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(54) A unit for treating containers and a method for the reconfiguration of a unit for treating containers

(57) A unit (100') for treating containers (101), comprising at least one station (103) with a bath (103B) for a treating medium, the bath (103B) being defined by non-deformable walls (103W) and comprising a horseshoe-shaped recess (110) for lodging a first driving wheel (109B) of transport means (106) adapted to advance containers (101) along a path (P) across the bath (103B); the U-shaped recess (110) comprising a semicircular portion (111) with diameter D_{SC}; the transport means (106) comprising at least a second driving wheel (109A) arranged downstream of said first driving wheel (109B) with respect to a direction of advancement of said containers (101) along said container path (P); the at least one first driving wheel (109B) having a diameter D_B substantially equal to the diameter D_{SC} of the semicircular portion (111) and smaller than the diameter D_A of the at least one second driving wheel (109A); the at least one first driving wheel (109B) being borne by a driving shaft (112B) having a diameter d_B smaller than the diameter d_A of a driving shaft (112A) of the at least one second driving wheel (109A); the difference (D_{SC} - d_B) substantially matching the difference (D_A - d_A) and twice the height (H) of the containers (101) to be treated.

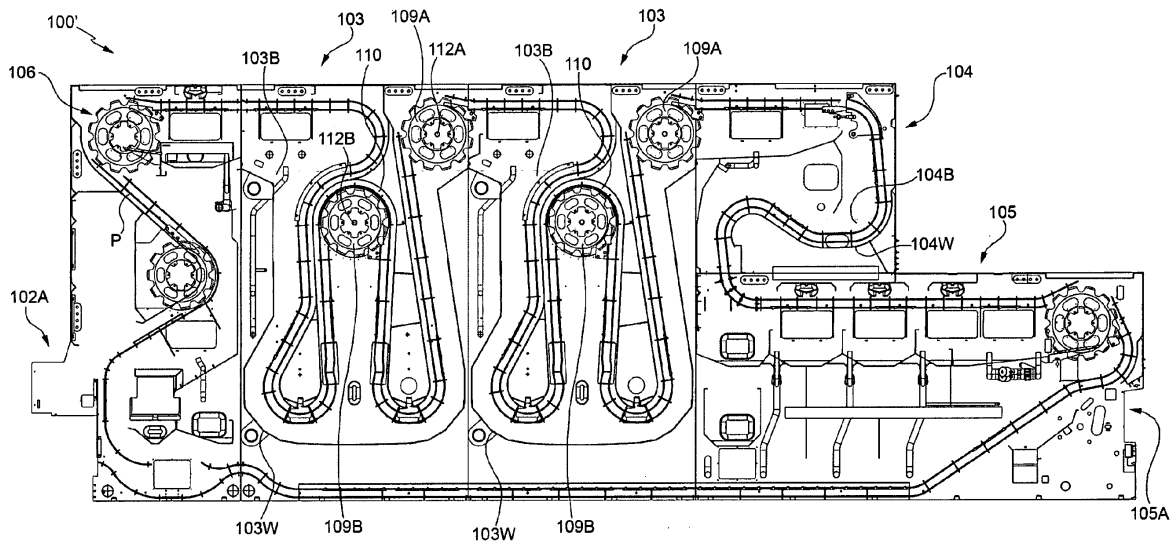

FIG. 2

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Description

TECHNICAL FIELD

[0001] The present invention relates to a unit for treating containers. In particular, the invention is directed to a unit for cleaning containers, such as bottles, e.g. in view of subsequent bottling operations by which bottles are filled with a pourable product.

[0002] Furthermore, the invention relates to a method for reconfiguring a pre-existing unit for treating containers so as to become adapted for treating extra-large (namely, extra-long) containers.

[0003] It is known, for example in the beverage industry, to treat containers needing to be cleaned, which are most commonly bottles of plastics or glass, with chemicals, such as caustic solutions, typically in combination with the application of heat.

[0004] To this purpose, use is commonly made of cleaning units wherein bottles are soaked and sprayed with detergent solutions at a high temperature; rinsed and cooled with potable water; and, finally, drained. The process is aimed not only at ensuring that any trace of dirt and any microorganisms possibly present in the bottles be removed, but also at eliminating from the surface of bottles labels or parts thereof, ideally without causing their defibration and kneading, which may bring about considerable drawbacks.

