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(54) A WASHING UNIT FOR WASHING EMPTY ARTICLES AND RELATED METHOD

(57) There is disclosed a washing unit (1) for washing empty articles (2), comprising a first conveyor (4) for advancing articles (2) along a washing treatment path (P); washing treatment path (P) comprises at least one zone (Z) along which articles (2) are advanced in an up-side-down position; washing unit comprises a second conveyor (70) arranged below first conveyor (4) and adapted to receive and move away the straws (93) fallen from said articles (2) travelling along zone (Z).

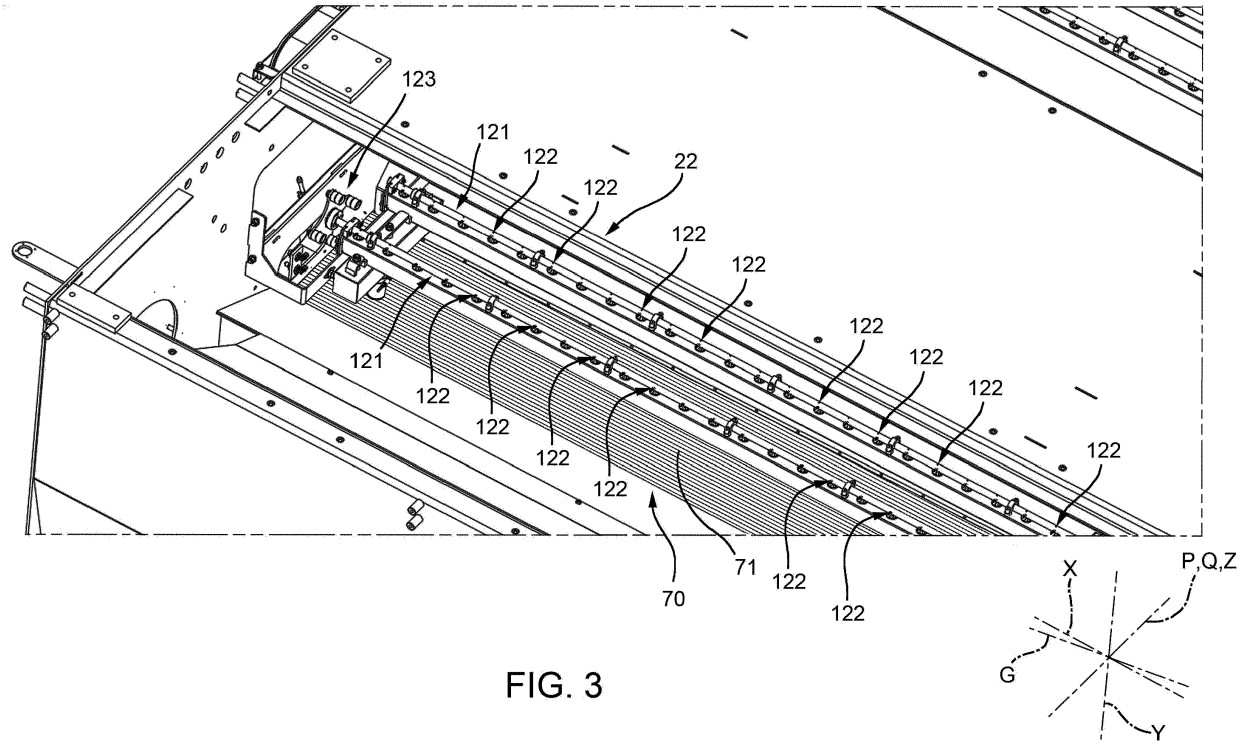

FIG. 3

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Description

[0001] The present invention relates to a washing unit for washing empty articles.

[0002] The present invention also relates to a method for washing empty articles.

[0003] Washing units are known with the purpose of cleaning the empty articles upstream of a filling and a labelling station, in which the articles are respectively filled with the pourable product and labelled with respective labels.

[0004] An example of washing unit is known, e.g. from EP2727660 in the name of the same of Applicant.

[0005] The known washing unit comprises:

- a feeding system;
- a washing tunnel;
    - a looped chain conveyor for advancing the articles along a closed path and which extends inside the washing tunnel from an inlet station to an outlet station;
- a plurality of nozzles for ejecting a washing agent inside the inner volume of the articles; and
- a plurality of successive treatment zones through which the chain conveyor advances the articles.

[0006] In detail, the feeding system comprises an endless conveyor and a sequencing device interposed between the endless conveyor and the inlet station of the chain conveyor.

[0007] The endless conveyor comprises a plurality of channels along which respective rows of articles are advanced towards the inlet station of the chain conveyor.

[0008] The sequencing device withdraws, one after the other, the empty articles from respective rows of the endless conveyors and convey them to the chain conveyor with a given rate to the inlet station.

[0009] The treatment zones are arranged between the inlet station and the outlet station.

[0010] In detail, the treatment zones comprise: a prewash zone, a first cleaning zone, a second cleaning zone and a final rinsing zone.

[0011] The prewash zone, the first cleaning zone, the second cleaning zone comprise respective baths filled with a chemical agent and through which the articles are advanced.

[0012] Especially in case of glass recycled articles, the latter might be fed to the washing unit with relative straws still arranged inside the same articles and outwardly protruding from the neck of the articles.

[0013] A need is felt within the industry to remove the straws from the washing unit upstream of the outlet station of the chain conveyor and as efficiently as possible.

[0014] A need is also felt within the industry to prevent the straws from interfering with the advancement of the articles to be washed inside the washing unit.

[0015] It is an object of the present invention to provide a washing unit for washing empty articles, which meets the above requirements.

[0016] The aforementioned object is achieved by the present invention as it relates to a washing unit for washing empty articles, as claimed in claim 1.

[0017] The present invention also relates to a method of washing empty articles, as claimed in claim 8.

[0018] One preferred embodiment is hereinafter disclosed for a better understanding of the present invention, by way of non-limitative example and with reference to the accompanying drawings, in which:

- Figure 1 is a lateral view of a washing unit for treating empty articles comprising a plurality of bars fitted with pockets having respective end portions, in accordance with the invention;
- Figure 2 is a section taken along line II-II of Figure 1;
- Figure 3 is a perspective top view in an enlarged scale of first components of the washing unit of Figure 1, with parts removed for clarity;
- Figure 4 is lateral view in an enlarged scale of second components of a first zone the washing unit of Figure 1, with parts removed for clarity;
- Figure 5 is a lateral view in a further enlarged scale of the second components of Figure 4, with parts removed for clarity;
- Figure 6 is a front view in a further enlarged scale of a spraying group of the washing unit of Figures 1 to 5;
- Figure 7 is a lateral view of the spraying group of Figure 5, with parts removed for clarity and in three subsequent operative positions;
- Figure 8 is a lateral view in some components of the spraying group of Figures 6 and 7 in consecutive operative steps, with parts removed for clarity; and
- Figure 9 is a front view of some components of the spraying group of Figures 6 to 7, with parts removed for clarity.

[0019] With reference to figure 1, numeral 1 indicates a washing unit for washing articles 2, in particular empty articles intended to be filled with a pourable product.

