(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 385 414 A1**

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**10.10.2018 Bulletin 2018/41**

(51) Int Cl.:
***D01H 9/18*** *(2006.01)*

(21) Application number: **18164532.6**

(22) Date of filing: **28.03.2018**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA ME**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **06.04.2017 IT 201700037751**

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## (54) APPARATUS AND METHOD FOR TRANSPORTING BOBBINS AND TUBES BETWEEN ROVING FRAME AND SPINNING FRAME OF A SPINNING LINE

(57) An apparatus of a spinning line comprises a rail (22) of a roving frame (6), a secondary transport device (26) associable to at least one spinning frame (8), and an integrated device (50) to locally carry out the collection of several tubes (12,14) originating from the spinning frame, of several bobbins (10) originating from the roving frame (6), the exchange of the bobbins (10) with the tubes (12,14) and the release of the bobbins (10) to the spinning frame and of the tubes (12,14) to the roving frame (6). Rail moving means are further provided for, adapted to advance the rail (22) with a variable stroke (C1,C2) between the step of collecting the bobbins (10) from the rail and the step of releasing the tubes (12,14) to the rail.

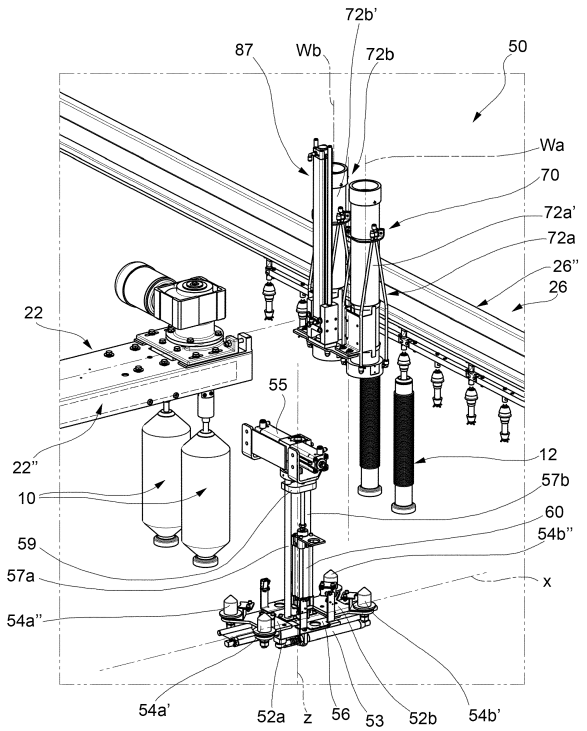


FIG.3

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## Description

**[0001]** The present invention relates to an apparatus of a spinning line and a method for transporting bobbins and tubes between a roving frame and a spinning frame.

**[0002]** As is known, the bobbins formed at the roving frame, consisting of a tube on which the roving stretched at the frame is wound, are transported to the spinning frame. At the spinning frame, the bobbins being worked are located, hanging from a loom, from which the rovings to be worked start. When the bobbins being worked are exhausted, they are replaced by bobbins originating from the roving frame.

**[0003]** The exhausted bobbins consist of the tube completely devoid of roving (defined as "empty tube") or of the tube provided with some roving residues windings (defined as "dirty tube").

**[0004]** The dirty tubes (and sometimes even the empty ones) are cleaned in a special device, usually called "cleaner", which removes the residual roving, thus obtaining empty tubes.

**[0005]** The empty tubes originating from the cleaner and those collected from the spinning frame are brought back to the frame and replaced here with the bobbins that have been formed in the meantime; the empty tubes may thus be reused to form new bobbins.

**[0006]** Such steps were traditionally performed manually or by means of completely or partially automatic mechanized systems.

**[0007]** Recently, the Applicant devised an integrated device which locally carries out the collection of the empty or dirty tubes and of the bobbins, the cleaning of the dirty tubes and the exchange of the bobbins with the empty tubes. Such integrated device and the related working method are described in the International Application WO 2016/083944.

**[0008]** Despite the high degree of automation that such integrated device allows to obtain, the tendency is to further speed up the performance of such operations, above all because of the tendency of the roving frames and of the spinning frames to foresee an ever increasing number of spindles.

**[0009]** It is the object of the present invention to provide an integrated device and a method capable of further reducing the overall execution times of the collection, exchange and release steps, and, possibly, of the cleaning step.

**[0010]** Such object is achieved by an apparatus according to claim 1 and by a method according to claim 10. The respectively dependent claims describe alternative embodiments of the device and alternative executions of the method.

**[0011]** Features and advantages of the apparatus and of the working method will become apparent from the following description, given by way of explanation and not by way of limitation, in accordance with the following Figures, in which:

- Figure 1 shows a portion of a spinning line provided with a roving frame, a plurality of spinning frames, a transport system and an integrated device according to an embodiment of the present invention;
- Figure 2 shows a diagram of the roving frame of Figure 1;
- Figure 3 shows the integrated device of Figure 1, according to an embodiment of the invention;
- Figures from 4a to 4e diagrammatically show the working method of the integrated device of Figure 3.

**[0012]** With reference to the accompanying Figures, numeral 1 indicates, overall, a portion of a spinning line comprising a vessels region 2, in which a plurality of vessels 4 is housed, each containing a roving roll, a roving frame 6 adjacent to the vessel region 2, to be fed the roving therefrom, and a plurality of spinning frames 8, for example arranged parallel to one another.

**[0013]** The frame 6 stretches the roving originating from the vessels 4 and winds it on empty tubes, forming bobbins 10 to be transported to the spinning frame. For such purpose, the bobbins 10 are made available to a carrier 20 of the frame 6.

