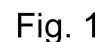


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(57) The invention relates to a bobbin handling device for transporting a bobbin from a spindle of a spinning station of a ring spinning machine to yarn end (4) searching position, the device being displaceable between a resting position, a clamping position for clamping the bobbin at the spinning station and the yarn end (4) searching position. The handling device comprises a supporting part (6), which is coupled to a drive for vertical reversible linear motion, a clamp (7) of the bobbin mounted on the supporting part (6) and coupled to a drive for reversible horizontal linear motion, vertical clamping mandrel (8) mounted on the clamp (7) and coupled to a rotary drive (82) for rotating about the longitudinal axis (X), and a controlled clamping element (9), provided at the lower end of the vertical clamping mandrel (8) for insertion into the cavity of the upper end of the tube (1) of the bobbin. The invention also relates to a method for transporting a bobbin by means of a bobbin handling device. In addition, the invention relates to a service robot of a ring spinning machine and to a ring spinning machine as such.



Description

Field of the invention

[0001] The invention relates to a bobbin handling device for transporting a bobbin from a spindle of a spinning station of a ring spinning machine to a yarn end searching position, which is displaceable between a resting position, a clamping position for clamping a bobbin at a spinning station and the yarn end searching position.

[0002] The invention also relates to a method for transporting a bobbin by means of a bobbin handling device from a spindle of a spinning station of a ring spinning machine to a yarn end searching position, in which a tube of the bobbin is gripped by the handling device, pulled off the spindle, moved to the yarn end searching position, whereupon the yarn end on the bobbin is detected and afterwards the bobbin is put back on the spindle.

[0003] The invention further relates to a service robot of a ring spinning machine comprising a bobbin handling device. In addition, it relates to a ring spinning machine.

Description of related art

[0004] Ring spinning machines comprise a row of spinning stations arranged next to each other, each of which comprises a roving drafting device, from which the processed roving is carried to a twisting device, from which the produced yarn is withdrawn and wound in a winding device on a tube carried by a spindle, thus forming a bobbin, or, in other words, a cop, i.e. a tube with a package. If the yarn production is interrupted, e.g., owing to breakage, it is necessary to resume the yarn production at a given spinning station. During the resumption of the spinning process at the spinning station, when spinning is interrupted, roving feed rollers of the drafting device are stopped, or the drafting device is working and the fibers from the roving are sucked into waste, etc., and then the motion of the traveller on the ring is terminated, which is usually recorded by a traveller motion sensor. Subsequently, it is necessary to find the yarn end on the bobbin, unwind the yarn from the package, thread it through the traveller, a balloon limiter and a guide eyelet and finally bring the yarn end back between the end rollers of the roving drafting device in such a manner that during the spinning resumption the yarn end is joined to the end of the roving. Thus, the spinning station is prepared for the renewal of the yarn production. All these service operations are performed during permanent vertical reversible motion of a ring bench and a balloon limiter carrier, since the other spinning stations continue to produce the yarn. To avoid unwanted contact of the device for detecting the yarn end and the ring bench, the bobbin is lifted to a safe height above the ring bench and above the spindle for detecting the yarn end. A bobbin handling device is used for this purpose, e.g., the device according to EP394671.

[0005] For handling a bobbin, for example, for its re-

placement, other handling devices are known, e.g., a handling device according to EP410021A1, which comprises a gripper, by which the tube is gripped by the outer circumference, lifted and handled. Another possibility of manipulating the bobbin is gripping the tube by the inner walls through the upper opening, as described, for example, in EP2031104, which is, however, primarily intended for removing the residual yarns from the tubes by means of an external picker member.

[0006] There is very little space at a spinning station of a ring spinning machine, because the spacing between the spinning stations is, e.g., only 70 or 75 mm, and so the requirements for the handling device are challenging in terms of the size of the handling device, as well as in terms of its reliability and uncomplicated design.

Brief summary of the invention

[0007] The goal of the invention is to propose a reliable and manageable handling device, both from the point of view of construction and from the point of view of day-to-day operation.