[0020] In detail, each article 2 extends along an axis A and comprises:

- a bottom portion 90;
- a neck portion 91; and
- a body 92.

[0021] In the embodiment shown, articles 2 are re-cycled and made of glass. Articles 2 can also comprises relative straws 93 housed inside relative bodies 92 and protruding therefrom.

[0022] Axis A is vertical, in the embodiment shown.

[0023] Washing unit 1 substantially comprises:

- a washing tunnel 3, which is fed with empty articles 2 to be washed and in which articles 2 are washed;

- a chain conveyor 4 for advancing articles 2 inside washing tunnel 3 along a closed loop path P; and
- a plurality of treatment zones 5, which are arranged inside washing tunnel 3 and comprise, in the embodiment shown, respective tanks 6 filled with respective cleaning agent and through which chain conveyor 4 advances articles 2.

[0024] With reference to Figure 1, it is possible identify:

- a direction X orthogonal to path P and horizontally arranged; and
- a direction Y orthogonal to both path P and direction X and vertically arranged in the embodiment shown.

[0025] In the following of the present description, the expression "below", "upward", "downward", "forward", "rearward", "horizontal plane" will refer to the normal positioning of washing unit 1 shown in Figure 1.

[0026] Washing unit 1 also comprises:

- a feeding system 8, which feeds a sequence of rows 20 of articles 2 to be cleaned to chain conveyor 4 along a direction F and at an inlet station I of washing tunnel 3; and
- an outfeed conveyor 14, which receives a sequence of rows of cleaned articles 2 from chain conveyor 4 at an outlet station O of washing tunnel 3.

[0027] Direction F is, in the embodiment shown, horizontal and orthogonal to axes A of articles 2.

[0028] In greater detail, feeding system 8 comprises, with special reference to Figure 2:

- a plurality of endless conveyors 103 (only schematically shown) comprising respective channels 104 aligned along path P;
- a motor (not shown in the Figures), which drives conveyors 103; and
- a sequencing device 105, which receives a plurality of rows 20 of articles 2 from relative conveyors 103 and feeds, one after the other, articles 2 of rows 20 to inlet station I of washing tunnel 3.

[0029] In detail, rows 20 are aligned parallel to direction F.

[0030] Sequencing device 105 comprises a frame.

[0031] In particular, sequencing device 105 comprises, for each channel 104,:

- a conveying surface 106, which extends from conveyor 103 to station I of washing tunnel 3 along an arch-shaped shape;
- a lever 107 which is hinged to the frame about an hinge axis; and
- a lever 108 which is hinged to lever 107 about an axis C parallel to hinge axis of lever 108 and comprises two end fingers 111 adapted to contact bottom portions of articles 2 and to thrust articles 2 along surface 106.

[0032] Axis C and hinge axis of lever 107 are, in the embodiment shown, parallel to one another.

[0033] Axis C and hinge axis of lever 107 are, in the embodiment shown, orthogonal to axis A and path P.

[0034] Sequencing device 105 also comprises a pair of actuators for causing the rotation of lever 107 with respect to frame about hinge axis thereof and the rotation of lever 108 with respect to lever 107 about axis C.

[0035] Thanks to the presence of levers 107, 108 hinged to another, each sequencing device 105 can transfer, one after the other, the sequence of article 2 of respective row 20 towards inlet station I of washing tunnel 3 with the right position, horizontal in the embodiment shown.

[0036] In the embodiment shown, each sequence is formed by only forward-most article 2, with reference to the advancing direction of articles 2 parallel to direction F.

[0037] In particular, sequencing device 105 can transfer article 2 of respective channel 104 along a not circular arch.

[0038] Path P comprises a work branch Q and a return branch R.

[0039] Work branch Q extends from inlet station I to outlet station O while return branch R extends from outlet station O to return station I.

[0040] Chain conveyor 4 advances articles 2 along work branch Q and returns without articles 2 along return branch R.

[0041] In the embodiment shown, path P lies on a vertical plane, and conveyor surface 106 and conveyor 4 advance articles 2 along a horizontal direction.

[0042] Furthermore, chain conveyor 4 comprises, along work branch Q:

- a plurality of driven and driving wheels 7, which mesh with conveyor chain 4 and causes the movement thereof along path P; and
- a plurality of stationary supporting structures 22, which interacts with conveyor chain 4 to prevent the bending thereof.

[0043] As shown in Figure 1, chain conveyor 4 comprises:

- a pair of chains 15 (only one of which is shown in Figures 1, 4 and 5) elongated parallel to path P and parallel to one another; and
- a plurality of subsequent conveying beams 16, which extend between chains 15 and orthogonally to chains 15 and path P.

[0044] Chain conveyor 4 further comprises a stationary guide 80 for supporting chains 15.

[0045] Guide 80 is shaped in the same way as path P.

[0046] Each beam 16 comprises:

- a rod 18 extending parallel to direction X and defining a plurality of pockets 17 for holding relative articles 2; and
- a pair of fingers 19 arranged at opposite ends of rods 18 with reference to direction X and downwardly protruding from beam 16.

[0047] In particular, pockets 17 of each beam 16 are adapted to receive forward-most articles 2 of respective rows 20 travelling at inlet station I from sequencing device 105.

[0048] Pockets 17 of each beam 16 are aligned along direction X. Accordingly, also articles 2, when conveyed along work branch Q and housed inside relative pockets 17, are aligned onto relative beams 16 along direction X to form respective rows 20.

[0049] Treatment zones 5 comprise a prewash zone, a first cleaning zone, a second cleaning zone.

[0050] The prewash zone, the first cleaning zone, the second cleaning zone comprise respective baths 11, 12, 13 filled with a cleaning agent.

[0051] For a better understanding, in Figure 1, the volume occupied by the cleaning solution has been highlighted by colouring the relative cross section in grey.

[0052] Due to the temperature of the cleaning agent, articles 2 are heated up as they travel inside bath 11, 12, 13.

[0053] Furthermore, the labels possibly arranged on articles 2 are removed as articles 2 travel inside bath 11, 12, 13.

[0054] Treatment zones 5 also comprise a rinsing zone 9, which is aimed to remove the chemical agents out of articles 2 and to cool them down. Rinsing zone 9 comprises a plurality of sprinkling device acting one after the other on articles 2.

[0055] Bath 11, 12, 13 and rinsing zone 9 are arranged, in this succession, along work branch Q of path P.

[0056] Washing unit 1 further comprises (Figure 1), proceeding from inlet station I to outlet station O according to the advancing direction of articles 2 along a path P:

- a collector 21 aimed to collect, under the gravity action, the residual objects contained in articles 2 advancing along work portion P, e.g. cigarette butts;
- a spraying group 22 which is configured to spray a a washing fluid inside articles 2, while the latter are advanced along a zone Z of work branch Q and in an upside-down configuration; and
- treatment zones 5.

[0057] As evident from Figure 1, as they are advanced along work branch Q by chain conveyor 4, articles 2 can be arranged upside-down, i.e. with relative neck portions 91 arranged below bottom portions 90 and relative axes A parallel to direction Y.

[0058] In particular, articles 2 are upside-down when they are conveyed through zone Z.

[0059] Spraying group 22 is arranged below chain conveyor 4, with reference to vertical direction Y.