[0005] Composition of the washing cycle, operation modes and temperature, type of washing solution (acid, alkaline or neutral), etc., all depend on the type of cleaning unit used, on the degree of dirt of the bottles to be washed, on the features of the water used and on the pressure of water jets, on the glue used for the labels, on the degree of concentration of the detergent solutions used, etc. In most cases, however, the detergent solution used for washing bottles contains, as its main constituent, NaOH, generally mixed with other alkaline substances or synthetic detergents.

[0006] A longitudinal section of a typical unit 100 for cleaning bottles 101 in a beverage bottling plant is illustrated schematically in Figure 1. Cleaning unit 100 generally comprises a plurality of operating stations, namely a pre-treatment station 102, one or more washing stations 103, a rinsing station 104 and a cooling section 105. Furthermore, cleaning unit 100 comprises transport means 106 for: receiving the bottles to be cleaned at an input station 102A; conveying bottles 102 along a bottle path P which crosses each one of said operating stations; and for delivering cleaned bottles at an output station 105A.

[0007] Pre-treatment station 102, washing stations 103, and rinsing station 104 all typically comprise a respective tub, which can be filled with cleaning agents (i.e. the chemicals in aqueous solution referred to above) for actively washing bottles 102, or water for rinsing bottles 102 and removing any possible residue of those cleaning agents.

[0008] The speed at which bottles 101 are advanced along path P by transport means 106 is such that the permanence time of bottles 101 in each tub is enough to achieve the desired cleaning effect by ensuring a sufficiently prolonged contact with either cleaning agents or rinsing water.

[0009] Transport means 106 typically consist of a conveyor which comprises a plurality of bars 107 extending along an axis substantially perpendicular to the plane of Figure 1, each bar carrying a respective plurality of bottle holders 108. Commonly, bottle holders 108 are in the form of bottle baskets, each of which is adapted to receive and convey a respective bottle. As they travel across cleaning unit 100, bars 107 are driven, typically by means of a pair of parallel chains arranged about a plurality of wheels of a relative drive system, along a closed loop which substantially replicates, in a relative portion connecting input and output stations 102A and 105A, bottle path P.

[0010] In greater detail, the drive system of cleaning unit 100 comprises: a plurality of first driving wheels 109A that are, in use, above the level L reached by the detergent/rinsing solution in the tub of the relative operating stations; and a plurality of second driving wheels 109B (also referred to, in the following, as "immersed driving wheels") that are, in use, below the level L reached by the detergent/rinsing solution in the tub of the relative operating stations. By way of example, each washing station 103 in cleaning unit 100 of Figure 1 has: one first driving wheel 109A arranged above the surface of the washing bath contained in the relative tub, immediately upstream, with reference to a direction of advancement of bottles 101 along path P, of the subsequent operating station; and one second driving wheel 109B arranged below the surface of the washing bath contained in the relative tub, in an approximately central position and defining a 180° bend in bottle path P.

[0011] Transport means 106 are continuously cycled through the various parts of cleaning unit 100 to permit a substantially uninterrupted operation thereof and, thus, an essentially constant throughput of a substantial number of bottles to meet the needs of high-speed bottling plants) in certain instances, these machines may process as many as 150,000 bottles per hour).

[0012] Plastic bottles have been for years a popular choice with both manufacturers and consumers, by virtue of their lightweight nature and relatively low production costs, compared with glass bottles. The food industry has almost completely replaced glass with plastic bottles, if not for wine and beer. Bottles made of Polyethylene Terephthalate (PET, PETE or polyester) are typically used for bottling carbonated beverages, soft drinks in general, water and many pourable food products. In this context, PET provides an attractive alternative to glass, because it offers similar size with 75% less material weight, it is unbreakable and allows the use of larger size containers for carbonated products with a higher degree of safety. Furthermore, several markets are opening up

to the introduction of extra-large bottle formats which are perceived by consumers as even more economical. By way of example, plastic bottles taller than 340 mm are becoming more and more common.

[0013] Bottle washing machines are always designed taking into account the largest bottle size they will have to handle and the maximum throughput required among the various bottle sizes. Under all circumstances, a minimum treatment time - i.e. a minimum permanence time in the washing baths of the machine - must be ensured at all times. Accordingly, when a washing machine is intended for use with bottles coming in a very wide range of sizes, it will be designed with a view to meeting the production requirements of the smallest bottle size, which normally corresponds to the highest throughput.