**[0014]** A transport system comprises a frame side transport device 22, usually called "rail", adapted to collect the bobbins 10 from the carrier 20 and to move them in suspension, at a predetermined height, generally by means of a main belt 22'. The frame side transport device 22 is further adapted to load the carrier 20 with empty tubes 14.

**[0015]** For example, according to a preferred embodiment, the roving frame 6, which extends along a frame axis along which working points are distributed successively, provides for a pair of flaps 6a for each working point.

**[0016]** Each flap 6a is rotating about a vertical axis, to guide the roving in the winding around an empty tube 14, thus forming the spool 10.

**[0017]** The empty tube 14 is removably inserted on a spindle 6b integral with the spindle moving carrier 20.

**[0018]** In a working position (Figure 2), the carrier 20 is arranged at a height adapted to allow the winding of the roving around the tube, so as to produce the spool 10.

**[0019]** In other words, in said working position, the axes of the spindles carried by the carrier 20 substantially coincide with the axis of the flaps.

**[0020]** Once obtained the spools, for example, of the desired weight, the carrier 20 is lowered, from the raised working position to a lowered retracted position, in which it cooperates with carrier translation means for the horizontal translation of the carrier towards the advanced doffing position below the rail.

**[0021]** Said horizontal translation means comprise a slide 6c which cooperates with motor means for the horizontal translation of the carrier.

**[0022]** Following the horizontal translation of the carrier 20 carried by the slide 6c, the carrier 20 moves into the advanced doffing position adapted to allow the co-

operation of said carrier 20 with the spool carrying rail 22, to doff the spools from the carrier and/or arrange new empty tubes 14 on said spindles 6b for the formation of new spools.

**[0023]** The rail 22 is supported by a support and guiding structure 6d, comprising a vertically movable crosspiece 6e.

**[0024]** The rail 22 is thus vertically movable between a raised position, in which the moving of the spools towards the next processing occurs, and a lowered position adapted to collect the spools from the carrier in the doffing position.

**[0025]** For such purpose, the frame 6 comprises support and moving means adapted to support said rail and to allow the vertical movement thereof.

**[0026]** For example, said support and moving means comprise a preferably flat band 6f, connect, at an end, to the crosspiece 6e and wound, at the opposite end, to a rail moving shaft 6g connected to a motor.

**[0027]** The transport system further comprises a spinning frame side transport device 26 adapted to move the bobbins 10 towards the spinning frames 8 and the dirty tubes 12 (or sometimes empty 14) towards the frame 6.

**[0028]** For example, the secondary device 26 has a closed ring shape and comprises a track 26' having sections 8' which run parallel to the spinning frames 8, seamlessly.

**[0029]** Furthermore, the transport system comprises management means, comprising, for example, a PLC or a microprocessor, adapted to command the advancement of the spools along the rail and the advancement of the empty 14 or dirty tubes 12 along the track 26'.

**[0030]** Furthermore, the spinning line 1 comprises an integrated device 50 adapted to cooperate with the frame side transport device 22 which serves the frame 6 and with the spinning frame side transport device 26 which serves the spinning frames 8, to locally carry out, i.e., in a predetermined area of the transport system, the removal of the dirty tubes 12 from the secondary device 26 and of the bobbins 10 from the primary device 22, possibly the cleaning of the dirty tubes 12 to obtain empty tubes 14, the exchange of the bobbins 10 with the empty tubes 14 and the release of the bobbins 10 to the secondary device 26 and of the empty tubes 14 to the primary device 22.

**[0031]** In accordance with an embodiment, for example shown in Figure 3, the integrated device 50 cooperates with an end section 26'' of the track 26' of the secondary device 26 which serves the spinning frames 8 and with an end section 22'' of the transport belt 22' of the primary device 22 which serves the frame 6.

**[0032]** For example, the end section 22'' of the belt 22' extends along a direction perpendicular to the end section 26'' of the track 26'.

**[0033]** The integrated device 50 comprises a first support plate 52a and a second support plate 52b, arranged angularly out of phase by 180°, i.e., in diametrically opposed positions.

**[0034]** Said plates 52a,52b are movable horizontally according to opposing directions along a radial translation direction X, so as to carry the two plates below the end section 22'' of the belt 22' and below the end section 26'' of the track 26'.

**[0035]** In other words, said integrated device 50 comprises radial translation means adapted to force on command said radial translation to the plates 52a, 52b; preferably, said radial translation means comprise a pair of translation actuators 53, for example, with pneumatic actuation. Alternatively, the actuation is electric or oleodynamic.

**[0036]** Each plate 52a, 52b is provided with a plurality of tube supports, for example, a pair of tube supports 54a',54a'' and 54b',54b'', each tube support being adapted to be inserted below the tube and to hold it at the respective plate 52a, 52b.

**[0037]** Furthermore, the integrated device 50 provides for a vertical rotation axis Z, arranged between the two plates 52a, 52b; said plates 52a, 52b are adapted to perform a rotation around said rotation axis Z to exchange position with one another.

**[0038]** In other words, said integrated device 50 comprises rotation means adapted to force on command said rotation to the plates 52a, 52b.

**[0039]** Preferably, said rotation means comprise a rotation actuator 55, for example with pneumatic actuation, and a rack, so as to confer a clockwise and counterclockwise rotation, alternatively.

**[0040]** Alternatively, the actuation is electric or oleodynamic.

**[0041]** According to an embodiment, said rotation means comprise a central body 56, which supports the two plates 52a, 52b and the translation actuators 53, and is arranged therebetween.