[0008] The aim of the invention is achieved by a bobbin handling device for transporting a bobbin from a spindle of a spinning station of a ring spinning machine according to the preamble of the independent claim 1, **characterized in that** the handling device comprises

- a supporting part, which is coupled to a drive for a vertical linear reversible motion;
- a bobbin clamp mounted on the supporting part and coupled to a drive for a reversible horizontal linear motion;
- a vertical clamping mandrel mounted on the bobbin clamp and coupled to a rotational drive for rotation about longitudinal axis and
- a controlled clamping element provided on the lower end of the vertical clamping mandrel for to be inserted into the cavity of the upper end of the tube.

[0009] The principle of the method for transporting a bobbin by the bobbin handling device consists in moving the vertical clamping spindle by a set of linear motions above the upper end of the bobbin, the bobbin being placed on a spindle at the spinning station, inserting an elastic clamping element at the lower end of the vertical clamping spindle into the cavity of the upper end of the tube and expanding the elastic clamping element for gripping the bobbin, removing the bobbin by a set of linear motions from the spindle and moving the bobbin to a yarn end detecting device on a service robot outside the spinning station and, after detecting the yarn end, putting the bobbin back on the spindle at the spinning station of the machine by a set of linear motions.

[0010] The principle of the service robot of a ring spinning machine consists in that it comprises the bobbin handling device according to any of claims 1 to 9. Preferably, the drive of the horizontal linear reversible motion

of the bobbin clamp is formed by a pneumatic linear drive.

[0011] Preferably, the drive of the rotation of the vertical clamping mandrel is formed by a rotary motor, whose output shaft is coupled to the vertical clamping mandrel by a toothed belt.

[0012] Preferably, the rotary motor is formed by a stepper motor.

[0013] Preferably, the controlled clamping element is formed by an elastic means for clamping the tube in the cavity of the upper end of the tube.

[0014] Preferably, the elastic means is formed by a reversibly deformable ring which abuts by its upper end against the lower end of the vertical clamping mandrel and by its lower end abuts against the upper side of the end collar, which is mounted at the lower end of a vertical control rod, which is arranged vertically reversibly displaceable in the opening of the hollow vertical clamping mandrel and is connected to a drive of vertical reversible sliding motion.

[0015] Preferably, the drive of the vertical reversible sliding motion of the vertical control rod is formed by a pneumatic linear drive.

[0016] Preferably, the supporting part is coupled to a vertical linear guide.

[0017] Preferably, bobbin clamp is coupled to a horizontal linear guide.

[0018] The invention relates as well to a service robot of a ring spinning machine comprising such a bobbin handling device. Furthermore, the principle of the ring spinning machine consists in that it comprises the above-described service robot.

[0019] The aim of the invention is achieved by a method for transporting a bobbin by a bobbin handling device according to the independent method claim, which is characterized in

- positioning a vertical clamping mandrel by a set of linear motions above the upper end of the bobbin, which is mounted on the spindle at the spinning station;
- inserting an elastic clamping element on the lower end of the vertical clamping mandrel into the cavity of the upper end of the tube and expanding the elastic clamping element for gripping the tube of bobbin;
- removing the bobbin from the spindle by a set of linear motions and moving the bobbin to the yarn end searching position on the service robot outside the spinning station; and
- after detecting the yarn end, putting the bobbin back on the spindle at the spinning station by a set of linear motions.

[0020] Preferably, during the searching of the yarn end on the bobbin, the tube rotates due to the rotation of the vertical clamping mandrel.

[0021] Preferably, after returning the bobbin to the spindle positioning the bobbin handling device returns to a resting position outside of the spinning station at the

service robot.

[0022] Preferably, rotating of the vertical clamping mandrel is rotated by a rotary motor driving a toothed belt coupled to the vertical clamping mandrel.

[0023] Preferably, the step of expanding the elastic clamping element for clamping the tube of the bobbin consists of the vertical displacing of the vertical control rod, which is arranged in the opening of the hollow vertical clamping mandrel and which is connected to a drive of the vertical reversible sliding motion, so that a reversibly deformable ring which abuts by its upper end against a lower end of the vertical clamping mandrel and by its lower end abuts against the upper side of the ending collar, which is mounted at the lower end of the vertical control rod, expands.