[0060] With particular reference to Figures 6 to 9, spraying group 22 comprises:

- a stationary tank 120 filled with the washing fluid to be injected;
- a plurality of tubular elements 121 having respective axes parallel to direction X, rotatable about respective axes, in fluid connection with tank 120 and provided with a plurality of nozzles 122 spaced parallel to direction X.

[0061] Tubular elements 121 are spaced parallel to path P.

[0062] Nozzles 122 of each tubular element 121 are spaced parallel to direction X for a first pitch. Articles 2 are spaced for the same first pitch along direction X. Nozzles 22 are arranged in correspondence of relative articles 2 parallel to path P.

[0063] Each tubular element 121 comprises a pair of lobed wheels 123 arranged at opposite axial side thereof.

[0064] Wheels 123 are rotatable integral with respective tubular elements 121 about respective axes thereof.

[0065] In the embodiment shown, each wheel 123 comprises four lobes, which are angularly equi-spaced along the rotation axis of wheel 123 and, therefore, of relative tubular element 121.

[0066] As a result of the rotation of each wheel 123, the relative lobes may rotate between a upward vertical position, a forward horizontal position, a downward vertical and rearward horizontal position.

[0067] Fingers 19 of each beam 16 advancing through zone Z contact (Figures 6 and 7) the lobes of each wheel 123 set at that time in the upward vertical position.

[0068] As a result, the lobes of each wheel 123 set in the upward vertical position rotate towards respective forward horizontal positon, thus causing also the rotation of relative tubular element 121 and respective nozzles 122.

[0069] As they continue to advance through zone Z, fingers 19 of each beam 16 cause the rotation of the lobes of relative wheels 123 set in the upward vertical positions towards the forward horizontal positions, and the rotation of lobes of each wheel set in the downward vertical positions towards the rearward horizontal positions.

[0070] In this way, as shown in Figure 8, as beams 16 advance along path P, nozzles 122 of each tubular element 121 rotate, thus directing the washing fluid inside the inner volume of articles 2 carried by the advancing beam 16.

[0071] Advantageously, washing unit 1 comprises a removal conveyor 70, which is arranged below chain conveyor 4 and collects and moves away, in use, straws 93 fallen by articles 2 travelling along zone Z.

[0072] In particular, removal conveyor 70 is arranged below chain conveyor 4 along direction Y.

[0073] Removal conveyor 70 is, in the embodiment shown, arranged below spraying group 22 which is, in

turn, arranged below zone Z of path P along direction Y.

[0074] Removal conveyor 70 is an endless conveyor, a belt conveyor in the embodiment shown.

[0075] In particular, removal conveyor 70 is a looped conveyor and comprises a work branch 71 and a return branch 72 wound onto pulleys 75, 76.

[0076] Branch 71 is vertically interposed along direction Y between spraying group 22 and zone Z on one side and branch 72 on the other side.

[0077] Branches 71, 72 extend along a direction G, which is transversal to the extension direction of work portion Q inside zone Z and to direction Y.

[0078] In the embodiment shown, direction G lies on a plane orthogonal to the extension direction of work portion Q inside zone Z.

[0079] Still more precisely, direction G is slightly angled with respect to direction X.

[0080] Branch 71 extends between ends 73, 74 with reference to direction G; ends 73, 74 are arranged at respective pulleys 75, 76 onto which braches 71, 72 are wound.

[0081] The inclination of branch 71 is ascending with respect to a horizontal plane, proceeding from end 73 towards end 74.

[0082] Conversely, the inclination of branch 72 is descending with respect to the horizontal plane, proceeding from end 74 towards end 73.

[0083] Washing unit 1 also comprises a discharge station 77, which is adapted to receive straws 93 collected by branch 71, under gravity action in the embodiment shown.

[0084] In the embodiment shown, discharge station 77 is arranged downstream of end 74, proceeding according to the advancing direction of branch 71.

[0085] Washing unit 1 further comprises a collecting element 79 for collecting the washing fluid sprayed by spraying group 22 and fallen down, under gravity action, from articles 2.

[0086] In detail, collecting element 79 has substantially the same extension of zone Z parallel to the advancing direction of chain conveyor 4 inside zone Z and substantially the same extension of beams 16 along a direction X.

[0087] In the embodiment shown, removal conveyor 70 is vertically interposed between spraying group 22 and collecting element 79.

[0088] The operation of washing unit 1 is described in detail in the following.

[0089] Feeding system 8 advances a plurality of rows 20 of articles 2 to be washed inside channel 104 defined by conveyor 103 and parallel to direction F.

[0090] Especially when they are re-cycled, articles 2 might house relative straws 93 protruding from the respective neck portions 91.

[0091] Articles 2 properly positioned are arranged with respective axes A orthogonal to path P and with respective bottoms 90 lying on conveyor 103.

[0092] Beams 16 of chain conveyor 4 withdraw respective rows 20 of articles 2 at inlet station I from sequencing device 105, advance articles 2 inside washing tunnel 3 along work branch Q, discharge rows 20 of cleaned articles 2 at outlet station O onto outfeed conveyor 14 and return along return branch R without articles 2.

[0093] In greater detail, articles 2 of each row 20 are inserted inside respective pockets 17 of relative beam 16, along a curved portion of path P interposed between inlet station I and zone Z.

[0094] Afterwards, chain conveyor 4 advances articles 2 in a partially upside-down configuration - i.e. with relative neck portions 91 below corresponding bottom portions 92 and relative axes A inclined with respect to direction Y - along an ascending zone of path P along which collector 21 is arranged (Figure 3).

[0095] Thanks to the fact that articles 2 are in the partially upside-down configuration, the residual objects, e. g. cigarettes butts, contained in articles 2 fall down inside collector 21.

[0096] However, smaller and lighter objects like for example straws 93 might remain inside articles 2.

[0097] Chain conveyor 4 advances articles 2 through zone Z of path P in the upside-down configuration.

[0098] As articles 2 are advanced through zone Z, spraying group 22 sprays the washing fluid inside articles 2 in the upside-down configuration, so as to clean the inner volume of these articles 2. The washing fluid falling down from articles 2 is collected in collecting element 79.

[0099] In the meanwhile, straws 93 fall down from articles 2 travelling in zone Z on branch 71 of conveyor 70, are moved from branch 71 towards end 74 and fall under gravity action inside discharge station 77.

[0100] In particular, branch 71 advances along an ascending path with reference to a horizontal plane, thus avoiding to advance towards discharge station 77 also the washing fluid falling down from articles 2.

[0101] Furthermore, washing fluid is conveyed from tank 120 to tubular elements 121, and is ejected by respective nozzles 122 and directed towards the inner volume of advancing articles 2.

[0102] In particular, as beams 16 move through zone Z, respective fingers 19 contact, one after the other, the lobes of wheels 123 arranged in the upward vertical position and causes the rotation of these lobes 123 towards the forward horizontal position.

[0103] As a result, the lobes of wheels 123 previously set in the rearward horizontal positon are rotated in the upwards vertical positon and are contacted by the respective fingers 19 of the next beam 16.

[0104] Furthermore, tubular elements 121 and relative nozzles 122 are intermittently driven in rotation about the axes of tubular elements 121. Nozzles 122 remain therefore oriented towards advancing articles 2 as shown in Figure 8.