**[0042]** The central body 56 is rotatably constrained to a pair of vertical stems 57a, 57b, fastened in turn to a transmission element 59, engaged with the rack.

**[0043]** According to additional alternative embodiments, the rotation may be only clockwise or only counterclockwise.

**[0044]** Furthermore, the plates 52a, 52b are vertically movable along a vertical translation axis Y, parallel to the rotation axis Z, so as to move from a lowered position, to a base height, to a raised position, to an engagement height, in which the bobbin 10 or the dirty 12 or empty tubes 14, supported by said plates, interact with the spinning frame side transport device 26 and with the frame side transport device 22.

**[0045]** In other words, said integrated device 50 comprises vertical translation means adapted to force on command said vertical translation to the plates 52a, 52b.

**[0046]** For example, said vertical translation means comprise a vertical translation actuator 60, engaged between the central body 56 and the transmission element 59 and adapted to raise/ lower said central body 56 by virtue of the fact that the stems 57a, 57b are slidingly engaged with the central body 56.

**[0047]** According to an alternative embodiment, the integrated device 50 comprises cleaning means 70 adapted to operate simultaneously on a pair of dirty tubes 12 to suction from these the roving residues windings R.

**[0048]** According to a preferred embodiment, said cleaning means 70 comprise suction means adapted to create, on command, a forced suction current, for example, comprising a fan, and a pair of cleaning tubes 72a, 72b, each provided with a straight functional section 72a', 72b', each having an extension along a respective vertical suction axis Wa, Wb, parallel to the rotation axis Z.

**[0049]** The cleaning tubes 72a, 72b are operatively connected to said suction means so that, once the latter are activated, a suction current is generated inside the tubes 72a, 72b and, in particular, inside the respective functional section 72a', 72b'.

**[0050]** Furthermore, said cleaning means 70 comprise moving means adapted to move at least the functional section 72a', 72b' of the cleaning tubes 72a, 72b between a resting position and a working position, in which they operatively engage, in suction, the respective dirty tubes to suction the roving residues.

**[0051]** In other words, in the working position of the functional section 72a', 72b' of the cleaning tube 72a, 72b, the roving residues windings R are subject to an action carried out by the air suction current, such to tear such windings and free the tube.

**[0052]** According to an embodiment, said moving means comprise a cleaner actuator 87, for example, with pneumatic actuation, operatively connected with the functional sections 72a', 72b' of the tubes 72a, 72b. In additional variants, the actuation is electric or oleodynamic.

**[0053]** Furthermore, preferably, the cleaning means 70 comprise secondary cleaning means adapted to locally direct a jet of compressed air towards the dirty tube 12 for removing additional roving residues present on an adhesive strip, generally in Velcro, which the tube is provided with for the attachment of the head and of the first windings of the roving.

**[0054]** The two suction axes Wa, Wb are contained in an imaginary suction plane Pa.

**[0055]** According to such embodiment of the invention, said suction plane Pa is substantially perpendicular to the advancement direction of the bobbins 10 on the frame side transport device 22, or substantially parallel to the advancement direction of the dirty tubes 12 on the spinning frame side transport device 26.

**[0056]** Again, in other words, said suction plane Pa is substantially orthogonal to the radial translation direction X of the support plate 52a, 52b.

**[0057]** Furthermore, said suction plane Pa is proximal to the spinning frame side transport device 26, i.e., proximal to the area for the collection of the dirty tubes 12 by the tube supports 54a', 54a''; 54b' 54b".

**[0058]** In particular, the suction plane Pa is arranged between the rotation axis Z and the advanced position assumed by the tube supports 54a', 54a''; 54b' 54b" for the collection of the dirty tubes 12. Preferably, the suction plane Pa is arranged aligned to the retracted position assumed by the tube supports 54a', 54a"; 54b', 54b".

**[0059]** In the normal operation of the spinning line, comprising the aforesaid integrated device (Figures 4a to 4e), the frame side transport device 22 carries two bobbins 10, hanging by means of a respective engagement/release device, generally called "pendulum"; the two bobbins 10 stop in a bobbin collection position such that the respective axes define an imaginary bobbin exchange plane Pb, substantially perpendicular to the advancement direction of the bobbins along the frame side transport device 22.

**[0060]** Furthermore, the spinning frame side transport device 26 carries two dirty tubes 12, provided with some roving windings R, hanging by means of respective engagement/release devices; the dirty tubes stop in a tube collection position in which they are aligned on an imaginary tube transport plane Pt, on which the advancement direction of the tubes along the spinning frame side transport device 26 also lies.

**[0061]** Preferably, the plates 52a, 52b are already initially in an advanced position (Figure 4a).

**[0062]** In said advanced position, the supports 54a', 54a" carried by the first plate 52a are vertically aligned to the bobbins 10 to be collected, i.e., aligned on the bobbin exchange plane Pb, and the supports 54b', 54b" carried by the second plate 52b are vertically aligned to the dirty tubes 12 to be collected, i.e., aligned on the tube transport plane Pt.

**[0063]** Subsequently, the plates 52a, 52b, starting from the base height, translate vertically upwards, engage the bobbins 10 to be collected and the dirty tubes 10 to be removed at the engagement height, disengage said bobbins and said tubes at the respective engagement/release devices rising slightly beyond the engagement height, and finally move downwards, back to the base height.

**[0064]** Furthermore, subsequently, the plates 52a, 52b translate radially towards the retracted position, so that the dirty tubes 12 are aligned on the suction plane Pa (Figure 4b).