[0024] The invention enables to grip the bobbin reliably, and at the same time in a straightforward manner, by the cavity of the tube and handle it to find the yarn end outside the spinning station and afterwards return the bobbin correctly to the spinning station, all this being performed with required speed and accuracy. The invention allows this to be done by just one act of clamping the bobbin firmly by the inner opening of the bobbin, so that not only can the tube be reliably handled, but also rotated during the search for the yarn end. The handling of the bobbin, based on a set of linear motions, is also advantageous in terms of easy manageability and position control in the individual axes of the rectangular coordinate system, i.e. in space.

Brief description of the drawings

[0025] The invention is schematically represented in the drawing, wherein

- Fig. 1** shows an arrangement of a bobbin handling device at a spinning station of a ring spinning machine before clamping the bobbin, and
- Fig. 2** shows a detail of a system of clamping the bobbin by the inner walls of the cavity of a tube.

Detailed Description of the invention

[0026] The invention will be described with reference to an exemplary embodiment of a bobbin handling device at a spinning station of a ring spinning machine, whereby the machine comprises a row of identical spinning stations arranged next to each other. On principle, the spinning station is well-known and therefore the entire spinning station will only be described hereinafter in a simplified manner. Those parts, elements and nodes of the spinning station that are of significance to the present invention will be described in greater detail. The spinning station of a ring spinning machine comprises an unillustrated roving drafting device, below which a yarn twisting and winding device is arranged. The roving is fed from an unillustrated supply package to the drafting device,

behind which the yarn being formed passes through a guide eyelet, a balloon limiter and then through a traveler which circulates around the circumference of a ring 3 mounted in a holder on the ring bench 2, whereupon after the passage through the traveler, the produced yarn is wound on a package 40 on a tube 1, thus forming a bobbin or cop, which is placed on a drive spindle, which rotates about the axis Y. The tube 1 constitutes the basic supporting body for winding yarn.

[0027] The bobbin, i.e. the tube 1 with a package 40, is formed by a continuous reversible vertical motion of the ring bench in the interaction with the yarn winding device after the passage of the yarn through the traveler (not shown), which circulates on the upper part of the ring 3, whereby due to the traveler being delayed behind the revolutions of the spindle, a twist is created on the yarn, thereby changing the processed roving into the yarn of the desired properties. The spindle is usually driven in its lower portion by means of a flat belt driven by a drive shaft.

[0028] Along the row of spinning stations is displaceably arranged a service robot, which comprises mechanisms and means for performing service operations at the spinning station, or for performing at least some of the service operations at the spinning station.

[0029] One of these operations is handling the bobbin for the purposes of finding a yarn end 4 on the bobbin or on the package 40. Handling the bobbin includes gripping the bobbin, raising it above the level of the upper end of the spindle and the ring bench 2 and ejecting the bobbin from the spinning station towards the service robot, i.e. out of the spinning station of the machine, in order to find the yarn end 4 on the bobbin, and subsequently putting it back to the respective spinning station.

[0030] For performing this operation, the service robot is provided with a bobbin handling device at a spinning station of a ring spinning machine, hereinafter only a bobbin handling device.

[0031] The bobbin handling device is mounted by its supporting part 6 reversibly vertically displaceably in the direction A+ and A- on a vertical linear guide 5 of the service robot. The supporting part 6 is coupled to a rotary or linear drive, which is coupled to a control device. As a result, the supporting part 6 is controllably reversibly positionable in the vertical direction on the guide 5.

[0032] A bobbin clamp 7 is mounted on the supporting part 6 on the horizontal linear guide 10 reversibly horizontally displaceably in the directions B+ and B- relative to the supporting part 6. The clamp 7 is coupled to a rotary or linear drive, which is coupled to the control device. Consequently, the clamp 7 is controllably reversibly positionable in the horizontal direction relative to the supporting part 6. In the illustrated example of embodiment, the drive of the linear reversible motion of the clamp 7 consists of a pneumatic linear drive.