[0105] Subsequently, chain conveyor 4 advances articles 2 through baths 11, 12, 13 where they move through the cleaning agent.

[0106] Finally, chain conveyor 4 discharges washed articles 2 without straws 93 to outfeed conveyor 4.

[0107] From an analysis of the features of washing unit 1 and to the method according to the present invention, the advantages it allows to obtain are apparent.

[0108] In particular, washing unit 1 comprises a conveyor 70 arranged below chain conveyor 4. Conveyor 70 receives straws 93 fallen down from articles 2 travelling in the upside-down configuration through zone Z and conveys straws 93 towards discharge station 77.

[0109] In this way, straws 93 can be efficiently removed from washing unit 1 upstream of outlet station O substantially without affecting the advancement of articles 2 along work branch Q of path P.

[0110] Furthermore, branch 71 conveys collected straws 93 along an ascending path towards discharge station 77.

[0111] In this way, it is possible to reduce the risk that branch 71 conveys the cleaning fluid fallen down from articles 2 towards discharge station 77.

[0112] Finally, conveyor 70 is interposed along direction Y between spraying group 22 and collecting element 79.

[0113] In this way, it is possible to remove straws 93 without altering the overall design and size of washing unit 1.

[0114] Clearly, changes may be made to washing unit 1 and to the method as described and illustrated herein without, however, departing from the scope of protection as defined in the accompanying claims.

[0115] In particular, conveyor 70 might be arranged below a zone of conveying path other than zone Z and along which articles 2 are arranged in the upside-down configuration.

Claims

1. A washing unit (1) for washing empty articles (2), comprising:

   - a first conveyor (4) for advancing said articles (2) along a washing treatment path (P); said washing treatment path (P) comprising at least one zone (Z) along which said articles (2) are advanced, in use, in an upside-down position;

   characterized by comprising a second conveyor (70) arranged, in use, below said first conveyor (4) and adapted to receive and move away the straws (93) fallen, in use, from said articles (2) travelling, in use, along said zone (Z).

2. The washing unit of claim 1, **characterized in that** said second conveyor (70) extends transversally with respect to an extension direction (X) of said path (P) inside said zone (Z).

3. The washing unit of claim 3, **characterized in that** said second conveyor (70) extends orthogonally with respect to the said extension direction (X) of said path (P) inside said zone (Z).

4. The washing unit of any one of the foregoing claims, **characterized in that** said second conveyor (70) comprises a conveying branch (71) adapted, in use, to receive and move away said straws (93); said conveying branch (71) being sloped with respect to a first direction (Y), which is set, in use, vertically.

5. The washing unit of claim 4, **characterized in that** said conveying branch (71) is cyclically movable along an ascending second path with respect to said first direction (Y) and towards a discharge section (77) at which said fallen straws (93) are, in use, discharged.

6. The washing unit of any one of the foregoing claims, **characterized by** comprising:

   - spraying means (22) for ejecting a washing fluid towards said articles (2) travelling in said zone (Z); and
   - a collecting element (79) for collecting said washing fluid, which, in use, falls down after having washed said articles (2);

   said second conveyor (70) being interposed, in use, along said first direction (Y) between said spraying means (22) and said collecting element (79).

7. The washing unit of any one of the foregoing claims, **characterized by** comprising at least one bath (11, 12, 13) filled, in use, with a cleaning agent and through, which, said washing treatment path (P) extends;
   said zone (Z) being arranged upstream of said bath (11, 12, 13) proceeding along said washing treatment path (P) according to an advancing direction of said articles (2).

8. A method of washing a plurality of empty articles (2), comprising the step of:

   i) advancing said empty articles (2) by means of a first conveyor (4) along a zone (Z) of a washing treatment path (P) in an upside-down position;

   characterized by comprising the further steps of:

   ii) advancing a second conveyor (70) below said first conveyor (4);
   iii) collecting and moving away the straws (93) fallen from said articles (2) travelling along said zone (Z), by means of said second conveyor (70).

9. The method of claim 8, **characterized in that** said

step ii) comprises the step iv) of advancing a conveying branch (71) of said second conveyor (70) along a sloped second path with respect to a first direction (Y).

10. The method of claim 9, **characterized in that** said step iv) comprises the step v) of advancing said conveying branch (71) along an ascending said second path with respect to a first direction and towards a discharge section (77).

11. The method of any one of claims 8 to 10, **characterized by** comprising the steps of:

vi) spraying a washing fluid towards said articles (2) during said step i), by means of spraying means (22); and
vii) collecting said washing fluid fallen down after having washed said articles (2) inside a collecting element (77) ;

said second conveyor (70) being vertically interposed, in use, between said spraying means (22) and said collecting element (77).

12. The method of any of claims 8 to 11, **characterized by** comprising the steps of:

viii) advancing said empty articles (2) through at least one bath (11, 12, 13) arranged along said washing treatment path (P);

said zone (Z) being arranged upstream of said bath (11, 12, 13) proceeding along said washing treatment path (P) according to an advancing direction of said articles (2).