**[0065]** In such configuration, if provided for by the embodiment, the cleaning tubes 72a, 72b are lowered onto the dirty tubes 12, which are thus inserted into said cleaning tubes, and the cleaning step is started by means of the suction air current.

**[0066]** Once ended the cleaning of the dirty tubes, the cleaning tubes 72a, 72b are removed from the tubes (now clean).

**[0067]** The plates 52a, 52b, therefore, perform a 180° rotation, so that the clean tubes 12' move into the area proximal to the frame side transport device 22, the bobbins 10 move into the area proximal to the spinning frame side transport device 26 and the frame side transport device 22 advances of a first stroke C1 (Figure 4c) .

**[0068]** Said first stroke C1 is such that two engagement/release devices are positioned on the bobbin ex-

change plane Pb.

**[0069]** Subsequently, the plates 52a, 52b translate into the advanced position, so that the bobbins 10 are aligned with the tube transport plane Pt and the clean tubes 12' are aligned with the bobbin exchange plane Pb (Figure 4d), positioned aligned below the engagement/release devices positioned on said bobbin exchange plane Pb.

**[0070]** Subsequently, the plates 52a, 52b, starting from the base height, translate vertically upwards up to an engagement height, so that the bobbins 10 engage to the spinning frame side transport device 26 and the clean tubes 12' engage to the frame side transport device 22, and, in particular, to the engagement/release devices positioned on the bobbin exchange plane Pb.

**[0071]** Finally, the tube supports 54a', 54a"; 54b', 54b" disengage the clean tubes and the bobbins, and the plates 54a,54b translate downwards, back to the base height (Figure 4d).

**[0072]** The frame side transport device 22 advances the bobbins carried by the rail 22 of a second stroke C2, so that two additional bobbins 10, between which, typically, an empty engagement/release device is arranged, are located on the bobbin exchange plane Pb.

**[0073]** Typically, the second stroke C2 is greater than the first stroke C1, since the first stroke C1 allows the alignment of only one additional engagement/release device on the bobbin exchange plane Pb, while the second stroke C2 allows the positioning of two subsequent bobbins on the bobbin exchange plane Pb.

**[0074]** Furthermore, the spinning frame side transport device 26 advances of a third stroke C3, so that other two dirty tubes 12 are ready for the spinning frame side collection (Figure 4e).

**[0075]** In other words, said management means comprise rail moving means adapted to advance the rail of a predetermined stroke, variable according to the operating step of the integrated device 50.

**[0076]** In particular, said rail moving means are adapted to make the rail 22 complete an advancement of a first stroke C1 to align two engagement/release devices on the bobbin exchange plane Pb and to make the rail 22 complete an advancement of a second stroke C2 to align two bobbins 10 on the bobbin exchange plane Pb.

**[0077]** Innovatively, the integrated device described above satisfies the requirements referred to with reference to the background art, as it allows to reduce the overall times required to exchange the bobbins with the tubes, and possibly to clean the dirty tubes.

**[0078]** It is clear that a skilled in the art, in order to satisfy contingent requirements, may make changes to the integrated device and to the working method described above, all included within the scope of protection as defined by the following claims.

## Claims

**1.** Apparatus for a spinning line, comprising:

- a primary transport device or rail (22) associable to a roving frame (6);
- a secondary transport device (26) associable to at least one spinning frame (8);
- an integrated device (50) comprising exchange means suitable to carry out locally the collection of a plurality of tubes (12,14) from the secondary device and a plurality of bobbins (10) from the primary device (22), the exchange of the bobbins (10) with the tubes (12,14) and the release of the bobbins (10) to the secondary transport device (26) and the tubes (12,14) to the primary transport device (22);
- rail moving means configured to advance the rail (22) with a variable stroke (C1,C2) between the step of collecting the bobbins (10) from the rail and the step of releasing the tubes (12,14) to the rail (22).

**2.** Apparatus according to claim 1, wherein the rail moving means are configured to make the rail (22) complete an advancement of a first stroke (C1) to align two engagement/release devices on a bobbin exchange plane (Pb) and to make the rail (22) complete an advancement of a second stroke (C2) to align two bobbins (10) on the bobbin exchange plane (Pb), wherein the first stroke (C1) is less than the second stroke (C2).

**3.** Apparatus according to claim 1 or 2, wherein the integrated device (50) comprises a first support plate (52a) and a second support plate (52b), arranged in diametrically opposed positions, wherein each plate (52a,52b) is provided with a pair of tube supports (54a', 54a"; 54b',54b"), each tube support being adapted to be inserted in the bottom of the tube and to hold it on the respective plate (52a, 52b).

**4.** Apparatus according to claim 3, wherein said integrated device (50) comprises radial translation means adapted to force on command a radial translation to the plates (52a,52b) in opposing directions.

**5.** Apparatus according to claim 3 or 4, wherein the integrated device (50) provides for a vertical rotation axis (Z) and comprises rotation means suitable to force on command a predetermined rotation of the plates (52a,52b) around said rotation axis (Z), preferably alternating.

**6.** Apparatus according to any one of the claims 3 to 5, wherein said integrated device (50) comprises vertical translation means suitable to force on command a predefined vertical translation to the plates (52a,52b).

**7.** Apparatus according to any one of the preceding claims, wherein the integrated device (50) comprises

cleaning means (70) suitable to operate simultaneously on said several tubes (12) to suction from these roving residues windings (R).

**8.** Apparatus according to any one of the preceding claims, comprising said roving frame (6), wherein the rail (22) is vertically movable between a raised position in which the advancement of the spools occurs and a lowered position suitable for collecting the spools from a carrier (20) in a doffing configuration.