[0033] A vertical clamping mandrel 8 is mounted rotatably about its longitudinal axis, which is situated vertically, by its upper end on the clamp 7. The vertical clamping

mandrel 8 is coupled to its rotation drive, preferably a bi-directional rotary actuator. In the illustrated example of embodiment, the drive for the rotation of the vertical clamping mandrel 8 consists of a bi-directional rotary actuator, in particular a stepper motor, which comprises a rotary motor 82, about whose output shaft, or a toothed pulley 820 mounted on the output shaft of the rotary motor 82, is wrapped a toothed belt 83, which is in an unillustrated manner wrapped around the upper part of the vertical clamping mandrel 8, e.g., also by means of a toothed pulley mounted on the vertical clamping mandrel 8. At its free bottom end, the vertical clamping mandrel 8 comprises a vertical control rod 81 and a vertical drive 811 and is provided with a clamping element 9 of the bobbin. In the exemplary embodiment shown, the clamping element 9 of the bobbin consists of an elastic means for clamping the bobbin by the inner wall of the upper end of the cavity of the bobbin tube 1. This elastic means is formed, for example, by a deformable ring 90, which with its upper end rests against the lower end 80 of the vertical clamping mandrel 8 and with its lower end abuts the upper side of an end collar 810, which is mounted at the lower end of the vertical control rod 81. The control rod 81 is mounted reversibly slidably in the vertical direction C+ and C- in the cavity of the vertical clamping mandrel 8, whereby at its end above the upper end of the vertical clamping mandrel 8 it is connected to the vertical drive 811 of the reversible slidable motion in the vertical direction C+ and C-. The vertical drive 811 is formed, for example, by a linear drive, e.g. a pneumatic linear drive or a rotary drive with a linear gear, which, for example, comprises a gear wheel on a rotary motor, the gear wheel being associated with a rack gear on the vertical control rod 81.

[0034] In an unillustrated example of embodiment, mounted at the lower end of the vertical clamping mandrel 8 is an elastic means in the form of an inflatable body, which is connected to a source of compressed air, e.g. through compressed air distribution in the cavity of the vertical clamping mandrel 8. The clamping element 9 at the lower end of the vertical clamping mandrel 8 at the time when the bobbin is not clamped has a smaller outer diameter than is the diameter of the upper opening of the tube 1, whereby with the bobbin being clamped the clamping element 9 has a greater diameter than is the diameter of the upper opening of the tube 1 and therefore the clamping element 9 abuts with its outer circumference the inner wall of the tube 1 cavity, as shown in Fig. 2.

[0035] The device operates in such a manner that if it is necessary to handle the bobbin by removing the bobbin from the spinning station for finding the yarn end 4 on the yarn package 40, the clamp 7 is inserted in its resting position in the service robot outside the spinning station, see Fig. 1. The clamping element 9 at the lower end of the vertical clamping mandrel 8 is arranged above the level of the upper end of the bobbin and at a displacement V. Subsequently, the clamp 7 moves forward along the horizontal linear guide 10 until the vertical longitudinal

axis X of the vertical clamping mandrel 8 gets to the axis Y of the rotation of the bobbin (displacement V). After that, the supporting part 6 moves on the vertical linear guide 5 downwards and the clamping element 9 at the lower end of the vertical clamping mandrel 8 is inserted into the opening of the upper end of the bobbin tube 1. Next, the bobbin is clamped by the inner wall of the tube 1 cavity, this operation being performed by controlled deformation of the clamping element 9, which expands in the inner space of the tube 1 cavity, see Fig. 2, here by the motion of the control rod 81 in the direction C+.