[0014] However, despite the above-mentioned and widely recognised commercial appeal of extra-long bottles, cleaning units are not conventionally designed for handling them. In particular, cleaning units of the known type described above would need to be equipped with correspondingly extra-large bottle holders, which inevitably would end up interfering with the shafts of wheels 109 and/or with the walls of the tubs in the various operating stations.

[0015] In order for a cleaning unit of the type described above to be able to accommodate for extra-large bottles, an overall re-design of the unit would therefore be necessary. In particular, this would entail re-designing the walls of the tubs of the different operating stations and, in general, it would result in an increase in the overall bulkiness of the cleaning unit.

[0016] The cleaning/washing unit is traditionally the most bulky piece of equipment in a bottling plant. Therefore, an effort is generally made, in the art, to reduce its overall volume or at least, wherever possible, to avoid a further increase thereof.

[0017] The need is therefore felt, in the art, for a unit for treating containers, in particular a cleaning unit for use in bottling operations by which bottles are filled with a pourable product, which makes it possible to treat extra-large bottles whilst substantially maintaining the overall bulkiness of the cleaning unit unchanged with respect to units designed for treating smaller bottles.

[0018] In particular, the need is felt in the art for a unit by virtue of which the cleaning/washing operations of larger-size bottles may be carried out reliably and safely without needing to alter the design of the tubs of the different operating stations in the cleaning unit, in particular without needing to increase their overall volume.

[0019] It is an object of the present invention to provide a unit for treating containers, particularly for cleaning containers in beverage bottling operations, which makes it possible to meet the above needs in a straightforward and low-cost manner. This object is achieved by a unit as claimed in Claim 1.

[0020] Furthermore, the invention provides a method for reconfiguring a pre-existing unit for treating containers so as to become adapted for treating extra-large containers, in accordance with Claim 2.

[0021] Further features and advantages of the present invention will be better understood from the description of a preferred embodiment, which is given below by way of a non-limiting illustration, with reference to the accompanying drawings, in which:

Figure 1 shows a schematic longitudinal section of a known unit for cleaning bottles in a beverage bottling plant;

Figure 2 shows a schematic longitudinal section of a unit for cleaning bottles in a beverage bottling plant according to the invention; and

Figure 3 shows a larger scale view of a detail of Figure 2.

[0022] In Figure 2, a cleaning unit 100' of the type commonly forming part of a beverage bottling plant, which was briefly described above with reference to Figure 1, is illustrated.

[0023] For the sake of conciseness and simplicity, the description given in the following of cleaning unit 100' shall not cover in detail certain constructional aspects which virtually reproduce corresponding features already described above with reference to cleaning unit 100 according to the prior art. Therefore, wherever possible, when describing cleaning unit 100', the same reference numbers shall be used for parts that are identical or functionally alternative to corresponding parts of cleaning unit 100 described above.

[0024] Cleaning unit 100' comprises a plurality of operating stations, including at least one washing station 103, a rinsing station 104 and a cooling section 105. Furthermore, cleaning unit 100' comprises transport means 106 for: receiving the bottles to be cleaned at an input station 102A; conveying bottles 102 along a bottle path P which crosses each one of said operating stations; and for delivering cleaned bottles at an output station 105A.

[0025] The one or more washing stations 103 and the rinsing station 104 comprise respective baths 103B, 104B, wherein bottles 101 are brought into contact with cleaning agents (i.e. the chemicals in aqueous solution referred to above) and rinsed for removing any possible residue of those chemicals.

[0026] Each bath 103B, 104B is delimited by suitably shaped walls 103W, 104W which are configured and arranged to hold a liquid medium - namely the cleaning solution, or rinsing water - and are so designed to accommodate for the bends and turns in bottle path P.

[0027] For a better understanding, in Figure 2, the volume occupied, in use, by either detergent solution or rinsing bath has been highlighted by colouring the relative cross section in grey.

[0028] In practice, at least in one washing station 103, bath 103B (namely, walls 103W) is (are) defined by a number of substantially non-deformable metallic elements (e.g. sheets) and comprises at least one substantially horseshoe-shaped recess 110 for receiving and

lodging an immersed driving wheel 109B of transport means 106, whereby the direction of advancement of bottles within bath 103B, in use, is varied. In particular, in the embodiment of Figure 2, the direction of advancement of bottles 101 within bath 103B is varied of 180° or more as they travel about the relative wheel 109B.

[0029] In greater detail (reference may conveniently be made to Figure 3), horseshoe-shaped recess 110 comprises a substantially semicircular portion 111, the outer diameter D_B of immersed wheel 109B substantially matching the diameter D_{SC} of semicircular portion 111. In other words, immersed wheel 109B is lodged with a slight play in recess 110.