**9.** Apparatus according to claim 8, wherein the carrier (20) is vertically movable from a raised working position to a lowered retracted position and in said lowered retracted position cooperates with carrier translation means for the horizontal translation towards the advanced doffing position below the rail.

**10.** Working method of a spinning line, comprising the steps of:

- arranging a plurality of tubes (12,14) on a tube transport plane (Pt) of a secondary transport device (26) associated with a spinning frame (8) and a plurality of bobbins (10) on a bobbin exchange plane (Pb) of a primary transport device or rail (22) associated with a roving frame (6);
- taking said tubes (12,14) and said bobbins (10);
- commanding the advancement of the rail (22) of a first stroke (C1) for arranging a plurality of engagement/release devices on said bobbin exchange plane (Pb) ;
- exchanging the bobbins (10) with the tubes (12,14);
- releasing the bobbins (10) to the secondary transport device (26) and the tubes (12) to the engagement/release devices supported by the rail (22);
- commanding the advancement of the rail (22) of a second stroke (C2), different from the first stroke (C1), to carry additional bobbins onto said bobbin exchange plane (Pb) .

**11.** Working method according to claim 10, comprising the step of cleaning the dirty tubes (12) between the step of taking said several tubes (12,14) and the step of releasing the tubes (14) to the engagement/release devices.