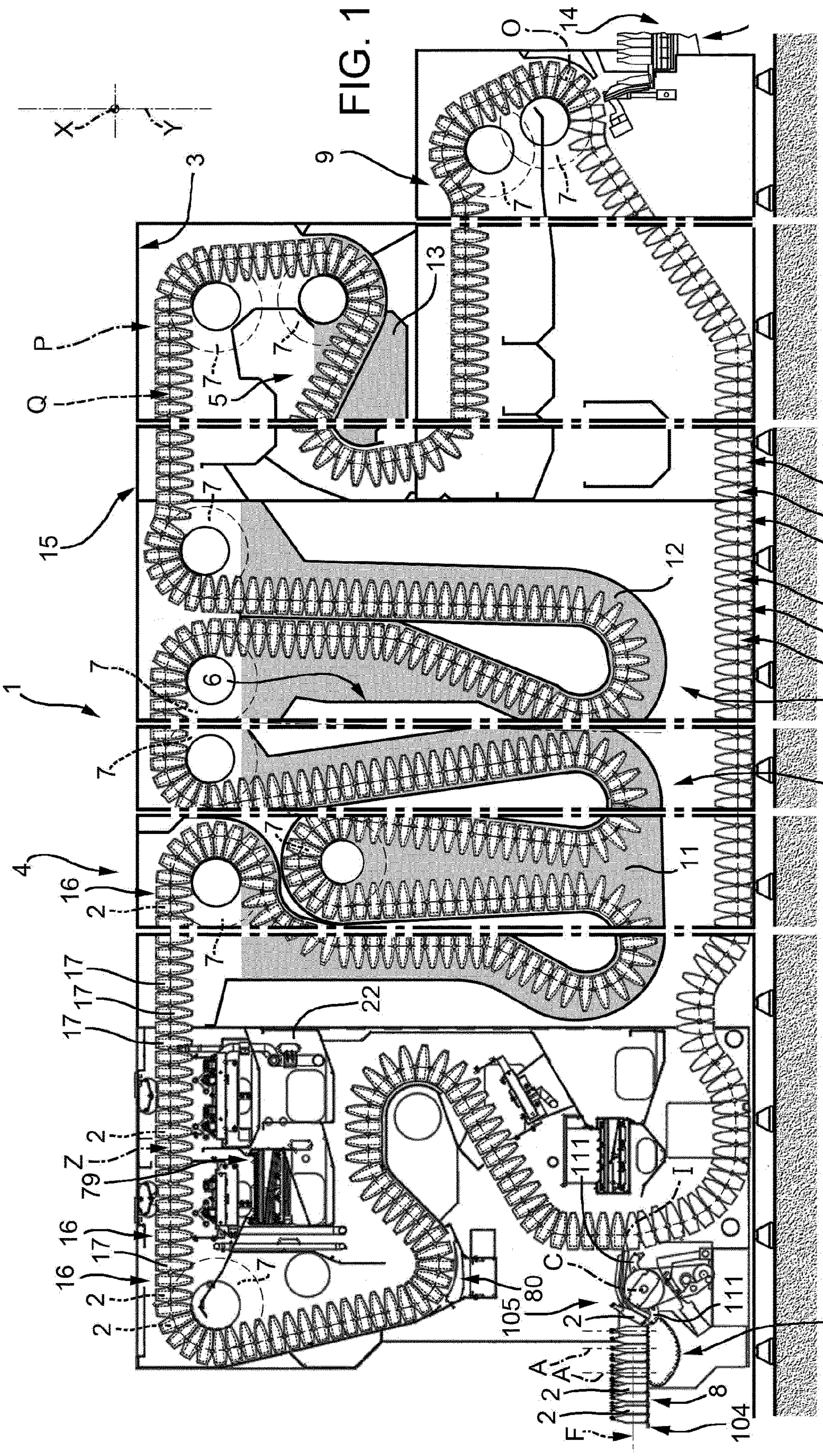


FIG. 1

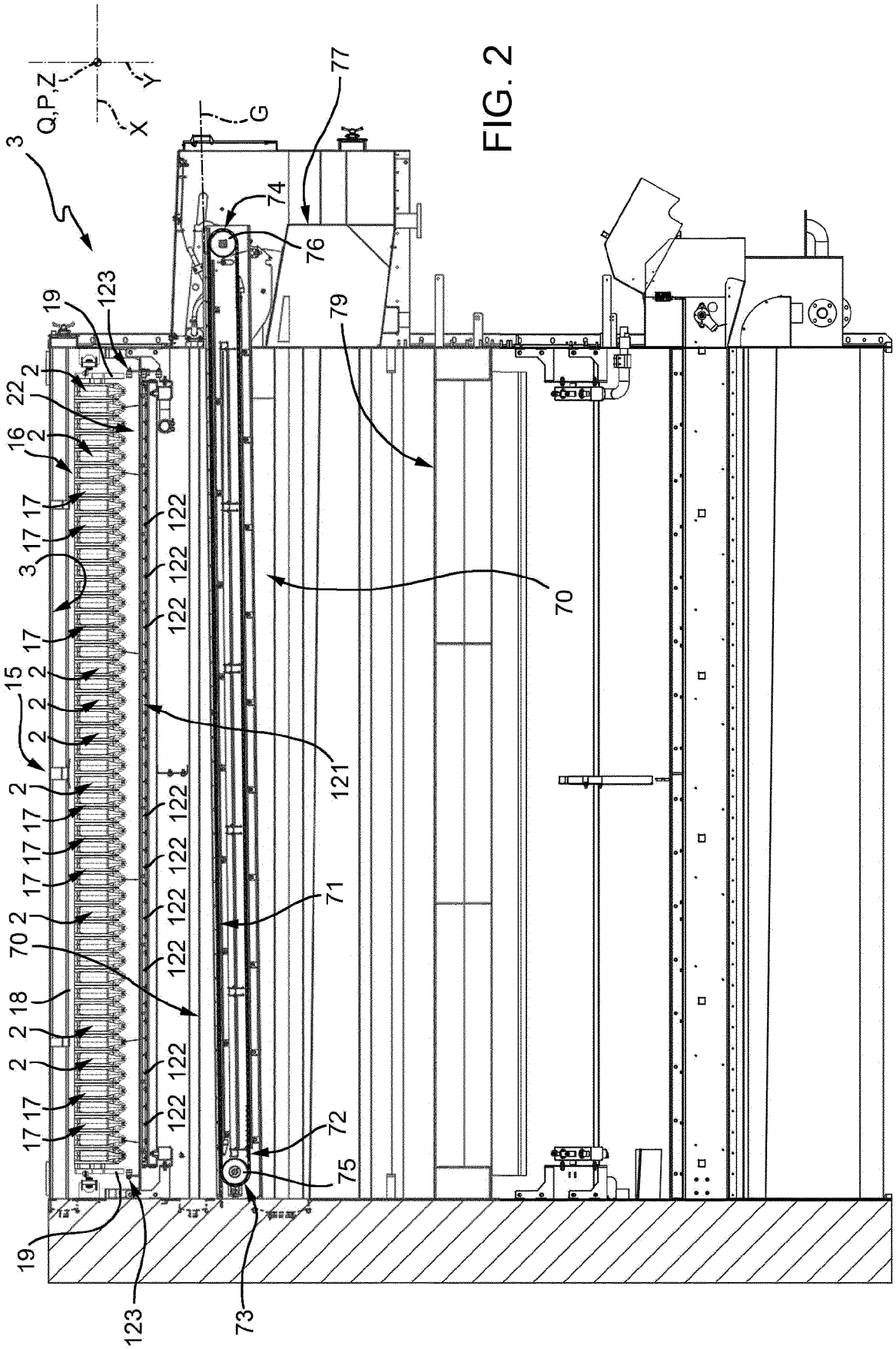


FIG. 2

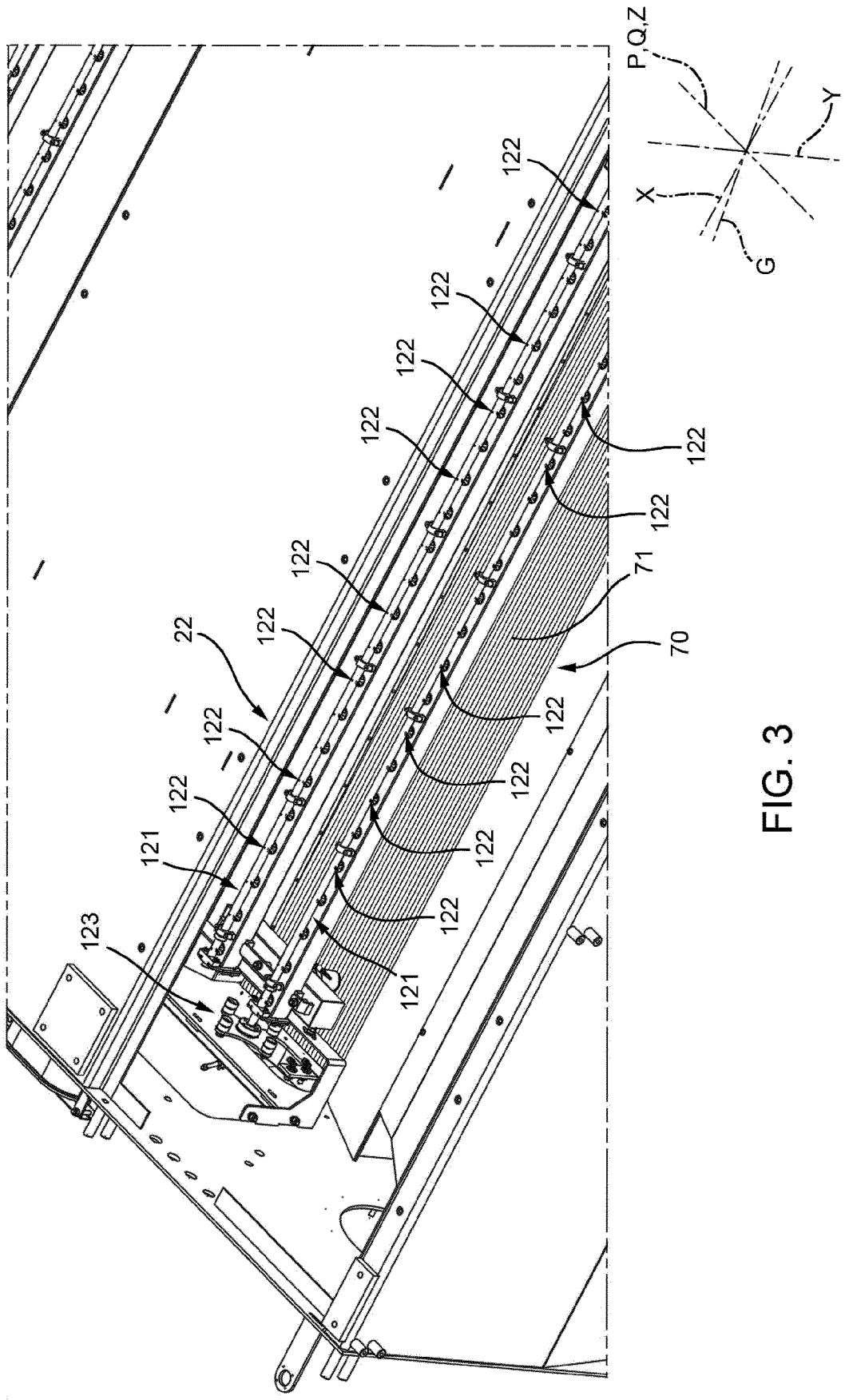