[0036] Subsequently, the supporting part 6 moves upwards on the vertical linear guide 5, by which means the bobbin is removed from the unillustrated spindle at the spinning station, whereupon the lower end of the bobbin gets above the level of the upper end of the spindle and the ring bench 2. Subsequently, the clamp 7 moves along the horizontal linear guide 10 backwards, which causes the clamp 7 with the bobbin on the vertical clamping mandrel 8 to move away from the spinning station towards the service robot and set the bobbin to the desired searching position for finding the yarn end 4 on the bobbin outside the spinning station by means of the unillustrated yarn end detecting device. During the search for the yarn end 4 the bobbin rotates about its longitudinal axis in the required direction in such a manner that the vertical clamping mandrel 8 rotates about its longitudinal axis X. After detecting the yarn end 4, the clamp 7 with the bobbin on the vertical clamping mandrel 8 moves back to the space of the spinning station so that the vertical longitudinal axis X of the vertical clamping mandrel 8 gets again to the axis Y of the rotation of the bobbin at the spinning station. Subsequently, the supporting part 6 moves downwards on the vertical linear guide 5 and places the bobbin by the tube 1 back on the unillustrated spindle of the spinning station. After that, the clamping element 9 at the lower end of the vertical clamping mandrel 8 releases the bobbin tube 1, here by the motion of the control rod 81 in the direction C-. Subsequently, upon ejecting the supporting part 6 on the vertical linear guide 5 upwards, the clamping element 9 at the lower end of the vertical clamping mandrel 8 is ejected from the tube 1 cavity above the level of the upper end of the bobbin, whereupon the clamp 7 is retracted along the horizontal linear guide 10 back to its rear, i.e. resting position in the service robot outside the spinning station, as shown in Fig. 1. By this, the entire cycle has been completed.

Reference numbers

[0037]

- | | |
|----|-----------------------|
| 1 | Tube |
| 2 | Ring bench |
| 3 | Ring |
| 4 | Yarn end |
| 40 | Package |
| 5 | Vertical linear guide |

- | | |
|-----------------------------------|---|
| 6 | Supporting part |
| 7 | Bobbin clamp |
| 8 | Clamping mandrel |
| 80 | Lower end of clamping mandrel 8 |
| 5 81 | Control Rod |
| 810 | Ending collar |
| 811 | Drive |
| 82 | Rotary motor |
| 820 | Toothed pulley |
| 10 83 | Toothed belt |
| 9 | Clamping element |
| 90 | Deformable ring |
| 10 | Horizontal linear guide |
| 15 A ⁺ -A ⁻ | Vertical movement |
| B ⁺ -B ⁻ | Horizontal movement |
| C ⁺ -C ⁻ | Vertical direction |
| 20 V | Displacement |
| Y | Longitudinal axis of Bobbin |
| 25 X | Longitudinal axis of clamping mandrel 8 |

Claims

- | | | |
|----|----|---|
| 30 | 1. | A bobbin handling device for transporting a bobbin from a spindle of a spinning station of a ring spinning machine to a yarn end (4) searching position is displaceable between a resting position, a clamping position for clamping a tube (1) of the bobbin at the spinning station and the yarn end (4) searching position, characterized in that the handling device comprises |
| 35 | | |
| 40 | | • a supporting part (6), which is coupled to a drive for a vertical linear reversible motion; |
| | | • a bobbin clamp (7) mounted on the supporting part (6) and coupled to a drive for a reversible horizontal linear motion; |
| 45 | | • a vertical clamping mandrel (8) mounted on the bobbin clamp (7) and coupled to a rotational drive (82) for rotation about longitudinal axis (X) and |
| | | • a controlled clamping element (9) provided on the lower end of the vertical clamping mandrel (8) for to be inserted into the cavity of the upper end of the tube (1). |
| 50 | | |
| | 2. | The bobbin handling device according to claim 1, characterized in that the drive of the horizontal linear reversible motion of the bobbin clamp (7) is formed by a pneumatic linear drive. |
| 55 | | |
| | 3. | The bobbin handling device according to claim 1, |