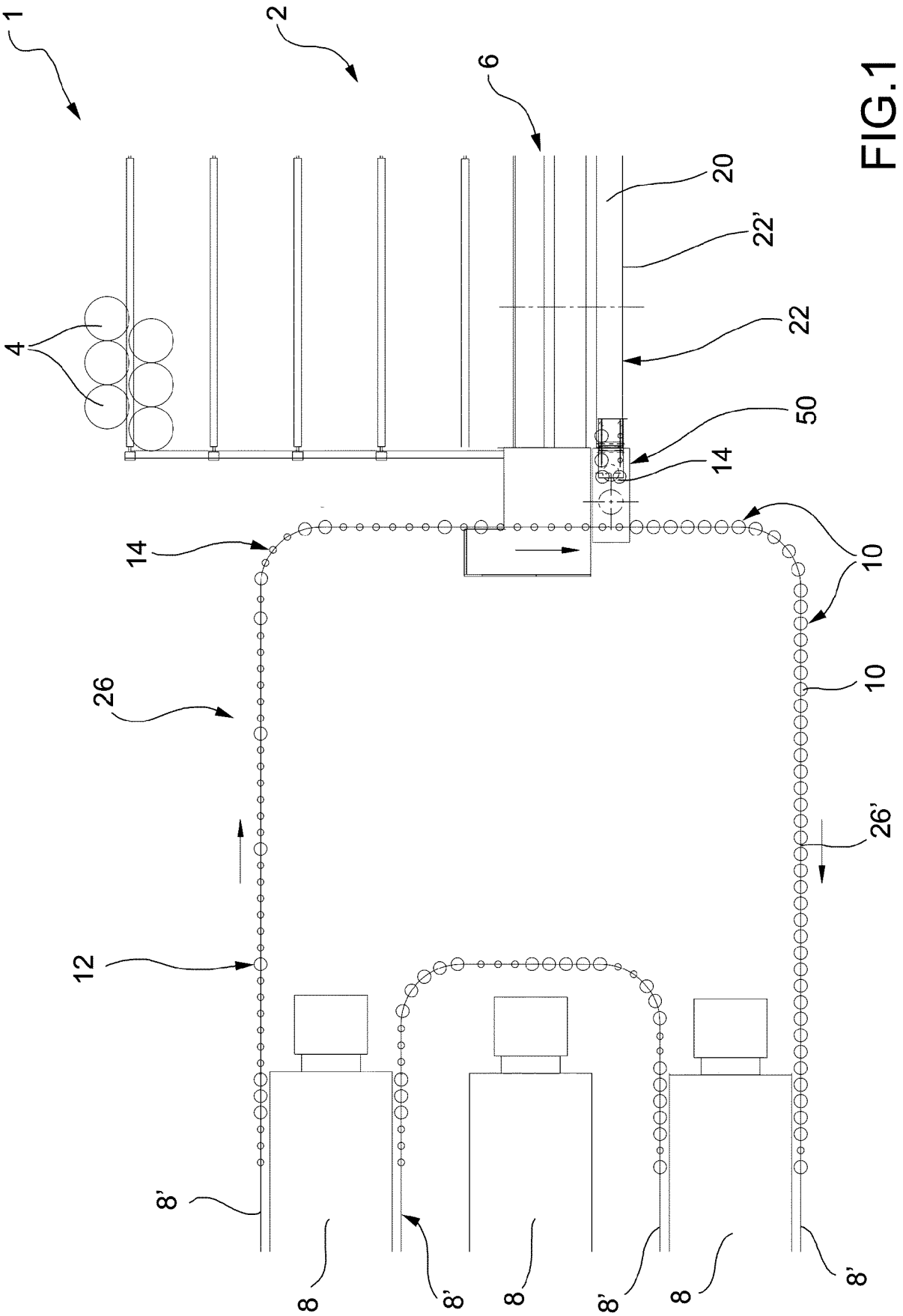


FIG.1

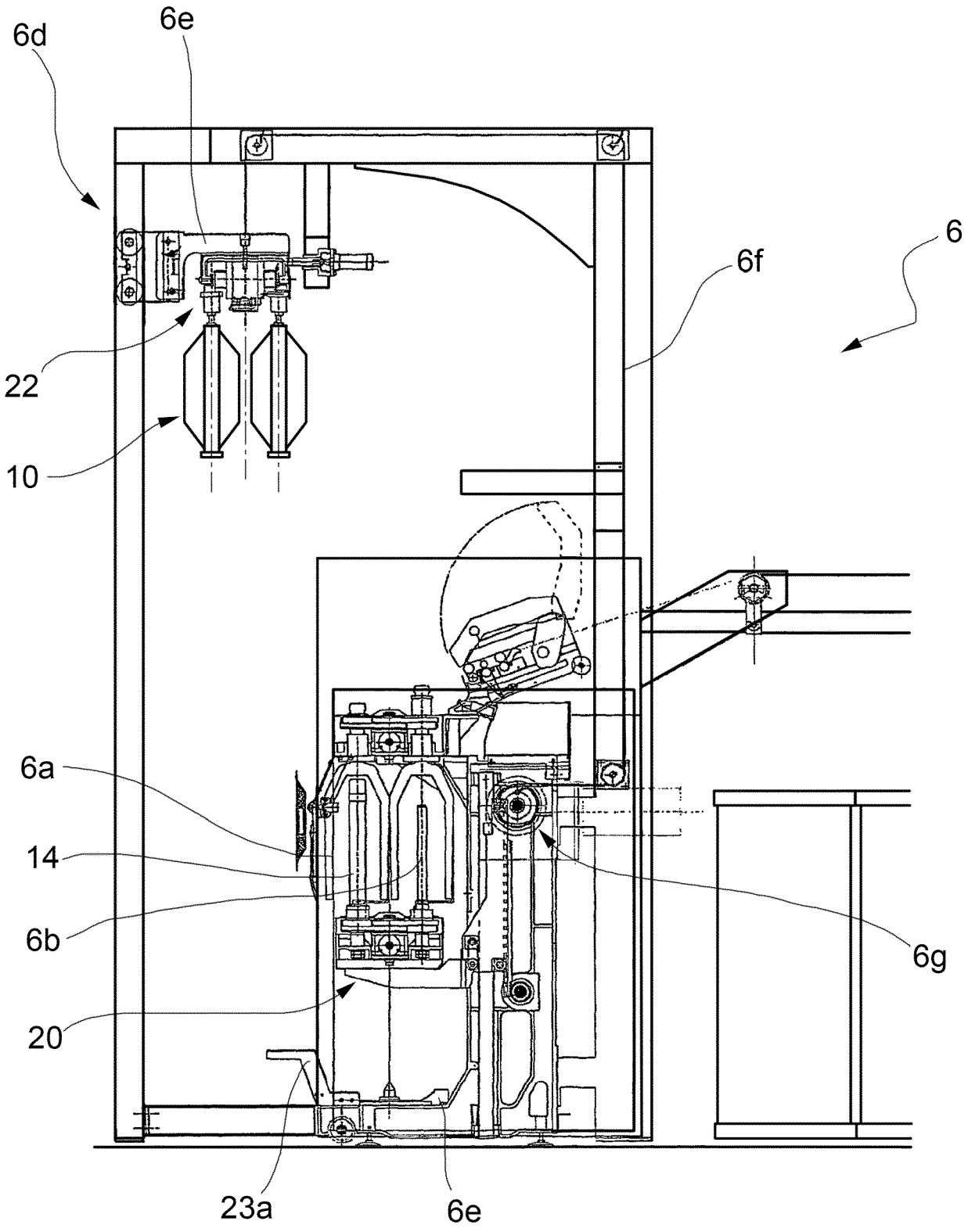


FIG.2

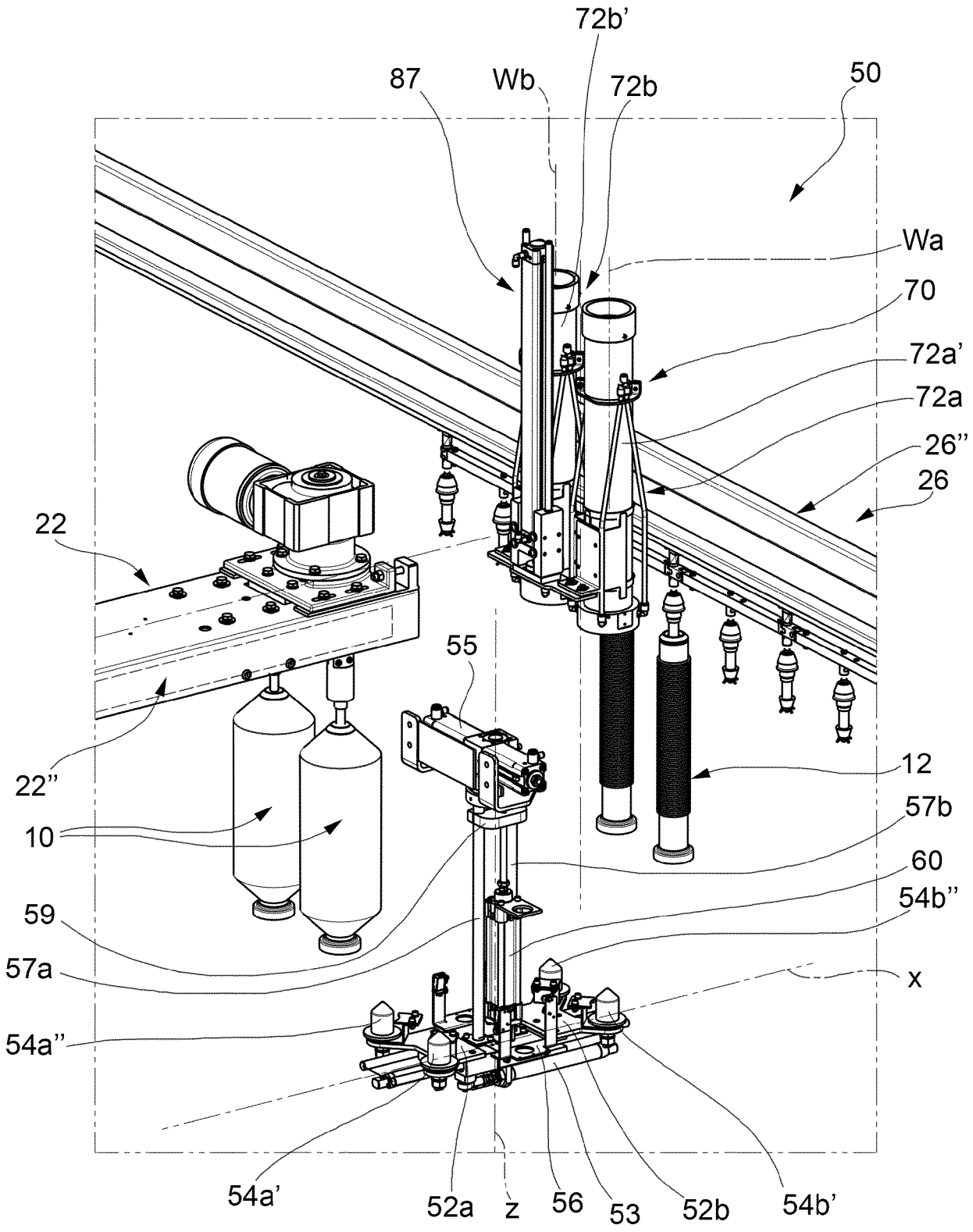
72b'
87
Wb
72b
50
Wa
70
72a'
72a
26''
26
22
55
22''
12
10
57b
60
59
54b''
57a
x
54a''
54a'
52a
z
56
53
52b
54b'