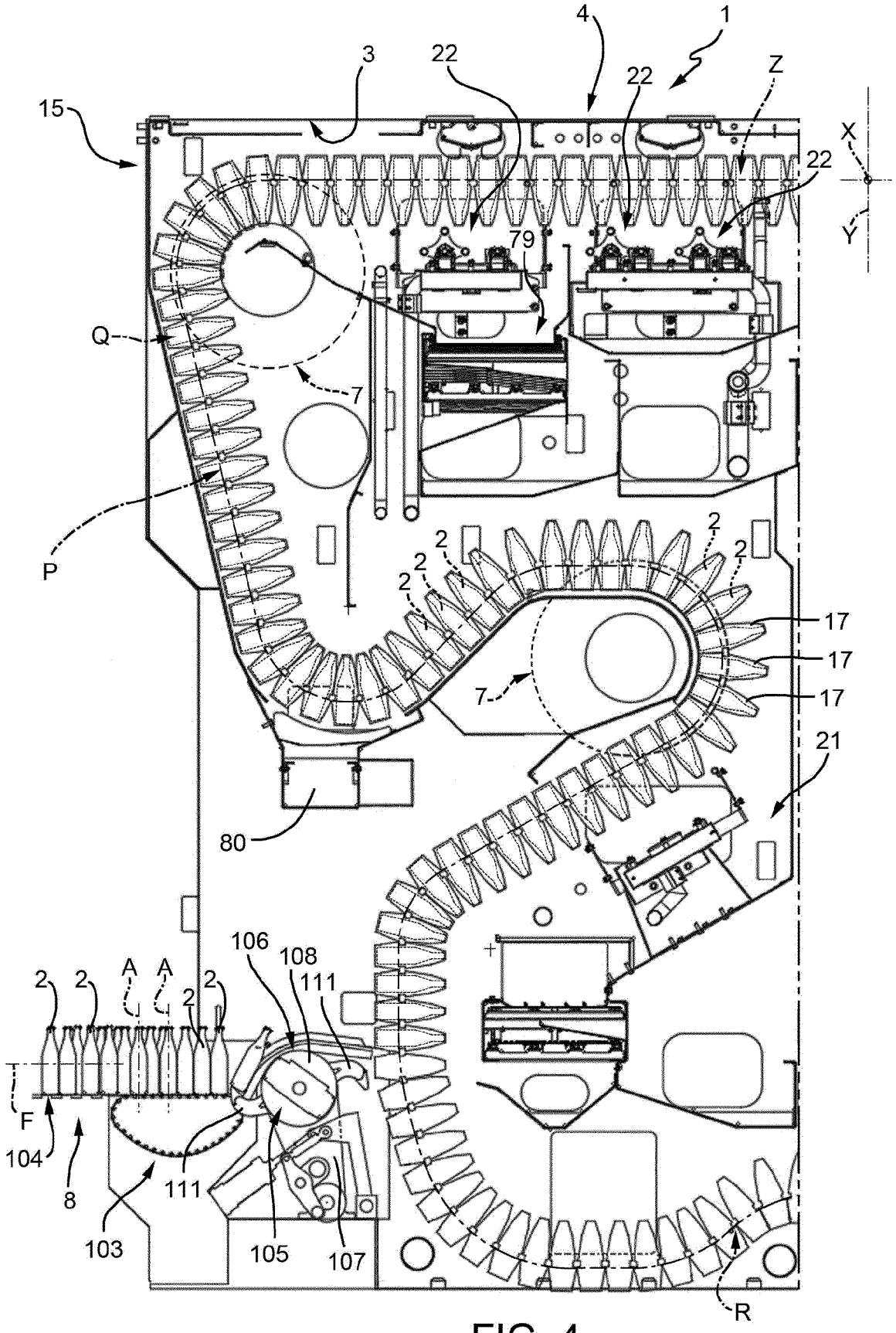


FIG. 3


4
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104
8
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107
R

