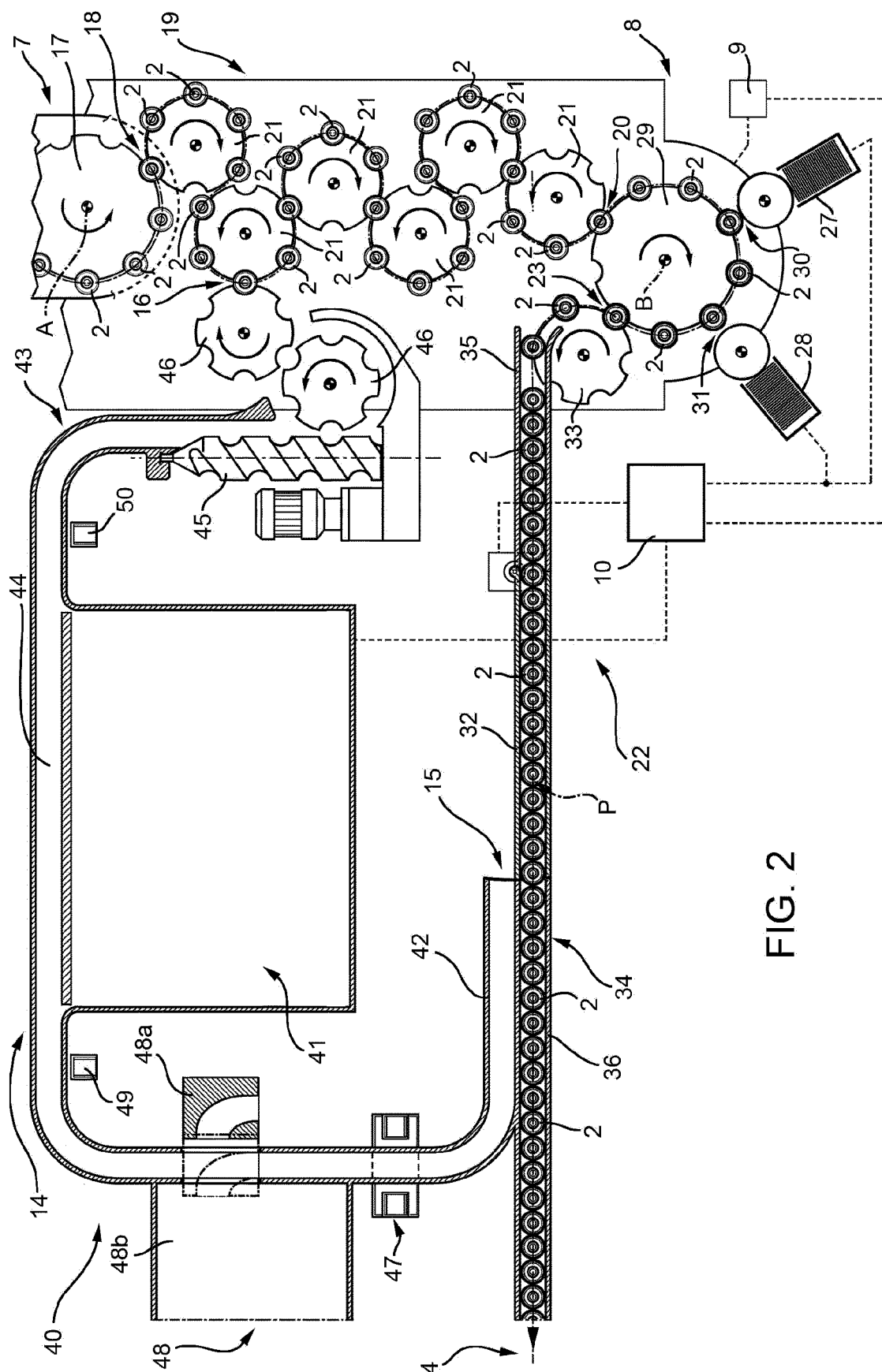