[0030] Furthermore, washing station 103 comprises one driving wheel 109A which is arranged above the surface of the detergent solution contained in bath 103B.

[0031] In the embodiment shown in Figure 2, at driving wheel 109A the direction of advancement of the bottles in washing station 103 is varied from a substantially vertical direction to a substantially horizontal direction, i.e. the bottles are received by wheel 109A as they rise from a bottom portion of bath 103B towards and above its surface and they are delivered on to the next operating station at an exit of washing station 103.

[0032] Many alternative layouts can be considered for bottle path P. However, in order for the bottles to have, in each bath 103B, 104B, a permanence time which is enough to achieve the desired cleaning effect, bottle path P is generally designed in an attempt to maximise a path-length to bath-volume ratio, which results in bottles 101 changing direction several times between an entrance and an exit of each operating station, let alone between input station 102A and output station 105A of cleaning unit 100'. Besides, the speed at which bottles 101 are advanced along bottle path P by transport means 106 is set such that the permanence time of bottles 101 in each bath is enough to achieve the desired cleaning effect.

[0033] By way of example, in the embodiment illustrated in Figure 2, the bottles coming from input station 102A and being held, upon reaching washing station 103, head first - i.e. with the opening facing downwards - are conveyed by transport means up and down within the relative bath 103B and then extracted from the same bath 103B, whereby the inclination of bottles 101 in space and their local direction of advancement undergo several major modifications, so as to carry out different operations concurring to completion of a cleaning process.

[0034] Bottle cleaning, in fact, typically involves three stages: first, bottles 101 are soaked in a bath, whereby dirt is chemically attacked by the caustic action of soda, increased by high temperature; secondly, bottles 101 are emptied to remove the dissolved dirt and used detergent solution; finally, the mechanical action of jets directed to the inside of bottles 101 is resorted to for removing the dirt that has been chemically attacked and yet has stuck to the bottle inner wall.

[0035] To this purpose, following the washing operation carried out in the one or more washing station 103, bottles 101 are moved on to rinsing station 104, which may include an immersion zone, followed by a spray-cooling section 105.

[0036] As bottles 101 travel across rinsing station 105, temperature is gradually lowered and the detergent solution is removed from both bottles 101 and transport means 106. The water employed for rinsing is conveniently recovered to the pre-treatment section.

[0037] Transport means 106 typically consist of a conveyor comprising a plurality of bars (not shown) extending along an axis substantially perpendicular to the plane of Figure 1, each bar carrying a respective plurality of bottle holders 108. Commonly, bottle holders (not illustrated in Figure 2) are in the form of bottle baskets, each of which is adapted to receive and convey a respective bottle, as shown in Figure 1. As the bars 12 travel across cleaning unit 100', the bars are driven by a pair of parallel chains arranged about respective drive systems, along a closed loop path. The closed loop path connects input and output stations 102A and 105A. In particular, these drive systems are motorised via first and second driving shafts 112A, 112B, bearing driving wheels 109A and 109B, respectively.

[0038] Advantageously, in cleaning unit 100', driving wheels 109B have (see also Figure 3) a diameter D_B - which is slightly smaller than the diameter D_{SC} of the semicircular portion 111 of "U"-shaped recess 110. The diameter of the driving wheels 109B is also smaller than the diameter DA of the driving wheels 109A'. Driving wheels 109B are supported on the second driving shaft 112B, which have a diameter dB that is smaller than the diameter d_A of first driving shafts 112A. The difference (D_{SC} - d_B) being substantially equal to the difference (D_A - d_A) and to twice the height H of bottles 101 to be treated.

[0039] Certain driving wheels 109B of transport means 106 are housed within a space that is delimited by the inner surface of the "U"-shaped wall of bottle washing station 103. Therefore, when longer bottles have to be accommodated between the respective driving shaft 112B having diameter dB and the inner surface of the "U"-shaped wall, diameter dB of driving shaft 112B is reduced. This inward reduction of shaft diameter avoids the need for outward increase in the size of the "U"-shaped wall of the bottle washing station 103, and consequently, advantageously avoids the need to increase the external dimensions of the entire unit. This is possible because the shaft 112B having diameter dB is subjected, in use, to only a low level of torque.