FIG. 4

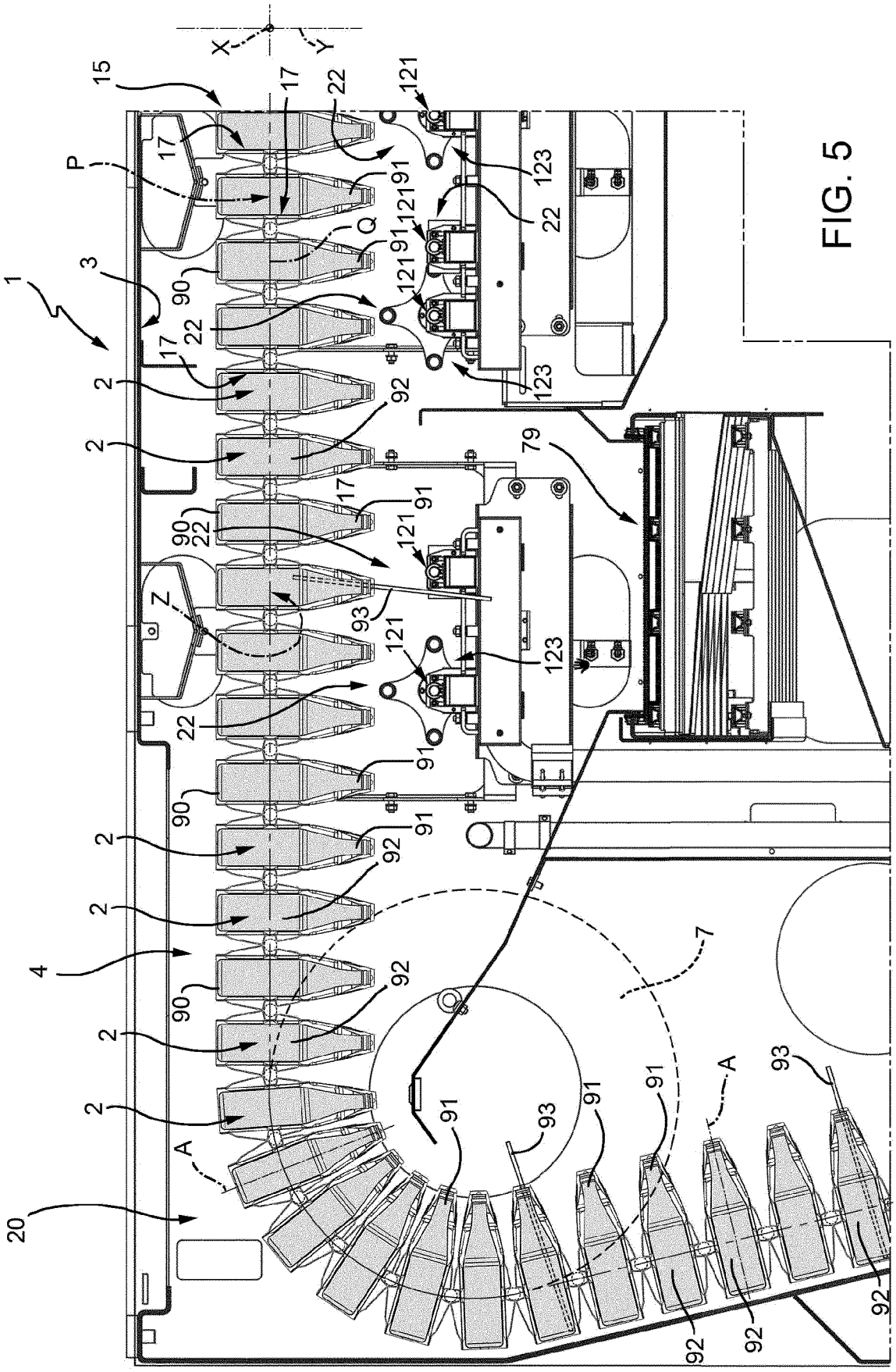


FIG. 5

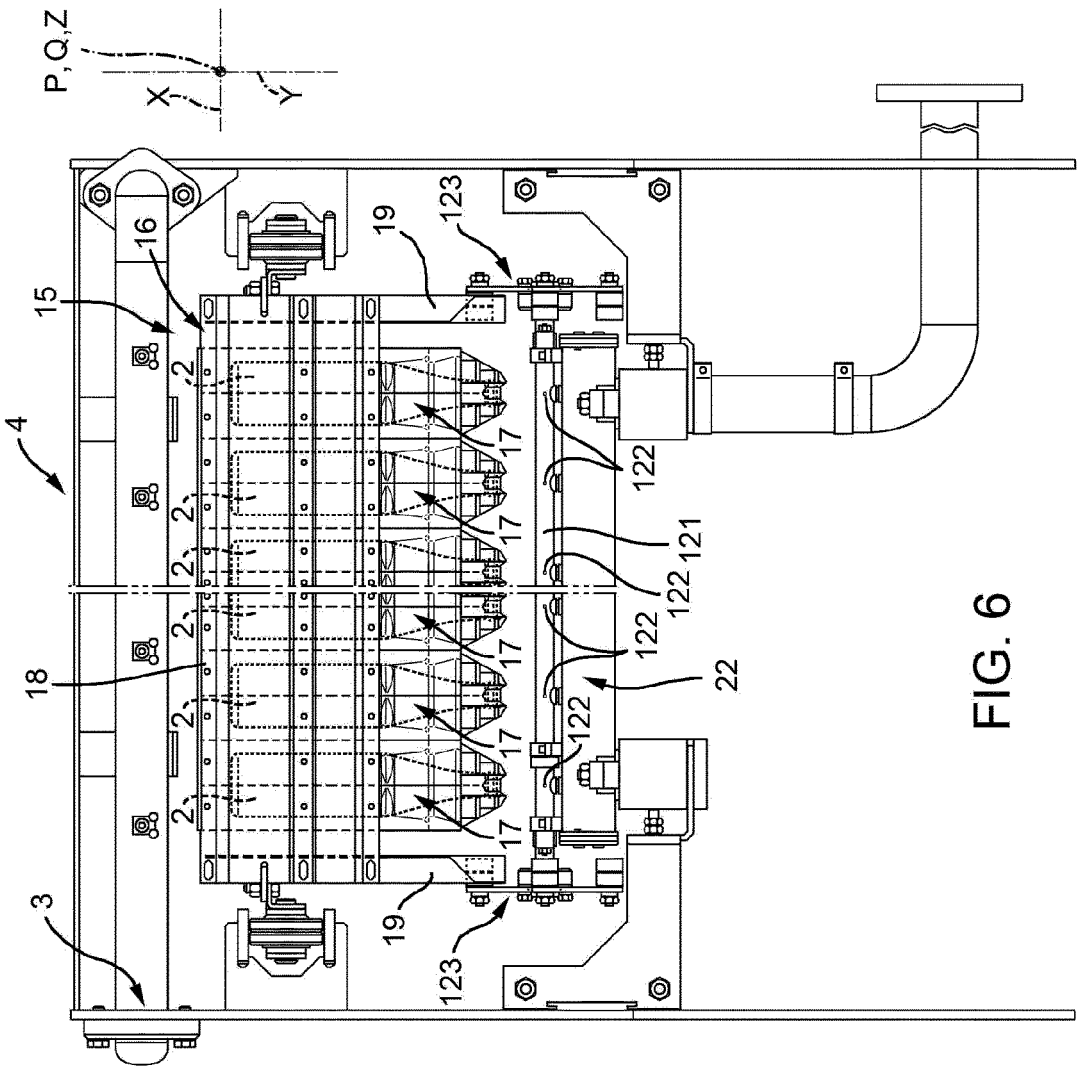


FIG. 6

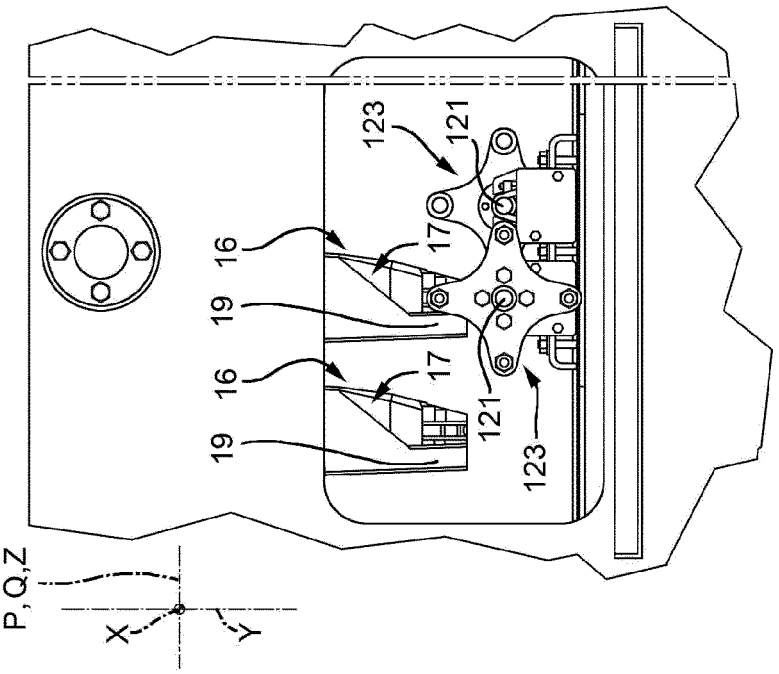


FIG. 7

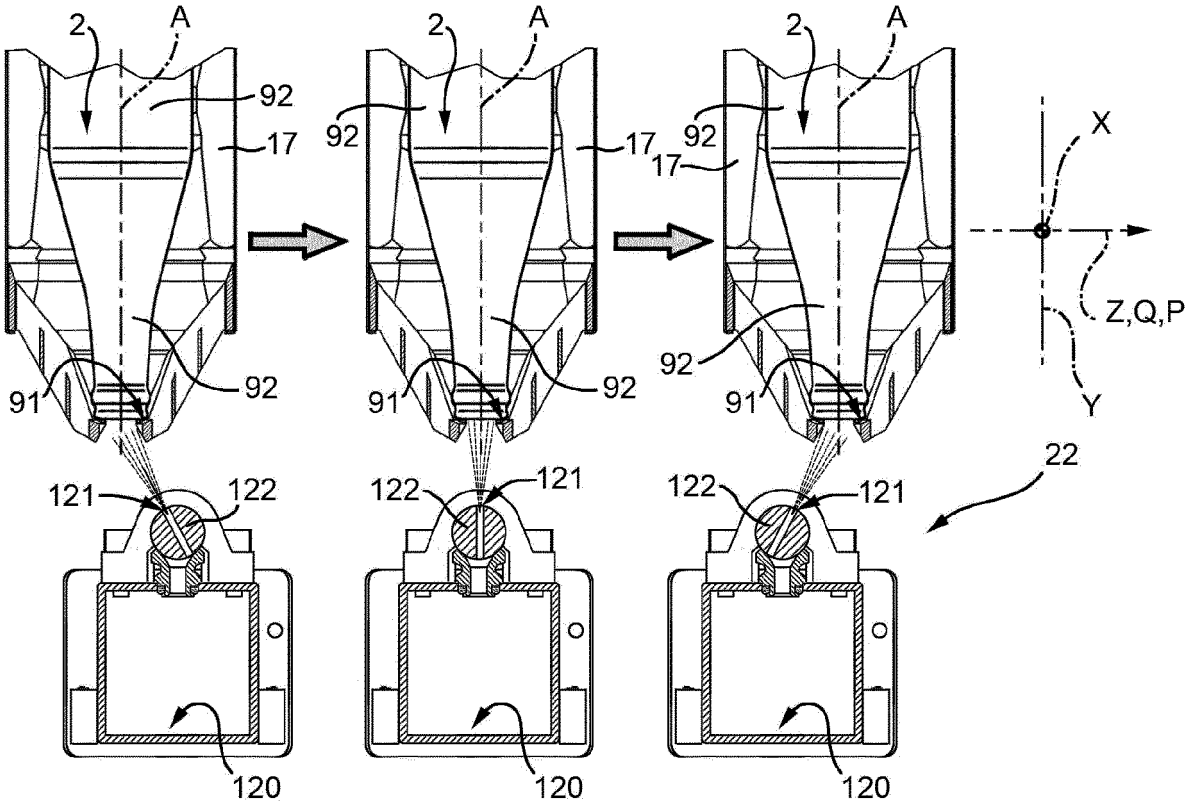