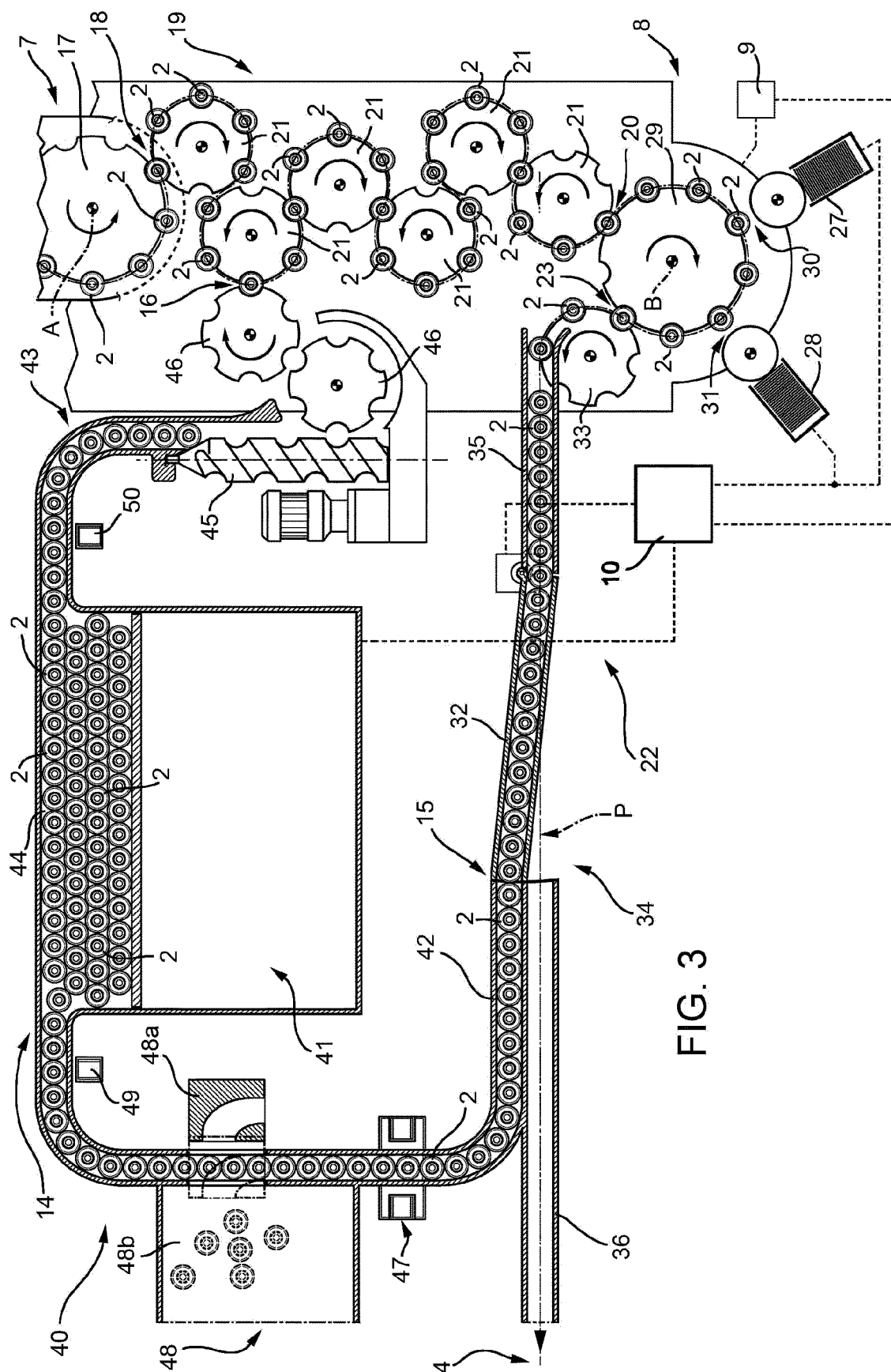
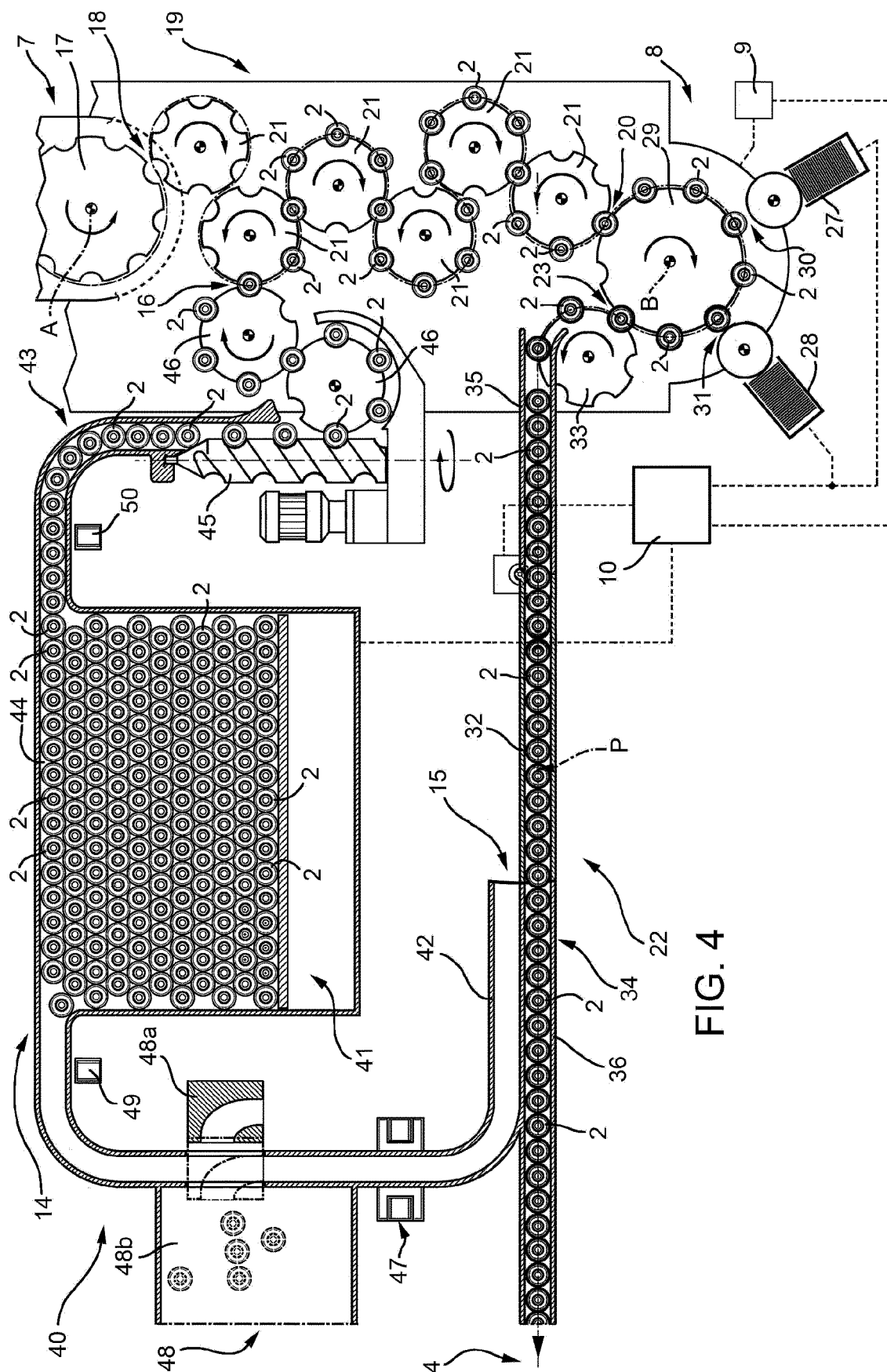