[0040] The other shafts, such as the shaft dA of driving wheel 109A, are subjected to higher torque forces. Consequently, the diameter dA of the respective shaft 112A is greater than the diameter dB of the shaft 112B of driving wheel 109B. Therefore, in order to transport longer bottles, the diameter DA of driving wheel 109A is increased. This increase in the diameter DA of driving wheel 109A is necessary, since the diameter dA of driving shaft 112A cannot be reduced due to the higher torque forces that act on it during operation.

[0041] In other words, when the diameter dB of driving shaft 112B of driving wheel 109B is reduced to accommodate bottles of greater length, within the confines of the "U"-shaped wall of the transport system, the outer diameter DA of the successive driving wheel 109A is increased. This enables longer bottles to be treated, without increasing the external dimensions of the bottle treating unit.

[0042] In particular, when the need arises to reconfigure a pre-existing cleaning unit 100' comprising at least one washing station 103 with a bath 103B comprising at least one substantially horseshoe-shaped recess 110 for receiving and lodging an immersed driving wheel 109B, the diameter DB' of immersed wheel 109B substantially matching the diameter DSC of a semicircular portion 111 of horseshoe-shaped recess 110; wherein all driving wheels 109A, 109B all have the same diameter DA'=DB' and are borne by respective driving shafts 112A, 112B all having the same diameter dA'=dB'; the cleaning unit 100' needing to be reconfigured so that it can accommodate bottles 101 having a height H greater than the diameter difference between immersed wheels 109B and the respective driving shafts, i.e. a height H greater than (DB'-dB')/2; the size of driving wheels 109A, 109B and of the relative driving shafts 112A, 112B may advantageously be modified so that the diameter DA of the driving wheels 109A which are arranged above the surface of the liquid media in the baths of cleaning unit 100' is greater than the diameter DB' of immersed driving wheels 109B; immersed driving wheels 109B being borne by second driving shafts 112B having a diameter dB smaller than the diameter dA of first driving shafts 112A; the difference (DSC - dB) being substantially equal to the difference (DA - dA) and to twice the height H of bottles 101 to be treated.

[0043] The advantages of the unit and method according to the present invention will be clear from the above description.

[0044] In fact, when faced with the need to reconfigure a pre-existing cleaning unit 100 so that it can conveniently process longer bottles, reducing the diameter of all driving shafts 112A, 112B by a length such as to accommodate extra-large bottle holders might appear to be a practical solution.

[0045] However, smaller shaft diameters are generally not compatible with the loads to which the driving wheel shafts are subjected, in operation. In fact, under these circumstances, shafts are required to bear loads larger than the usual ones, because extra-large bottles are even heavier, when filled, than average-sized bottles.

[0046] On the other hand, shifting bottle holders 108 to a radially outer position relative to the driving wheel shaft, and therefore increasing the diameter of immersed driving wheels 109B, could be an appealing alternative design option, yet it would require a complete re-design of the whole cleaning unit 100, especially as far as shape and size of the tubs of the different operating stations are concerned. In practice, this approach would be greatly disadvantageous, because it would entail a much too dramatic intervention on cleaning unit 100, whereby the geometry of the tubs of the baths 103B would have to be redesigned in its entirety, with an eventual and unavoidable increase of the overall bulkiness to make room for a greater distance between bottle holders 108 and their rotation axis.

[0047] The solution of the invention, on the contrary, provides for a rather straightforward and relatively inexpensive solution for accommodating longer bottles without having to redesign and increased the bulkiness of baths 103B of washing stations 103.

[0048] Clearly, changes may be made to the unit and method as described and illustrated herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. A unit (100') for treating containers (101), comprising at least one treatment station (103) with a bath (103B) for holding a liquid treating medium, said bath (103B) being defined by non-deformable walls (103W) and comprising at least one substantially U-shaped recess (110) for receiving and lodging a first driving wheel (109B) of transport means (106) adapted to advance said containers (101) to be treated along a container path (P) across said bath (103B); said U-shaped recess (110) comprising a substantially semicircular portion (111) having diameter D_{SC}; said transport means (106) comprising at least a second driving wheel (109A) arranged downstream of said first driving wheel (109B) with respect to a direction of advancement of said containers (101) along said container path (P); **characterised in that** said at least one first driving wheel (109B) has a diameter D_B which is substantially equal to the diameter D_{SC} of said semicircular portion (111) of said U-shaped recess (110) and is smaller than the diameter D_A of said at least one second driving wheel (109A); said at least one first driving wheel (109B) being borne by a driving shaft (112B) having a diameter d_B smaller than the diameter d_A of a driving shaft (112A) of said at least one second driving wheel (109A); the difference (D_{SC} - d_B) being substantially equal to the difference (D_A - d_A) and to twice the height (H) of said containers (101) to be treated.