- characterized in that** the drive of the rotation of the vertical clamping mandrel (8) is formed by a rotary motor (82), whose output shaft is coupled to the vertical clamping mandrel (8) by a toothed belt (83). 5
4. The bobbin handling device according to claim 3, **characterized in that** the rotary motor (82) is formed by a stepper motor. 10
5. The bobbin handling device according to any of claims 1 to 4, **characterized in that** the controlled clamping element (9) is formed by an elastic means for clamping the tube (1) in the cavity of the upper end of the tube (1). 15
6. The bobbin handling device according to claim 5, **characterized in that** the elastic means is formed by a reversibly deformable ring (90) which abuts by its upper end against the lower end (80) of the vertical clamping mandrel (8) and by its lower end abuts against the upper side of the end collar (810), which is mounted at the lower end of a vertical control rod (81), which is arranged vertically reversibly displaceable in the opening of the hollow vertical clamping mandrel (8) and is connected to a drive (811) of vertical reversible sliding motion. 20 25
7. The bobbin handling device according to claim 6, **characterized in that** the drive (811) of the vertical reversible sliding motion of the vertical control rod (81) is formed by a pneumatic linear drive. 30
8. The bobbin handling device according to any of claims 1 to 7, **characterized in that** the supporting part (6) is coupled to a vertical linear guide (5). 35
9. The bobbin handling device according to any of claims 1 to 8, **characterized in that** bobbin clamp (7) is coupled to a horizontal linear guide (10). 40
10. A service robot of a ring spinning machine comprising a bobbin handling device according to any of the preceding claims. 45
11. A ring spinning machine comprising a service robot according to any of the preceding claims. 50
12. A method for transporting a bobbin (1) by a bobbin handling device according to any one of claims 1 to 9 from a spindle of spinning station of a ring spinning machine to a yarn end (4) searching position, wherein the tube (1) of the bobbin is clamped by a handling device, removed from the spindle and transferred into the yarn end (4) searching position, whereupon the yarn end (4) is detected on the bobbin and then the bobbin is put back on the spindle, **characterized in** 55
- positioning a vertical clamping mandrel (8) by a set of linear motions above the upper end of the bobbin (1), which is mounted on the spindle at the spinning station;
 - inserting an elastic clamping element (9) on the lower end of the vertical clamping mandrel (8) into the cavity of the upper end of the tube (1) and expanding the elastic clamping element (9) for gripping the tube of bobbin;
 - removing the bobbin from the spindle by a set of linear motions and moving the bobbin to the yarn end (4) searching position on the service robot outside the spinning station; and
 - after detecting the yarn end (4), putting the bobbin back on the spindle at the spinning station by a set of linear motions.
13. The method according to claim 12, **characterized in that** during the searching of the yarn end (4) on the bobbin, the tube (1) rotates due to the rotation of the vertical clamping mandrel (8).
14. The method according to claim 12 or 13, **characterized in that** after returning the bobbin to the spindle positioning the bobbin handling device returns to a resting position outside of the spinning station at the service robot.
15. The method according to any of the claims 12 to 14, **characterized in that** rotating of the vertical clamping mandrel (8) is rotated by a rotary motor (82) driving a toothed belt (83) coupled to the vertical clamping mandrel (8).
16. The method according to any of the claims 12 to 15, **characterized in that** the step of expanding the elastic clamping element (9) for clamping the tube of the bobbin consists of the vertical displacing of the vertical control rod (81), which is arranged in the opening of the hollow vertical clamping mandrel (8) and which is connected to a drive (811) of the vertical reversible sliding motion, so that a reversibly deformable ring (90) which abuts by its upper end against a lower end (80) of the vertical clamping mandrel (8) and by its lower end abuts against the upper side of the ending collar (810), which is mounted at the lower end of the vertical control rod (81), expands.