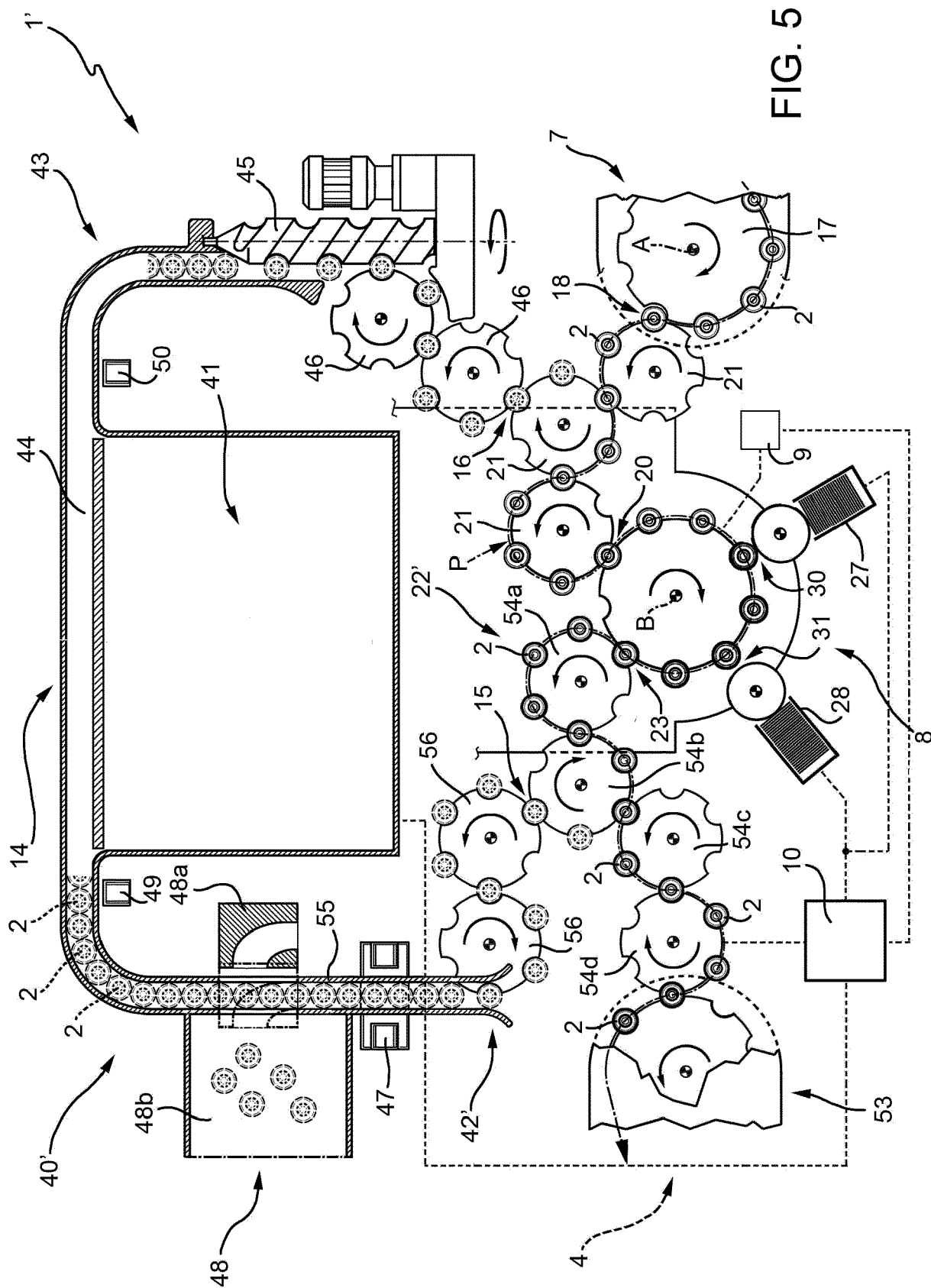


FIG. 2









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