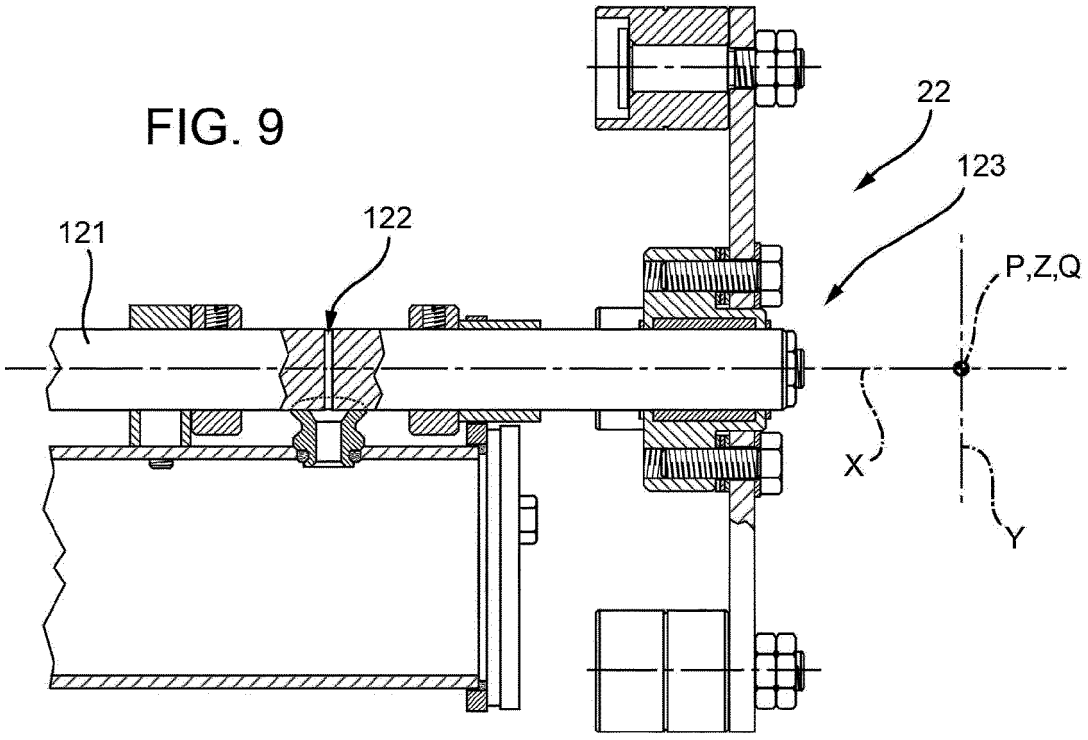


FIG. 8

FIG. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 4873

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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