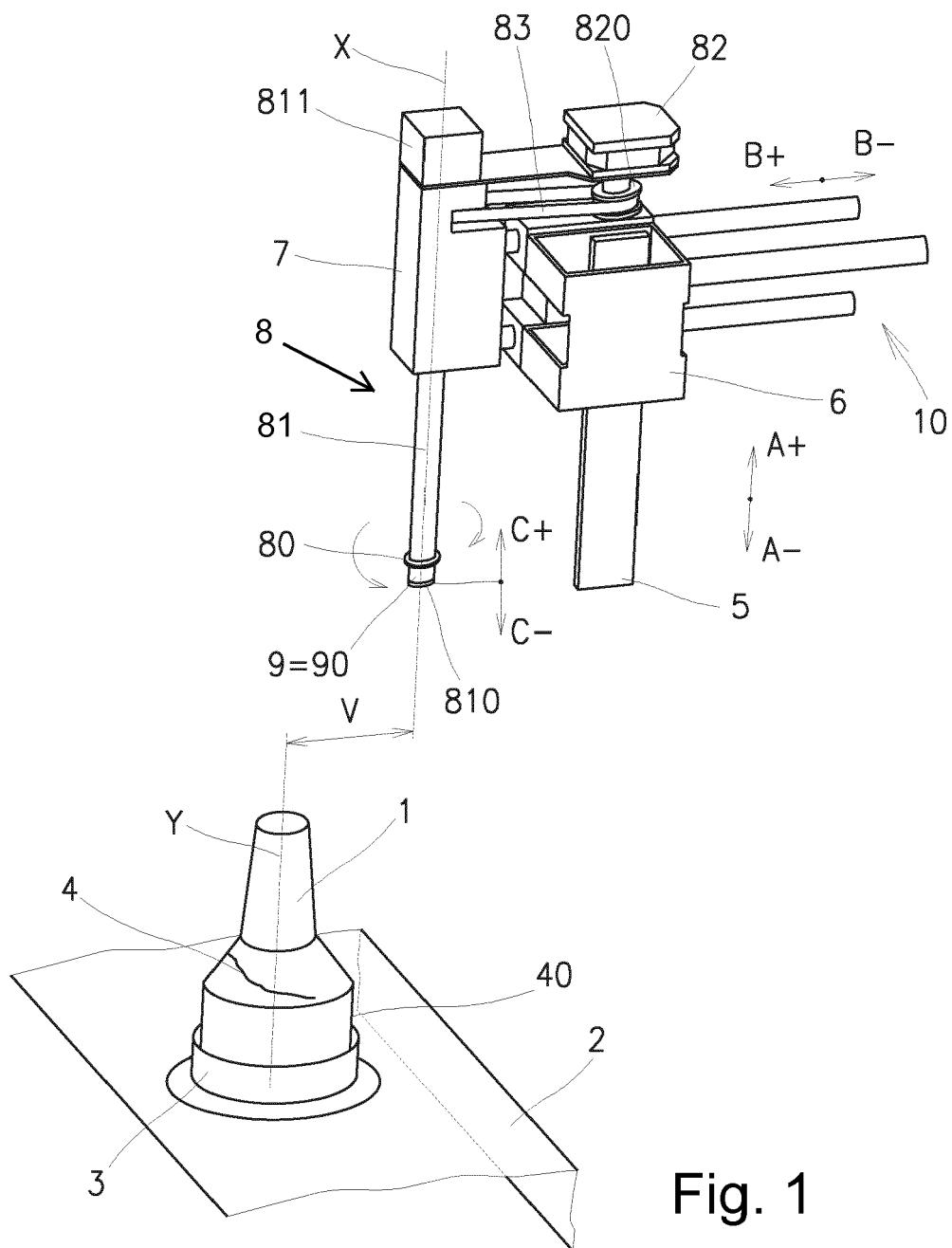


Fig. 1

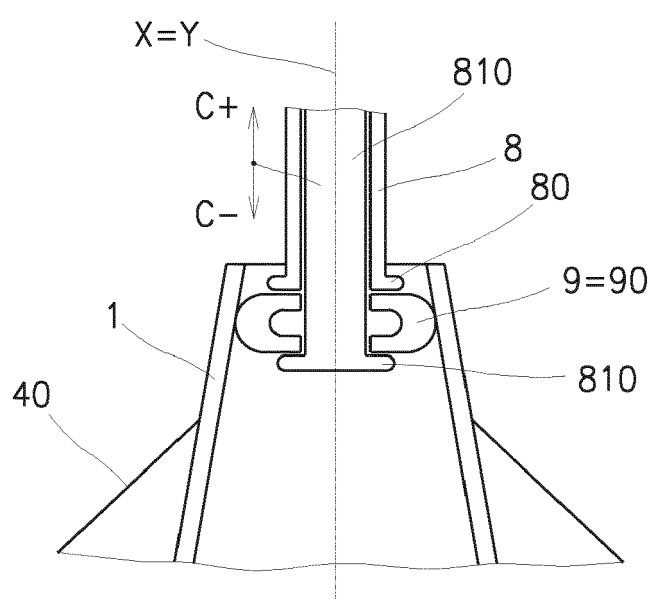


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 19 15 2785

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Place of search Munich		Date of completion of the search 19 June 2019	Examiner Humbert, Thomas
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19-06-2019

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