2. A method for reconfiguring a pre-existing unit (100) for treating containers (101), said unit (100) comprising at least one treatment station (103) with a bath (103B) for holding a liquid treating medium, said bath (103B) being defined by non-deformable walls (103W) and comprising at least one substantially U-shaped recess (110) for receiving and lodging a first driving wheel (109B) of transport means (106) adapted to advance said containers (101) to be treated

along a container path (P) across said bath (103B); said U-shaped recess (110) comprising a substantially semicircular portion (111) having diameter D_{SC}; said transport means (106) comprising at least a second driving wheel (109A) arranged downstream of said first driving wheel (109B) with respect to a direction of advancement of said containers (101) along said container path (P); said driving wheels (109A, 109B) all having the same diameter $D_A'=D_B'$ and being borne by respective driving shafts (112A, 112B) all having the same diameter $d_A'=d_B'$; said unit (100) needing to be reconfigured so that it can accommodate containers (101) having a height (H) greater than the diameter difference between said at least one first wheel (109B) and the respective driving shaft (112A); **characterised by** comprising the step of

a) modifying the size of said driving wheels (109A, 109B) and of relative driving shafts (112A, 112B) so that the diameter D_A of said at least one second driving wheel (109A) is greater than the diameter D_B' of said at least one first driving wheel (109B); said at least one first driving wheel (109B) being borne by a second driving shaft (112B) having a diameter d_B smaller than the diameter d_A of said first driving shaft (112A); the difference (D_{SC} - d_B) being substantially equal to the difference (D_A - d_A) and to twice the height (H) of said containers (101) to be treated.