FIG.3

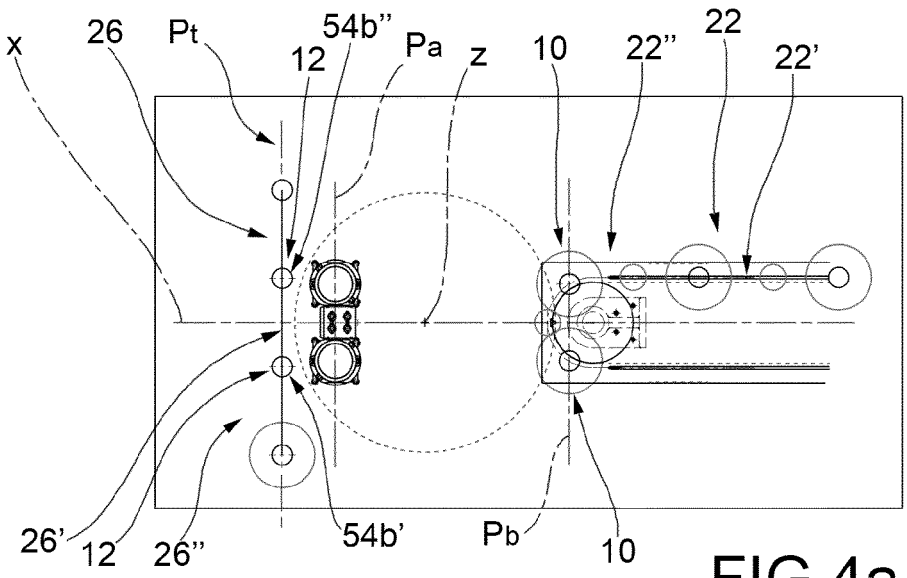


FIG.4a

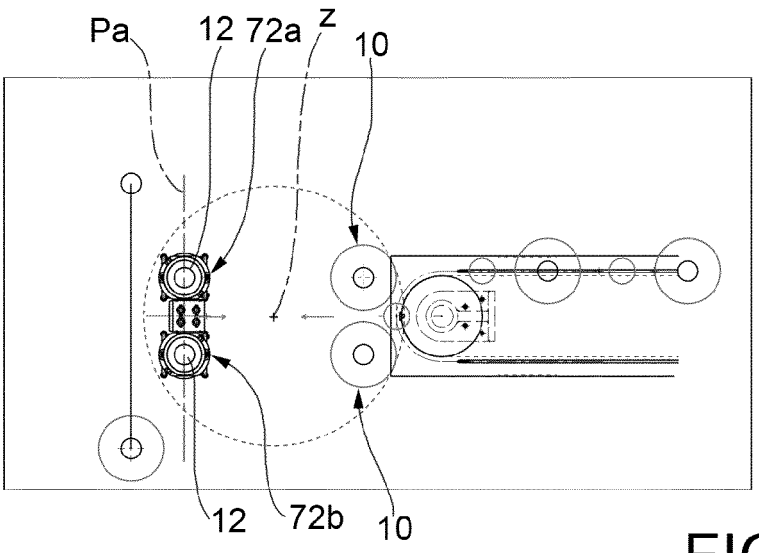


FIG.4b

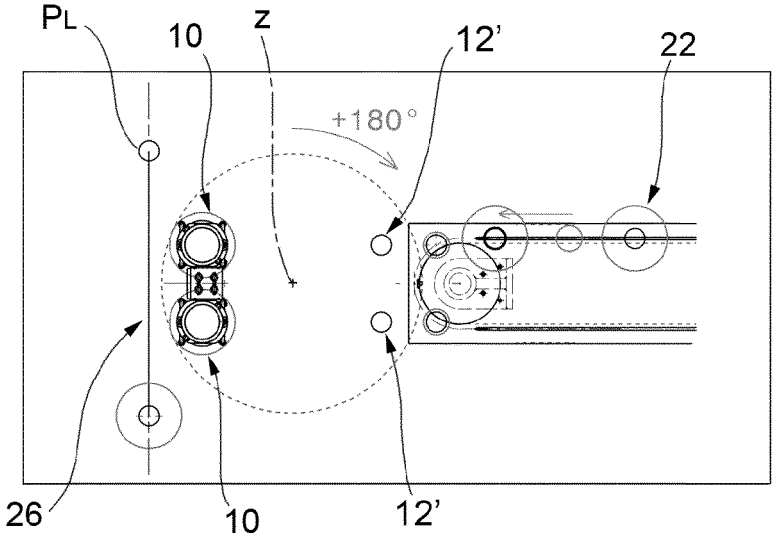


FIG.4c

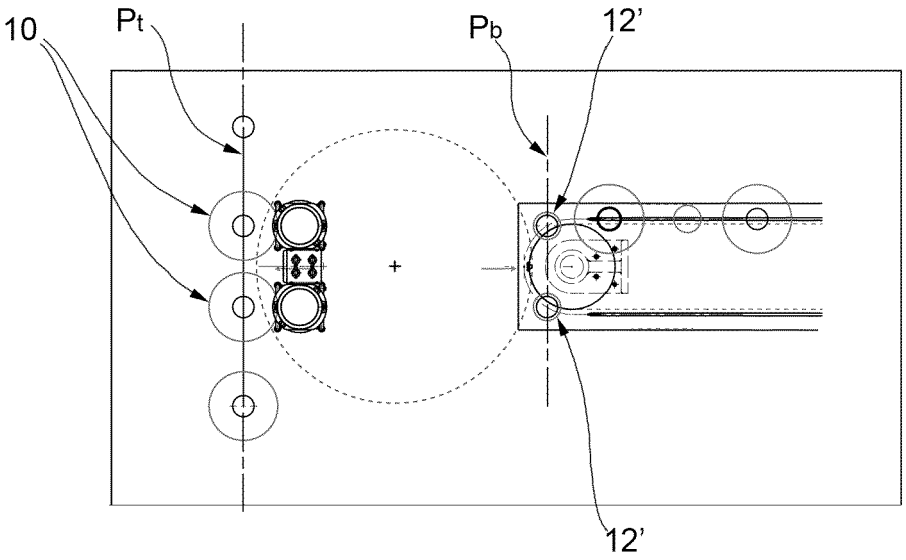


FIG.4d

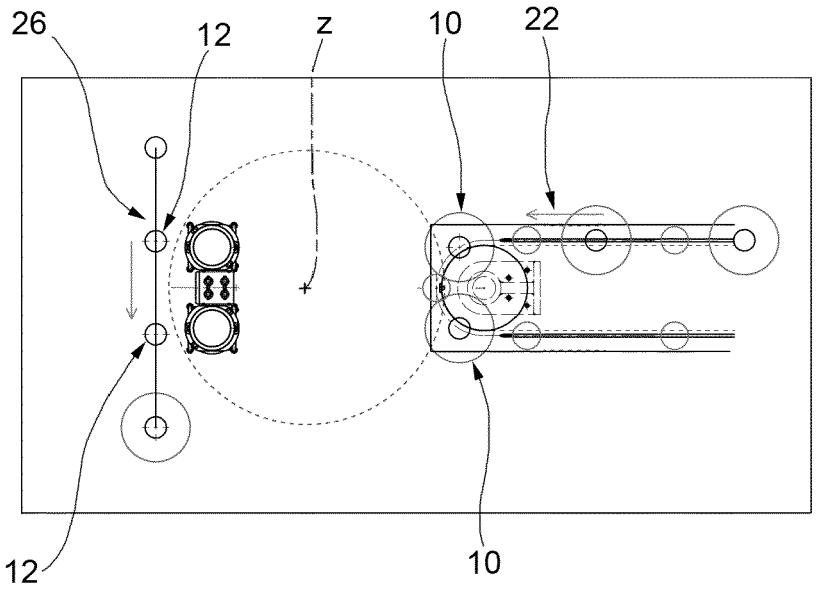


FIG.4e

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# EUROPEAN SEARCH REPORT

Application Number
EP 18 16 4532

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | EP 0 916 753 A2 (ZINSER TEXTILMASCHINEN GMBH [DE]) 19 May 1999 (1999-05-19)<br>* abstract *<br>* paragraph [0038] *<br>* figures 1,3 * | 1,10 | INV.<br>D01H9/18 |
| A | WO 2016/083944 A1 (MARZOLI MACHINES TEXTILE S R L [IT])<br>2 June 2016 (2016-06-02)<br>* abstract; figures 1,2 * | 3-7,11 | |
| A | EP 1 602 757 A1 (MARZOLI SPA [IT])<br>7 December 2005 (2005-12-07)<br>* paragraph [0028] *<br>* paragraph [0036] *<br>* figures 1,2 * | 8,9 | |

TECHNICAL FIELDS SEARCHED (IPC)

D01H
B65H

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 27 June 2018 | Humbert, Thomas |

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