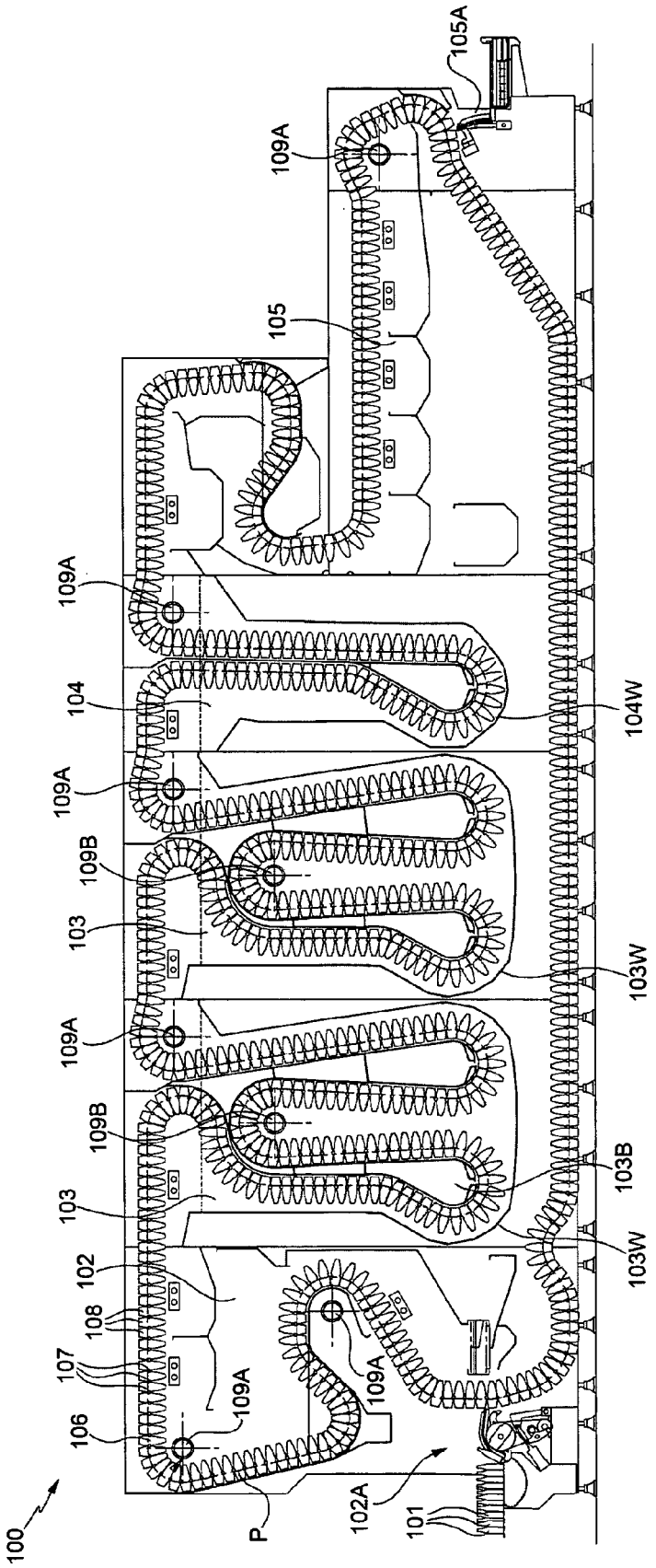
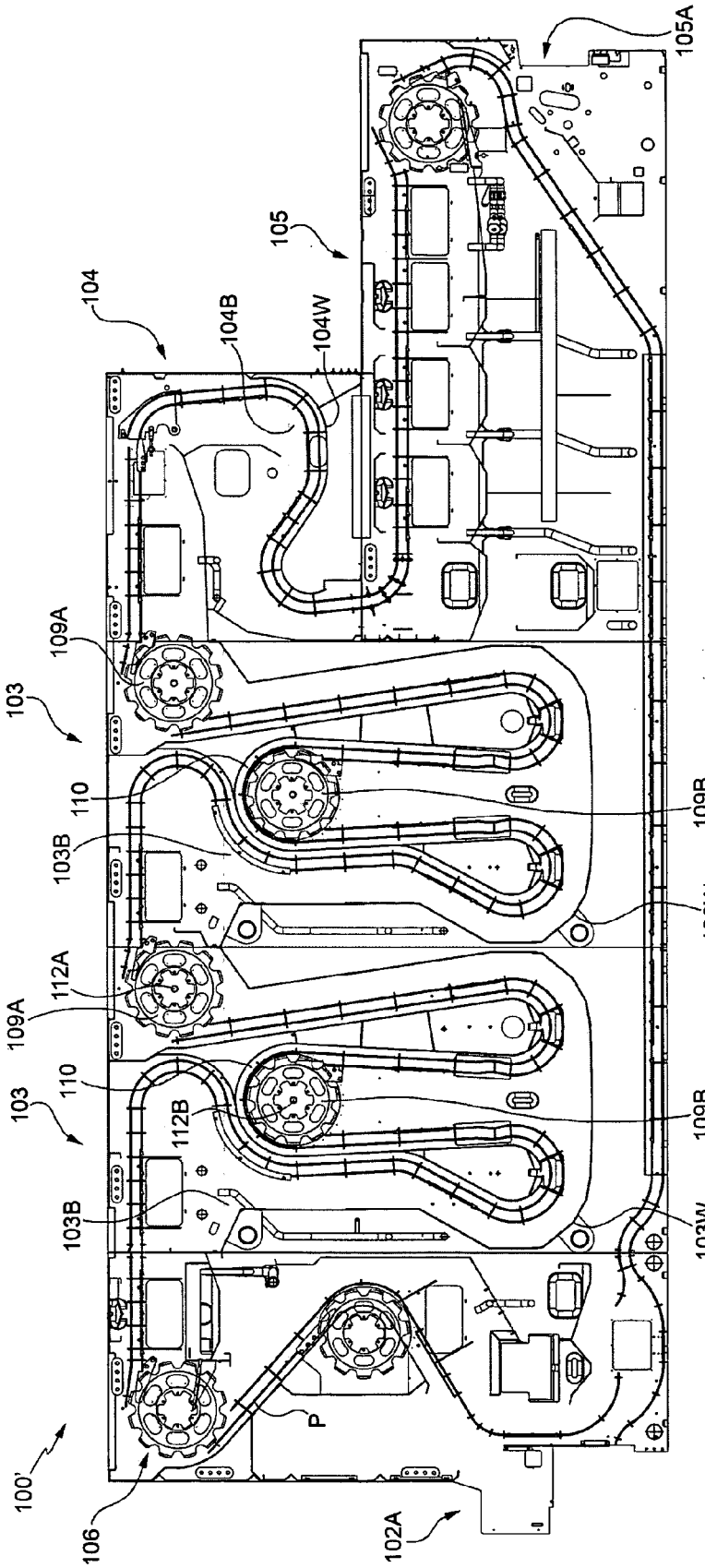


FIG. 1
(prior art)


105A
105
104
104B
104W
109A
103
110
103B
109B
103W
112A
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112B
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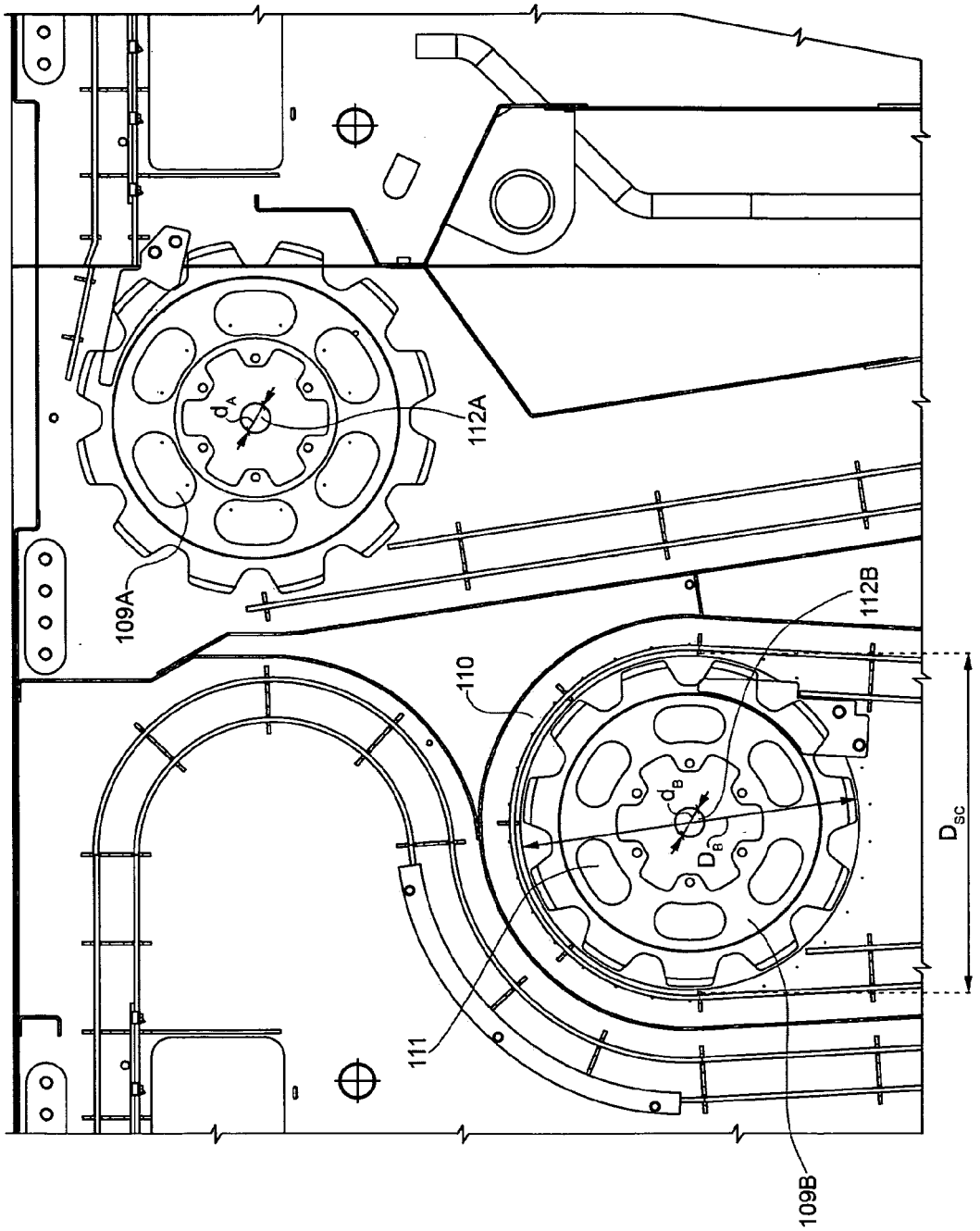
103B
103W
P
100'
106
102A

FIG. 2

FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 12 42 5178

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 1 761 450 A (MCKECHNIE ROBERT B) 3 June 1930 (1930-06-03) * page 1, line 72 - line 96; figure 1 *	1,2	
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			TECHNICAL FIELDS SEARCHED (IPC)
			B08B B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 March 2013	Appelt, Lothar

CATEGORY OF CITED DOCUMENTS

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27-03-2013

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